Slow Sand Filtration

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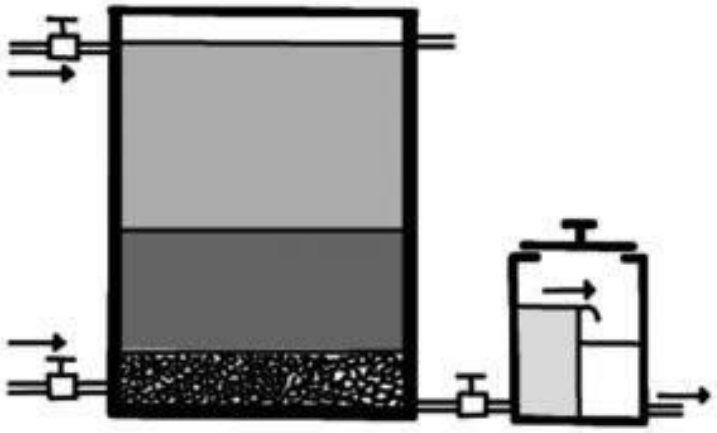
SSWM
sustainable sanitation and water management

Contents



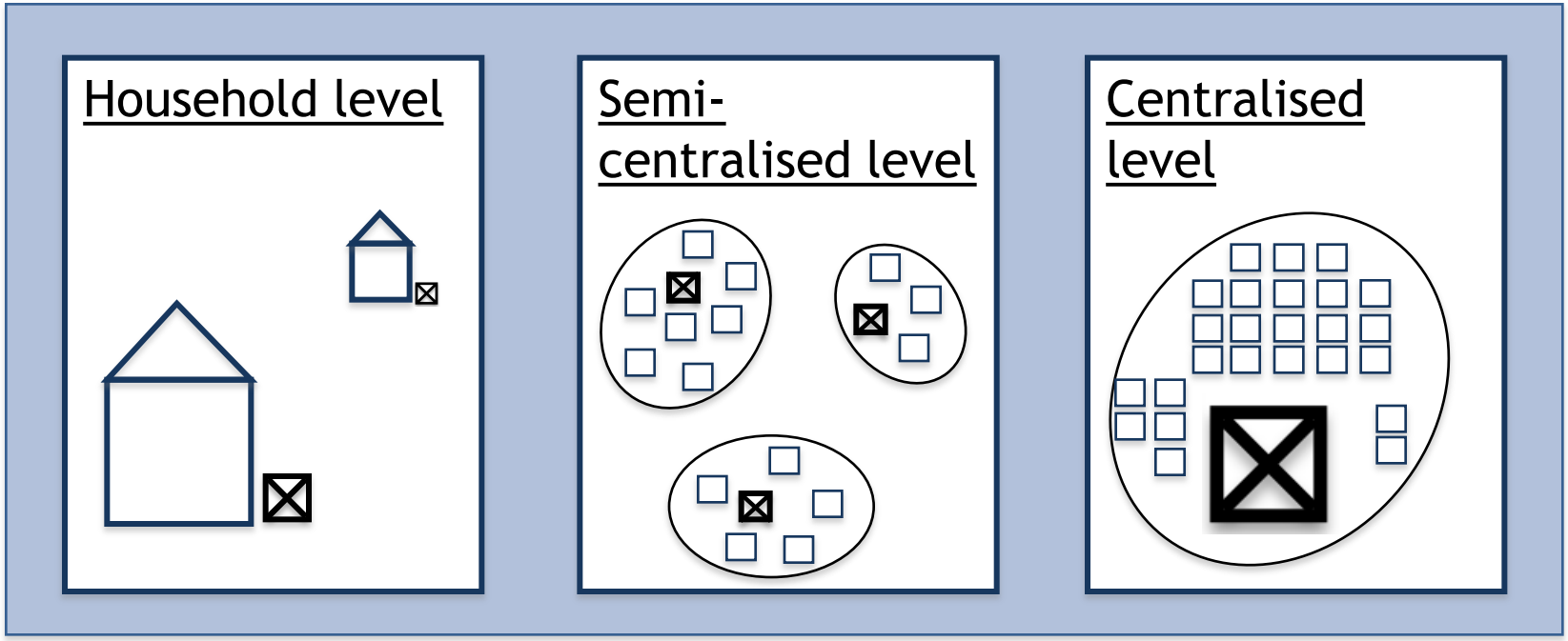
1. Concept

Water Purification

Households

Communities

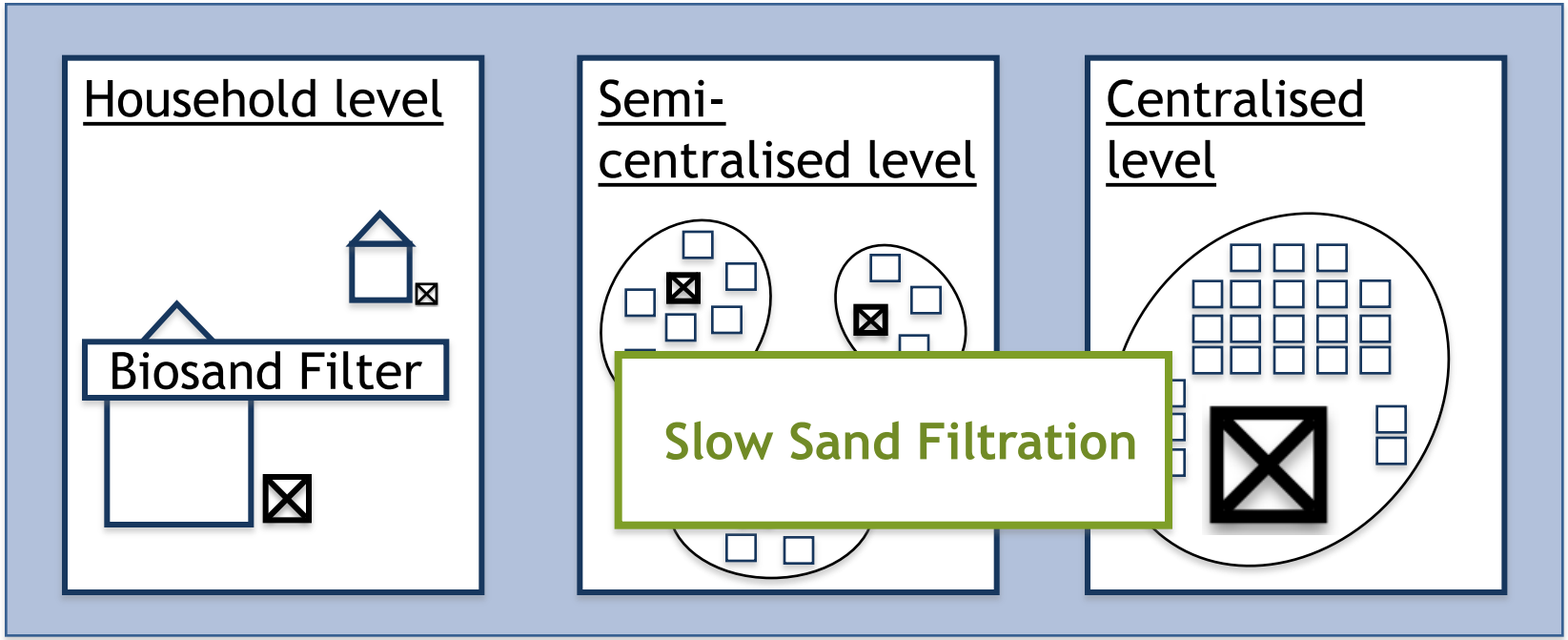
Water supply systems in densely populated urban areas



1. Concept

Water Purification

- **Slow sand filtration** is a type of water purification system on a centralised or semi-centralised level
- The working principle is equivalent to the biosand filter (household level)

