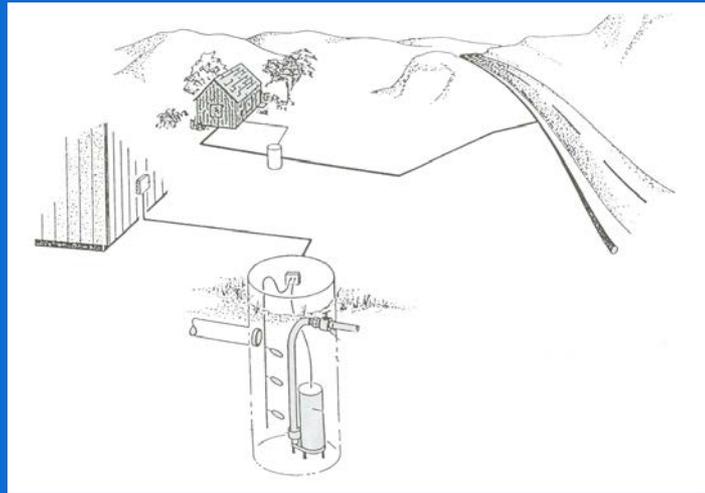
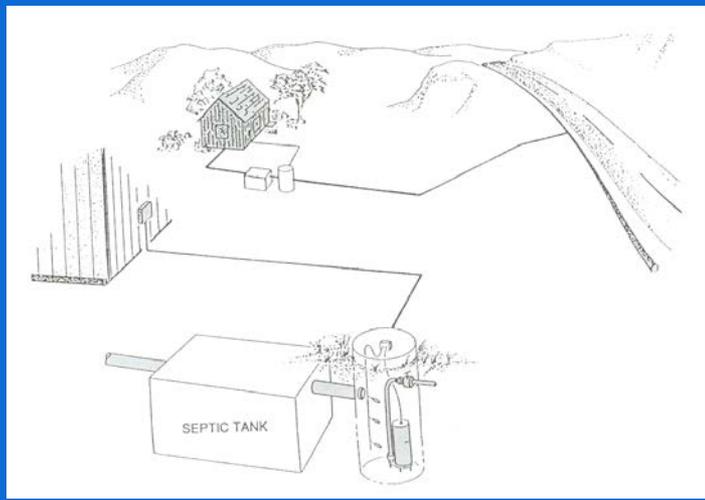
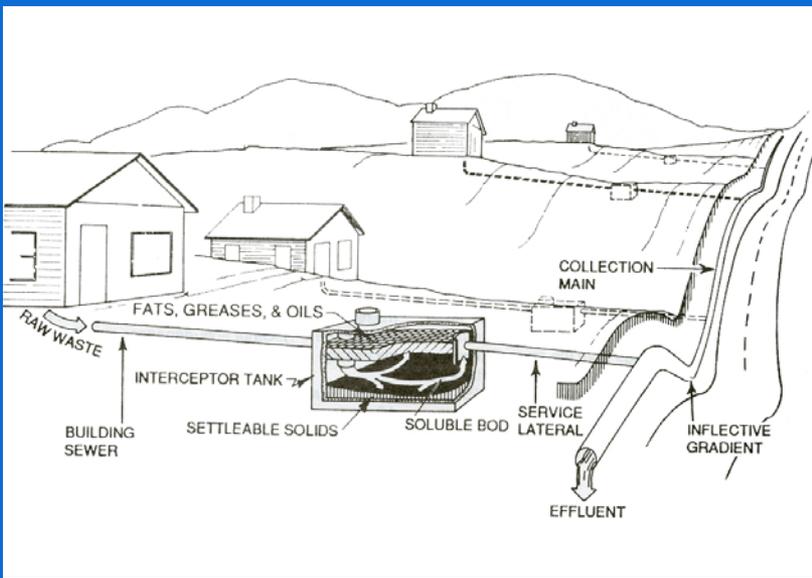


