

AXO-PHYT : Regeneration by Design

Systemic Problem



Located in the south of Mexico City, **Xochimilco preserves the last remaining agricultural paradise of chinampas from the Aztecs in Tenochtitlán.**

Part of UNESCO's World Heritage Sites, the chinampas are artificially made pieces of land floating within the lakes and waterways, forming a gridded system of canals with thriving vegetation.

Over the last three decades and as a result of urban expansion and lack of regulation, **many informal settlements have illegally occupied the land, causing significant pollution in the waterways due to poor management of organic and inorganic waste, affecting wildlife and residents.** Nowadays, they represent 48.71% of the total population of the borough and their impact is severely damaging the ecosystem.

Furthermore, several contextual facts also affect the area, such as children of the "chinamperos" (the people in charge of agriculture in the Chinampas) leaving the area to find new careers and interests. Additionally, the competition between local agriculture and large-scale companies, which has resulted in 1,000 hectares of abandoned chinampas. This circles back to the illegal settlements, because with the empty land, other people move illegally and occupy it.

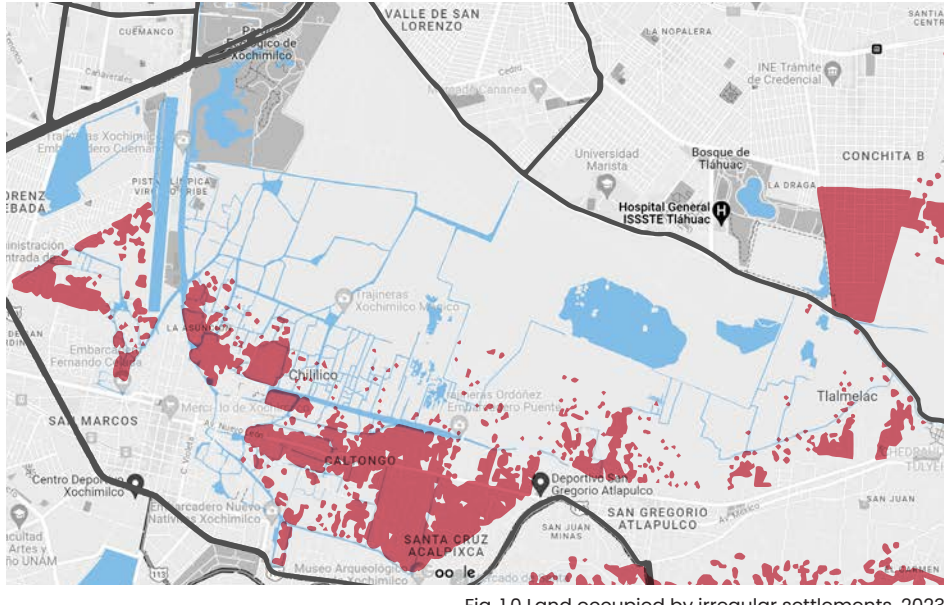


Fig. 10 Land occupied by irregular settlements, 2023

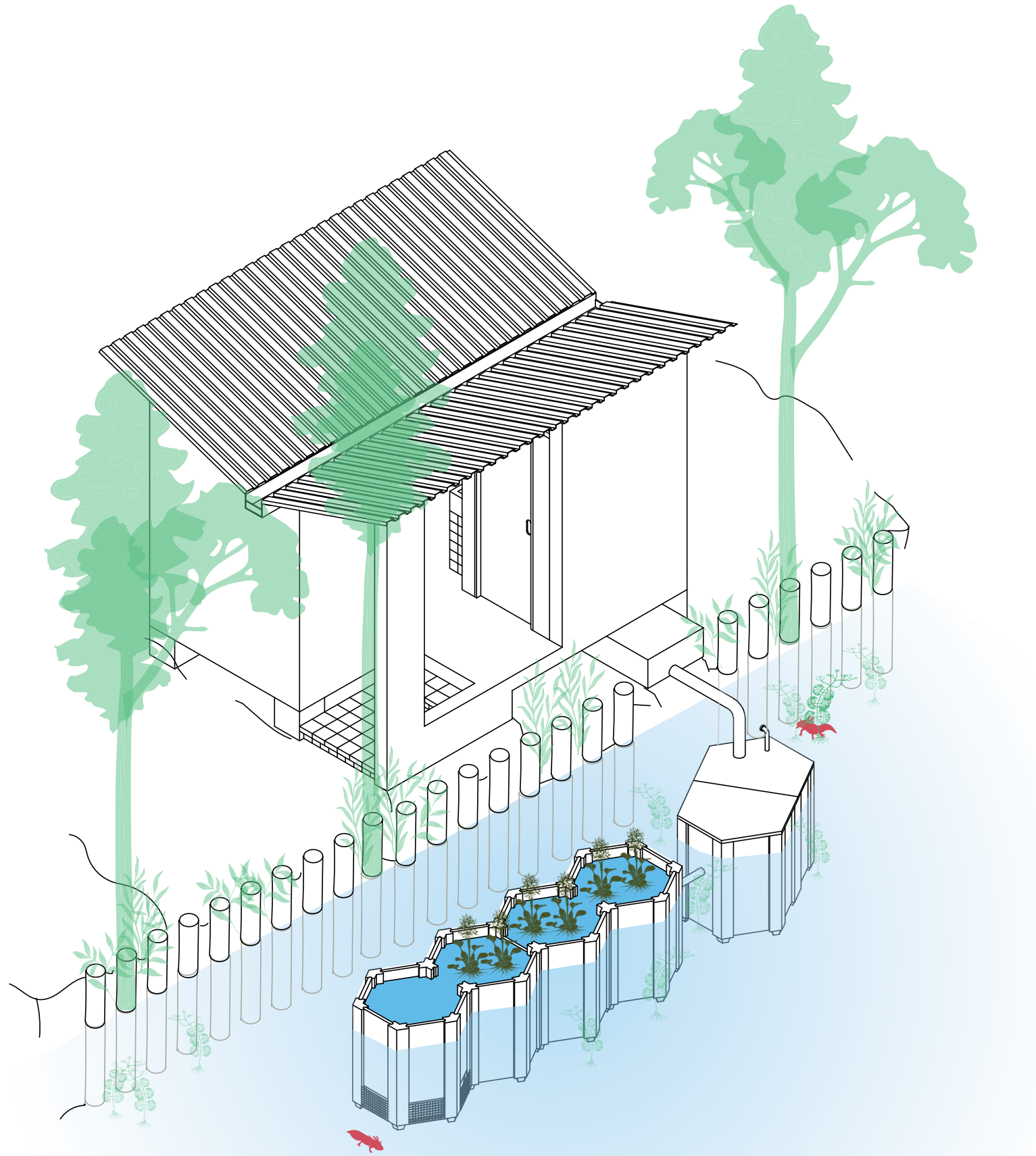


Design Solution

The proposal to mitigate this systemic problem is a **self-sustaining bathroom with a natural filtration system.** Local families can use it every day for their basic hygiene needs and from that use, the black and grey water can be disposed of through the filtering water system in order to be cleaned of toxins and pollutants and then reintegrated into the waterways of Xochimilco without damaging the ecosystem.

The overall design is intended to fall into the designated area with care, meaning that materials are to be sourced locally, and manufacturing has been thought through to be able to involve the community as much as possible. By involving the future users of the system from the installation process onward, they will develop a stronger sense of responsibility and care for its maintenance.

