

# Using Eco-Toilets to Manage Our Wastewater The Falmouth Initiative



## Overview of Eco-Toilets & Fate of Residuals

Earle Barnhart  
Hilde Maingay

April 5, 2013

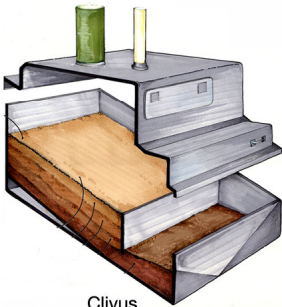
Cape Cod Eco-Toilet Center  
Falmouth, Massachusetts

# Composting Toilet Systems

## Large Bin Composting Toilet Systems



Phoenix



Clivus



Sunmar

## Batch Composting Toilet Systems



Full Circle



Carousel

## Self Contained Composting Toilet Systems

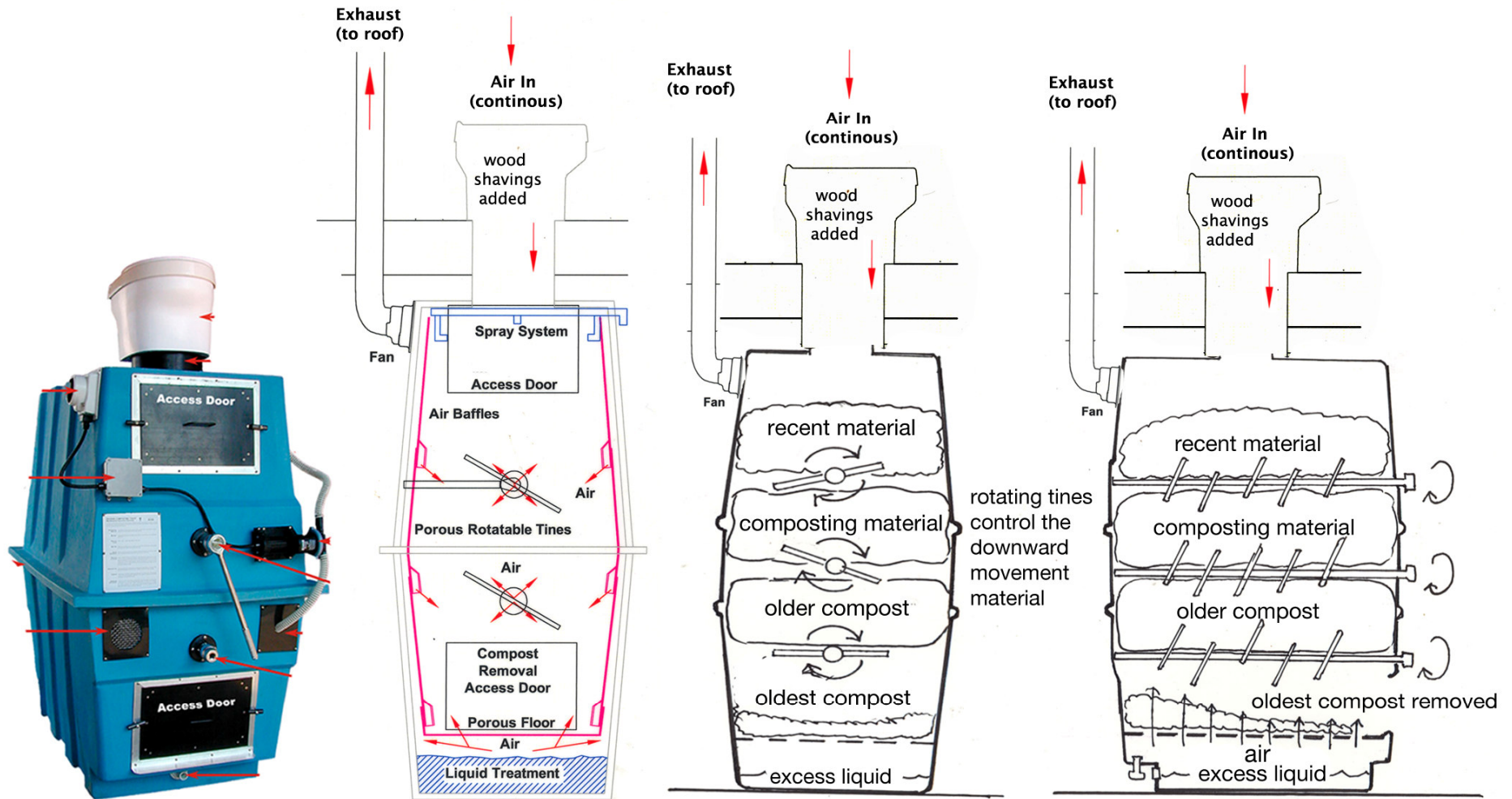