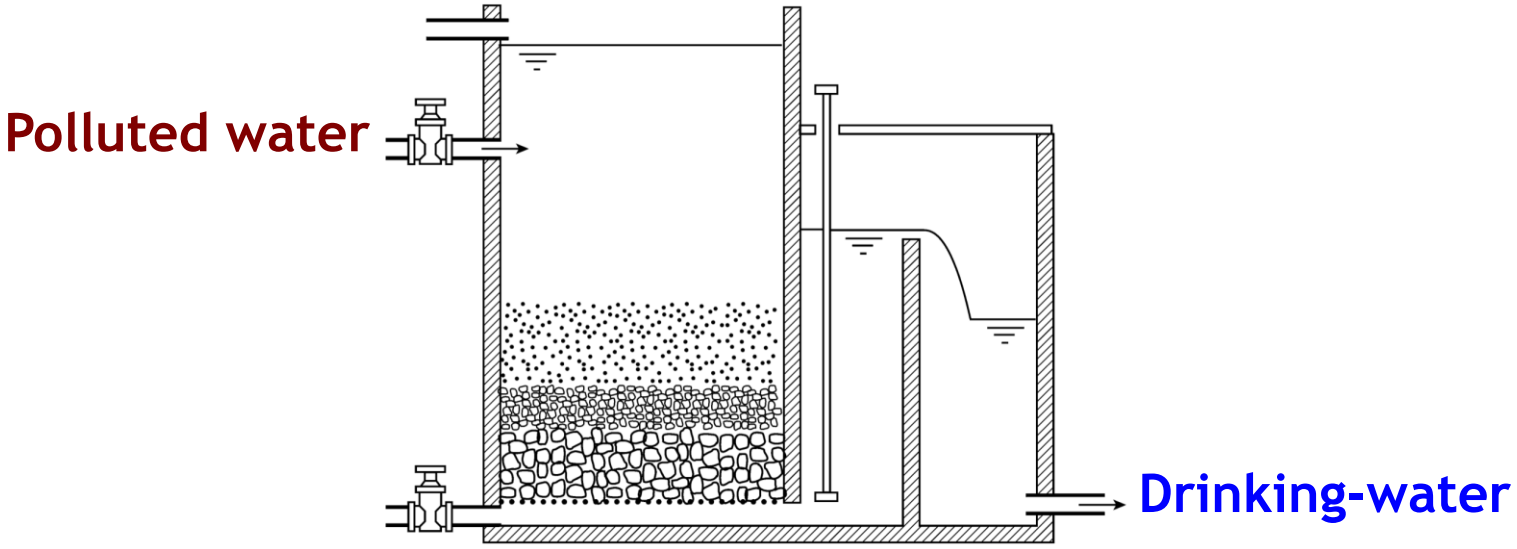


1. Concept

Simple but Effective

Working Principle

Freshwater flows through a sand-bed with a thin layer populated by microorganisms. Hereby, the water gets purified through various biological, physical and chemical processes.



Adapted from: WHO (n.y.)