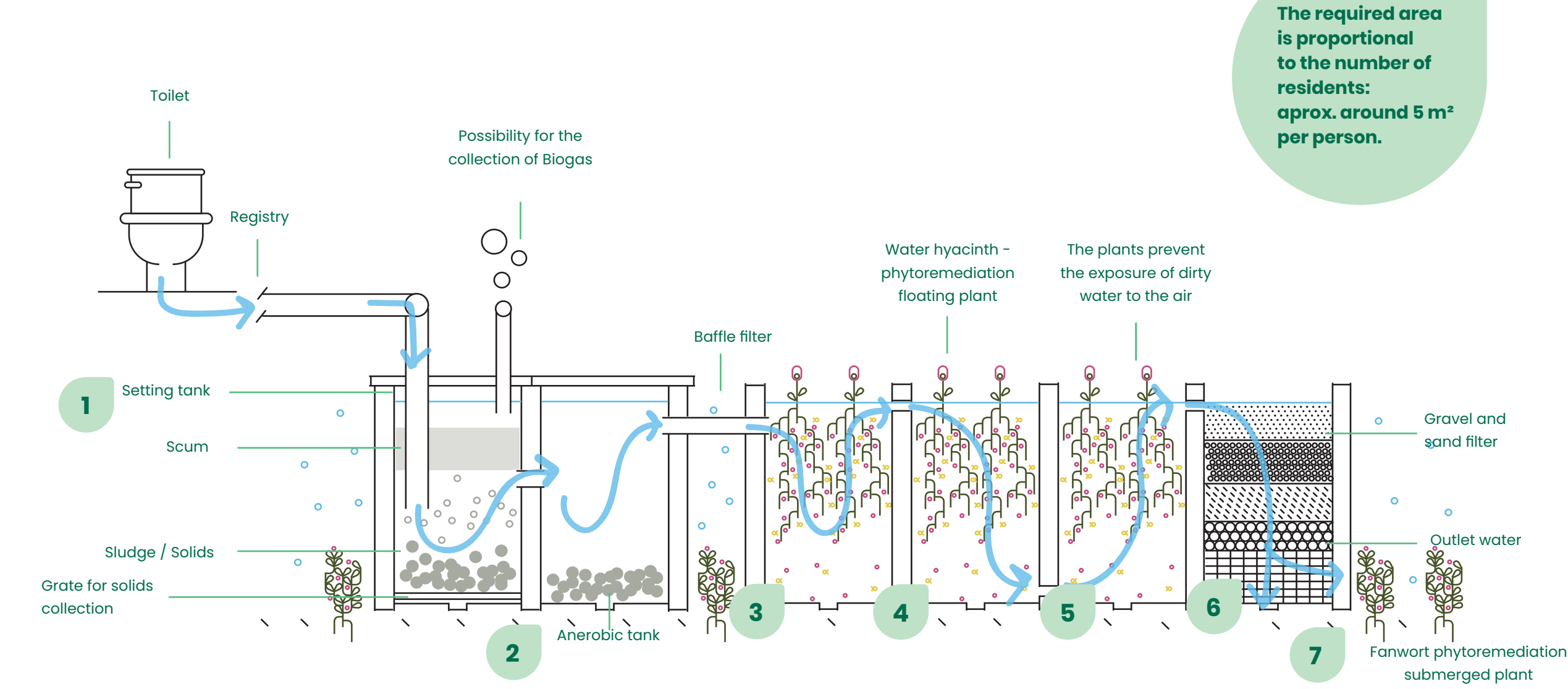
Placed in the chinampas, the system is an intervention needed in an ecological paradise in order to keep preserving the water balance and harmony.



Design Solution – How it works

Gravity system for toilet with biofilter for sewage water

The effluent flows to the right, as indicated by the arrows.
- **The filter needs to be cleaned every 6 – 12 months.**
- **The setting tank needs to be emptied every 3 years.**

