

Sub-surface flow wetland in the Merru neighbourhood of Ibarrangelu

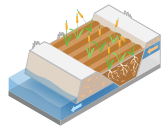
The Merru district (within the municipality of Ibarrangelu) had an issue, as the wastewater generated by the scattered farmhouses frequently caused diffuse and uncontrolled dumping on the land. Faced with this situation, Ibarrangelu Town Council proposed to implement an ecological phyto-purification system as a solution.

The system implemented collects the wastewater flows from the farmhouses in the Merru district into a new separate sewage network. The wastewater is then treated in an artificial wetland with sub-surface horizontal flow macrophytes. This type of solution is highly efficient, does not generate odours or noise, has a long service life, does not consume energy, and can generate an effluent that is suitable for reuse.



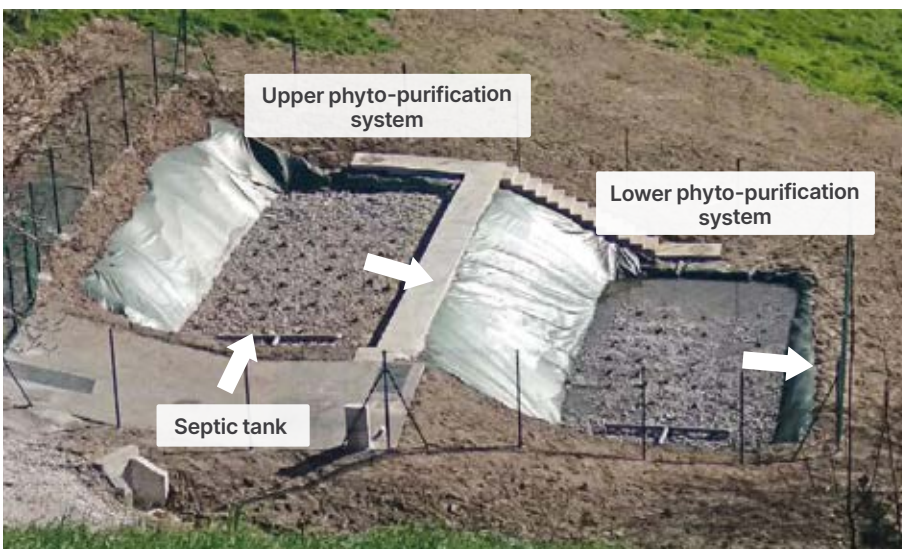
General view of the artificial sub-surface horizontal flow wetland using macrophytes in the Merru district.

Type of NBS implemented in the intervention



Phyto-purification system

Consisting of a septic tank for pre-treatment and a sub-surface horizontal flow wetland, sized for the **equivalent of 40 inhabitants**. Waterproofing is provided between the ground and the two wetlands with a high density polyethylene (HDPE) sheet that is more than 2 mm thick to prevent it from being perforated by plant roots and rhizomes, protected both below and above by a 300g/cm² geotextile sheet. A layer of sand has also been spread over the base of the basin to create an even surface and protect it. The HDPE sheet is anchored to the ground at the gravel level to prevent root systems from affecting the geotextile slopes. The anchoring trench is 1 m wide where the waterproof sheet is inserted and filled with soil to bury the sheet.



Phase I. Pre-treatment in a septic tank for roughing, desanding, and degreasing the wastewater, as well as providing primary treatment.

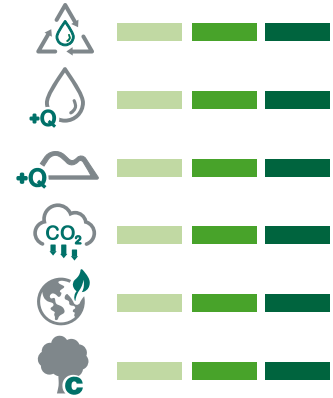
Phase II. Phyto-purification. Sub-surface horizontal flow wetland formed by two basins with a **surface area of 40 m²** (each measuring 4 m wide x 10 m long), with a 60 cm thick bed of coarse gravel (>100 mm grain size) and medium gravel (20-40 mm grain size), and reed plantations (4-6 plants of *Phragmites australis*/m²) found in the local area. This sizing is included within the range established for this type of treatment system (2-5 m² per inhabitant equivalent), taking into account the present scenario and future potential.

CLIMATE THREATS



CO-BENEFITS

Environmental



Social



Economic



SDG



Phase III. Discharge of treated effluent to the land: A manifold has been designed with three outlets at different heights, which allows the level of the pond to be maintained according to the wastewater requirements. This also allows the retention times and level of waterlogging to be controlled, which is usually kept about 10 cm below the level of the aggregates, preventing the water from being visible.

The treated effluent complies with the conditions to be discharged into the natural terrain in accordance with Royal Decree 509/1996 of 15 March, implementing Royal Decree-Law 11/1995 of 28 December, which establishes the rules applicable to urban wastewater treatment and the discharge limits to be complied with taking into account the characteristics of the municipality.

Filter trenches have been installed to discharge the effluent into the ground in a controlled and regular way. These ditches are outside the fenced area to allow them to be used as grazing areas.



Lower basin of the constructed wetland, showing the gravel filtering substrate with different grain sizes and a thickness of 60 cm, in which the aquatic vegetation is planted.

The wetland maintenance operations consist of cleaning the water distribution and collection structures, and controlling the vegetation in the basins which involves regularly removing reeds exposed above the water level. With regards to the septic tank, sludge collection is required on a 2-yearly basis.

The expected effluent yield (%) obtained from the implemented treatment system has the following general parameters:

BOD ₅ (mg/l)	COD (mg/l)	SS (mg/l)
70-90	75	90

BOD₅: Biological oxygen demand
COD: Chemical oxygen demand
SS: Suspended solids



Agents involved

- Albarrangelu Town Council
- URA - Basque Water Agency
- Bizkaia Provincial Council
- Busturialdea Water Consortium



Economic data

Approximate cost of the intervention:

€ 240,000

Funding:

€ 25,000 (Berringurumena Programme, 2018), € 135,300 (grant from the Basque Government Department of Economic Development and Infrastructures, 2018) and € 80,000 (grant from the Busturialdea Water Consortium)



Success factors

The use of *Phragmites australis*, with a **high nutrient removal capacity** (such as nitrogen and phosphorus), as a suitable species for domestic wastewater treatment.

The **reeds were planted** in such a way as to allow a **uniform distribution of the discharge** over the entire width of each basin, in order to enhance pre-treatment and to facilitate future maintenance in the event of clogging. **No reeds were planted in the first metre of each basin**, as this is the area where the water is most polluted and least diluted.

The importance of **planning a initial rooting and stabilisation stage** to complete the development of reed roots and rhizomes, and to extend the vegetation throughout the wetland. This period lasts from several months to 1 full cycle.

Uniform inflow is improved by placing larger gravel (10-15 cm) in the first 30 cm of the wetland, occupying the entire depth of the bed. In anticipation of facilitating maintenance and even occasionally operating the system without primary treatment, it would be appropriate to extend this area to 1 m.