A Pilot Implementation of Constructed Wetland System for Domestic Wastewater Treatment and Reuse in a Green Village

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Society for the Conservation of Philippine Wetlands, Inc.

Presentation Outline

- The SCPW, Inc.
- Constructed Wetlands and its Mechanisms
- Project Partners
- Project Objectives
- Project Site
- Methodology and Implementation
- Recent Developments and Way Forward

Society for the Conservation of Philippine Wetlands, Inc.

The SCPW was registered as a **non-stock, non-profit, non-governmental corporation** on **27 April 1998** at the Philippines Securities and Exchange Commission (No.A1998-05600).

Society for the Conservation of Philippine Wetlands, Inc.

Objectives:

- The principal objective of the SCPW is to promote the wise use of wetlands in the Philippines.
- To serve as network of wetland workers and advocates and establish linkages with local and international organizations
- To provide technical assistance on matters related to wetlands
- To engage in advocacy work supportive of wetland conservation objectives
- To complement wetland management activities such as research, training, IEC
- To serve as forum for wetland issues.

What is a Constructed Wetland?

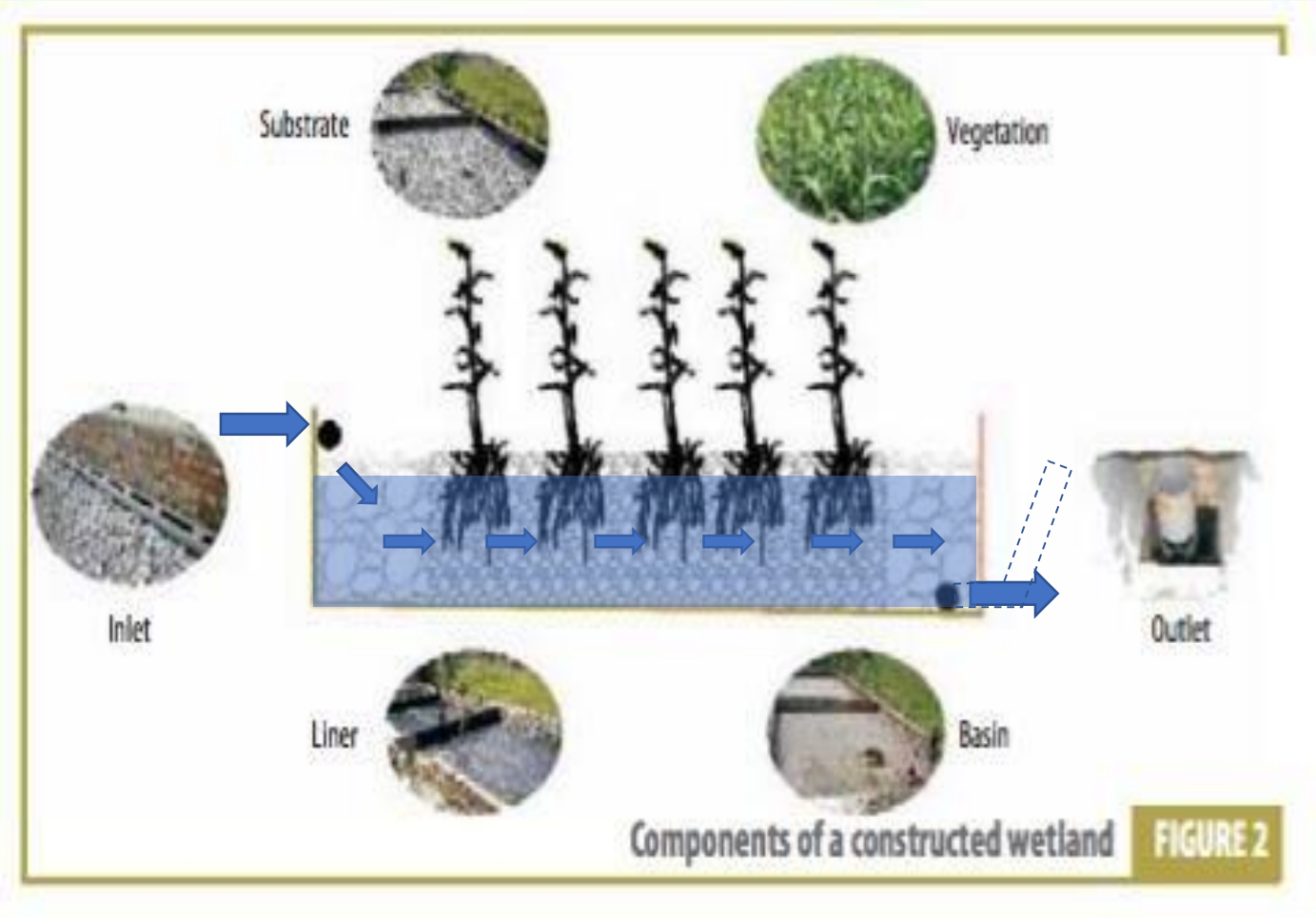
- A “natural” way of treating wastewater…so called Green Filters
- It’s artificial. A bio-mimicry. A human irony of reclaiming wetlands benefits.
- Plant based wastewater treatment systems that can be described as water channels whose surface is covered with macrophytes (or aquatic plants) planted on a bed of filter media, or covered with floating aquatic plants.
- Characterized by low initial investment costs as well as low operation and maintenance costs.

What is a Constructed Wetland? (UN Habitat, 2008)

Components of a CW:

A shallow basin filled with some sort of filter material (substrate), usually sand or gravel, and planted with vegetation tolerant of saturated conditions.

