Onsite Wastewater Systems

A Field Reference of System Types Used Across the United States

Introduction

Onsite wastewater treatment systems (OWTS) are not one-size-fits-all. Across the United States, the appropriate system type depends on a complex interplay of site-specific factors: soil permeability and depth, proximity to groundwater and surface waters, lot size, local regulatory requirements, climate, and the nature of the wastewater being generated. Selecting the wrong system — or failing to match design to site conditions — can result in early system failure, public health risk, and costly remediation.

About one-third of all new development in the U.S. is served by septic or other decentralized treatment systems.

U.S. EPA, Septic Systems Overview (epa.gov/septic)

The National Environmental Health Association's (NEHA) Private Water and Decentralized Wastewater (PWDW) Program Committee developed this resource to help environmental public health practitioners understand the range of onsite wastewater system types used across the U.S. and identify which systems are appropriate for different site conditions. It is intended as a field reference to support permitting decisions, site evaluations, and homeowner education.

The guide presents 14 system types, organized in a comparison table that covers system description, site suitability, maintenance requirements, benefits, and drawbacks. A closing note reminds practitioners that success always depends on matching system type to site conditions — and maintaining it properly.

Adequately managed decentralized wastewater systems are a cost-effective and long-term option for meeting public health and water quality goals, particularly in less densely populated areas.

U.S. EPA, 1997 Response to Congress on Use of Decentralized Wastewater Treatment Systems (epa.gov/septic)

How to Use This Resource

The table below provides a side-by-side comparison of 14 onsite wastewater system types. For each system, the table identifies:

- Description: How the system functions
- Best Suited For: Site conditions where the system performs well
- Maintenance: Key routine upkeep requirements
- Benefits: Primary advantages
- Drawbacks: Limitations or considerations

*See local requirements and manufacturer recommendations for operation and maintenance needs. System suitability is highly site-specific. Always conduct a site evaluation and consult applicable state and local regulations before recommending or approving a system.

Guide for Identifying the Appropriate System

The following table summarizes the major onsite wastewater system types used across U.S. , their key characteristics, and factors environmental health practitioners should consider when evaluating system suitability.

System Type	Description	Best Suited For	Maintenance*	Benefits	Drawbacks
Conventional Subsurface System	Septic tank followed by gravity-distributed effluent into trenches or beds. May include a distribution box prior to the drainfield.	Deep, permeable soils; adequate vertical separation to groundwater/ bedrock; moderate slopes.	Periodic tank pumping (every ~3–5 years)	Lowest maintenance and cost where natural site conditions allow.	Does not achieve uniform effluent distribution. Excessive water use or high-strength waste may overload the system.
Pressure Dosed System	Effluent is pumped to the below-grade Soil Treatment Area (STA) for even distribution.	Sites with moderate soils, slight restrictive layers, or variable topography.	Periodic tank pumping (every ~3–5 years) Flushing and cleaning of small-diameter distribution pipe Pump maintenance	Ensures uniform loading; allows use of areas not suitable for gravity flow.	Cost of pump and electricity to operate the pump.
Mound System	Engineered sand fill placed above natural soil, with a distribution network embedded in the mound.	High groundwater, shallow bedrock, slowly permeable soils.	Periodic tank pumping (every ~3–5 years) Flushing and cleaning of small-diameter distribution pipe Pump maintenance	Creates vertical separation and treatment where native soil cannot.	Higher costs than conventional systems due to design and materials.
Spray Irrigation System	Specialized low-angle irrigation sprinklers spray treated wastewater over a predetermined area with ground	Low installation costs; long life span.	Must be on an aerobic treatment system Spray heads must be checked and adjusted periodically	Easy to install and maintain.	Requires large areas of green space. Wastewater must be treated to kill pathogens at the pump tank.

