COMPARISON OF COSTS FOR WASTEWATER SYSTEMS APPLICABLE TO CAPE COD

Presentation to Orleans Board of Selectmen

July 14, 2010

1

Wastewater Costs Report

- Goals
  - Determine what has already been spent for wastewater systems of all sizes (use local data wherever possible)
  - Establish a comprehensive set of cost items for evaluation
  - Conduct an “apples-to-apples” comparison of large and small systems
  - Perform a sensitivity analysis and identify key factors impacting costs
  - Guide towns in CWMP preparation

2

Wastewater Costs Report

- Task Force Members
  - Tom Cambareri, Cape Cod Commission
  - Brian Dudley, DEP
  - Mike Giggey, Wright-Pierce
  - George Heufelder, Barnstable County
  - Sue Rask, Barnstable County

3

Wastewater Costs Report

- Sponsors
  - Association to Preserve Cape Cod
    - Cape Cod 5 Charitable Trust Foundation
    - Horizon Foundation
  - Cape Cod Business Roundtable
  - Cape Cod Water Protection Collaborative

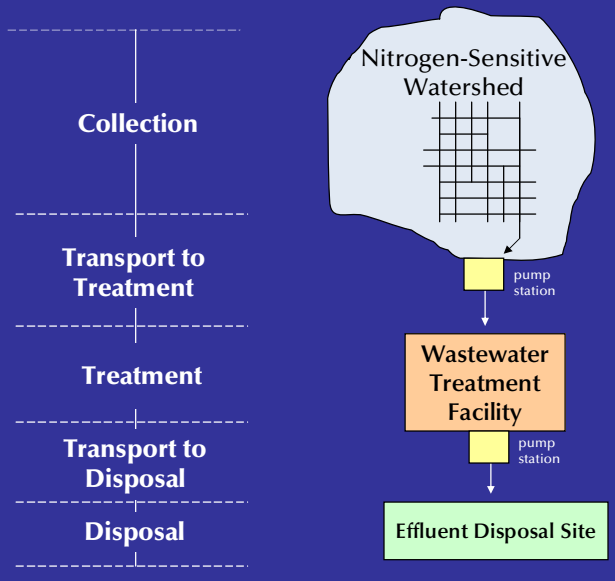
4

Types of Wastewater Systems

- **Individual** nitrogen-removing systems
  - serving one home or business
- **Cluster** systems
  - multiple lots—flow < 10,000 gpd
  - no Groundwater Discharge Permit
- **Satellite** systems
  - flows of 10,000 to 300,000 gpd
- **Centralized** systems

5

Elements of a Wastewater System



6

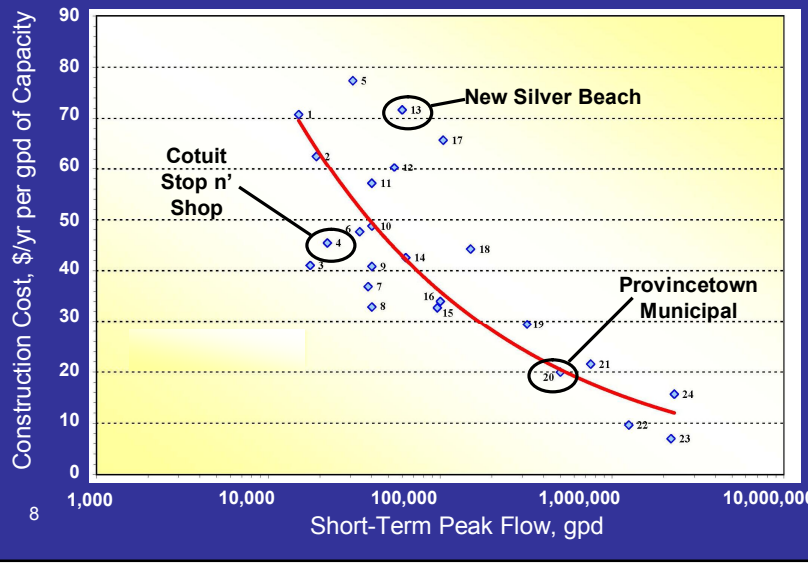
Wastewater Costs Report

- Survey of construction costs
  - 24 plants
  - 15,000 gallons per day (gpd) to 3.2 million gallons per day (mgd)
- Survey of O&M costs
  - 21 plants
  - 17,000 gpd to 4.2 mgd