Sunmar

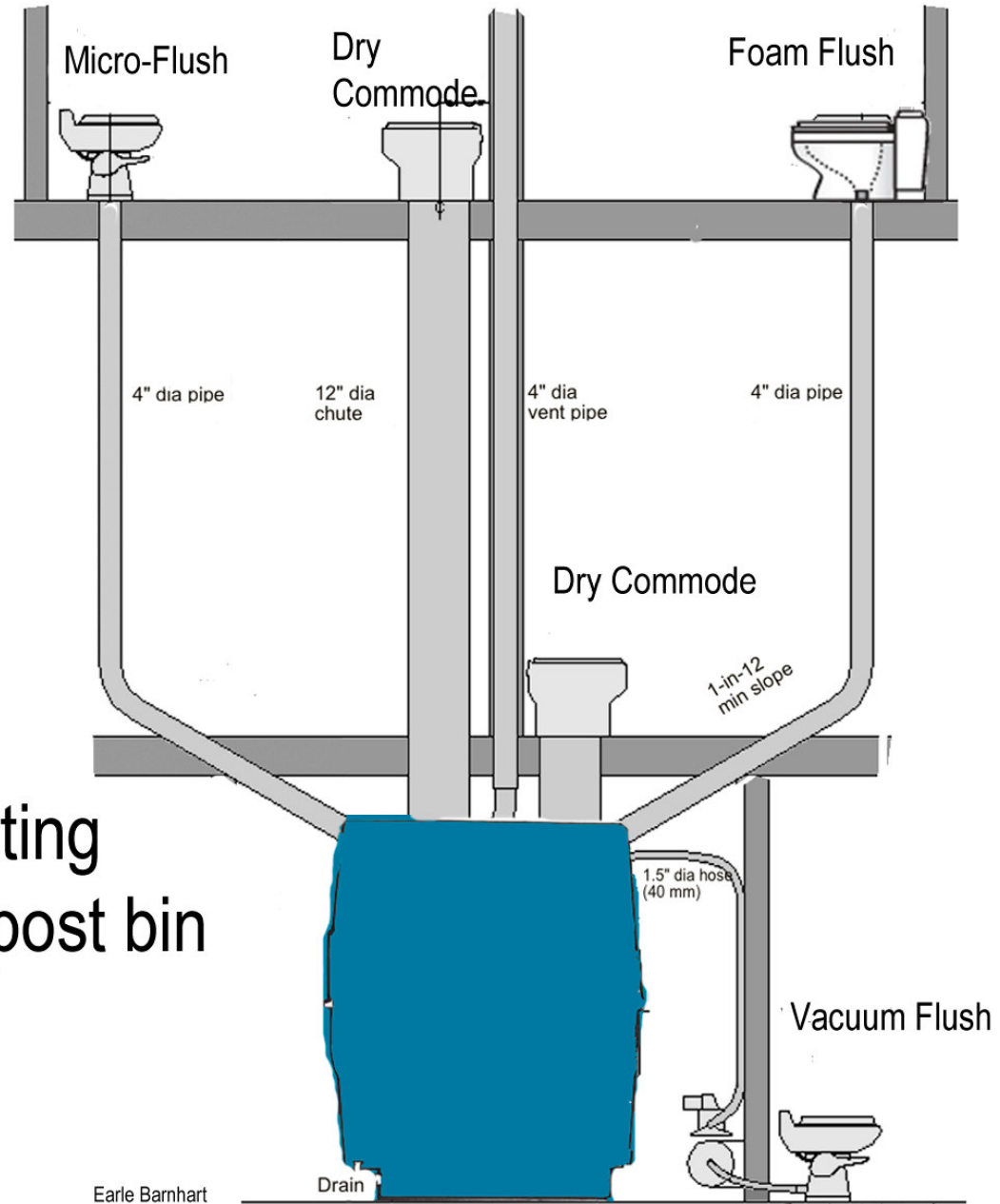


Separett Earle Barnhart  
The Green Center, Inc

# Large Bin Composting Toilet System



# Options for connecting commodes to compost bin



# Urine-Diverting Waterless Toilets

**Diverts 80% of Total Nitrogen From House**

- approx. 90 gallons of urine /person/year is produced



EcoDry



Separett



Waterless Urinal

urine 80%

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Earle Barnhart  
Hilde Maingay

