

Dry Toilets Can Offer a Sustainable Wastewater Treatment System in Rural Areas

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Government Decree on Treating Domestic Wastewater in Areas Outside Sewer Networks (209/2011)



- *Objective is to reduce domestic wastewater emissions and environmental pollution, giving special consideration to national water protection targets*
- Sets minimum standards for wastewater treatment and design, construction, use and maintenance of treatment facilities

Wastewater conducted into the environment must be reduced by at least

- **80 % for organic matter (BOD₇)**
- **70 % for total phosphorus**
- **30 % for total nitrogen, compared with the load in untreated wastewater.**



Table 1. Composition of the person-equivalent load for dispersed settlements; origin of loading and the amounts of different types of loading as grams/person/day (g/p/d) and their percentages (%).

Origin of loading	Organic matter (BOD ₇)		Total phosphorus		Total nitrogen	
	g/p/d	%	g/p/d	%	g/p/d	%
Faeces	15	30	0.6	30	1.5	10
Urine	5	10	1.2	50	11.5	80
Other	30	60	0.4	20	1.0	10
Person equivalent load	50	100	2.2	100	14	100

Source: www.finlex.fi, Decree 209/2011

Thus the allowed load of WW in households located in dispersed settlements is

- 10 g/p/d of BOD₇
- 0,66 g/p/d of TP
- 9,8 g/p/d of TN

Requirements: Design and construction

- Construction and operations permit and building notice required according to The Land Use and Building Act (1999).
- Report on assessment of surrounding surface and ground water systems that may be affected by the system.
- Construction plan to be produced and meet design requirements.
- System plans showing the activities to be implemented in different phases.
- Report on wastewater system containing a site plan showing the location of wastewater and effluent discharge points.
- System design to be based on at least 5 users
- Waste separation based on the load of wastewater



Requirements: Operation and maintenance (O&M)

- Up to date operation and maintenance instructions to be made available at any time to authorities
- Use and maintenance instructions to include processes and equipment maintenance
- Contact information of system designers, builders, management, supervision and maintenance people
- Level of waste water treatment requirements to be achieved in normal operations
- Periodic system inspections and checks, at least once in every 10 days
- Periodic evacuation of excess sludge, at least once a year
- Methods to deal with common fault conditions
- Auditing the system structural integrity at least once every 10 years



Requirements: Monitoring of the system



- A reliable method to assess the achieved results
- Updating the board and maintenance instructions
- A method to monitor and record information e.g. quantities of water, urine and other matter into the system