Most data from S.E. Massachusetts
Costs adjusted to late 2009

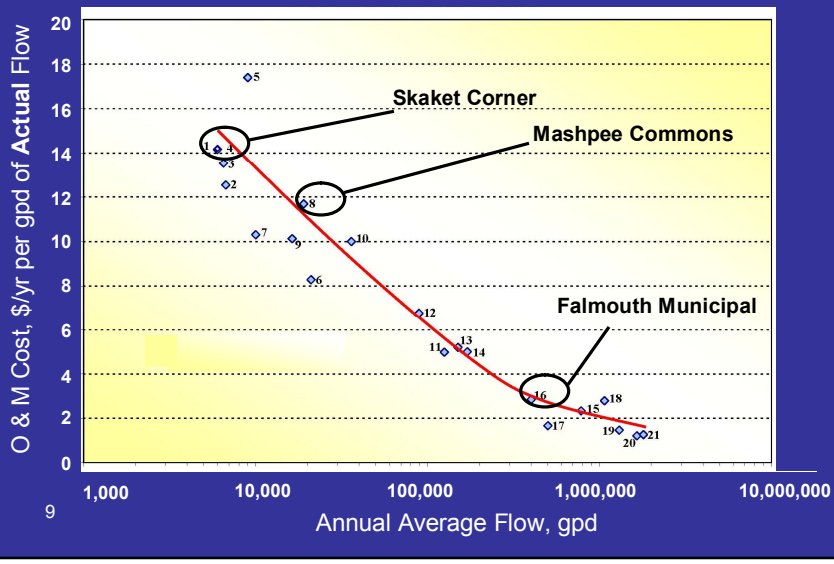
7

Construction Costs for Treatment ($/gpd)



8

O&M Costs for Treatment ($/yr/gpd)



9

Economies of Scale

The cost per gallon treated decreases as the size of the facility increases

Bus fare is less than cab fare

$6 per person

$20 per person

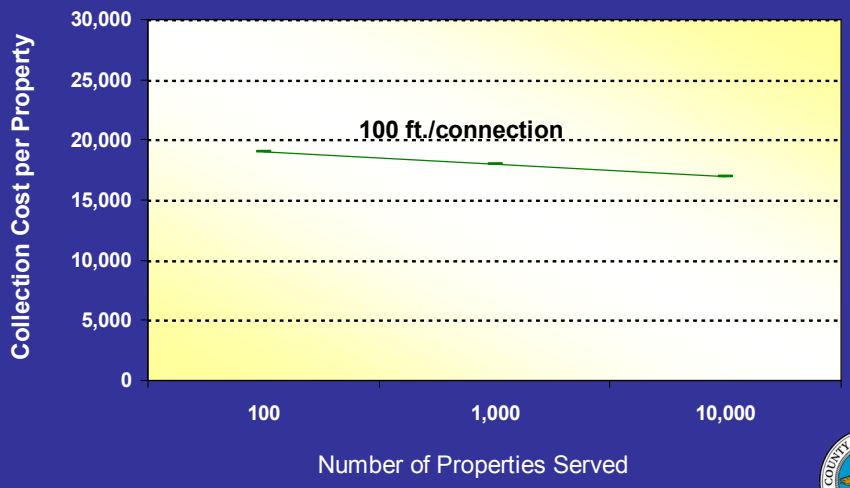
10

Economies of Scale

- Construction costs for treatment
  - 10,000 gpd $70 / gpd
  - 100,000 gpd $35 / gpd
  - 1,000,000 gpd $17 / gpd
- O&M costs for treatment
  - 10,000 gpd $13 /yr / gpd
  - 100,000 gpd $ 5 /yr / gpd
  - 1,000,000 gpd $ 2 /yr / gpd