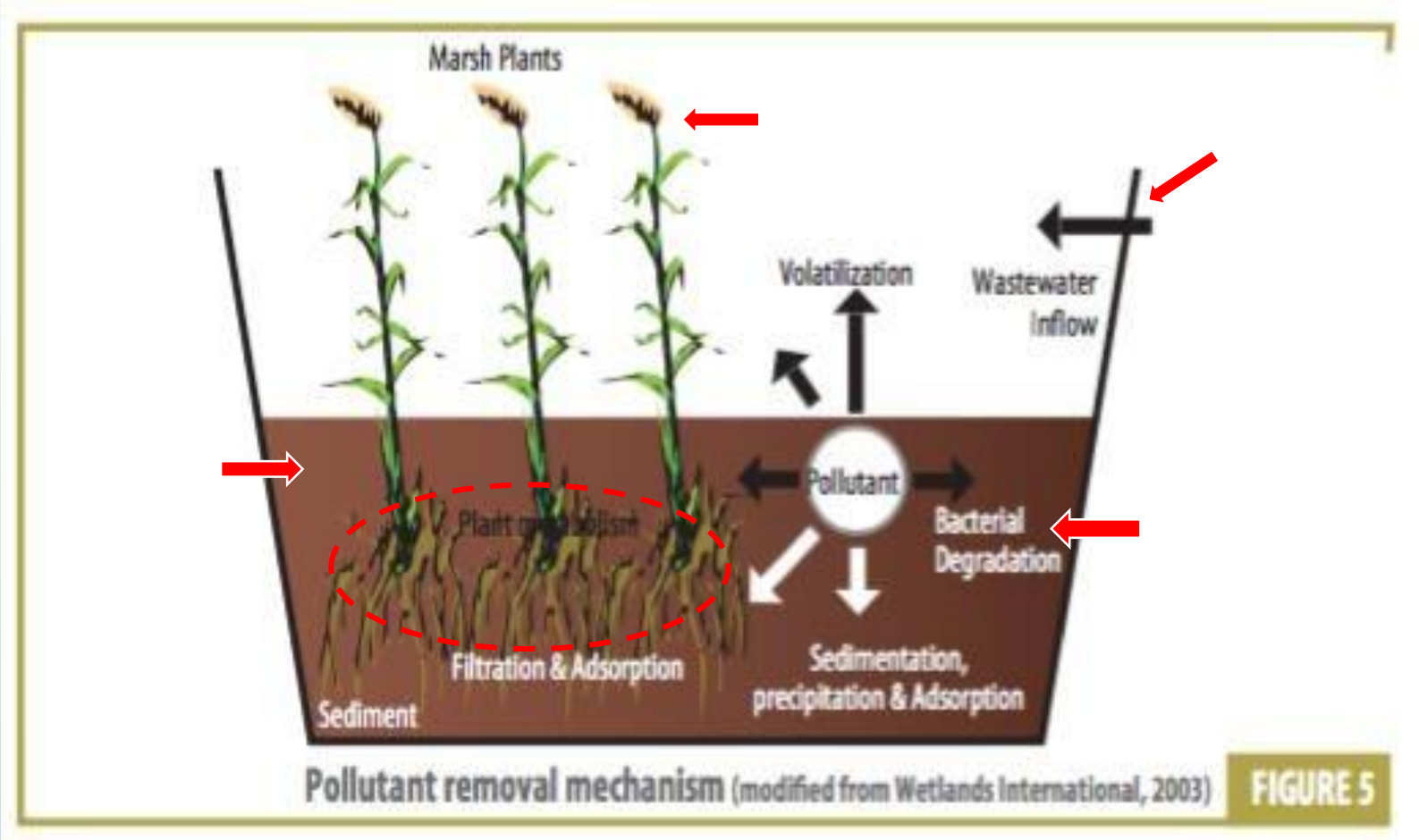
Wastewater is introduced into the basin and flows over the surface or through the substrate, and is discharged out of the basin through a structure which controls the depth of the wastewater in the wetland.



Mechanisms in Constructed Wetland (UN Habitat, 2008)

Mechanisms for pollutant removal in a CW:

- A complex assemblage of waste water, substrate, vegetation and an array of microorganisms (mostly importantly bacteria).
- Vegetation plays a vital role in the wetlands as they provide surfaces and a suitable environment for microbial growth and filtration.



Mechanisms in Constructed Wetland (UN Habitat, 2008)

TABLE 2 **Pollutant Removal Mechanisms in CW (Cooper et al, 1996)**

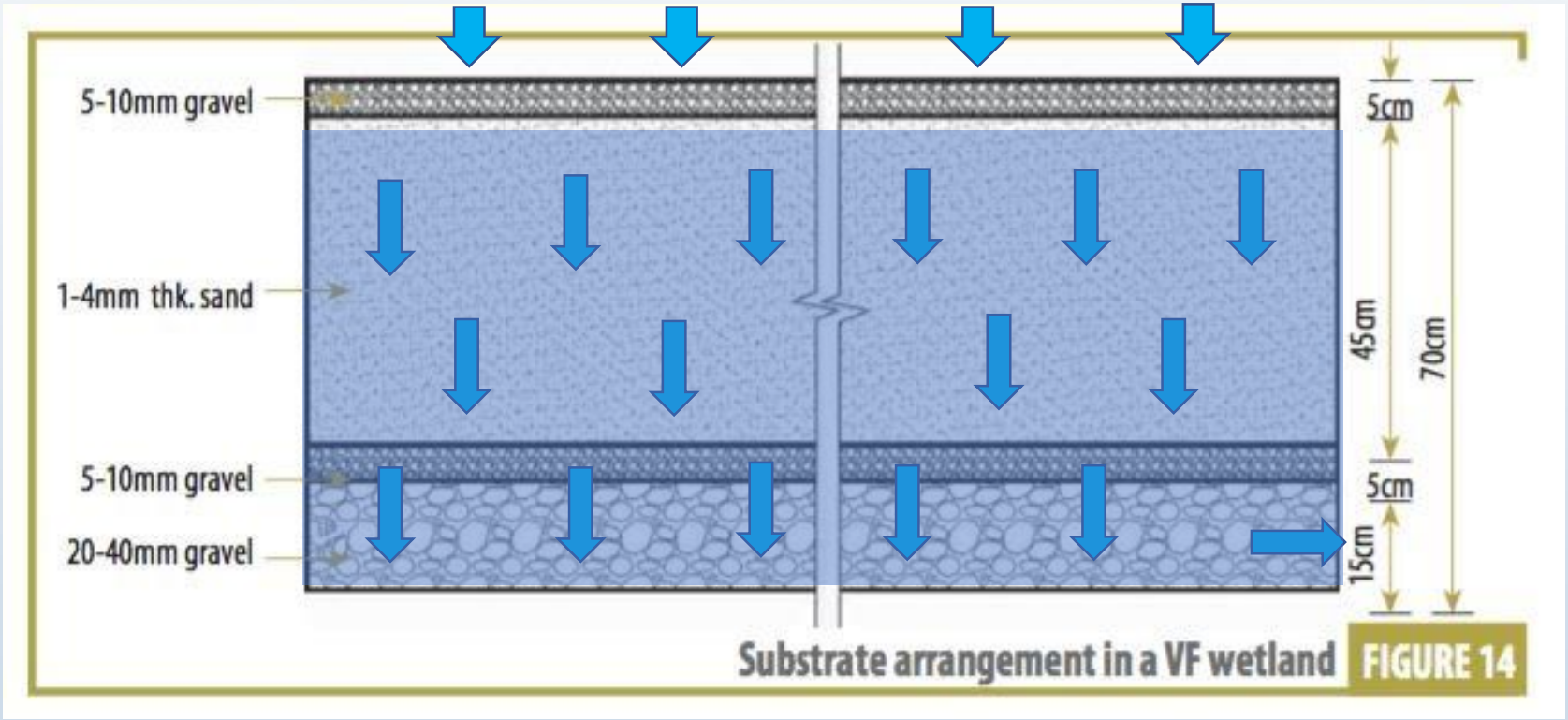
WASTEWATER CONSTITUENTS	REMOVAL MECHANISM
Suspended Solids	-Sedimentation -Filtration
Soluble Organics	-Aerobic microbial degradation -Anaerobic microbial degradation
Posphorous	-Matrix sorption -Plant uptake
Nitrogen	-Ammonification→microbial nitrification -Denitrification -Plant uptake -Matrix adsorption -Ammonia volatilization (mostly in SF system)