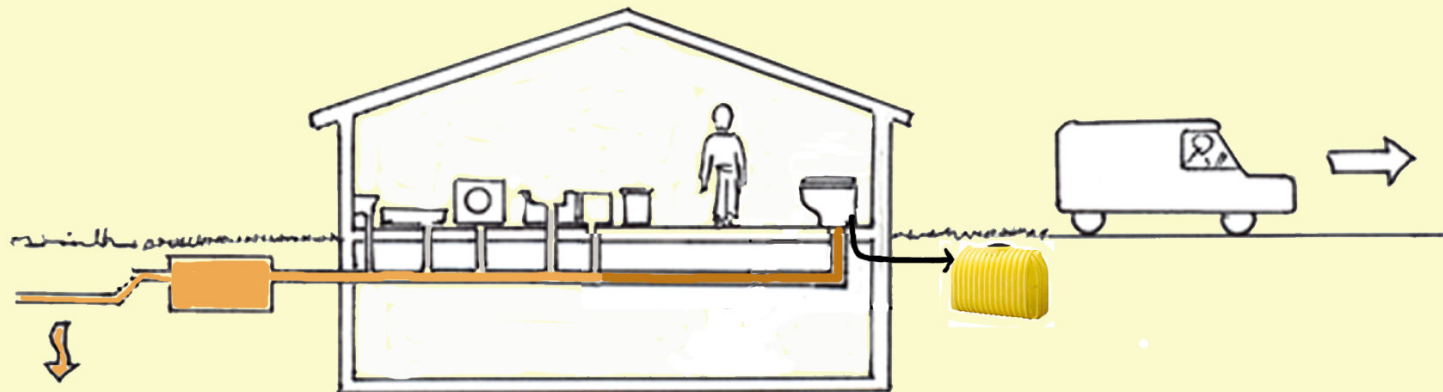
# Urine-Diverting, Flush Toilet

Diverts 80% of Total Nitrogen From House



- works like a flush toilet, with a front section to divert urine
- urine is diverted to a storage container for periodic removal
- approx. 120 gallons of urine /person/year is produced
- less water is used because fewer flushes are needed
- urine contains most excreted medicines (pharmaceuticals)