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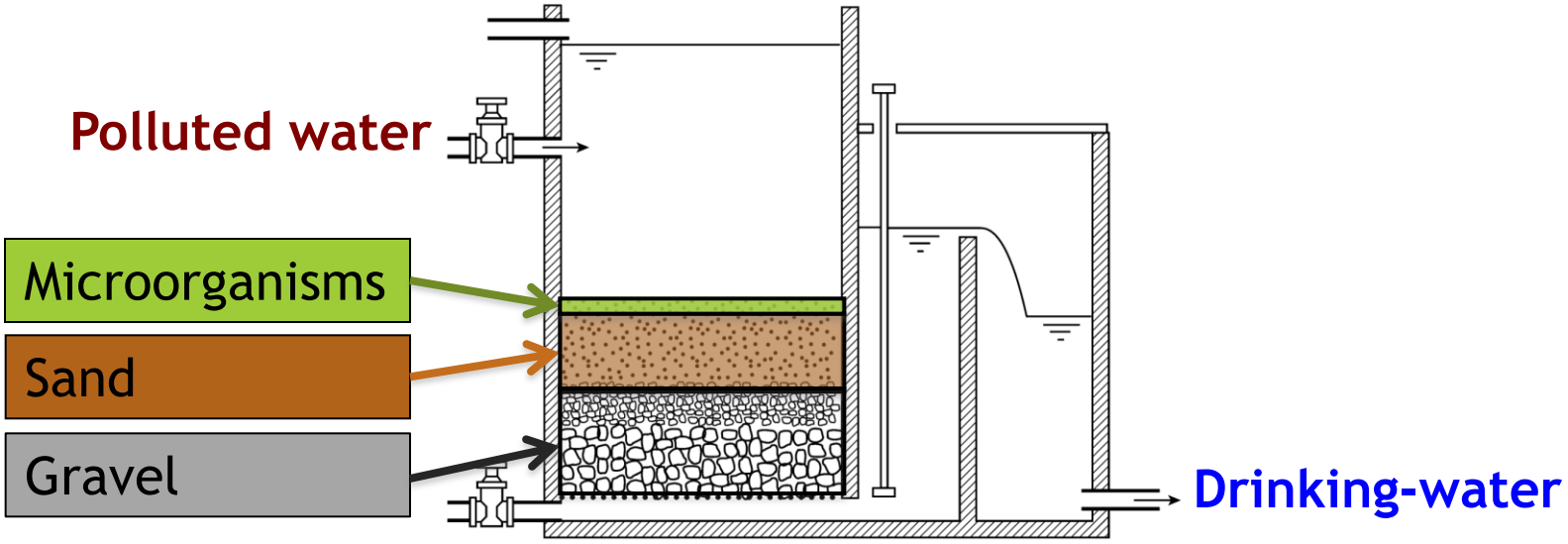

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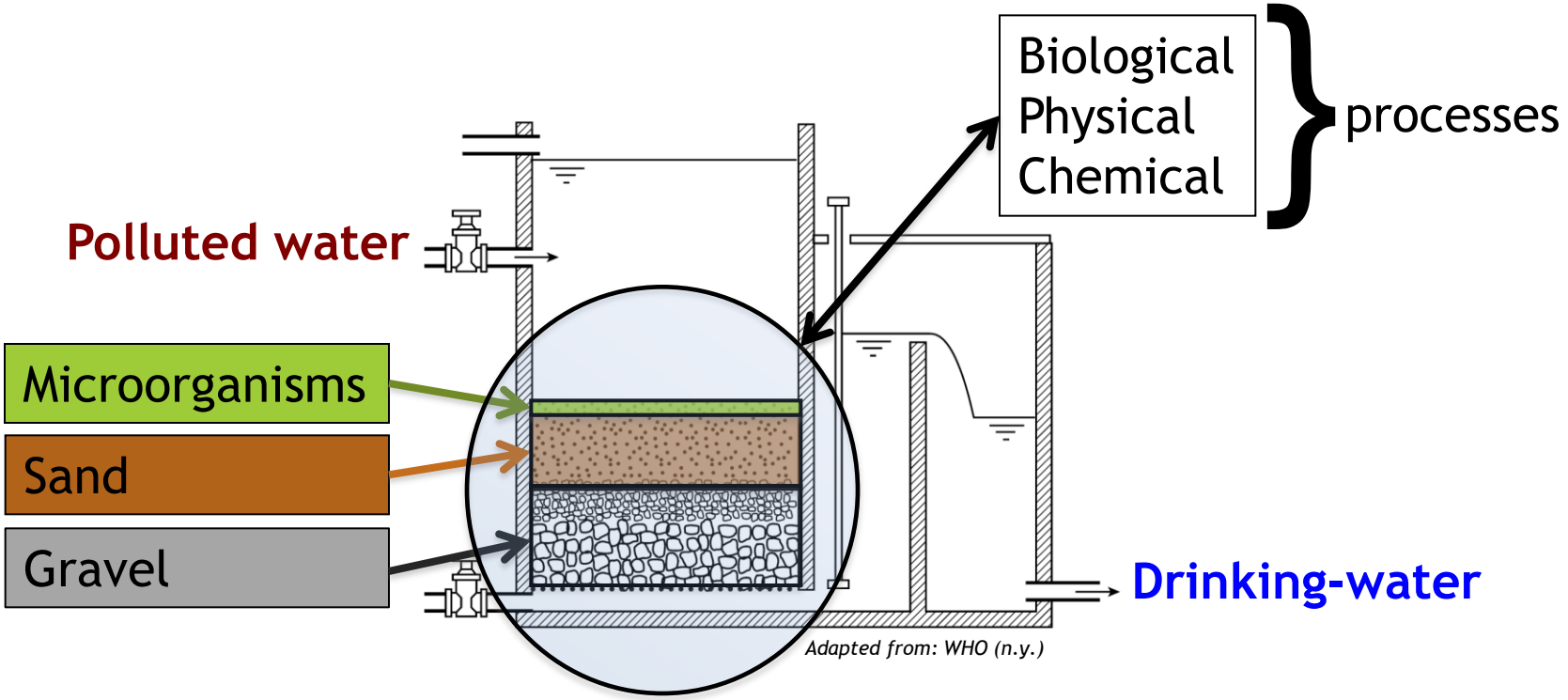