WASTEWATER CONSTITUENTS	REMOVAL MECHANISM
Metals	-Adsorption and cation exchange -Complexation -Precipitation -Plant uptake -Microbial oxidation/reduction
Pathogens	-Sedimentation -Filtration -Natural die-off -Predation -UV irradiation (SF System) -Excretion of antibiotics from roots of macrophytes

Mechanisms in Constructed Wetland (UN Habitat, 2008)

Substrate arrangement in a Vertical Flow Subsurface CW

Wastewater supplied from perforated pipes



Vertical Flow Subsurface Constructed Wetland (UN Habitat, 2008)

Mechanism:
-anaerobic process

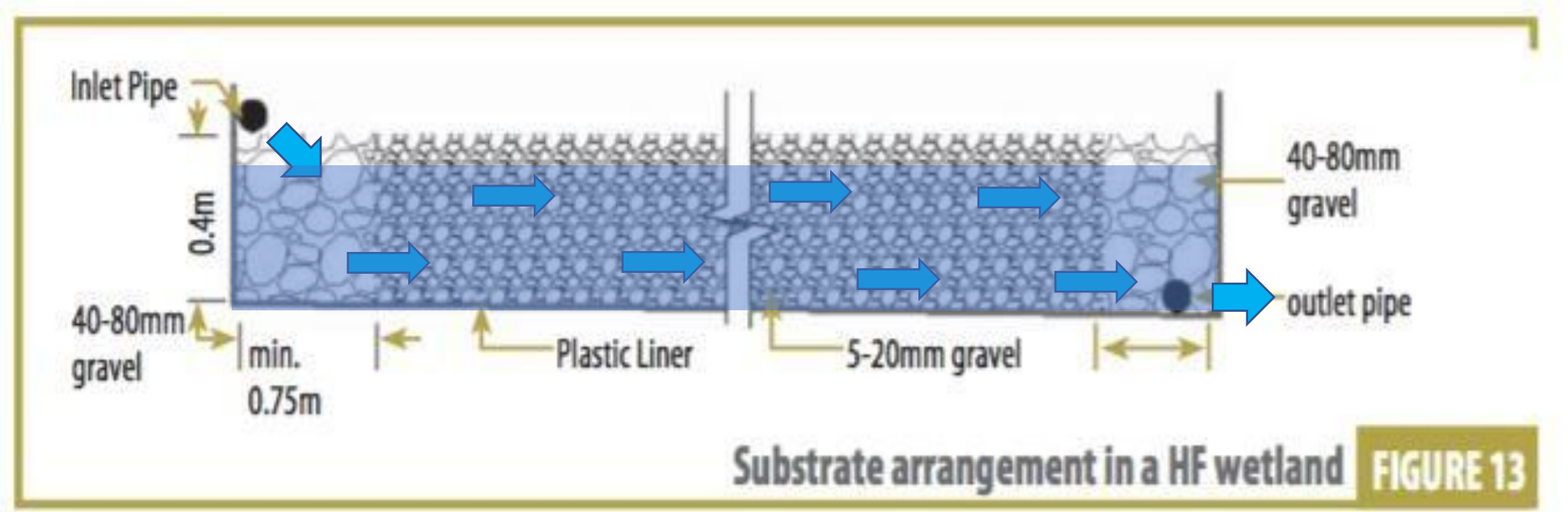
Usual application:
-low solid concentration
-BOD removal, etc.

Advantages:
-minimized odor and insects problems
-require smaller area than SF CW
-less clogging than HSF CW

Mechanisms in Constructed Wetland (UN Habitat, 2008)

Substate arrangement inside CW:

Substrate arrangement in a Horizontal Flow Subsurface CW



Horizontal Flow Subsurface Constructed Wetland (UN Habitat, 2008)

Mechanism:
-anaerobic process

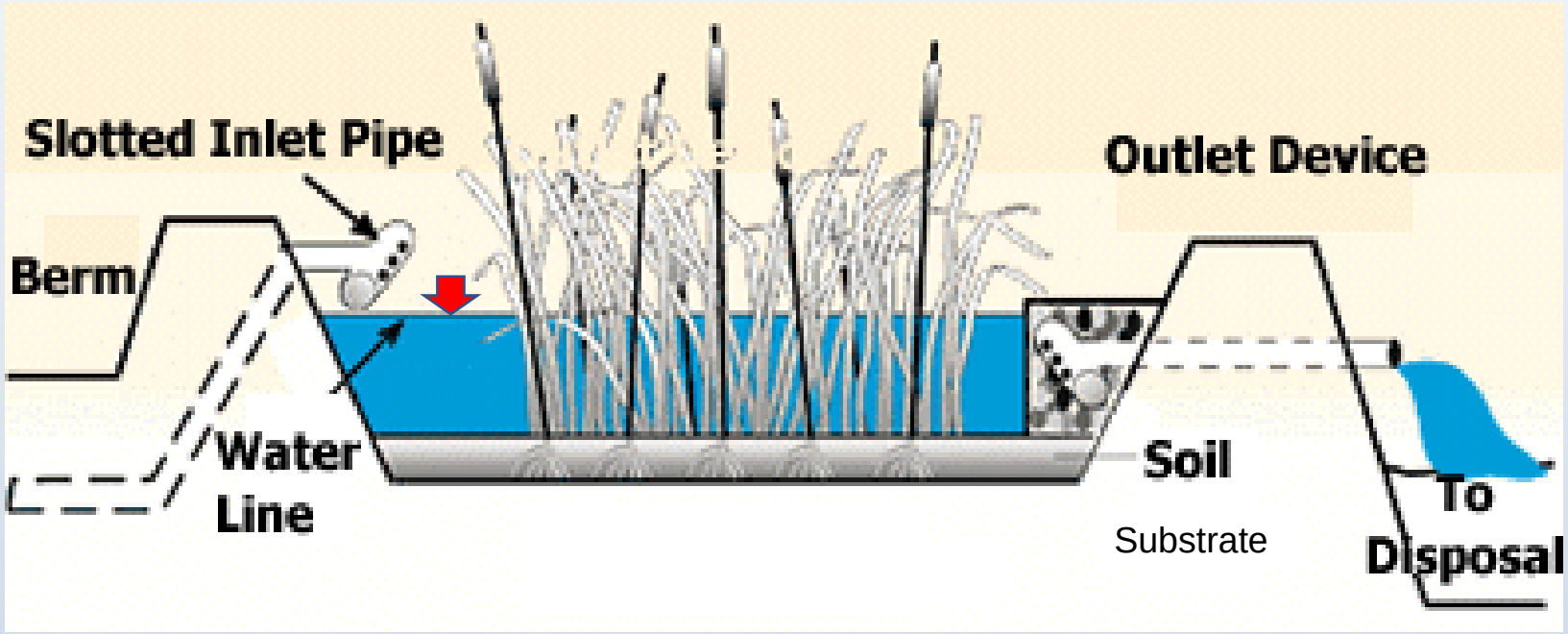
Usual application:
-low solid concentration
-BOD removal,etc.