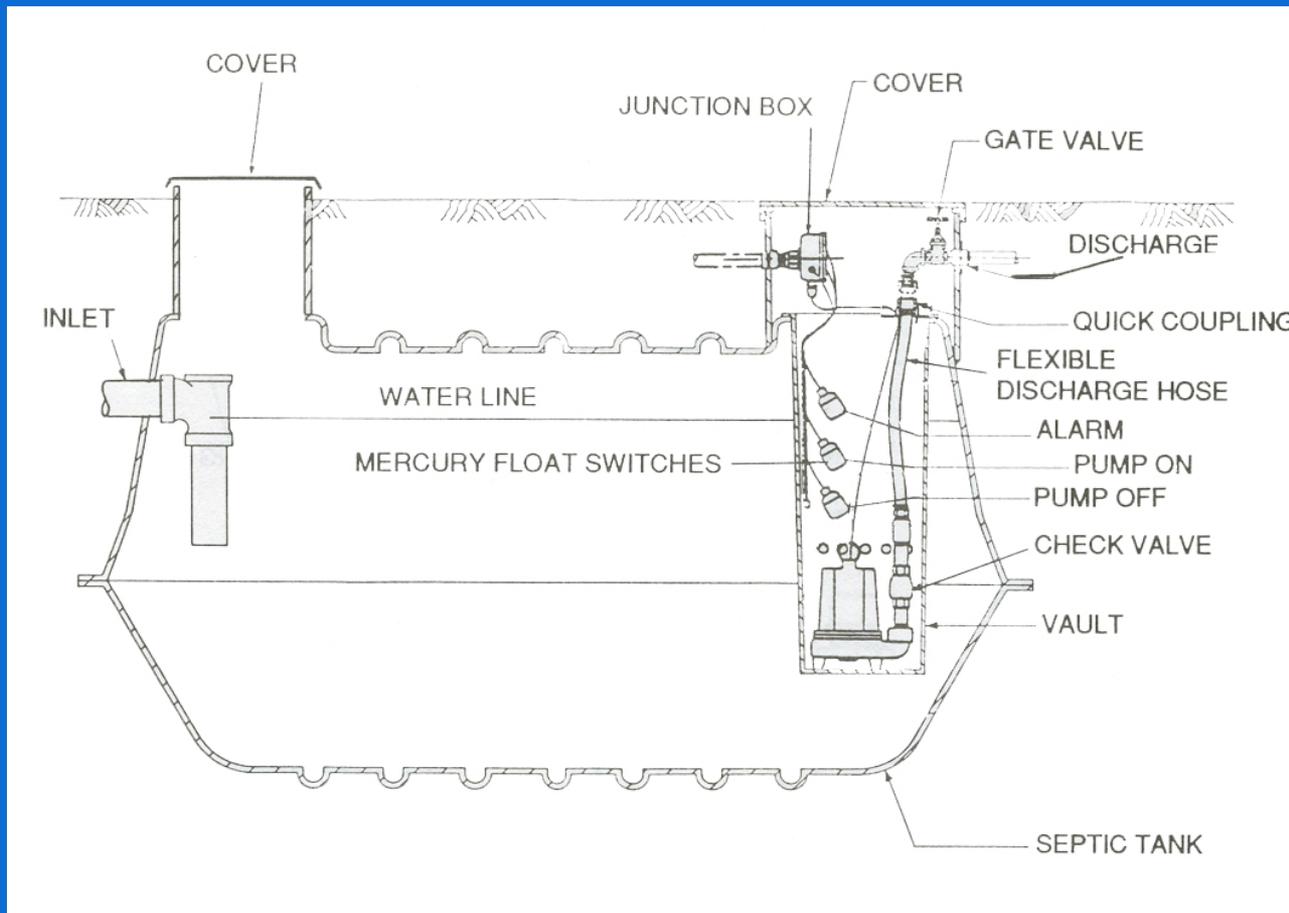
# Sunset Bay: Next Generation Approach to Decentralized Cluster Systems