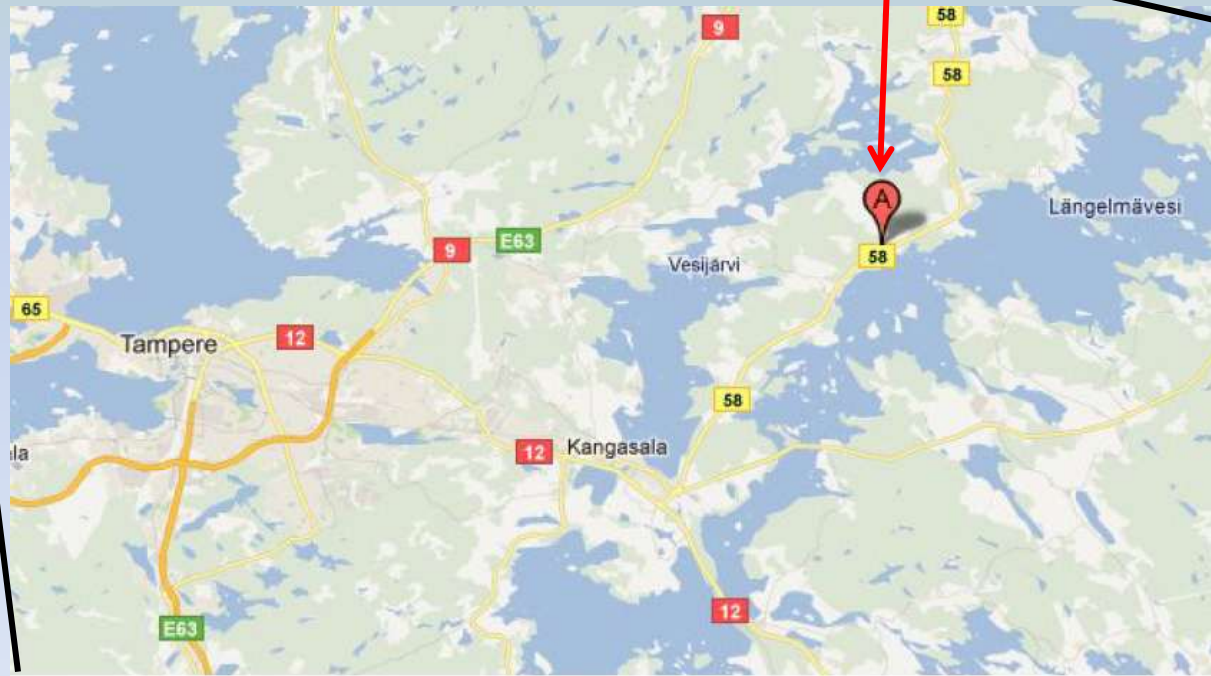
Case: Kautiala

- Kautiala is rural area in Kangasala municipality with homeowners affected by the decree 209/2011
- Cooperative main sewer trunk begin from Kautiala
- The study focuses on unconnected properties particularly on the Eastern side of the cooperative sewer network.
- About 185 unconnected properties: 144 summer dwellings (68 %) and 41 permanent houses. These properties are typical Finnish rural residential houses characterized by 3-5 persons households and currently use onsite wastewater treatment systems and water supply facilities