Advantages:
-minimized odor and insects problems
-require smaller area than SF CW
-requires less frequent maintenance than VFS CW

Mechanisms in Constructed Wetland (UN Habitat, 2008)

Substrate arrangement in a Surface Flow CW

Wastewater supplied from perforated pipes



https://www.wateronline.com

Mechanism:
-aerobic process

Usual application:
-storm water, agricultural run-off, mine drainage

Advantages:
-const'n and maintenance are simple
-low capital

Mechanisms in Constructed Wetland (UN Habitat, 2008)

Examples of wetlands species

Phragmites Australis (Common Reed)

Heliconia (Birds of Paradise)

Project Partners

Life Project for Youth Foundation

An international federation founded in France and Belgium in 2009 which aims to accompany young adults into professional and social integration

Other Partners

Holcim Philippines

Global Nature Fund

KÄRCHER makes a difference

Sika®

BUILDING TRUST

Global Water Partnership Southeast Asia

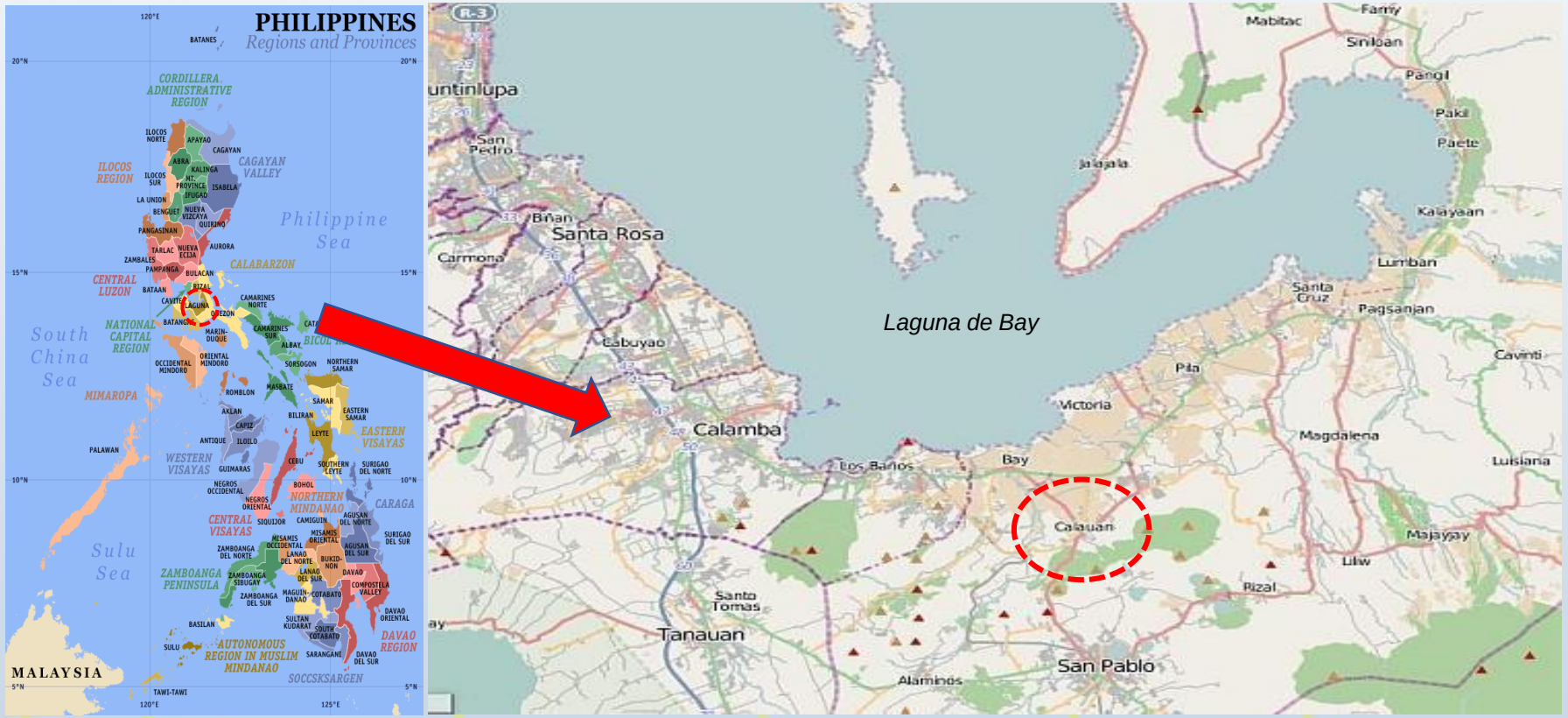
Philippine Water Partnership

Project Objectives

- To provide an economically- and ecologically-sound alternative technology for treating domestic waste
- The Green Filter system will try to achieve an overall design that blends with the natural environment according to the flow and the overall concept of the site plan and the total landscape of the eco-village.
- To increase the awareness of local communities and the LGUs on the problems caused by pollution and its effects on people and the natural ecosystems

