

An aerial photograph of Lake Delhi, showing a large body of water with a dam on the right side. The lake is surrounded by dense green forest. Several houses and buildings are visible along the shoreline. In the foreground, there are several small boats on the water, and a larger boat is visible near the dam. The text "Lake Delhi Wastewater Treatment Project" is overlaid in the center of the image.

Lake Delhi Wastewater Treatment Project

Rustic State Warriors:

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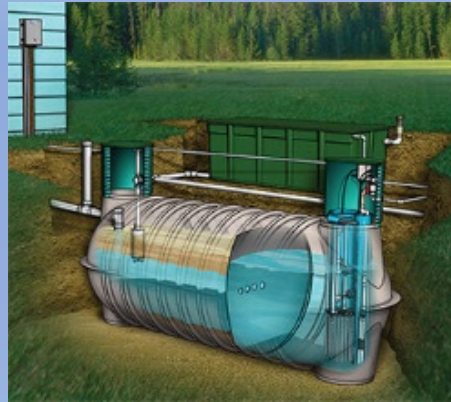
Esteban Londono

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Presentation outline



Assessing the problem



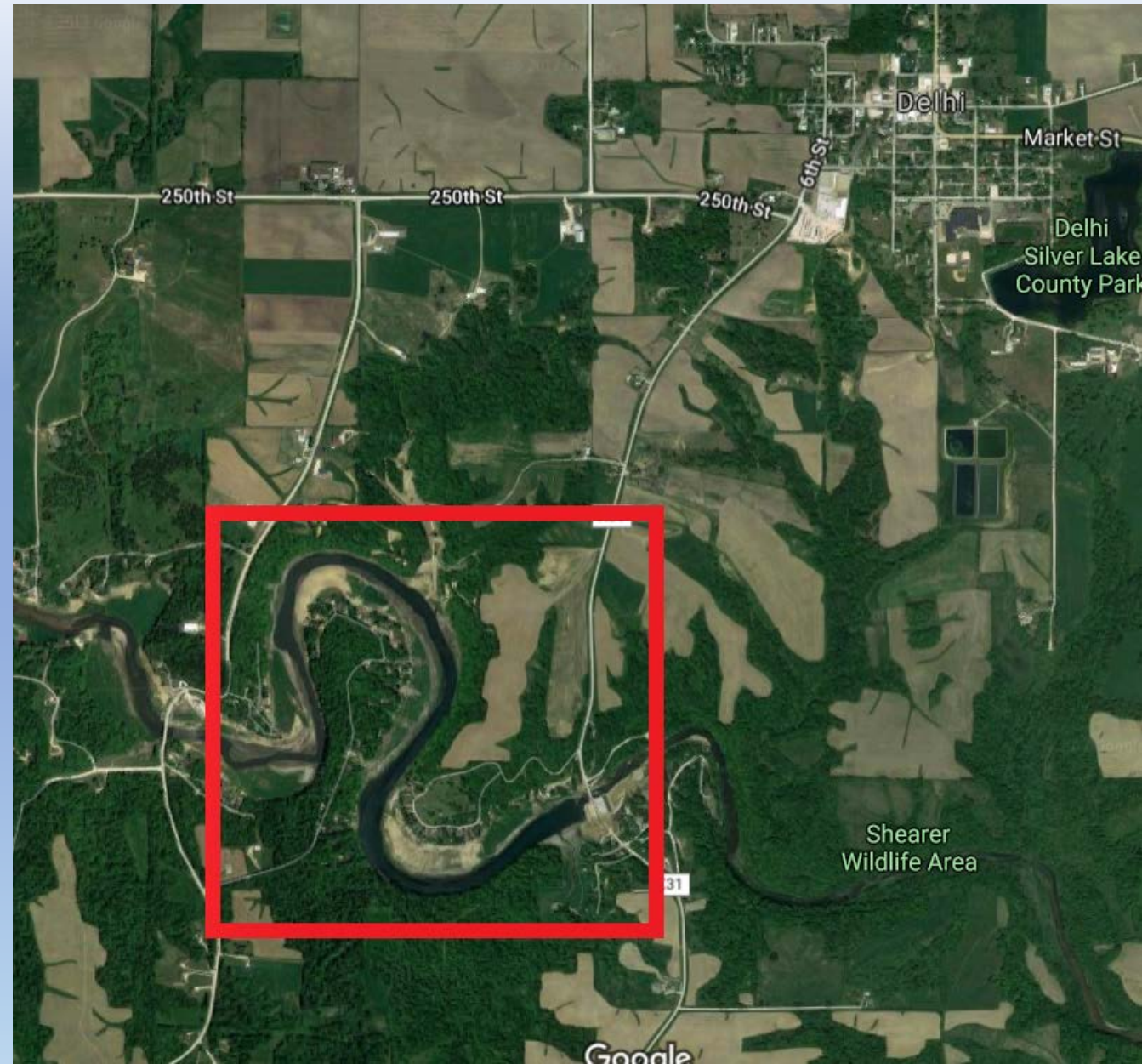
Selection Criteria and Identifying Alternatives