System Type	Description	Best Suited For	Maintenance*	Benefits	Drawbacks
	cover. Aerobic treatment prior to pump tank required.		A sanitizer is required in the pump tank (normally chlorine or UV)		Can be sensitive to solids. Typically, it has higher setback requirements.
Drip Dispersal System	Very similar to a pressure dosing system. Specialized irrigation pipe is buried about one foot underground. Commonly combined with aerobic treatment.	Easy to install; typically, less space required over a pressure dosed system. Can be installed in tight spaces.	Periodic tank pumping (every ~3–5 years) Filter must be cleaned at least every 4 months May require a sanitizer in the pump tank	Can be installed in tight spaces. Requires less space than other systems.	Very sensitive to solids. Filter must be maintained. A dosing tank makes these work better.
Combined Treatment and Dispersal	Synthetic media acts as both advanced treatment and the dispersal system. The media provides a higher surface area for biological treatment.	Area available requires a reduced footprint for the dispersal system.	Periodic tank pumping (every ~3–5 years) Maintenance as required by the manufacturer — typically an annual walk-over	Lower maintenance requirements as compared to other advanced treatment technologies.	The media can clog and require replacement.
Package Treatment Media Filters	Similar to a sand filter but utilizing media other than sand.	Poor native soil; high groundwater; sites requiring high treatment.	Periodic tank pumping (every ~3–5 years) Rake filter surface every year or maintain the media type Requires perpetual maintenance with a manufacturer-certified technician	Reliable, predictable treatment; often used to protect surface waters.	Media may require replacement on a frequent basis and replacement costs may be expensive.

System Type	Description	Best Suited For	Maintenance*	Benefits	Drawbacks
Aerobic Treatment Unit (ATU)	Mechanically aerated treatment producing high-quality effluent like small municipal plants.	Small lots, poor soils, environmentally sensitive areas.	Periodic tank pumping (every ~3–5 years) Inspect and pump secondary settling chamber as needed (as frequent as 3–6 months) Mechanical parts require periodic checks, maintenance, and repair	Higher treatment level; enables smaller dispersal areas; used near lakes/streams.	Costs more to install than other systems. Problems with sudden heavy loads or neglect. Electrical costs and associated maintenance. Requires final treatment in drainfield, sand filter, or other system.
Sand Filter	Effluent passes through graded sand media for advanced treatment before dispersal. Can be single-pass or recirculating.	Poor native soil; high groundwater; sites requiring high treatment.	Periodic tank pumping (every ~3–5 years) Maintenance varies by design Dosing chamber pumps, controls, and timer sequence must be checked	Reliable, predictable treatment; often used to protect surface waters.	Cost is high where media is expensive or must be transported long distances. Pumps require electricity. Surface-discharged water requires an NPDES permit.
Constructed Wetlands	Engineered beds planted with vegetation; effluent treated through biological and physical processes.	Moderate-to-warm climates; sites with ample area.	Periodic tank pumping (every ~3–5 years) Vegetation must be maintained	Eco-friendly, high treatment quality; useful where soil dispersal is limited.	Vegetation may require maintenance and replacement.
Textile / Media Filters	Synthetic or natural media provides high-surface-area biological treatment.	Variable soils; space-constrained lots.	Periodic tank pumping (every ~3–5 years) Requires perpetual maintenance with	Highly compact with excellent treatment performance.	Installation and maintenance requirements may be expensive.

System Type	Description	Best Suited For	Maintenance*	Benefits	Drawbacks
			a manufacturer-certified technician		
Advanced Nitrogen-Reducing Systems (e.g., N-series, denitrificants units)	Biological or chemical processes remove nitrogen before dispersal.	Coastal areas; drinking-water recharge zones; regions with nitrate impairment.	Periodic tank pumping (every ~3–5 years) Maintenance requirements vary by manufacturer Requires perpetual maintenance with a manufacturer-certified technician	May be required where nitrate contaminatio n is a concern.	Installation and maintenance requirements may be expensive.
Stabilization Pond / Lagoons	A large, shallow, lined or compacted earthen basin that treats wastewater through sunlight, algae, and natural biological processes.	Large parcels: moderate-to-low-permeability soils that can be compacted; low water table; adequate setback distances.	Periodic tank pumping (every ~3–5 years) Maintain vegetation in the lagoon	Simple, low-maintenance treatment; well-suited to rural properties; performs effectively in warm climates with sufficient land area.	May require fencing or other means of isolation. May produce odors. Not suitable for small properties.
Holding Tanks	No dispersal: wastewater stored and pumped by haulers.	Sites with no viable soil options; seasonal-use properties.	More frequent pumping is required Alarm or visible float needed to indicate when tank is close to full	Only used when no other system is feasible; often highly regulated or not allowed.	Restricted water use. Pumping and disposal costs.

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