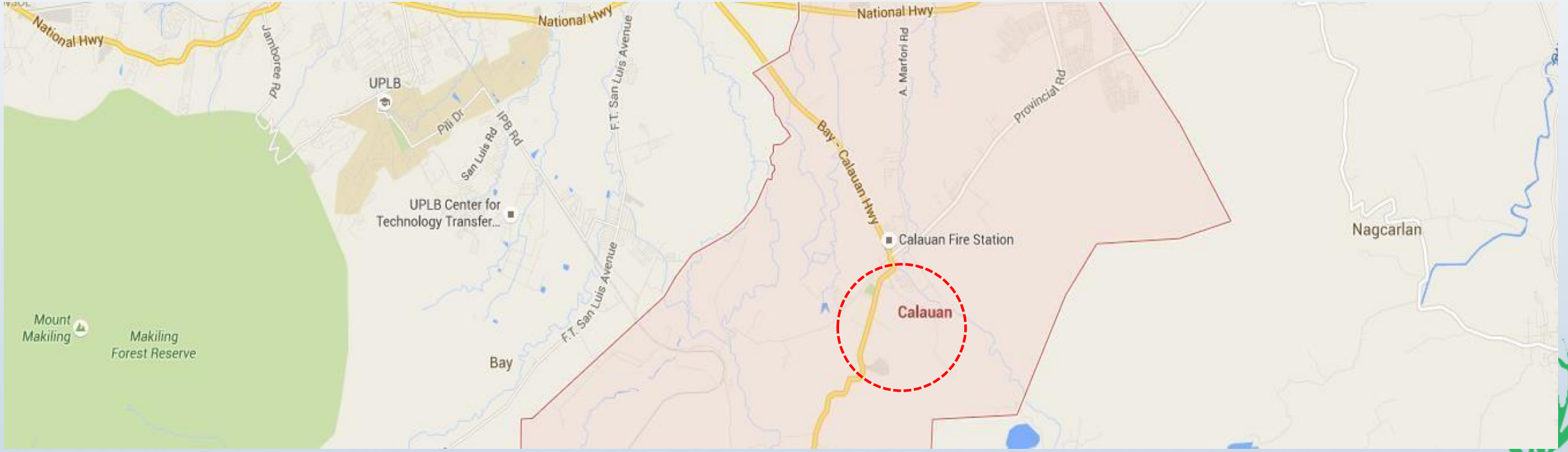
Project Site

Location: Eco-Village, Makati Home Ville, Brgy. Dayap, Calauan, Laguna, PHILIPPINES



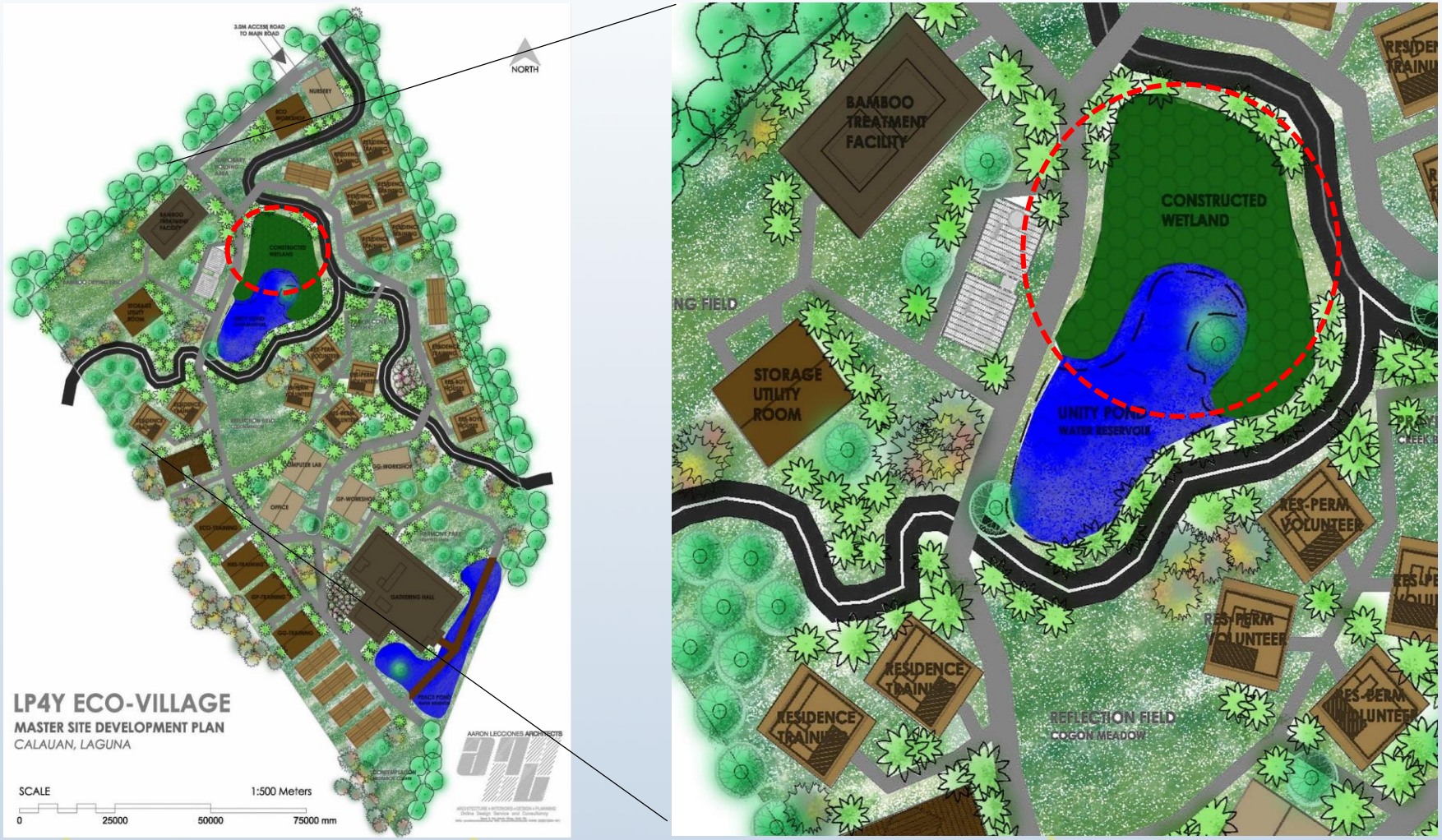
Project Site

Location: LP4Y Eco-Village, Makati Home Ville, Brgy. Dayap, Calauan, Laguna, PHILIPPINES



Project Site

Site Map


NORTH
LP4Y ECO-VILLAGE
MASTER SITE DEVELOPMENT PLAN
CALAUAN, LAGUNA
SCALE
1:500 Meters
0
25000
50000
75000 mm
BAMBOO TREATMENT FACILITY
CONSTRUCTED WETLAND
STORAGE UTILITY ROOM
RES-PERM VOLUNTEER
RESIDENCE TRAINING
REFLECTION FIELD
COGON MEADOW

