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OTHER RESOURCES

WASTEWATER TREATMENT SYSTEMS
Avoid polluting the natural world

Inadequately treated wastewater is a threat to human health, the environment and wildlife. Wastewater from toilets (black water) should never be released into the environment without treatment. Untreated water from other sources can likewise cause pollution. On the positive side, appropriately processed wastewater, if it meets the necessary standards, can be recycled for irrigation and toilet flushing and make a significant reduction in water use.

Darters. Photo: Shivaram Subramaniam.

EXAMPLES

A. Two Stage Filtration System

Stage 1: Grease Trap
Grease traps are typically used as primary treatment units in small-scale grey water filtration systems for sources with high oil and grease content (eg kitchen and restaurant grey water) prior to a secondary treatment step. Traps are best constructed of concrete or bricks with an airtight cover to avoid odour nuisance. Accumulated grease is best disposed of with solid waste. Maintenance of grease traps is usually required on a monthly basis as a minimum. This process is cost effective, requires very little investment and helps to avoid potential problems in subsequent wastewater treatment.

Stage 2: Installation of a Septic Tank
The septic tank, which collects and stores grey/black water, is the most common, small-scale treatment system worldwide. Septic tanks consist of either one compartment (also known as the settling or sedimentation tank) or two compartments. Septic tanks are designed for gravity separation, combined sedimentation and floatation of solids, oil and grease. Substances denser than water settle at the bottom of the tank. The organic waste undergoes anaerobic decomposition through microbial activity.

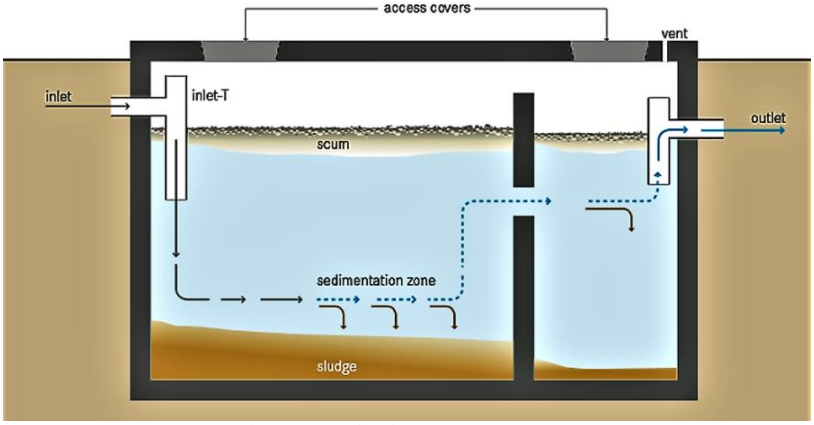


Image Source: Sustainable Sanitation and Water Management Toolbox

Septic tanks should have their sludge removed every two to five years. The sludge can be used as manure in gardens or on farmland. Septic tanks are usually made of reinforced concrete, bricks or plastic tanks. The tank structure should be airtight.

Post treatment, the waste water from the septic tank is sent to a soak pit (lined with porous materials - rocks, gravel, sand, wood - or highly absorbent minerals such as aluminum silicate). It can then be discharged into the soil or re-use for irrigation.*

**NOTE: Discharge regulations vary in different countries. Please consult country regulations if outside India and Nepal.*

B. Natural Plant Bed Filtration Systems

Natural plant bed filtration systems harness the power of aquatic and semi-aquatic plants to clean grey water. They can also be used as part of integrated systems such as phytorid below to treat black, sewage water. Plants provide appropriate environments for microbial growth and transfer oxygen to the root zone. Organic matter and suspended solids are removed by filtration and microbial degradation. Planted filters are often referred to as sub surface flow constructed wetlands, reed beds, root zone method, gravel bed hydroponic filters or vegetated submerged beds. Pre-treated wastewater flows continuously through the planted filter media and aeration and absorption of materials by the plants cleans the water. The filtered water can be used for irrigation purposes, toilet flushing or returned to the soil. This is one of the most effective, simple-to-maintain on-site treatment techniques available today.

See Aahana - The Corbett Wilderness case study.

Natural plant bed filtration systems can be designed into the landscape, making them a feature in their own right. They require time and know-how to establish, but once established, they can operate for many decades with low maintenance requirements and no chemical input. They should be used in conjunction with grease traps.

C. Decentralised Wastewater Treatment System (DEWATS)

DEWATS makes use of the natural biological and physical treatment processes outlined above to reduce and remove pollutants from wastewater. A typical DEWATS combines the following steps: **primary treatment** – in sedimentation ponds, settlers, septic tanks or bio-digester; **secondary treatment** – in anaerobic baffled reactors, anaerobic filters or anaerobic and facultative pond systems; **secondary aerobic/facultative treatment** – in horizontal gravel filters; and **post-treatment** – in aerobic polishing ponds.

See Forsyth Lodge case study.

DEWATS is low cost and low maintenance since the most important parts are locally available and work without energy inputs. The system can treat organic wastewater from both domestic and industrial sources with flows from 1 to 1,000 m³ per day.