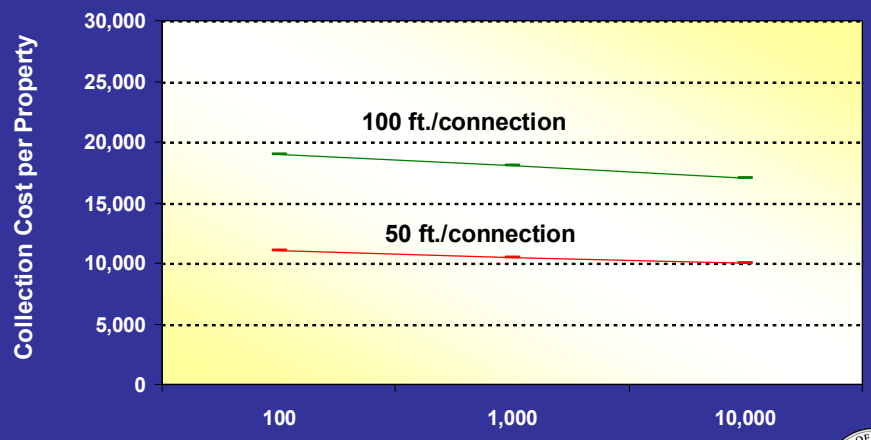
11

Construction Cost for Collection



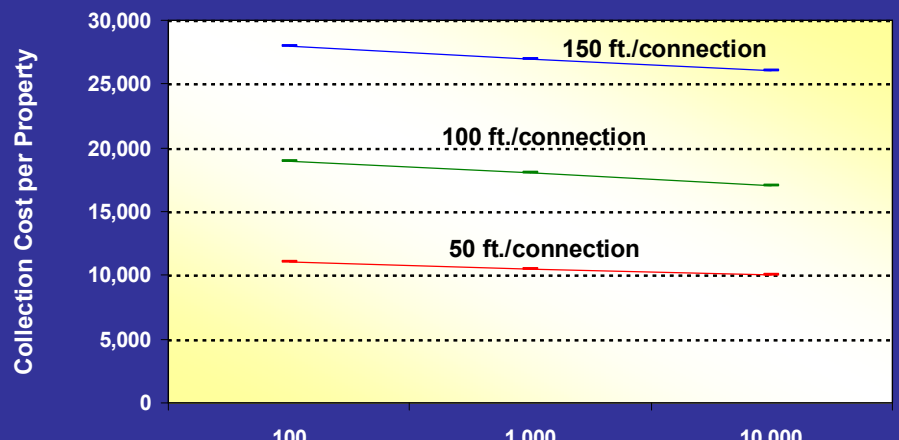
12

Construction Cost for Collection



13

Construction Cost for Collection



14

Measures of Cost

1. Capital costs (design, permitting, construction, land, etc)
2. O&M (labor, power, chemicals, etc.)
3. Equivalent annual costs (EAC)
   - Amortized capital cost, plus
   - O&M cost
4. EAC per pound of nitrogen removed from sensitive watershed