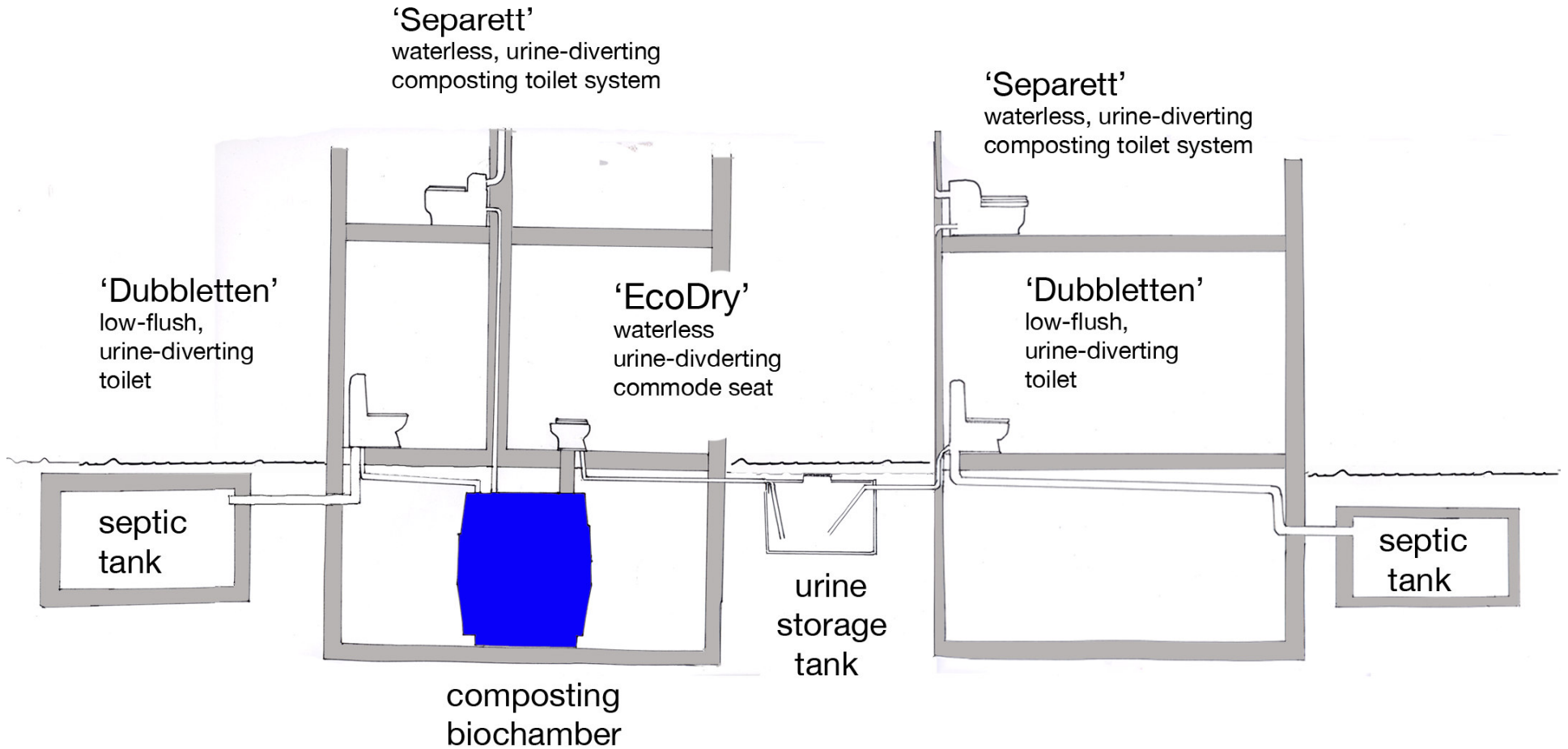
## Dubbletten



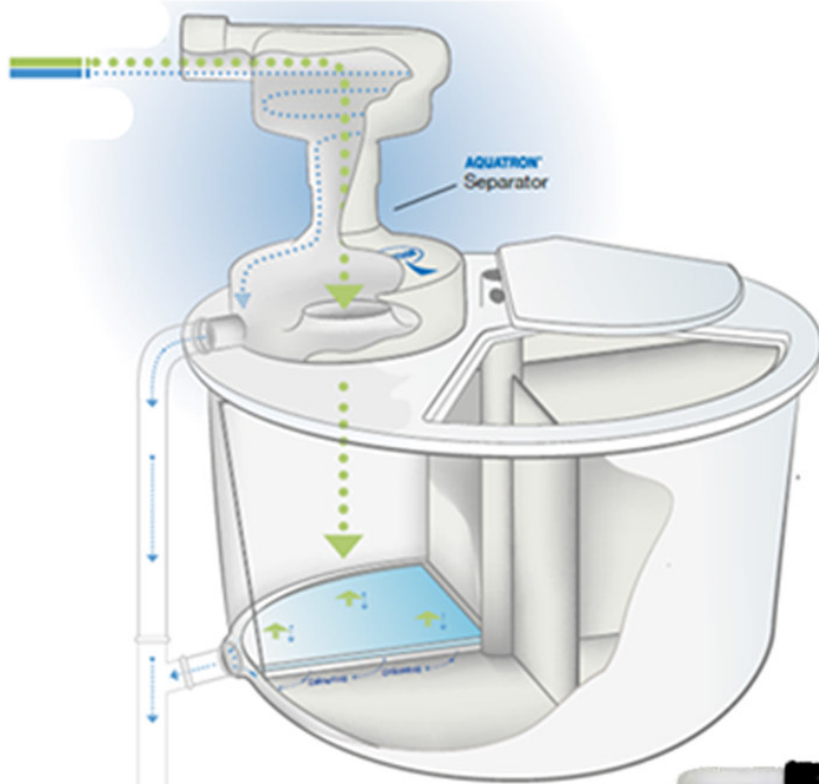
EcoFlush

# Urine-Diversion with Composter

# Urine Diversion with Storage Tank



# Hybrid Composting Toilet System



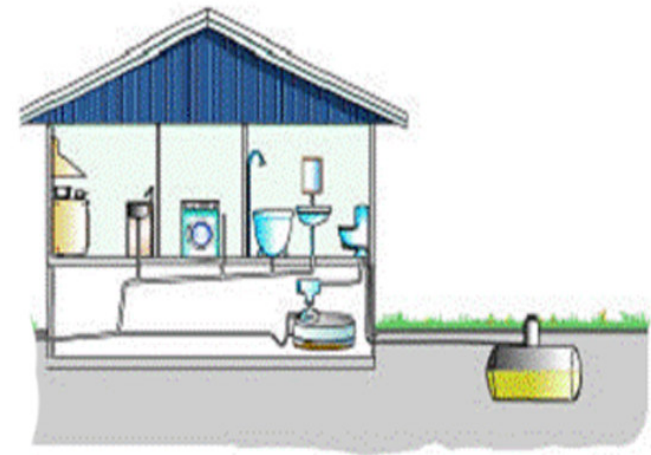