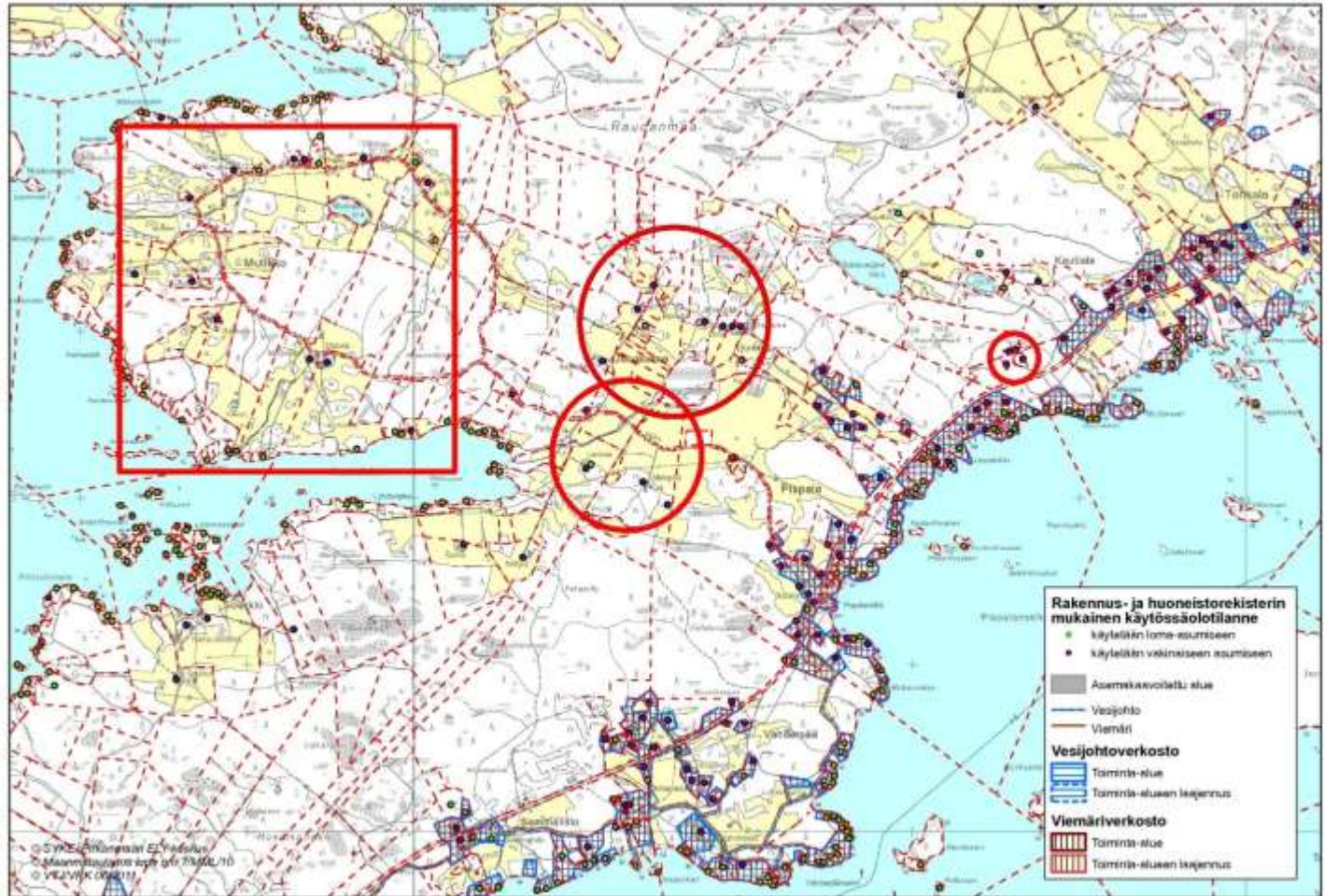




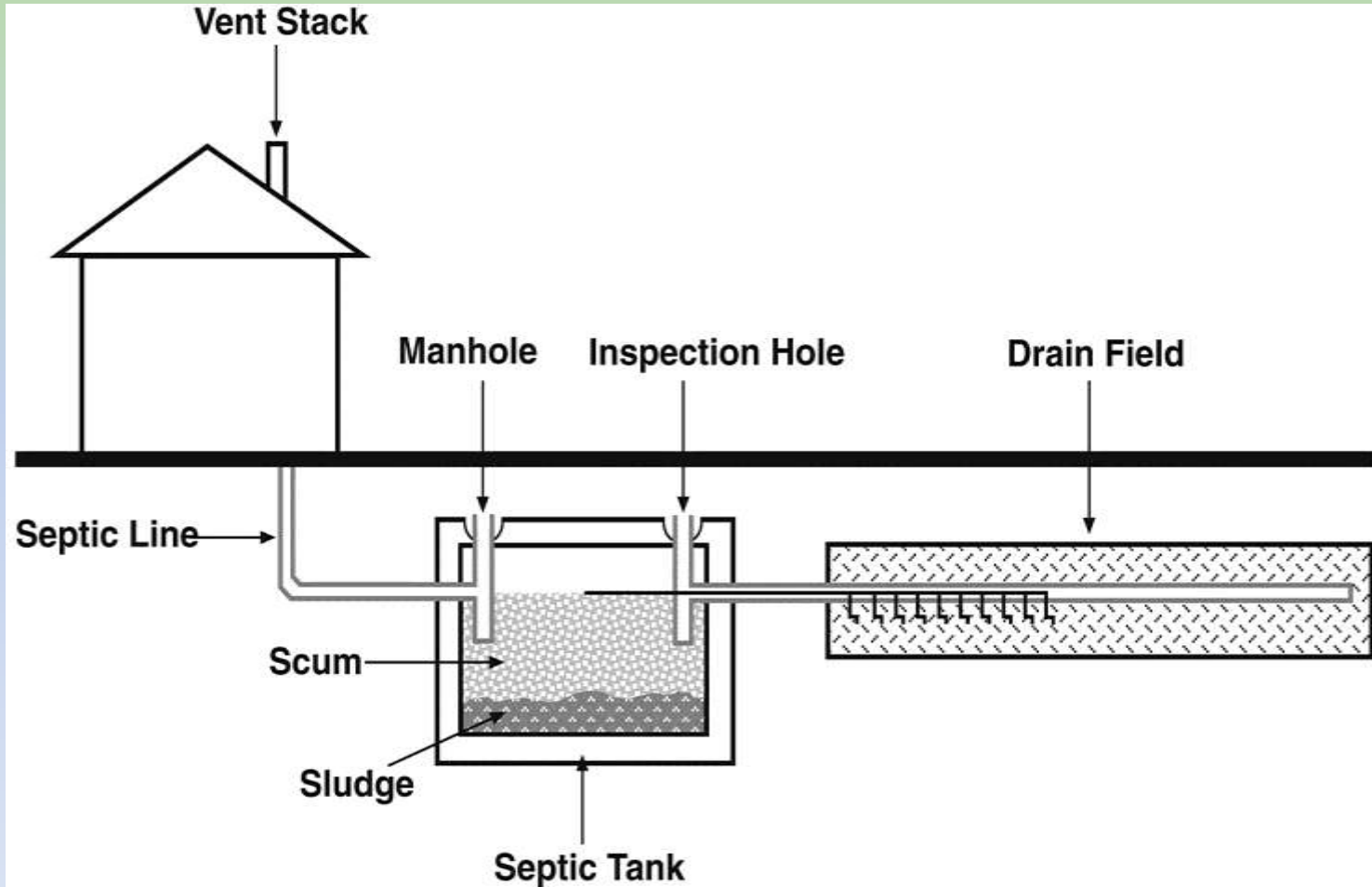
Kautiala area



Map of Kautiala showing sewer operational and non-operational areas



Typical onsite septic tank system, that may not meet the requirements of the decree



Case: Kautiala

The economical feasibility of four alternatives was evaluated for the unconnected properties.