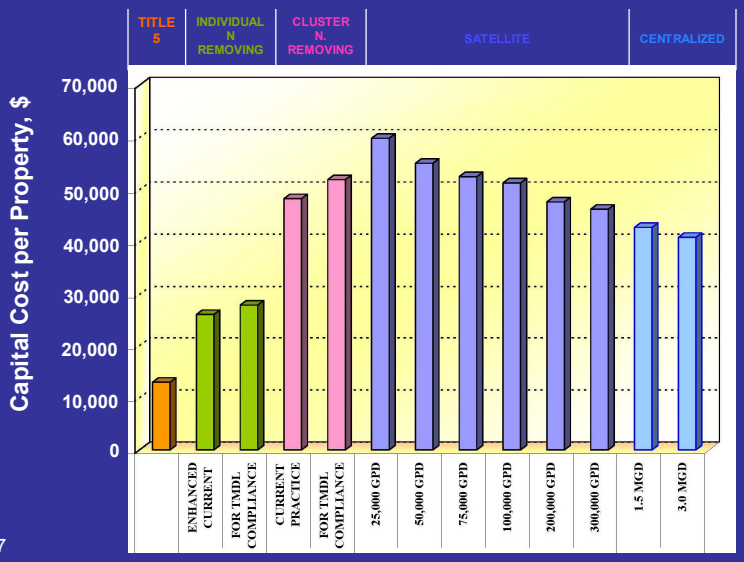
15

Cost Calculation Example

Capital Cost	**$31 M**
Amortized Capital Cost (5%, 20-yr)	**$2.5 M/yr**
O&M Cost	**$0.5 M/yr**
Equivalent Annual Cost	**$3.0 M/yr**
Nitrogen Load Removed	**8,700 lb/yr**
Unit Cost	**$350 / lb N**

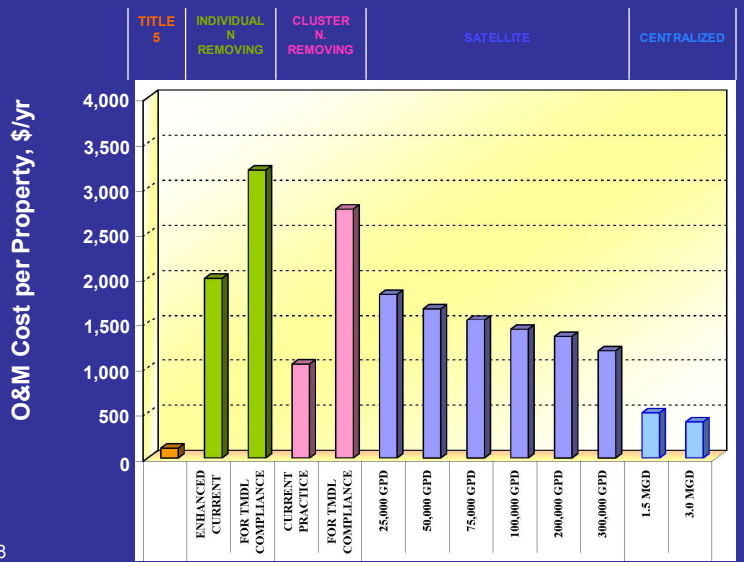
16

Predicted Costs—Capital ($/property)



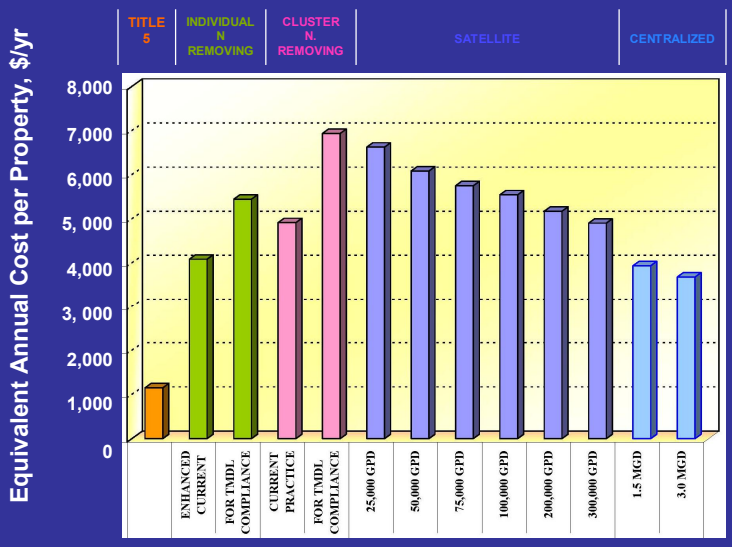
17

Predicted Costs—O&M ($/yr/property)