**Batch Composting**



**Low-Flush,  
Urine Diverting  
Toilet**

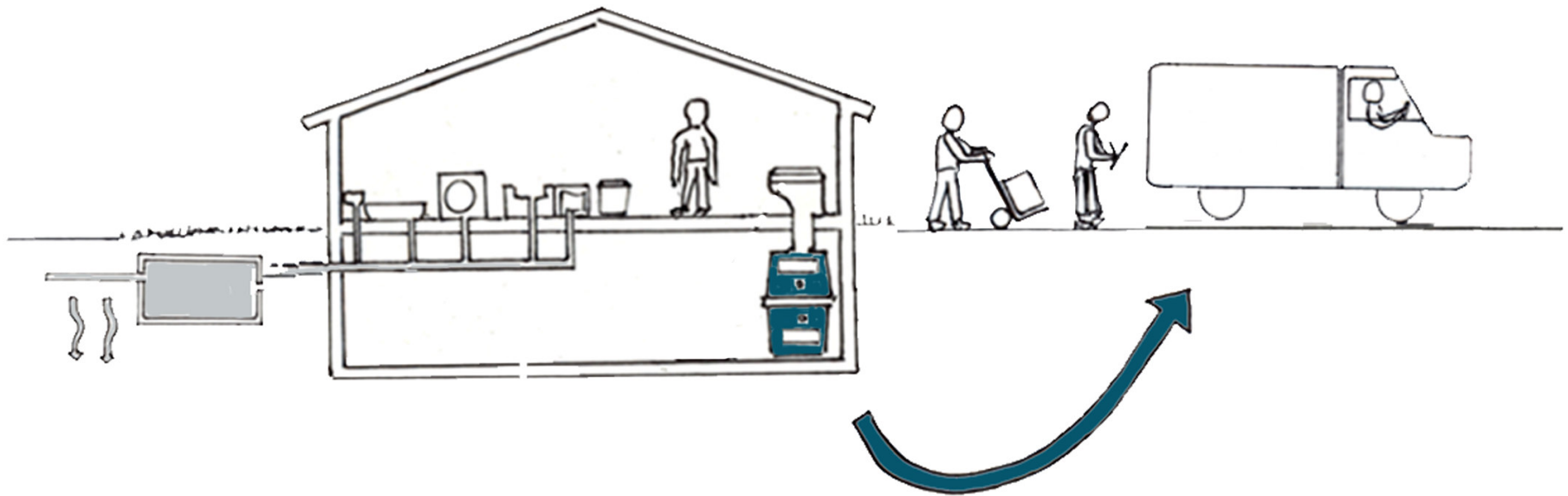


**'Aquatron'  
Separator**



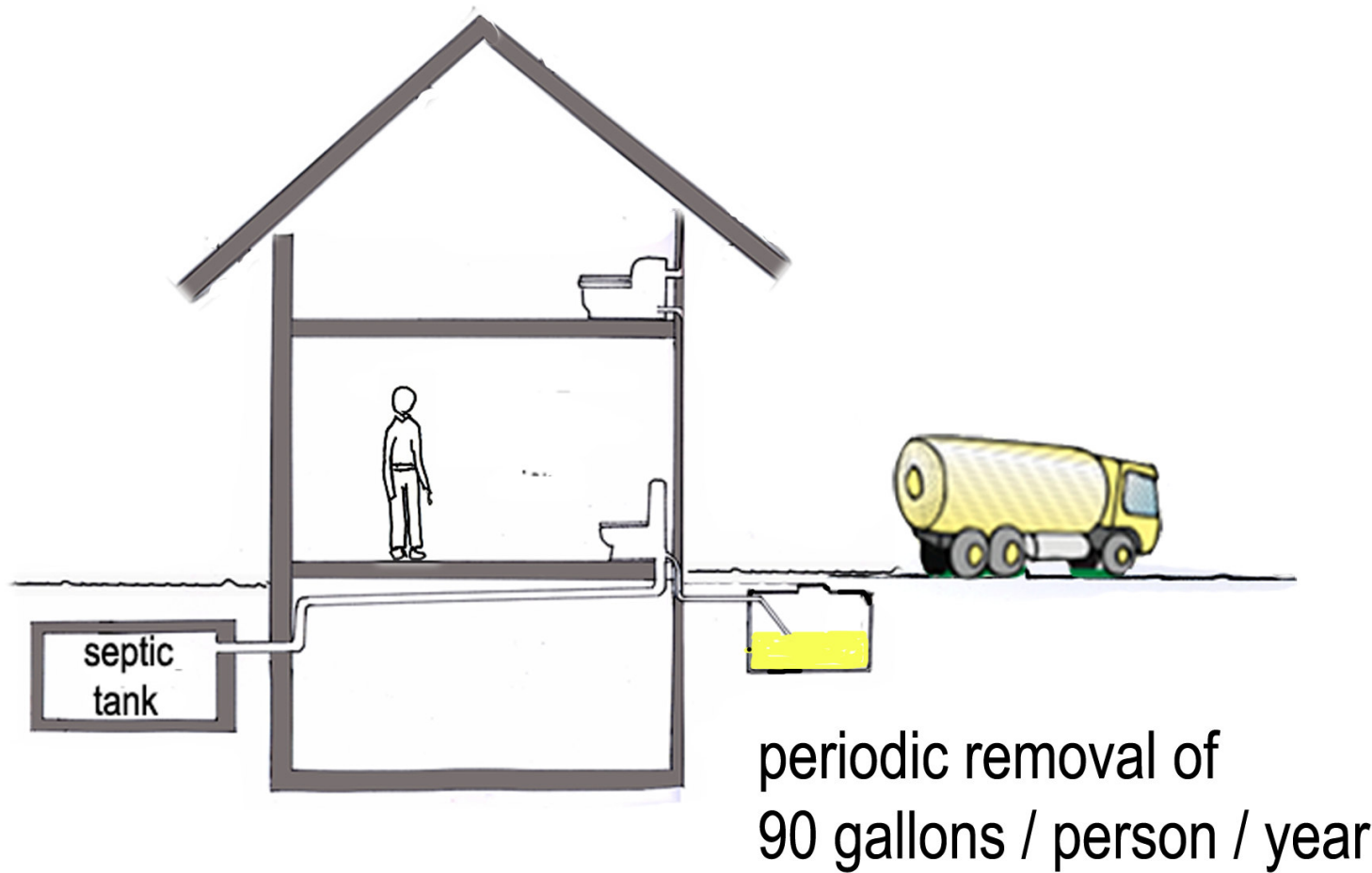


# Compost Residuals

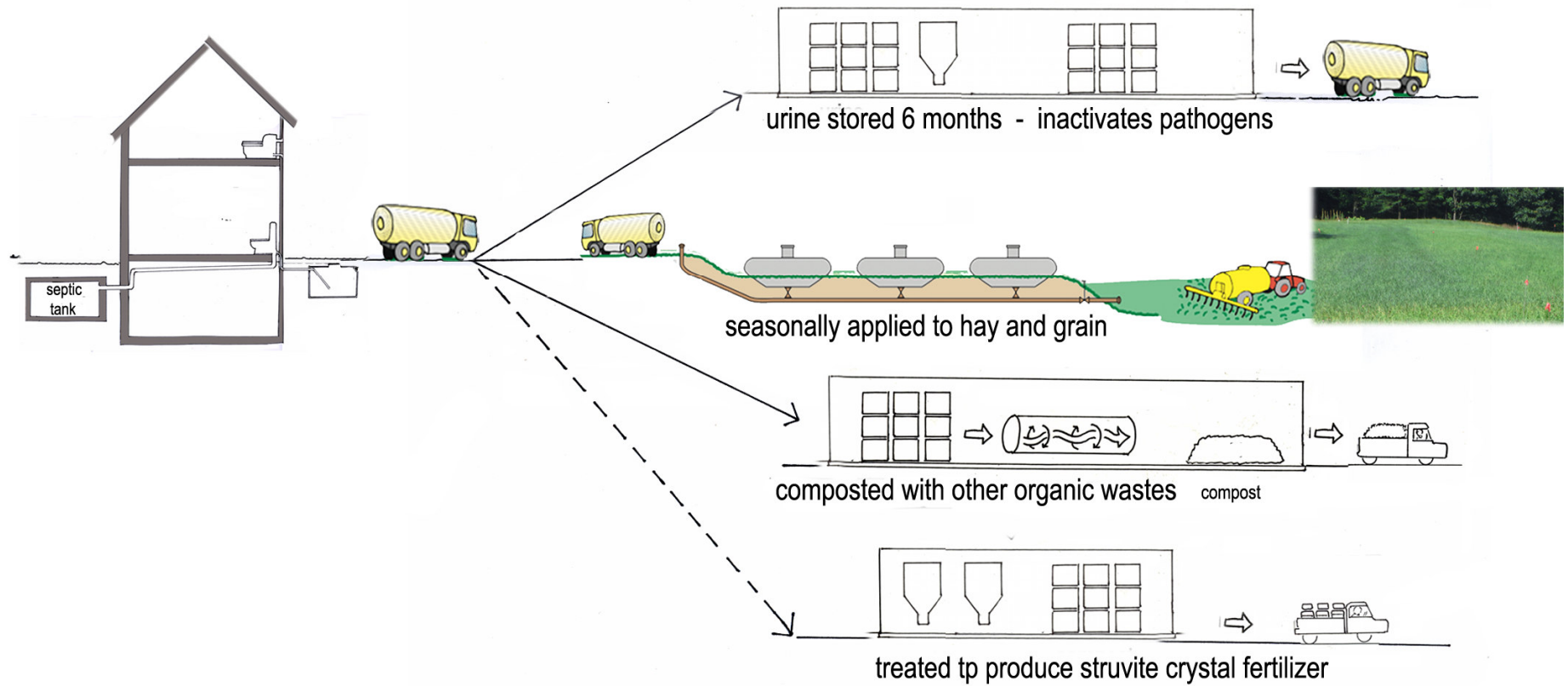


periodic removal of 1 1/2 cubic feet / person / year