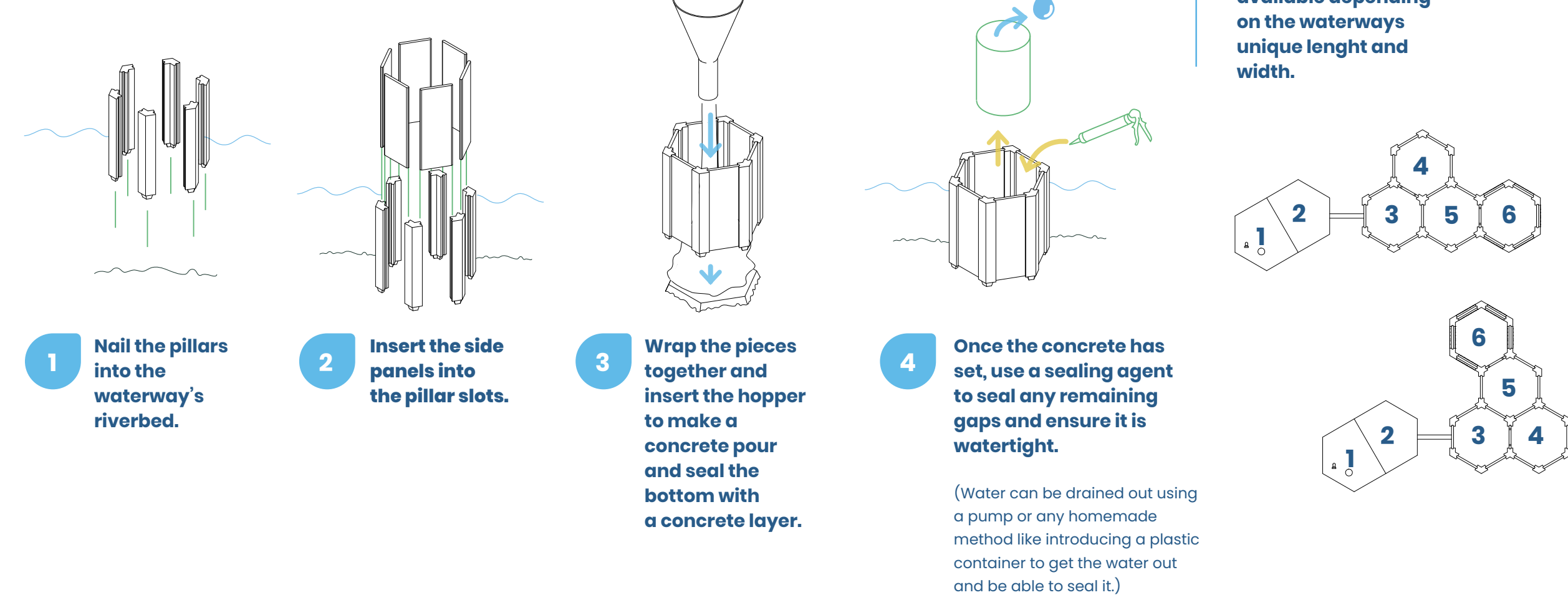


The required area is proportional to the number of residents: **aprox. around 5 m² per person.**

- 1** All solids settle as sludge which is decomposed by microorganisms. Gases are formed through anaerobic digestion of wastewater solids and exit by diffusion.
- 2** Anaerobic tanks help separate the remaining solids and further digest the sludge material.
- 3** Tanks with floating wetland plants get their CO2 and O2 from the atmosphere and absorb pollutants in the water through the microorganisms in the roots, which feed on pollutants and heavy metals. The biological activity breaks down waste and absorbs excess nutrients.
- 4**
- 5**
- 6** A final gravel and sand filter further cleans the water in the enclosed area before passing as it goes through the membrane.
- 7** Submerged plants absorb O2 and CO2 from the water column. They help oxygenate the water and absorb remaining pollutants.