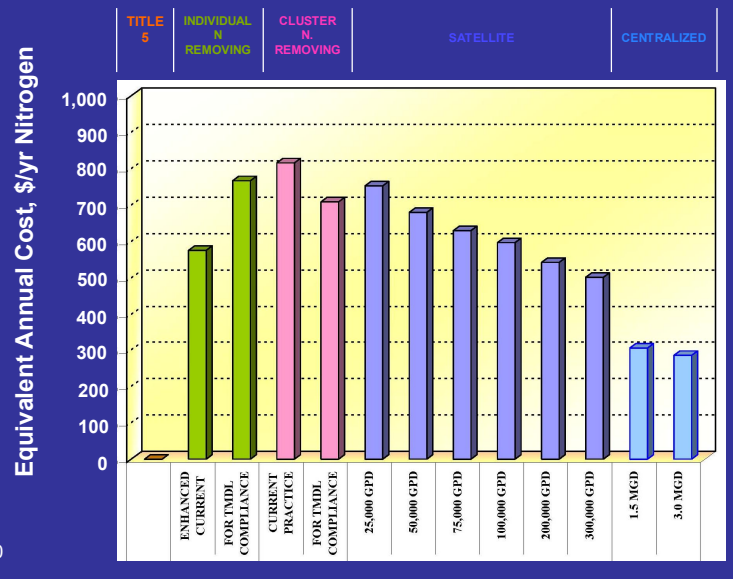
18

Predicted Costs—EAC ($/yr/property)



19

Predicted Costs—EAC ($/lb-N)



20

Predicted Costs—EAC/lb-N
"Base Case"

		"Premium"
• Individual	$770/lb	*+170%*
• Cluster—8,800 gpd	$710	*+150%*
• Satellite—50,000 gpd	$680	*+140%*
• Satellite—200,000 gpd	$510	*+ 80%*
• Central—1.5 mgd	$305	*+ 7%*
• Central—3.0 mgd	$295	------