# Urine Diversion Residuals



# Urine Recycling Options



The Green Center, Inc.  
Earle Barnhart  
Hilde Maingay

# RECOVERING NUTRIENTS OF LOCAL ORGANIC MATERIALS

**Compost**  
from  
composting  
toilet

**Urine**  
from  
urine-diverting  
toilets

**Food  
wastes**  
from  
kitchens

**Leaves,  
wood chips,  
landscape  
debris**

**Water Hyacinths**  
from  
freshwater  
ponds



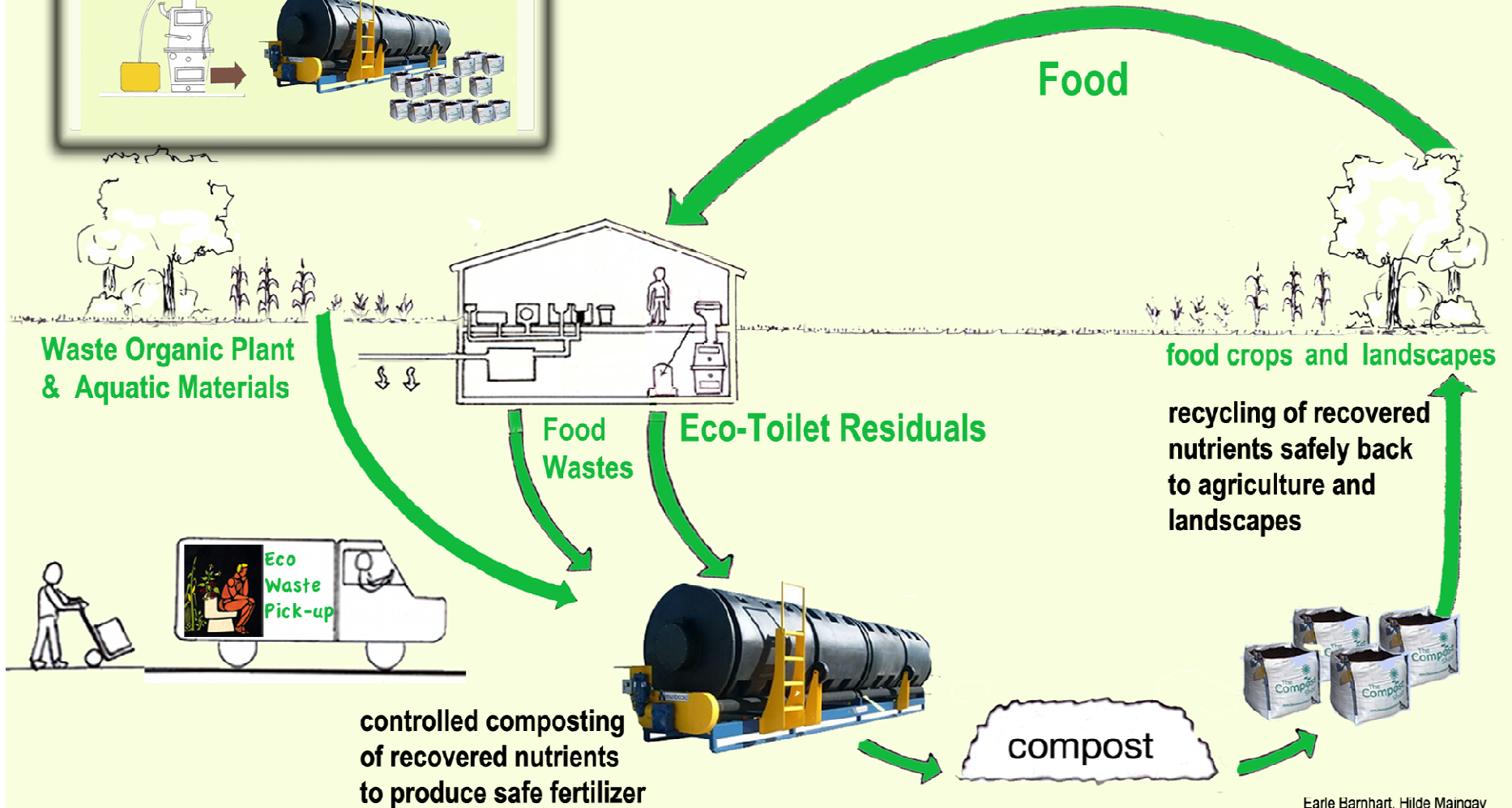
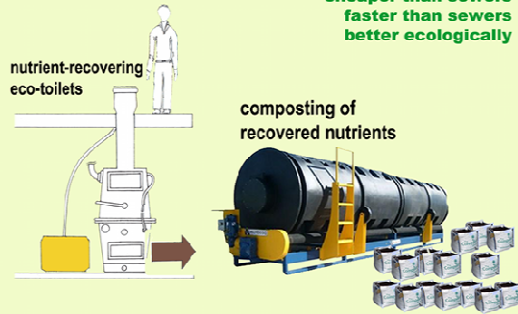
**'Ecodrum' Composter**  
engineered, controlled composting  
of mixed organic materials