D. Phytorid

Phytorid technology is a specific wetland-based natural treatment system developed by Dr Rakesh Kumar at CSIR – National Environmental Engineering Research Institute (NEERI) for treating wastewater in rural and urban environments. Wastewater typically passes through a screen chamber where solid waste is separated using bar screens and fat and oil is removed before passing onto a sedimentation tank. Wastewater next passes into a SWAB (Scientific Wetland with Active Biodegradation) which has three zones with filtering media such as recycled crushed bricks, stones and gravels and is also cleared through plant root zones. The system, which is chemical free and simple to use and maintain, can treat black and grey water to as high a standard as a conventional sewage treatment plant. It requires a small amount of electricity. Water can be recycled for irrigation and flushing toilets. This technology is also being explored to clean nullahs (watercourses). See: https://www.youtube.com/watch?v=QBwF2mFk7fE

See Limban Resort case study.

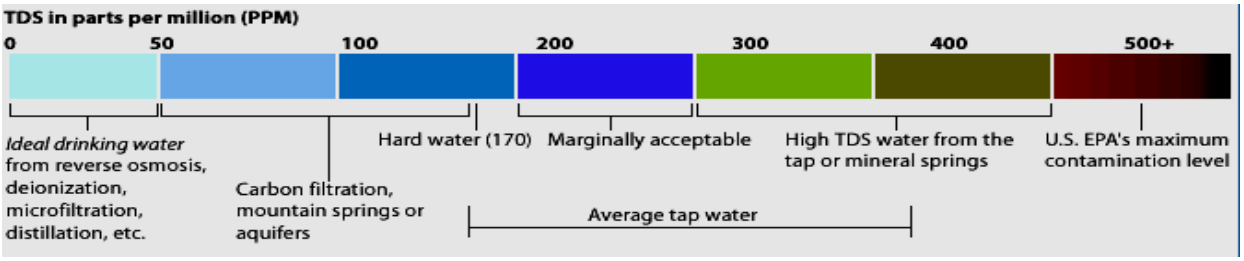
E. Sewage Treatment Plants

Conventional pre-made sewage treatment plants (STPs) operate with mechanical components and require a power supply. They treat any kind of black and grey wastewater combined from toilets, kitchen, laundry and bathrooms etc, and are more efficient than a septic tank. The treatment process involves four stages and purifies the effluent sufficiently to enable its release into streams without further filtering. The filtered water can be used for irrigation and toilet flushing and the activated sludge for manure. A septic tank by contrast merely separates the effluent.

STP at Oberoi Vanyavillas. See case study.

MONITORING WATER QUALITY

Monitoring levels of total dissolved solids (TDS) in water and its pH value are important measures of water quality. High levels of TDS and low levels of pH indicate that there are harmful contaminants in the water which can affect human health and wildlife. Fish die-off occur when pH levels dip below 4 or rise above 10. Safe levels for drinking reverse osmosis treated water are 50-150 ppm and 6-8 pH (7 is ideal.)



Source: Sycom Projects Consultants Private Limited

Information included may not be appropriate to every situation, destination and country and is intended for general guidance only and may be subject to change.

USEFUL ORGANISATIONS AND LINKS

- **Water Quality Standards**
  - **India**
    Indian water quality standard
    http://cgwb.gov.in/Documents/WQ-standards.pdf

  - **Nepal**
    Nepal water quality standard
    http://www.ess.gov.np/uploads/ck/a__1478598646_Nepal%20Drinking%20Water%20Quality%20Standard%202005.pdf

  - **World Health Organization (WHO)**
    WHO produces international norms on water quality and human health through guidelines that are used to help set worldwide standards.
    https://www.who.int/water_sanitation_health/water-quality/guidelines/en/

- **CSIR – National Environmental Engineering Research Institute (NEERI), India**
  Developer of Phytorid water treatment technology. See Cleaner Technology and Modelling Division.
  https://www.neeri.res.in/

USEFUL PUBLICATIONS

- ***Environmental Management for Hotels, the Industry Guide to Sustainable Operation, Section 3 Water*** International Tourism Partnership (third edition 2008, digital release 2014)

- ***Manual on Sewerage and Sewage Treatment Systems,*** Central Public Health & Environmental Engineering Organisation (CPHEEO), Government of India, 2013

- ***Composite Water Management Index (CWMI)***, A national tool for water measurement, management & improvement, Amitabh Kant, Niti Aayog, 14 June 2018

- ***Sustainable Sanitation and Water Management Toolbox***
  https://sswm.info/

- ***The United Nations World Water Development Report, 2018 Nature-Based Solutions for Water***, UNESCO on behalf of UN Water. See case study on p.40 on the impact of rainwater harvesting in Rajasthan.

TOFTigers is a global business-to-business nature travel charity with a mission to improve the ecological and economic sustainability of wildlands and wildlife across Asia. Well-planned and well-managed responsible tourism is a force for good bringing economic benefits to rural areas, restoring habitat, supporting conservation and local communities, changing poachers into protectors and giving visitors inspiring experiences of nature. We work with the travel trade, destinations, accommodation providers, governmental and conservation organisations to make this happen through training, advocacy, certification, promoting best practice and partnership working.

Our **certification programmes** place local communities, nature and environmental sustainability at the heart of business operations. They are a symbol of assurance for travellers and the travel trade that the places they select to stay at have been reviewed by environmental experts and exceed a minimum standard on a journey towards best practice. The PUG certification is recognised by the United Nation's Global Sustainable Tourism Council (GSTC) and is aimed solely at nature focused accommodation. The Footprint certification has a broader client base that is not wholly nature focused and encompasses accommodation providers in rural, natural or more urban landscapes.

Sign up for certification, get involved in our campaign or view sustainable travel options on our website and download the Great Wildlife Travel Guide.

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