Alternative Strategies for Improving Water Quality

Section 208 Plan Update, September 26, 2013

Precedent Studies & Alternatives
Cluster (3-30 Homes) & Satellite (30-1000) with offsite disposal
Centralized Treatment
Toilets: Urine Diversion
Waterless Urinal

IBC container (220 gallons)

40" x 40" x 48"

Toilets: Urine Diversion

Source: Earl Barnhart & Hilde Maingay, Falmouth
water vapor
CO2
ammonia N

bathroom is odor-free
air is continuously drawn
down the toilet and is
exhausted out a roof vent

Toilets: Composting

Source: Earl Barnhart & Hilde Maingay, Falmouth
A packaging toilet directs human wastes into a biodegradable package, that is sealed after each use and stored at the base of the toilet.

No water
No plumbing
No electricity
Movable
Installs immediately, anywhere
Water use in house is reduced 30-40%

Source: Earl Barnhart & Hilde Maingay, Falmouth
Eco-Machines & Living Machines
80,000 gpd wastewater treatment

PRECEDENT: South Burlington, VT WWTF
South Burlington:

- System was designed to deal with organic nitrogen loading from municipal sewage.

- Denitrification was later targeted through the uses of pulsed aerobic/non aerobic reactors and the addition of carbon.

- Consistent achievement of an 86.4% denitrification rate over a continuous 960 day data collection period.
Jan Vyzamal

PRECEDENT: Kamen, Czech Republic

Site Area Needed: 22 Square Feet per person
Provides both secondary and tertiary treatment:
BOD, TSS, Pathogenic Bacteria and Nitrogen, even in winter
PRECEDENT: Denmark Standard Vertical Wetland Details: SF House
PRECEDENT: Talking Water Gardens, Albany, Millersburg OR
Mark Madison, CH2M Hill, Portland, OR

PRECEDENT: RIVERBEND, OR WASTEWATER TREATMENT FACILITY

Hans Brix, 2006 and CWI Website

Koh Phi Phi, Thailand Vertical Wetland Treatment Plant
Shuangshan Island (Zhangjiagang, Jiangsu Province, China)

Site Area: 1000 sq m
Treats: 500 PE
Pre-treatment: sedimentation tank
2 vertical subsurface flow wetlands
1 horizontal subsurface flow wetland
1 Free water surface wetland

Blumberg Engineers
Excess Nutrient Capacity within the Poplar Tree Plantation Utilized for Biosolids Reuse

215 lb/ac/yr N Limit
(average across tree age classes)

<table>
<thead>
<tr>
<th>Annual lbs of Nitrogen per acre</th>
<th>Effluent</th>
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<tbody>
<tr>
<td>65 lb/ac/yr</td>
<td>@10 mg/L N</td>
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<td>28 in/yr</td>
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<td>@10 mg/L N</td>
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<table>
<thead>
<tr>
<th>Annual lbs of Nitrogen per acre</th>
<th>Biosolids</th>
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<tr>
<td>150 lb/ac/yr</td>
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<tr>
<td>2.9 dT/ac/yr</td>
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<td>@52 lbs</td>
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<td>PAN/dT</td>
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Phyto-buffer: LG
Poplars reach up to 20’ Ground Water Depths

Ecolotree and Sand Creek Engineers

PRECEDENT: Fertilizer Factory, North Carolina- Deep Rooting Poplars
PRECEDEHNENT: Wellfleet Harbor, Cape Cod
- Nitrate $\rightarrow$ to nitrogen gas by micro-organisms
- 90-99% removal of nitrate
- Also effective for Phosphorus - fresh water ponds
- 20-30 year media life estimated
Other Diagrams Drawn
SITE: Subsurface Wetland