**Recovered Nutrients**  
sold as fertilizer, compost,  
and mulch products

# HUMAN-WASTE NUTRIENT RECOVERY SERVICES

## HUMAN-WASTE RECOVERY SYSTEMS can solve the wastewater problem:

cheaper than sewers  
faster than sewers  
better ecologically

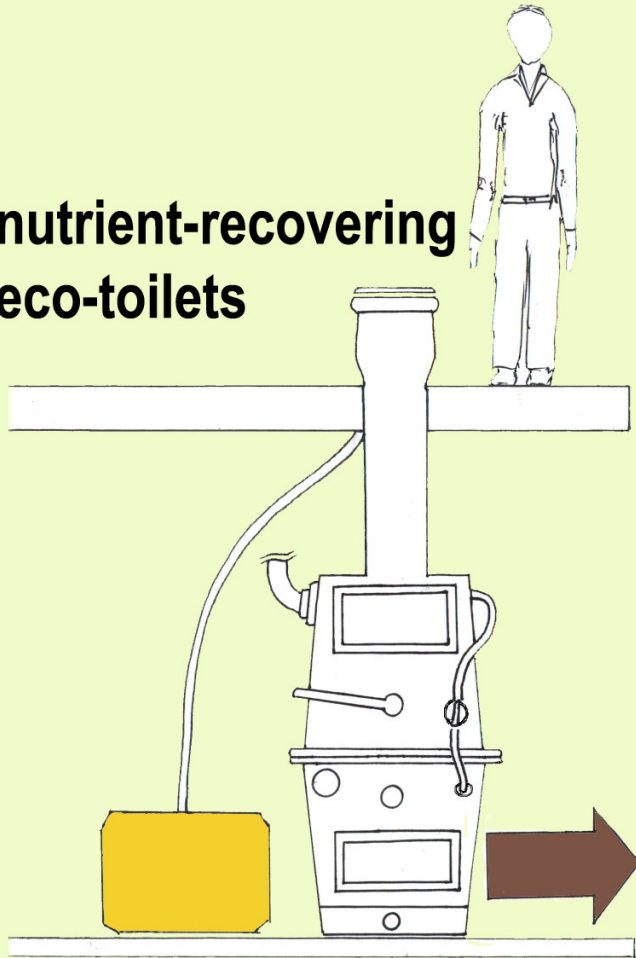


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# HUMAN-WASTE RECOVERY SYSTEMS can solve the wastewater problem:

**cheaper than sewers  
faster than sewers  
better ecologically**

**nutrient-recovering  
eco-toilets**



**composting of  
recovered nutrients**



Hilde Maingay  
Earle Barnhart  
capecodalchemists@gmail.com

Hilde Maingay and her husband Earle Barnhart were staff researchers at the New Alchemy Institute from 1972 to 1980, and were consultants and educators at New Alchemy from 1980 to 1991. Their **experience** includes teaching college-level courses, training interns, and publishing the results of their research. In recent years they have been strong advocates for water and nutrient sustainability as an ecological alternative to traditional centralized sewer systems.

Hilde and Earle live in an energy-efficient solar home attached to a large 100% solar greenhouse. The house has waterless composting toilets, solar electricity, solar heating/hot-water and rainwater storage. They have grown food year-round on Cape Cod since 1972, their landscape is based on permaculture principles and they have tested a wide range of agricultural strategies suited to Cape Cod's conditions.

Hilde Maingay and Earle Barnhart are board members of **The Green Center, Inc.**, a non-profit research and educational organization in Falmouth and steering committee members of '**Citizens for Ecological & Economic Sustainability (CEES) of Falmouth**. CEES' efforts have been primarily directed towards the wastewater and zero-waste issues in Falmouth and the Cape, with a focus on public outreach and educating residents and regulators of ecological alternatives to sewers.

Hilde Maingay is also a steering committee member of **Falmouth Climate Action Team (FCAT)**.

Earle Barnhart has a BA in marine biology and ecology.  
Hilde Maingay has a MA in environmental science education

28 Common Way  
East Falmouth MA