Methodology and Implementation

1. Team Mobilization and other Preparatory Activities
2. Social Preparation and Awareness Raising
3. Designing the Constructed Wetland
4. Construction of Green Filters infrastructure and establishment of aquatic ecosystem
5. Monitoring of the water quality and other environmental parameters

Methodology and Implementation

1. Team Mobilization and other Preparatory Activities

- includes team formation and conduct of an inception workshop
- involves coordination with the Local Government Units and the housing subdivision owner

Methodology and Implementation

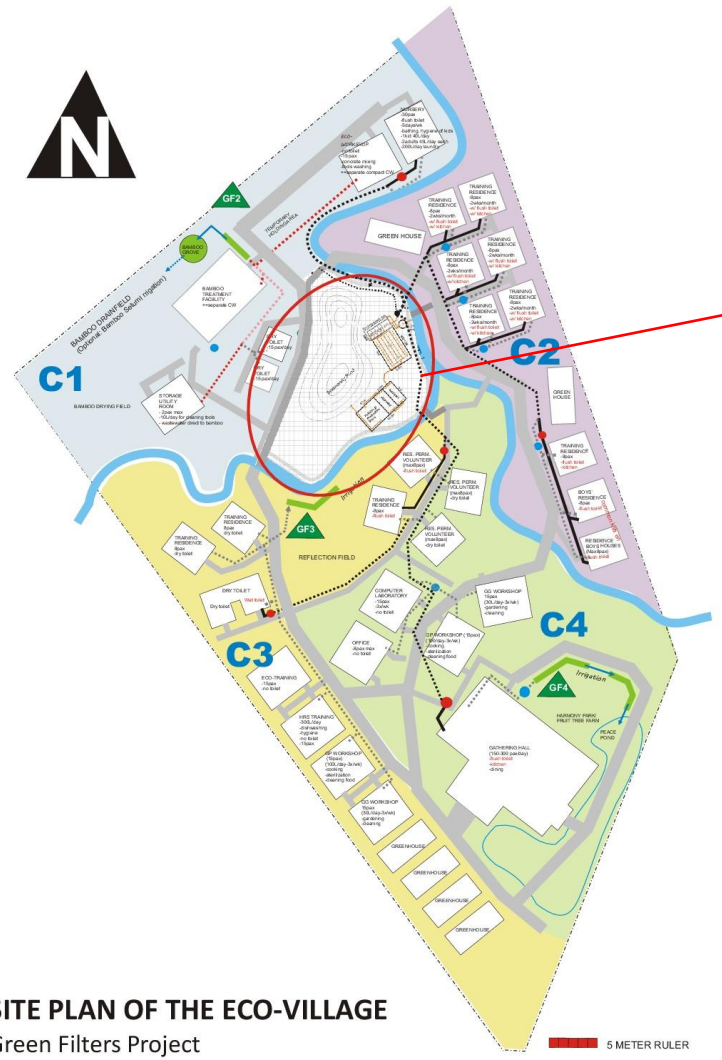
2. Social Preparation and Awareness Raising

- Communication, Education, Participation and Awareness (CEPA) activities
- Strategy to ensure the cooperation of the local community and the Barangay Officials