2. How Slow Sand Filtration Can Optimise SSWM

Or how Surface-water Becomes Drinking-water

Source: http://www.govisitcostarica.com/images/photos/full-cano-negro-brown-river.jpg *[Accessed: 21.02.2012]*

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Source: http://water1st.org/waterlog/wp-content/uploads/2009/05/01.jpg *[Accessed: 21.02.2012]*

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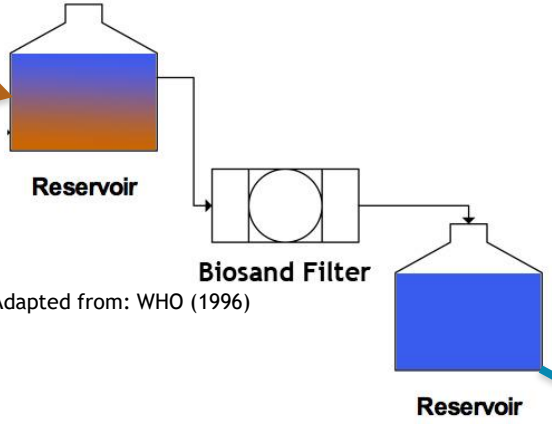

Adapted from: WHO (1996)

Source: http://water1st.org/waterlog/wp-content/uploads/2009/05/01.jpg *[Accessed: 21.02.2012]*

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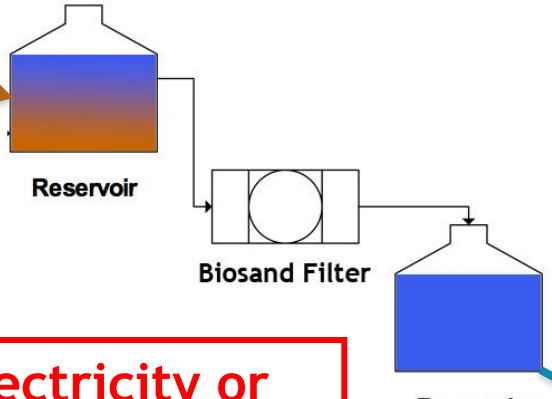
Source: http://www.govisitcostarica.com/images/photos/full-cano-negro-brown-river.jpg *[Accessed: 21.02.2012]*

NO chemicals required

Source: http://...home-air-purifier-expert.com/images/hazardous-chemicals.jpg *[Accessed: 21.02.2012]*



NO electricity or pumps required

Source: http://shop.gessato.com/images/ferm-living-wall-stickers-power-pole-gessato-gselect-thumb.jpg *[Accessed: 21.02.2012]*

Source: http://water1st.org/waterlog/wp-content/uploads/2009/05/01.jpg *[Accessed: 21.02.2012]*

3. Design Principles

Finding the Optimal Solution Adapted for the Local Conditions

- Different construction types of slow sand filters available
- Choice according to individual needs, possibilities and circumstances

  NOTE: They all work identically!