*Terry Bounds, P.E.*

# Decentralized Small Community Trends 1970's



# Decentralized Small Community Trends 1980's



# 1980' s Special Sewer District Glide, Oregon

- 240,000 gpd design
- STEP/STEG collection (1100 EDU' s)
- Oxidation ditch treatment (2 – 170,000 gallon channels)
- NPDES Permit (river discharge)
- Start-up: February 1980
- Average Influent characteristics
  - ~ BOD<sub>5</sub>: 106 mg/L
  - ~ TSS: 51 mg/L
  - ~ NH<sub>3</sub>-N: 64 mg/l



*Glide, Oregon treatment plant.*

# Recirculating Sand Filter

## Elkton, Oregon late 1980's

- 29,000 gpd design
- STEP/STEG collection
- RSF treatment
- Subsurface dispersal (Pressure)
- Start-up: 1989
- Average effluent characteristics
  - ~ BOD<sub>5</sub>: 3.8
  - ~ TSS: 5.4



# Elkton ... 11,000' Drainfield



# Starbuck, Washington 1990' s

- 20,000 gpd design
- STEG/STEP collection for 90 homes
- Community Self-Help project
- Drip Subsurface dispersal
- Effluent characteristics:
  - ~ BOD<sub>5</sub>: < 2.0 to 3.5 mg/L
  - ~ TSS: < 1.0 to 5 mg/L
  - ~ TN: 8.9 mg/L average



# Sunset Bay - Sharps Chapel, TN



# The Location

- Scenic Properties Overlooking and Bordering Pristine Lake in a Picturesque Mountainous setting in Tennessee



# The Challenge & Layout

- Rugged terrain
- Steep slopes
- Small lot layouts
- Build-as-you-go
- Seasonal Occupancy



# The Challenge & Layout

- High variable flows
- Bordering lake
- Nitrate requirements



# Boat Slips at Clubhouse



# Clubhouse and Pool



## The Solution

- Establish Utility
- STEP/STEG Effluent Sewer Collection
- AX-20 or AX20-RT On-lot Treatment
- Community drip field

## Project Partners

- Designer Engineers: Environmental Systems Corporation
- Utility and equipment supplier: Hallsdale-Powell Utility District

# Community Collection

- 4.5 miles of 3-, 6-, and 8-in PVC small diameter sewer lines



## Design Parameters

- Design flow: 165,000 gpd
- 750 edus at build out
- Clubhouse with tennis court and swimming pool, boat launch and parking area

## Permit Limits

- 45 mg/L BOD<sub>5</sub>
- 20 mg/L Nitrate NO<sub>3</sub>-N

# Drip Area Based on Monthly Nitrate Loading Rates

$$L_{wn} = \frac{C_p (Pr - PET) + U(4.413)}{(1 - f)(C_n) - C_p} \quad \text{(Equation 17-2)}$$

Where:	<b>L<sub>wn</sub></b>	=	allowable monthly hydraulic loading rate based on nitrogen limits, inches/month
	<b>C<sub>p</sub></b>	=	nitrogen concentration in the percolating wastewater, mg/L. This will usually be 10mg/L Nitrate-Nitrogen
	<b>Pr</b>	=	Five-year return monthly precipitation, inches/month
	<b>PET</b>	=	potential evapotranspiration, inches/month
	<b>U</b>	=	nitrogen uptake by cover, lbs/acre/year pounds/acre/year (value should not exceed 100 lbs/acre/year)
	<b>C<sub>n</sub></b>	=	Nitrate-Nitrogen concentration in applied wastewater, mg/L (after losses in preapplication treatment)
	<b>f</b>	=	fraction of applied nitrogen removed by denitrification and volatilization.