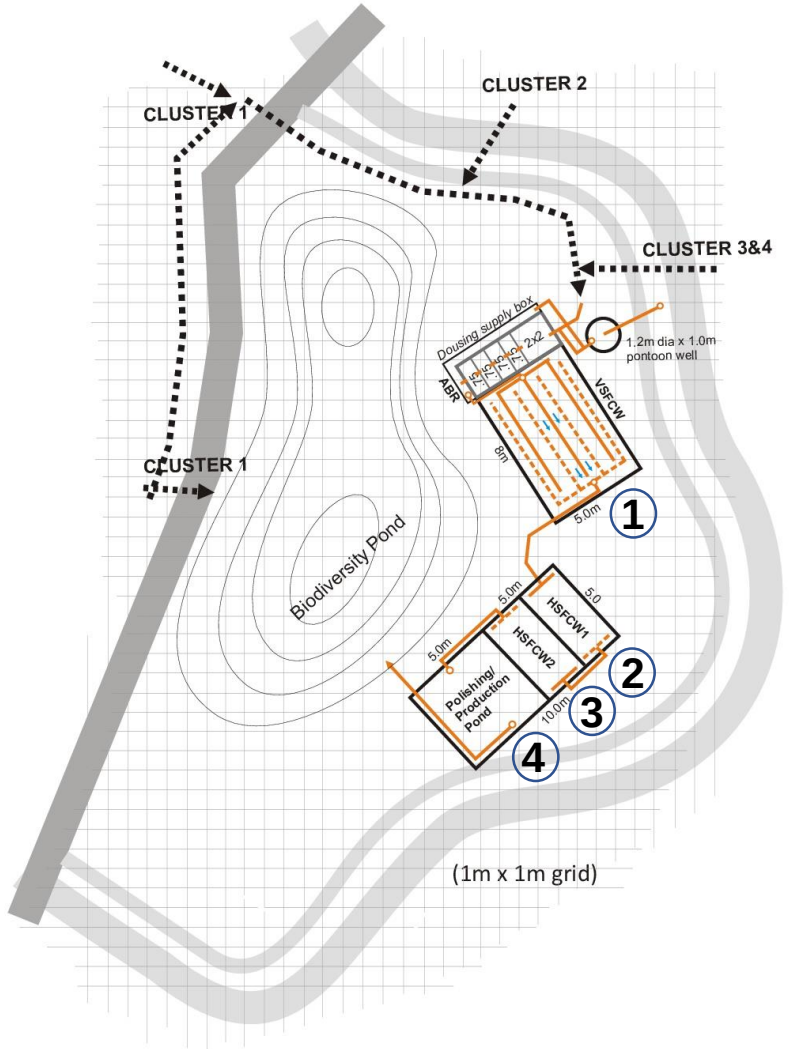
Methodology and Implementation

3. Designing the Constructed Wetland

- *Integrating the CW in the site Plan*

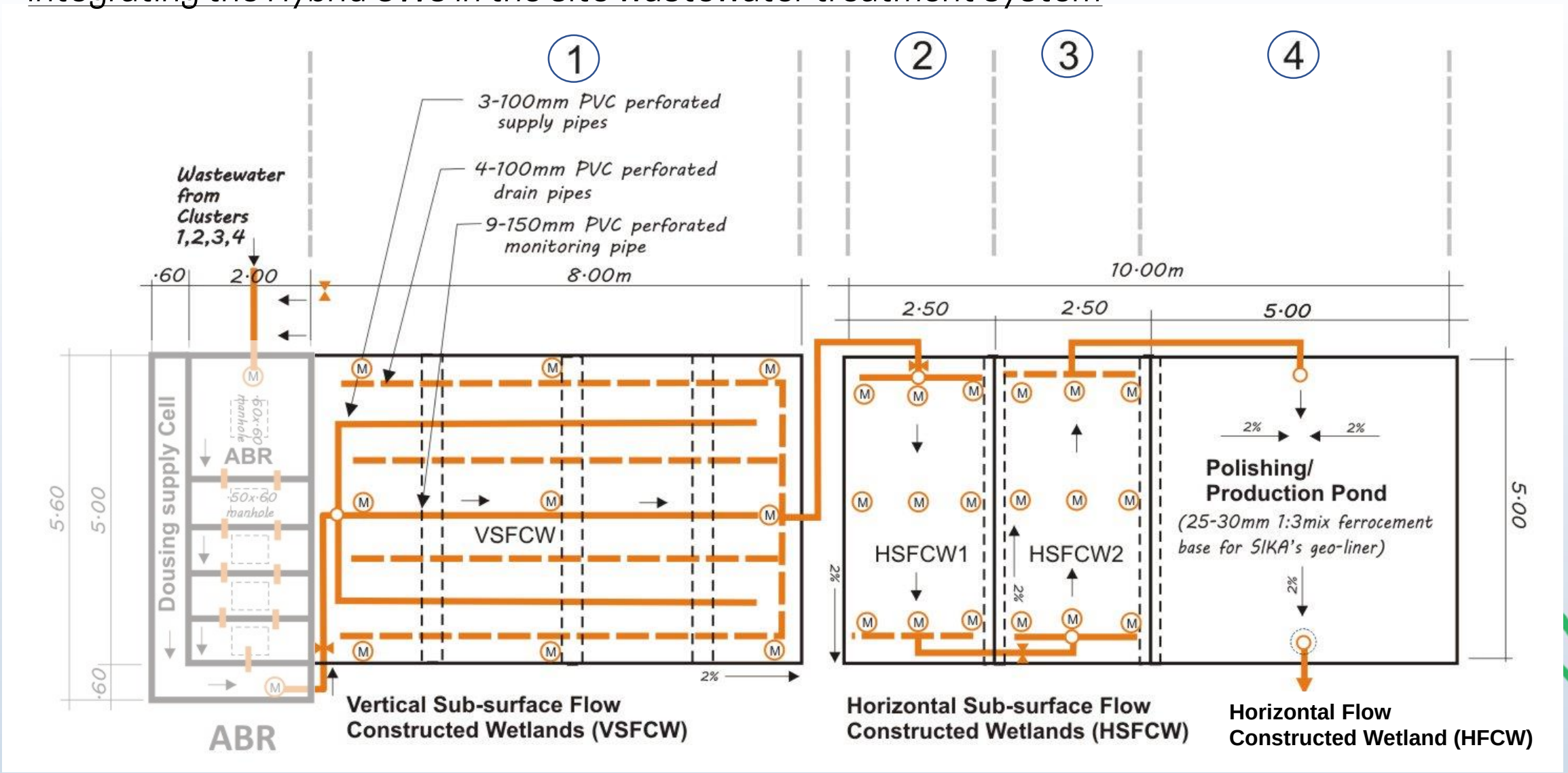


SITE PLAN OF THE ECO-VILLAGE
Green Filters Project
(SOCIETY FOR THE CONSERVATION OF PHILIPPINE WETLANDS,Inc.)

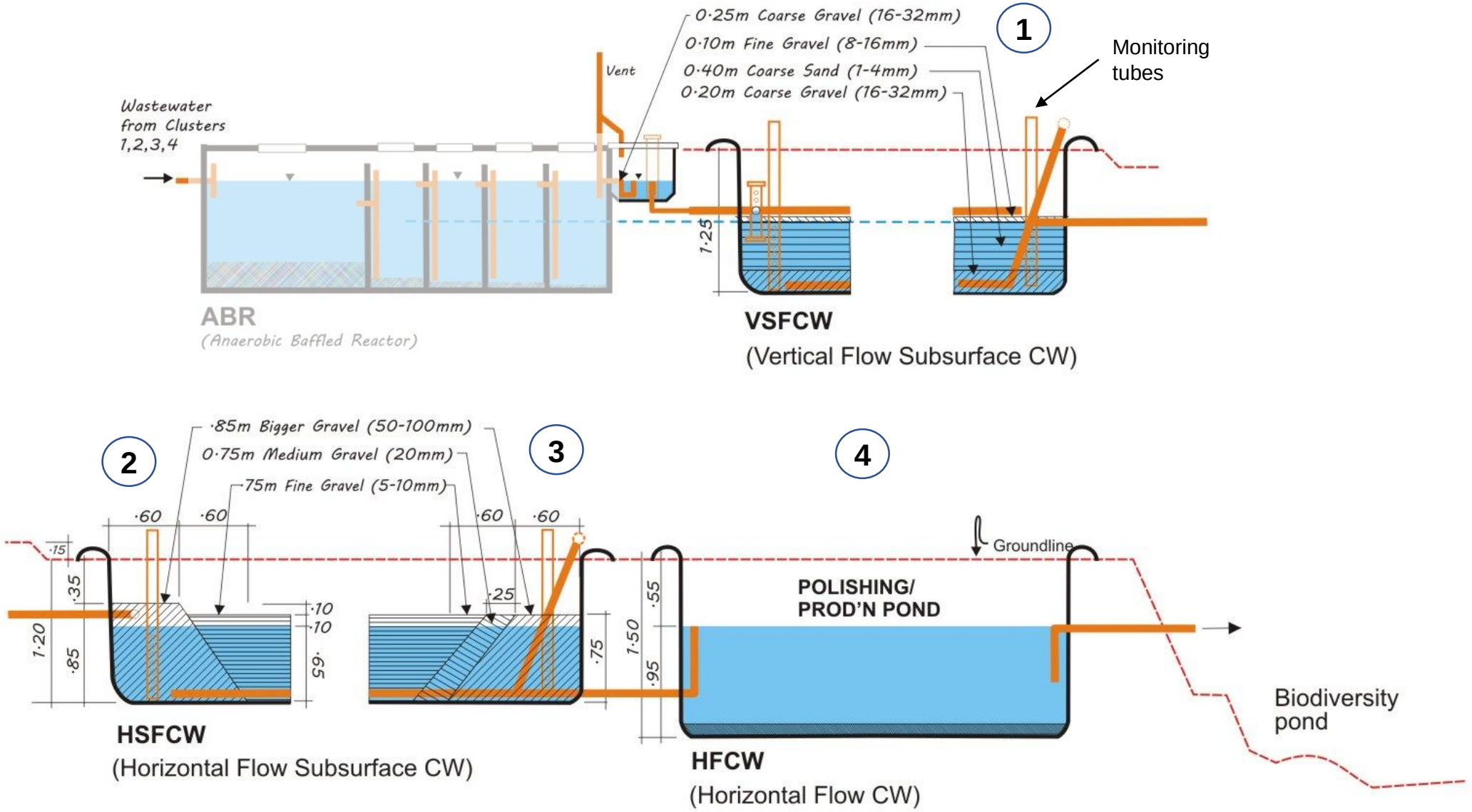


GF-1 CLUSTER SITE
Green Filters Project
(SOCIETY FOR THE CONSERVATION OF PHILIPPINE WETLANDS,Inc.)