Site A-26527	AdvanTex	Eco-flow	holding tank
Effectiveness	1	2	5
Cost	4	3	2
O&M Requirements	3	2	4
Footprint	3	3	4
Design longevity	1	2	2
Installation Feasibility	1	2	4
Total	13	14	21

Alternatives chosen for sites

Location

- Population of Delhi: 460
- Demographics of Lake Delhi:
 - More people in the summer (less in the winter)
 - Residents are mainly part-time homeowners
 - Predicted to see an increase in full-time homeownership



Old Dam was breached in 2010



The Problem? Lake Delhi needs improved wastewater treatment

- New dam built by the State of Iowa with stipulation that Lake Delhi area wastewater issues be addressed
- Proposed “centralized” systems to cost \$15 million, no funding available
- Decentralized wastewater systems on a case-by-case basis were deemed most feasible solution
- Two thirds of homes already have an approved system

3 Sites



Design Criteria

- Effectiveness

Effluents Discharging To	E. coli cfu/100 mL	CBOD ₅ mg/L	TSS mg/L
Class "A1", "A3" waters	235	25	25
Class "A2" waters	2880	25	25

- Cost

- O&M Requirements

- Footprint

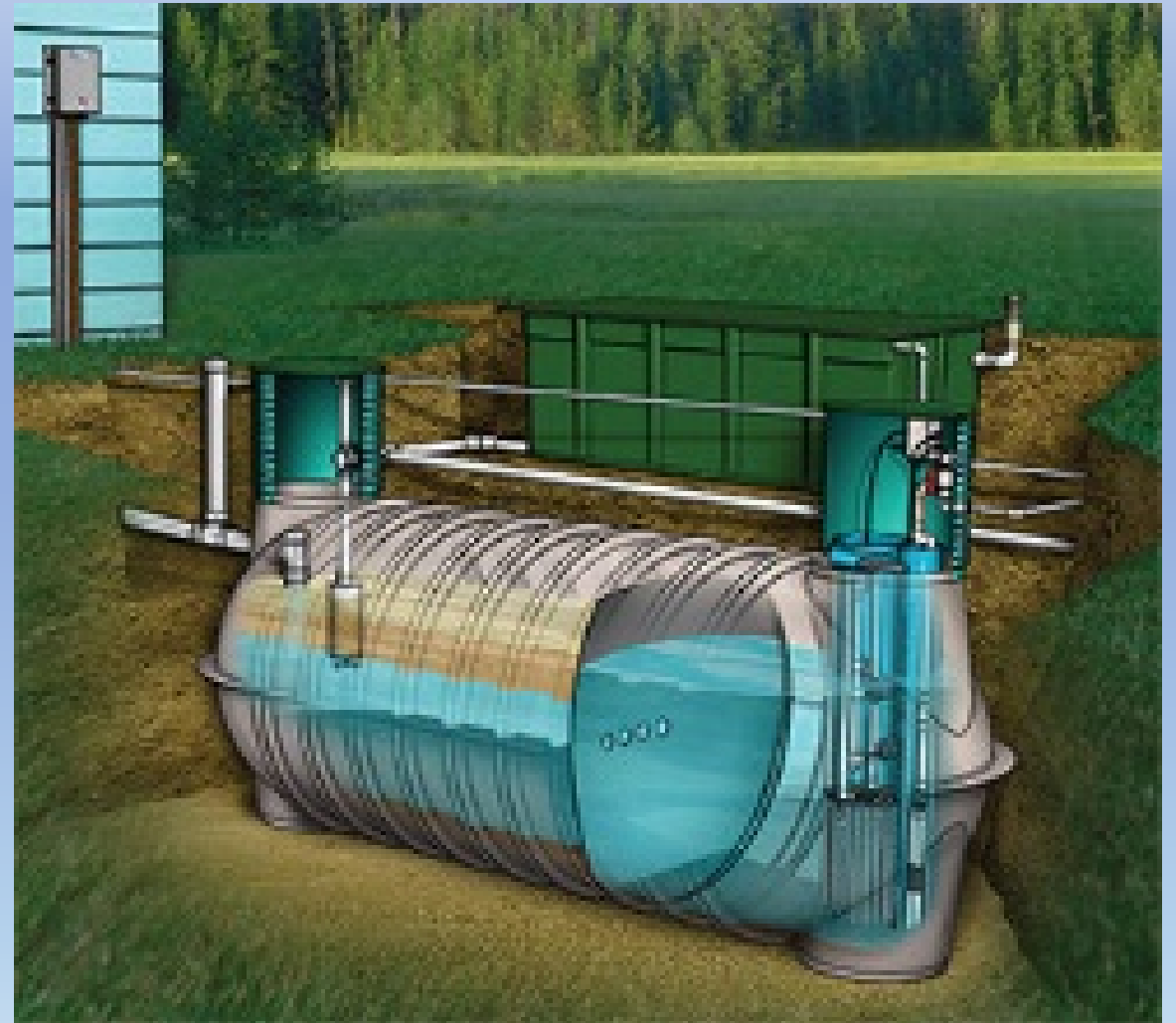
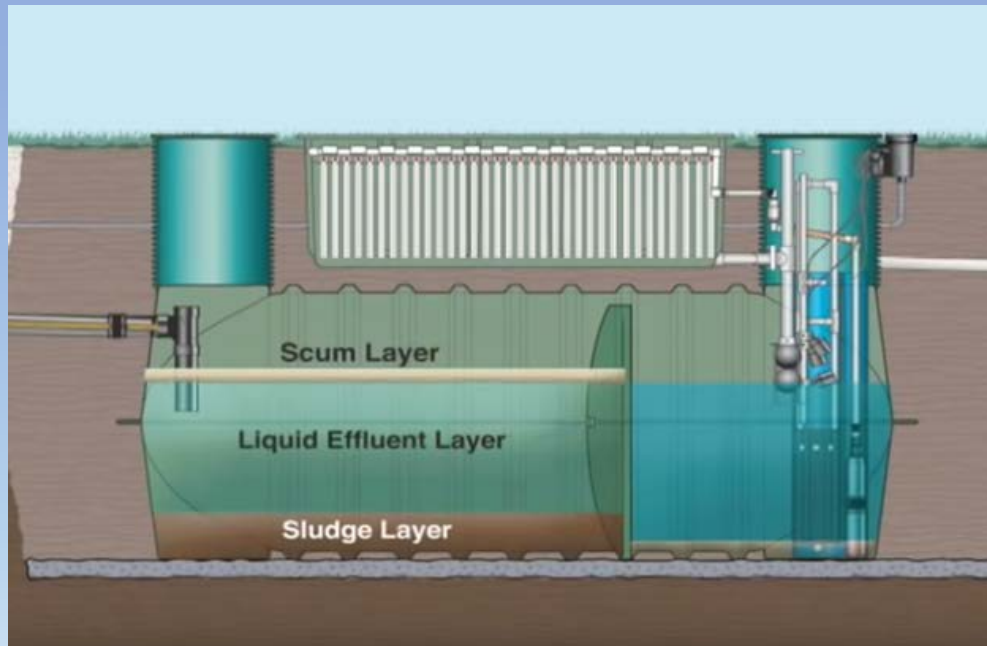
- Design Longevity

- Installation Feasibility

- Design Matrix is based on a scale from 1-5 where 1 is best and 5 is worst.