## Residential Units

- Primary Treatment
  - ~ 1500 gallon, 2-compartment Barger concrete tanks
- Secondary Treatment
  - ~ AdvanTex AX-20 and AX-20RT



# Phases

- First installations March 2003
- 120 homes as of 2013

# Dispersal

- Subsurface discharge
- Two 25,000 gal equalization tanks
- 41,400 ft drip dispersal field
- 4.8 acre dispersal site



# Dispersal Area



## Benefits for Developers

- Reduced up-front cost
- Allow slow build-out
- Shorter installation time

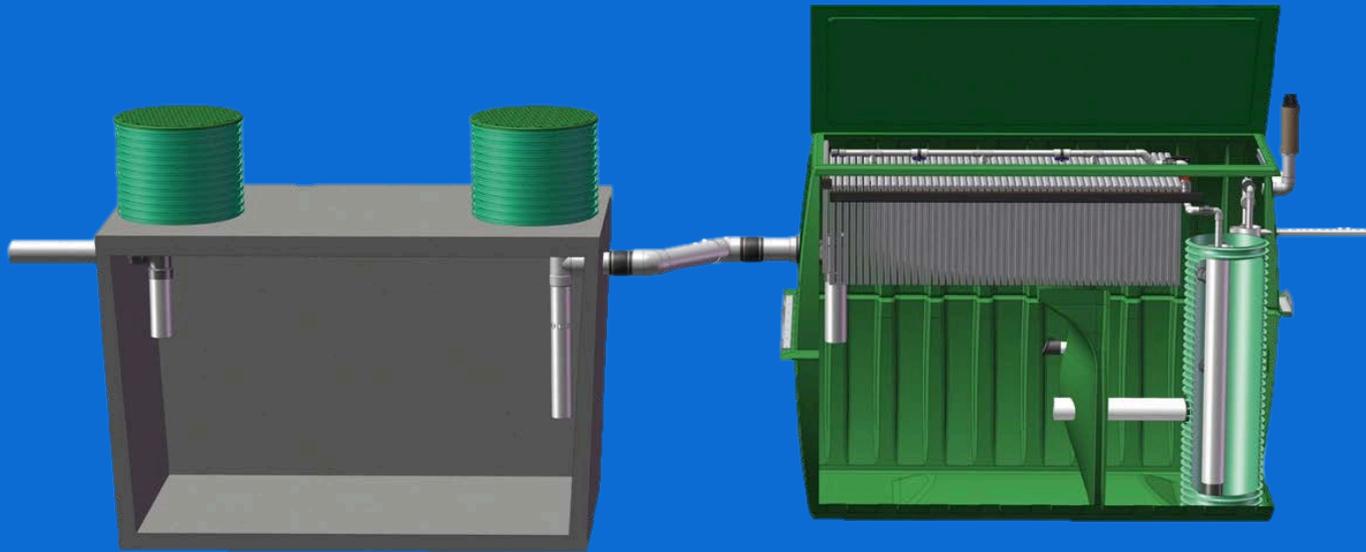
# Benefits for Homeowner and Utility

- Low energy cost
- Water re-use
- Water conservation
- Low capital investment



## Costs (2012)

- AX unit plus 1500 gal local tank: ~ \$7,845
- Installation: ~ \$2,600
- Pressure sewer mains and drip dispersal: ~ \$520/home



## Monthly Fees

- \$24.36 base rate for 1500 gallons used
- \$8.56 each additional 1000gal
- \$9 per user minimum for collection system

# Operation & Maintenance Cost 2012 - HPUD

- 151 Total Logged Visits
- 96 Yearly Inspections
- 7 Installation Inspections
- 7 System Start Ups
- 41 Service Calls
- Total Man-Hours - 186

# Benefits for the Environment

- Nutrient reduction
- Watertight system

# AdvanTex Effluent Quality

	BOD	TSS	TKN	NH <sub>3</sub> -N	NO <sub>3</sub> -N	pH	Alk
AX20	5.7	7.2	5.1	2.4	8.6	6.9	135

Permit limits were *45 mg/L BOD<sub>5</sub>* and *20 mg/L Nitrate NO<sub>3</sub>-N*

# Summary of Benefits

- Low infrastructure cost
- Modular build-out
- Shorter timeframe for design, approval, installation
- Utility managed system
- Power paid by property owners
- Lower power and billing costs for utilities
- Outstanding wastewater treatment
- Phasing in advanced treatment
- Protecting environment and reducing O&M costs
- Reduce risk of sewage overflows
- Improve troubleshooting characteristics
- Power and water conservation