DESIGNING A TREATMENT PROCESS CHAIN

In order to ensure a targeted level of discharge, a single treatment process (e.g. a first stage of vertical flow treatment wetland) may be implemented or may need to be combined with other processes. The succession of several treatment steps constitutes a treatment process chain. A treatment process chain may also include water recirculation loops between different stages. The choice of treatment process chain is based on the technical coherence of the combination of processes and on local constraints.

LOADS TO BE TREATED

The first step in defining a treatment process chain is to estimate the loads that the facility will receive. It is therefore necessary to define the population concerned and its evolution over time. Variations in the load variations due to rainy weather or seasonal populations must also be determined.

FIRST STAGE TREATMENT AND MANAGEMENT OF SLUDGE

Not all processes are suitable for receiving raw water directly (e.g. horizontal flow treatment wetlands and second stage of vertical flow treatment wetland). The choice of the first stage of treatment leads to a choice of sludge management. The installation of a treatment wetland that accepts raw wastewater allows simultaneous treatment of sludge and greatly facilitates its management (sludge withdrawal every 15 to 20 years in tropical climates). The installation of a decantation system (septic tank, Imhoff Tank) involves regular management and treatment of liquid sludge at a dedicated site. Therefore, treatment process chains should be chosen with sludge management in mind.

TREATMENT EFFICIENCY

The target level of discharge is an important factor when defining the treatment process chain. Depending on regulations, the sensitivity of the waterbody, and the reuse objective of treated wastewater, treatment requirements may vary. While treatment wetlands can easily deal with Carbon pollution (TSS, COD, BOD) and nitrification (KN), the treatment of overall nitrogen, phosphorus and pathogens requires a more elaborate treatment process chain.

For carbon treatment and nitrification, a more compact, robust, odourless aerobic treatment process chain is generally preferred. On the other hand, the treatment of total nitrogen requires a denitrification step that occurs in anoxic conditions. This involves implementing a treatment process chain that includes a saturated zone at a point where nitrates and carbon are available.

Phosphorus treatment is generally low in treatment wetlands. In order to achieve intense phosphorus treatment, it is necessary to either install a reactive material in the filters to promote adsorption and precipitation reactions, or to add a physico-chemical precipitation step with an appropriate reagent (e.g. FeCl). This makes the treatment process chain more complex.

The treatment of pathogens is about 1 to 3 log units for so-called passive systems and therefore does not allow for the very high levels of treatment required in some cases of reuse. Systems with forced aeration can achieve treatment levels of over 4 log units. To go even further it may be necessary to add a final disinfection step (e.g. UV). This requires installing an upstream treatment chain that guarantees a low level of TSS to ensure effective disinfection

THE LOCATION

The location of the site strongly influences the types of treatment process chain envisaged. A limited available surface area can strongly restrict the number of treatment stages. The depth of the water table and ease of soil excavation impact the depth of the treatment wetland. In addition, depending on the system, the slope of the land impacts the ability to operate by gravity. Finally, the accessibility of the site can have an impact on the operation and the construction phase, potentially leading to favor treatment chains of simple construction and operation modes.

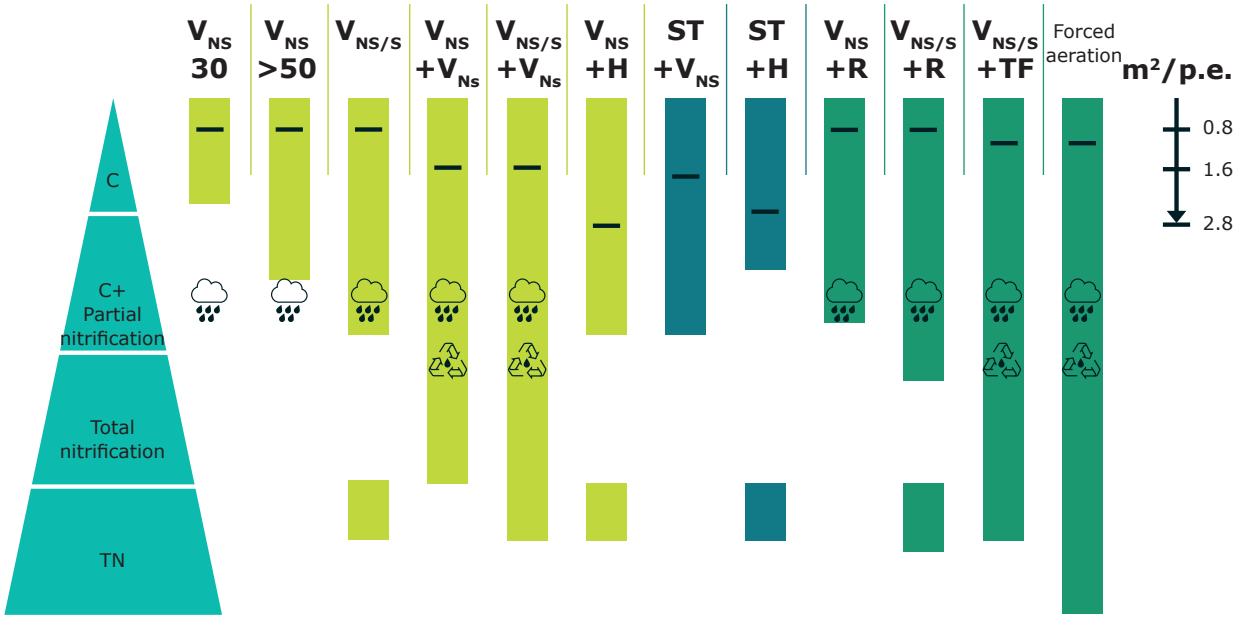
ELECTRICITY

If electricity cannot be delivered or produced on site, some energy-intensive processes (recirculation, forced aeration, etc.) should be avoided.

AVAILABLE MATERIALS

Depending on the processes, different types of materials - especially porous media - are required. If materials that meet the processing requirements are not available locally, or at a reasonable price, some processes may be excluded from the definition of the treatment pathway.

The following figure shows an example of the different process chains that can be employed in treatment wetlands in tropical environments and their main characteristics in terms of surface area, power requirements, robustness to storm events and achievable discharge levels.



	Can accept storm events	V_{NS}	Vertical no saturated	+R	+ Recirculation
	Reuse treated wastewater	$V_{NS/S}$	Vertical no saturated/saturated	+TF	+ Trickling Filter
	By gravity	H	Horizontal	C	Carbon
	Fecal sludge managment	ST	Septic Tank	TN	Total nitrogen
	Electricity needs				