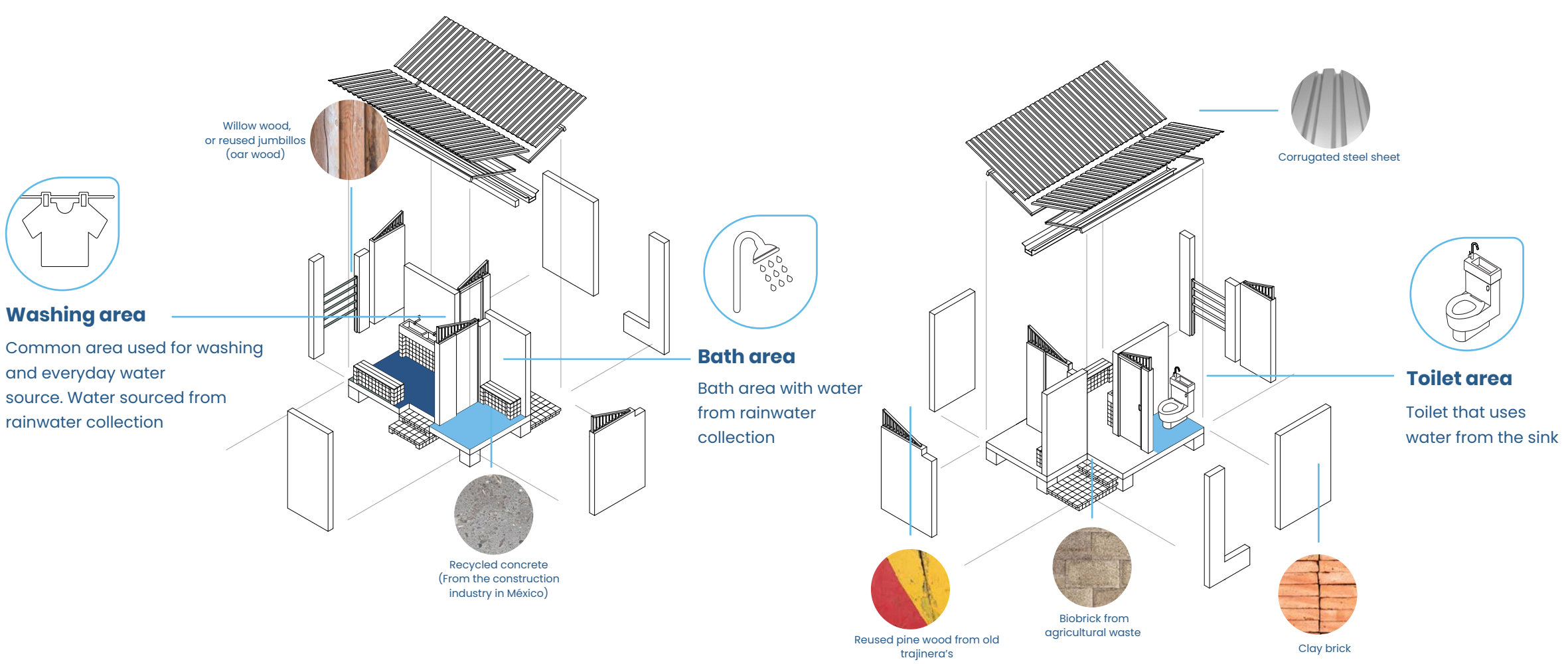
Installation – How it's built

Hexagon modules



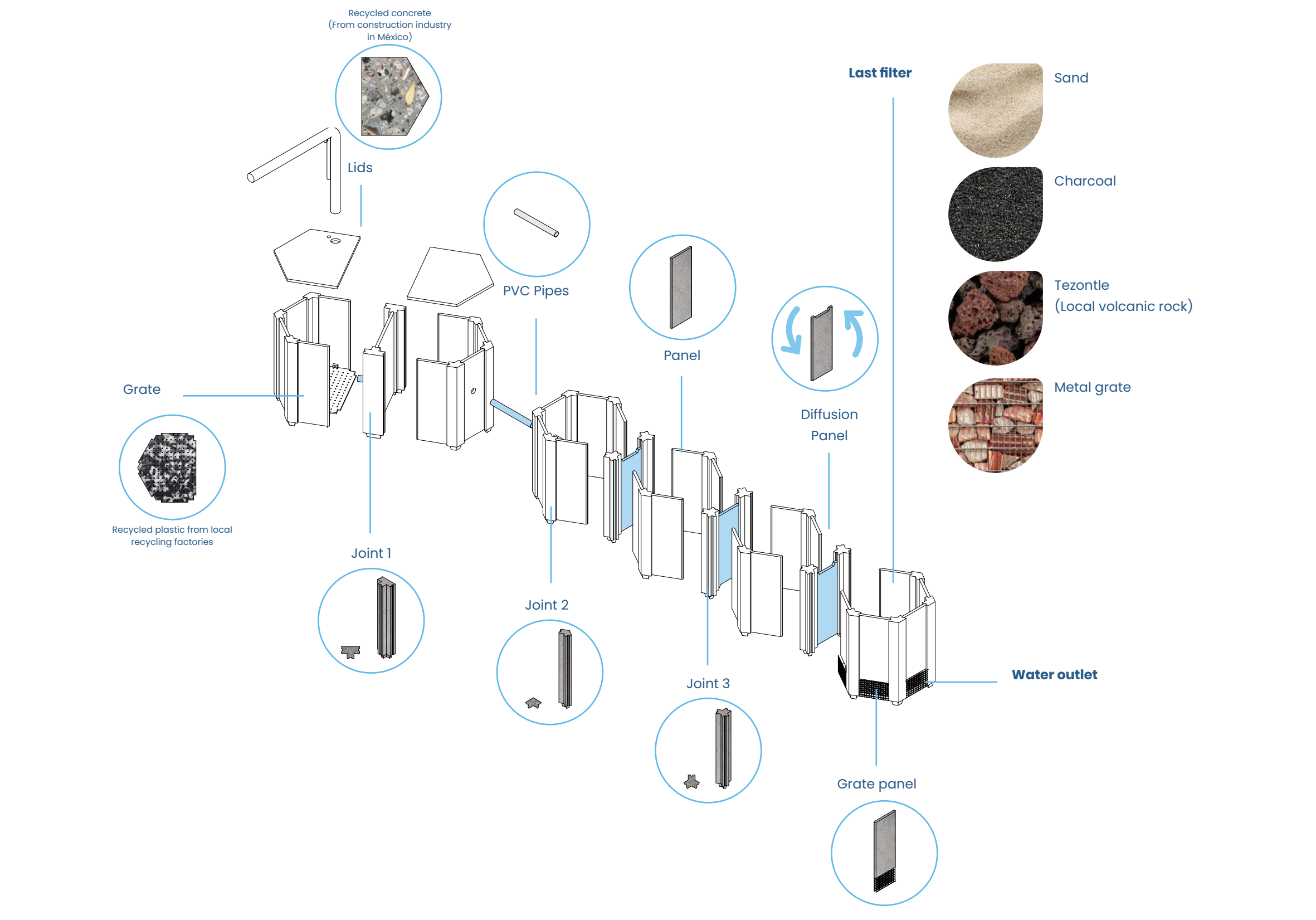
Bathroom functionality

Integrating alternative systems and area divisions



Installation – System Parts

Pipes and connections

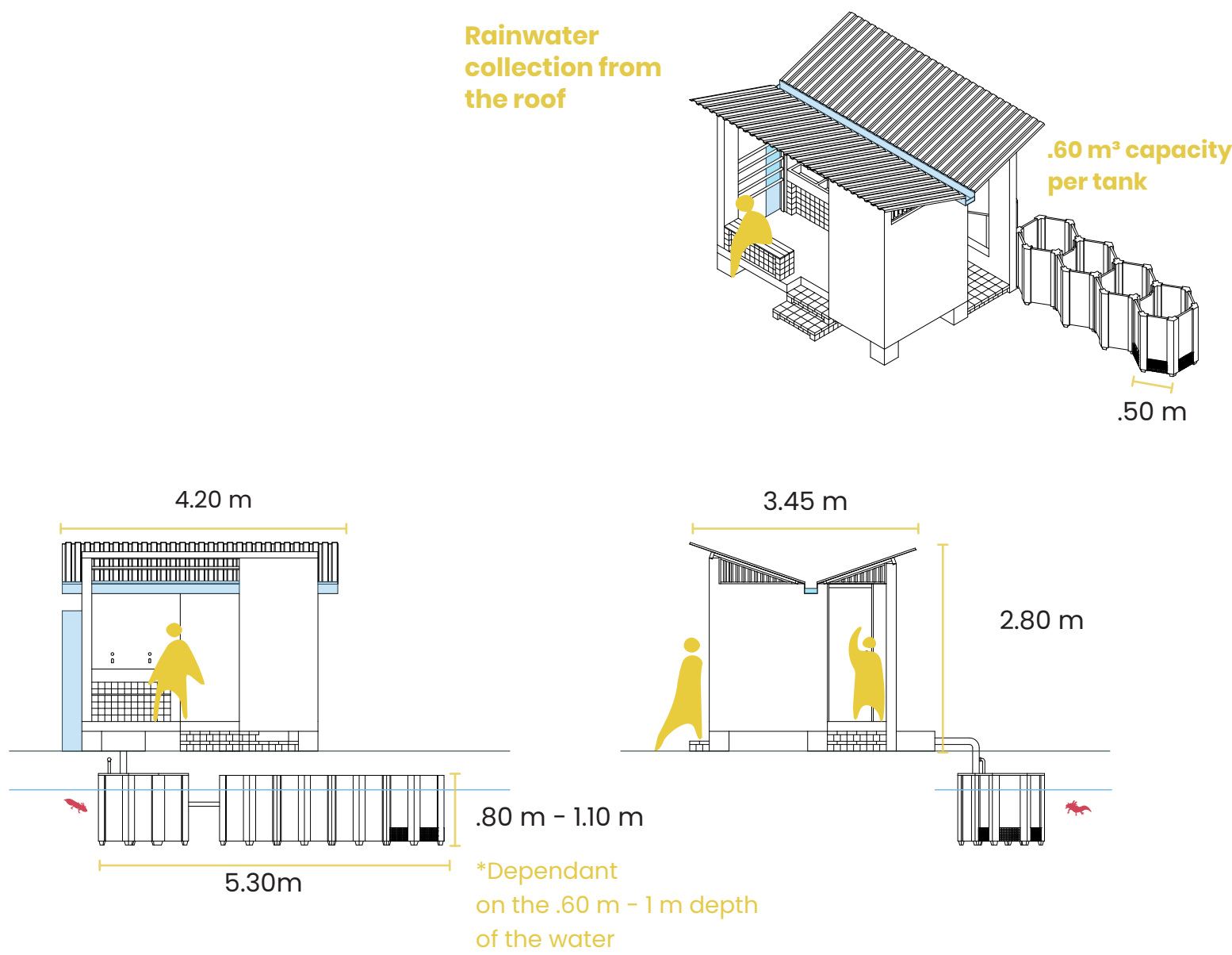


Context – How it's used

Living in synergy

The diagram shows a bathroom module for a small (1 – 4 person) family to be used in the system.

The proposed measurements of the configuration of this particular system use 1.05 m ϕ circumscribed hexagons, and a total of 6 tanks (with different filtering purposes). This means that 0.5 m³ of water is filtered per day and released back to the waterways through diffusion.



New Possibilities

Household
Basic household bathrooms for different numbers of users can have different configurations in the system's hexagonal tanks depending on the number of people in the household.

Community
Larger and better-equipped bathrooms could be developed as bathhouses for several families or closer communities. Bathhouses and shared bathing spaces can serve as places for the community to gather and relax.

Tourists
With the tourist industry being so large and active in the area, bathrooms for tourists could also be thought of with the addition of this system. Currently bathrooms are in poor condition and suffer from sewage issues. This could be a better way to welcome tourists while promoting sustainable toilet use.