1. **Upgrading failing septic systems by constructing sand filters with a P-adsorption material.**

- Unconnected homeowners already have some sort of wastewater filtration facility that may need minor or major renovations to meet the requirements of the new legislation

2. **Connecting to the Kautiala cooperative sewer network**

This network has both the capacity and plans to expand provided that there is a substantial number of interested homeowners.



3. **Using biochemical package plants which require constant power supply.**
 - Package plants support flushing toilets and other modern home water facilities. They can be a cheaper alternative to very expensive septic system renovations or sewer connection.

4. **Using DTs and treating GW separately using a purification system**
 - DTs particularly offer a reliable and sustainable non-flushing system in areas where flushing toilets are forbidden, in locations with low accessibility and in households with temporary occupancy or not connected to the national electricity grid.

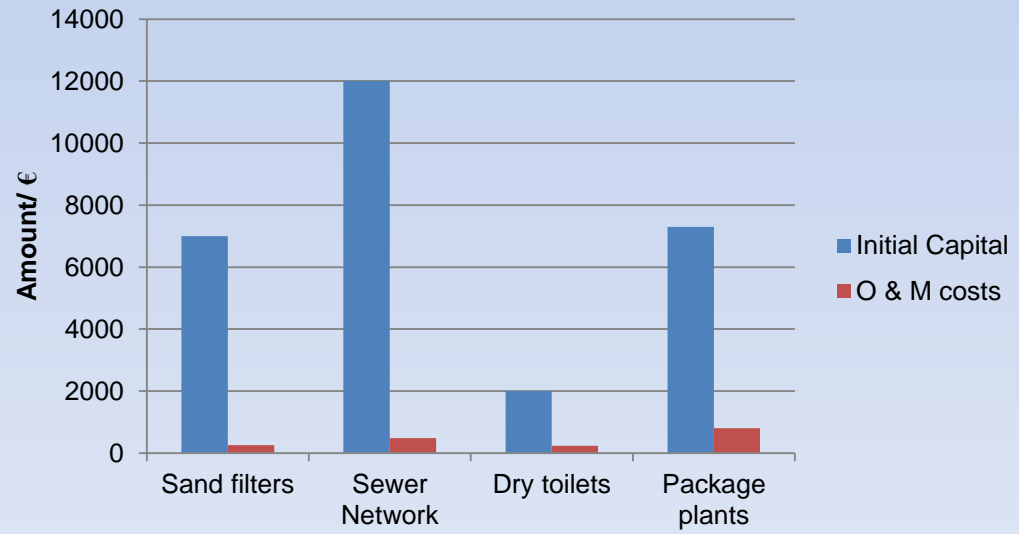
Results



Table 2. Initial investment and the annual O&M costs of the four alternative sanitation solutions.

Cost type	Sand filters with improved P-adsorption	Cooperative sewer network	Biochemical package plants	Dry toilets
Initial Capital costs	7000 €	12 000 €	6200- 8300 €	200-2000 €
O& M costs	260 €	480 €	800 €	240 €
TOTAL	7260 €	12480 €	7000 – 9100 €	440 – 2240 €

Initial Capital and O&M costs of the four alternatives



Results

Table 3. Average total O&M costs for 15 years

System	Amount
Sand filter + P-adsorption	5 200€
Cooperative sewer network	9 600€
Biochemical package plants	16 000€
Dry toilets	4 800€



Conclusions

- It is possible for Kautiala residents to achieve sustainable sanitation with minimal impact on the environment and financial expenditure.
- Unconnected properties located in close proximity to the sewer network, need to connect to the network
- Homeowners with functional septic systems should consider the option of upgrading their systems before exploring others
- If upgrading septic system is not feasible, then DT is the option



Conclusions

- DT is economically most feasible option when the property is not close to the sewer network and located in environmentally sensitive area
- Storage, transportation and disposal of compost needs to be considered – current legislation in Finland does not allow selling or giving the compost to anyone, use at your own garden is also questionable





Kiitos!
Thank you!