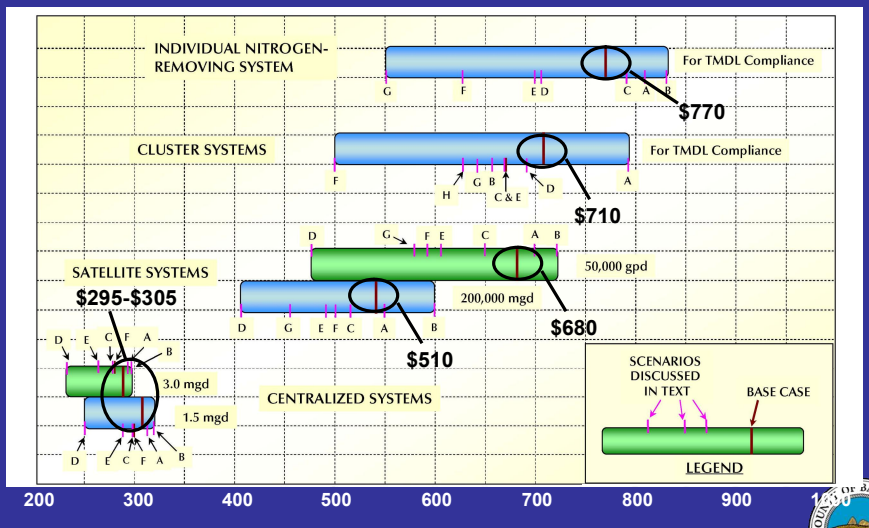
21

Predicted Costs—EAC/lb-N
Sensitivity Analysis

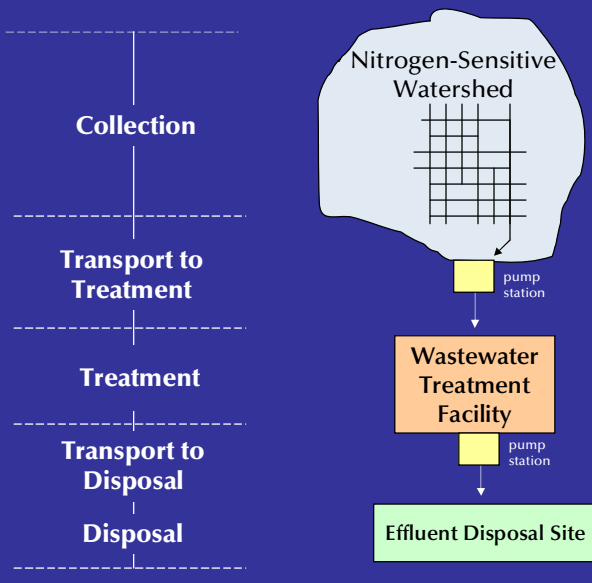
Better effluent quality
Longer transport distances
Discharges outside N-sensitive watersheds
Discharges within Zone IIs
Reduced costs from technology advances
Eliminating land costs
Regionalization
….Plus 11 other factors

22

Sensitivity Analysis (EAC/lb-N)



Elements of a Wastewater System



Cost per Pound of N

$200

$65

$25

Example Costs—EAC/lb-N

		Adjusted
• Chatham—2.3 mgd	$250 / lb	*($265)*
• Provincetown—0.575 mgd	$300	*($330)*
• Tisbury—104,000 gpd	$560	
• Mashpee Commons	$340	*($750)*
• --80,000 gpd		
• Brackett Landing	$455	*($550/$720)*
--8,230 gpd		

25

Orleans Example Costs—EAC/lb-N

	Orleans Only	Orleans Eastham & Brewster
• Collection	220	200
• Treatment	90	80
• Disposal	20	20
• Total	330	300

26

Wastewater Costs Report

- Best case for individual N-removing systems:
  - Average collection density > 200 ft/conn
  - TMDL < 50% septic N removal
  - Nearest sewer > 5 miles

27

Wastewater Costs Report

- Best case for cluster systems:
  - Small-lot developments remote from sewers with public land available
  - New cluster developments—developer later turns over to town
  - Near-shore areas of small poorly-flushed embayments where larger-scale system is not planned for some time.

28

Wastewater Costs Report

- Best case for satellite systems:
  - Remote areas (>4 to 5 miles) with public land available
  - New commercial/residential developments—developer later turns over to town
  - Existing satellite systems that can be expanded to serve nearby un-sewered areas

29

Wastewater Costs Report

- Best case for centralized systems:
  - Dense development in watersheds with high septic N removal requirements
  - Town-owned treatment/disposal sites within 3 miles
  - Disposal site outside sensitive watersheds
  - Opportunities for regionalization

30

Wastewater Costs Report

- Most significant cost drivers
  - Density of development—minimize sewer length per pound of N collected
  - Economies of scale
  - Location of effluent disposal—avoid N-sensitive watersheds and Zone IIs
  - Land costs—seek town-owned land or dual use of appropriate sites (e.g. golf courses and ball fields)

31

Wastewater Costs Report

What is the best wastewater system for a given community?

There is no one answer ! !

This report:

- Establishes a uniform basis for cost analyses
- Presents one cost comparison based on one set of assumptions
- Shows example projects
- Identifies the factors that most influence the costs, so towns can readily adapt this approach to their specific circumstances

32

Wastewater Costs Report

What is the best wastewater system for a given community?

Costs are not the only factor

$6 per person

$20 per person

33

Wastewater Costs Report

Comments are welcome…..

- *Additional data points from local operating facilities to amend the cost curves*
- *The approach to the financial analysis*
- *The conditions assumed in the "base case"*
- *Other cost factors to use in the sensitivity analysis*
- *Other example projects to "ground truth" the conceptual analysis*

34