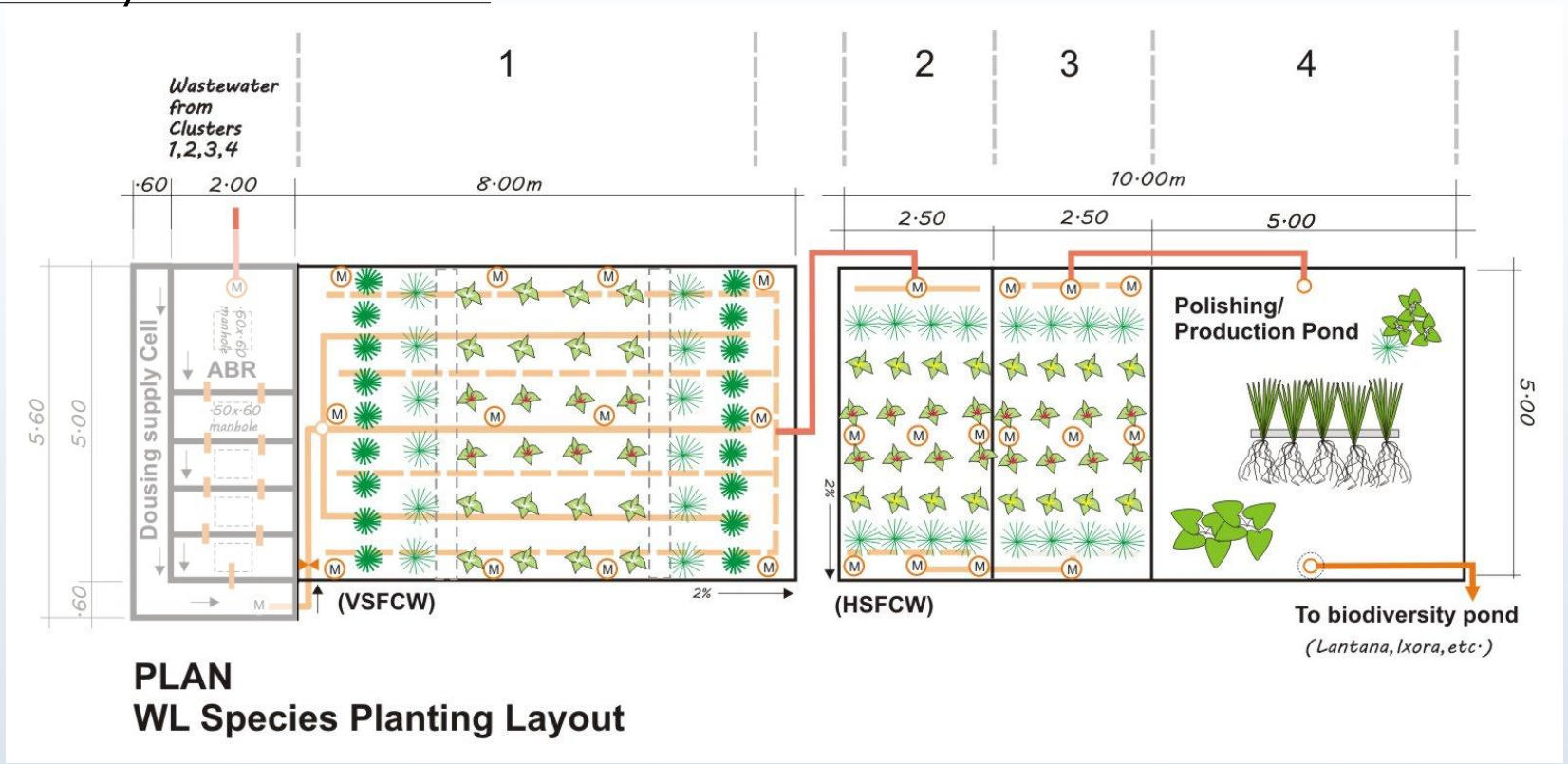
- *Integrating the Hybrid CWs in the site wastewater treatment system*



- *Schematic diagram of the CWs*



- *The plant layout for the CWs*



Canna Lily- red, yellow, white
(Canna spp·)

Umbrella plant
(Cyperus alternifolius)

Horse Tail
(Equisetum hyemale)

Vetiver grass
(Chrysopogon zizanioides)

Methodology and Implementation

4. Construction of Green Filters infrastructure and establishment of aquatic ecosystem

- selected local community members trained in the construction process as well as in the establishment of the aquatic ecosystem to ensure a pool of persons trained to construct, maintain and monitor the Green Filters


GREEN FILTERING
PONDS

Recent Developments

- The comfort rooms are built in which the toilets/showers are attached to the Green Filters system and are now operational.
- There is also a free-flowing spring water which they use within the village.
- Rainwater-harvesting facilities were also built beside the comfort rooms which also serves as an additional source of water.



Recent Developments

Feedback from the community:

- "The 1st basin is not smelling bad even on sunny weather, the water is brown (but it might be because we have some mud going in the sewage pipes)"
- "Many frogs "are swimming" in the basin and staying inside the other empty basin"

"Amphibians make good indicator species because we live in two environments, land and water, and have thin skin that we sometimes breathe through. Our thin skin can also absorb toxic chemicals, radiation, and diseases. If there are lots of frogs and other amphibians in a habitat, it means the ecosystem is healthy. If my buddies and I begin to disappear, it means our homes have become polluted or diseased and we have moved on to greener pastures."

-http://www.ecology.com/2011/11/01/indicator-species-proud/

Way Forward

- Monitoring of the water quality and other environmental parameters

  - A monitoring system including method, frequency, and reporting will be designed for water quality and other environmental parameters to ascertain the effectivity of the constructed wetlands and the improvement of the surrounding ecosystem.

- Continue with improving the natural landscape

  - Advise and guide the community to start the planting and blending the landscape elements of the site with other locally available wetland plant species to improve the biodiversity of the site.

Thank you!