Source: GLOBAL GIVING (2011)

Simple SSF – synthetic filter chamber

Source: http://www.travelblog.org/Photos/2411254 [Accessed: 21.02.2012]

Sophisticated SSF – solid filter chamber (concrete)

4. Treatment Efficiency and Health Aspects

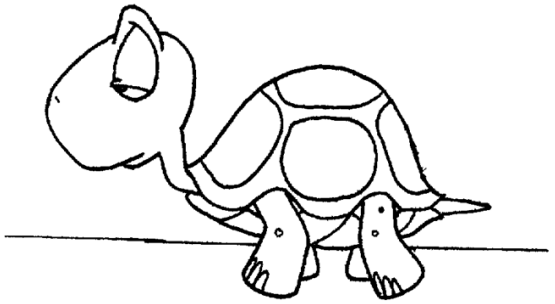
Efficiency versus Drinking-water Quality

Performance

100-300 litres per hour per m^2 of surface

→ rather slow rate

→ large land demand



Source: http://www.cibengineering.com/blog/wp-content/uploads/2010/10/dot_net_remoting_marshalling.png [Accessed: 21.02.2012]

Health Aspects

Slow sand filtration provides safe drinking-water.

Highly effective for:	Somewhat effective for	Not effective for:
- Bacteria - Protozoa - Viruses - Turbidity - Heavy metals (Zn, Cu, Cd, Pb)	- Odour, Taste - Iron, Manganese - Organic Matter - Arsenic	- Salts - Fluoride -Trihalomethane (THM) Precursors - Majority of chemicals

Adapted from: BRIKKE & BREDERO (2003), LOGSDON (2002) and WHO (n.y.)

Typical treatment performance of slow sand filters

5. Construction and Operation & Maintenance

Construction

- Use of local material and knowledge
- Can be built by experienced contractors or communities with little external technical assistance
- Cheap material

Construction Material

- (Reinforced-) concrete, brick-built or synthetic filter chamber
- Pipes
- Valves
- Sand, Gravel
- Tools

Source: EWB (2010)

Foundation of a slow sand filter

5. Construction and Operation & Maintenance

Operation & Maintenance

- SSF do not need much operational attention
- Maintenance is essential for proper functioning but can easily be conducted by a local caretaker or by communities.
- Cleaning of the filter-bed is labour-intensive and has to be done after several weeks or months of operation (depending on the turbidity level of the initial freshwater)

Cleaning

- Drainage of filter chamber
- Removal of the top layer of the sand
- Drying and cleaning of the removed sand → Reuse!
- Restart (takes some days for the microorganisms to develop)

Source: GLOBAL GIVING (2011)

Tayakome's village water committee cleaning their slow sand filters

6. Applicability

Universally Applicable

Prerequisites

- Availability of large land areas
- Low initial turbidity level (<30 NTU), otherwise pre-treatment necessary
- Moderate climate conditions (filter does not work if temperatures are too low)
- Experienced contractor for construction and trained caretaker for operation and maintenance

Main areas

- Primarily rural communities or small cities where land is no limiting factor

7. Advantages and Disadvantages

Slow Sand Filtration Put in a Nutshell

Advantages:

- Very effective removal of most contaminants
- Simplicity of design (simple and cheap construction)
- High self-help compatibility (simple operation and maintenance)
- No electricity required
- Construction with local material and knowledge
- No chemicals involved
- Long lifespan (> 10 years)

Disadvantages:

- Minimal quality of initial fresh water or pre-treatment required
- Cold climate lowers efficiency
- Majority of chemicals and fluoride is not removed
- Loss of productivity during maintenance
- Possible need for attitudinal change

8. References

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SSWM
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"Linking up Sustainable Sanitation, Water Management & Agriculture"

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SARAR Transformación

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