Decentralized system #1: AdvanTex

- Septic/Filter system
- 500-15,000 gpd units
- Textile filter requires pump
- Most expensive alternative
- Highest level of treatment

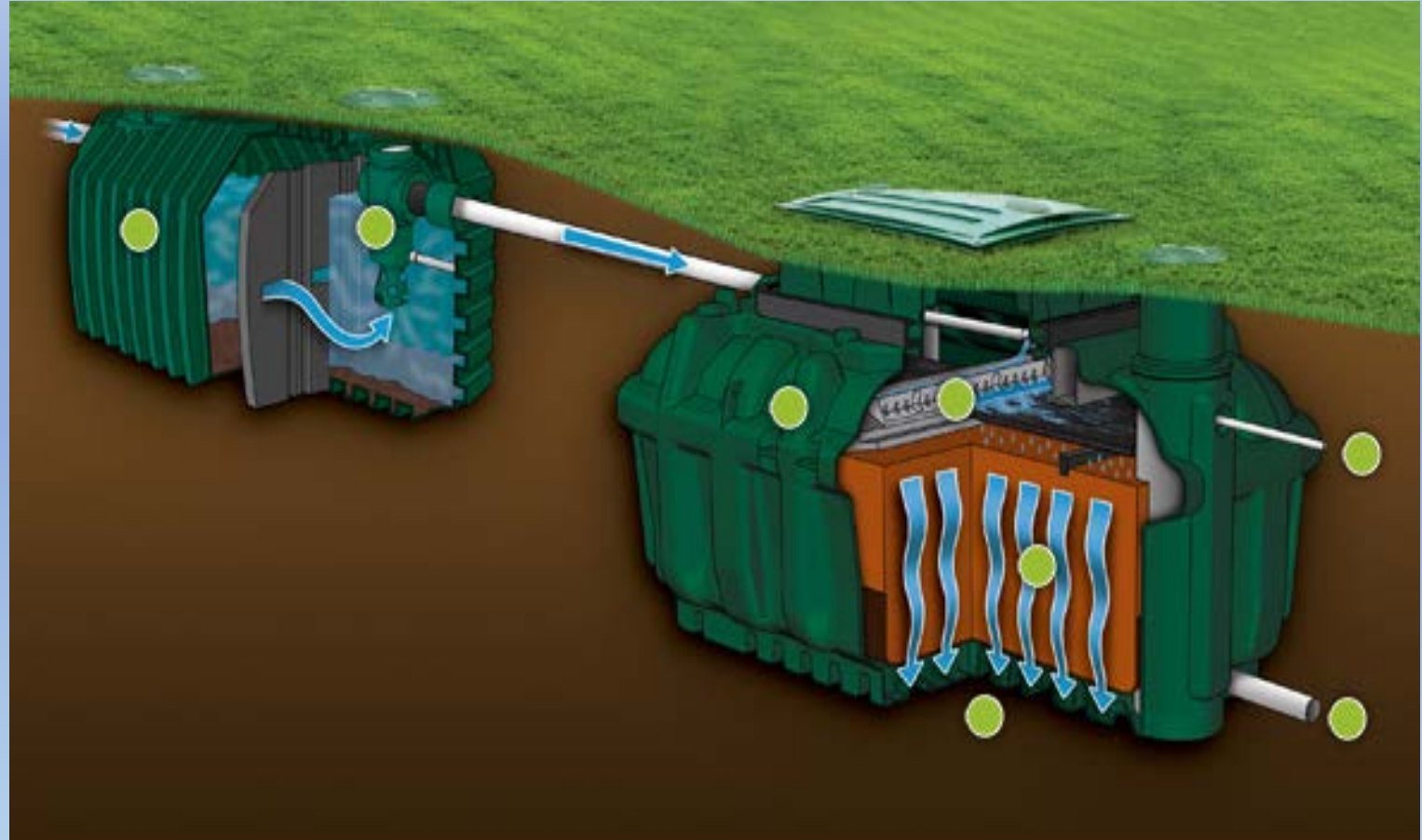


Performance: AdvanTex

System	Orengo AdvanTex Treatment Systems					
Wastewater Contaminant	CBOD ₅	TSS	Fecal Coliform	Total Nitrogen	NH ₃	Total Phosphorus
Average % Reduction	97	97	98	71	97	28
Meet Effluent Standards?	Yes	Yes	Yes	-	-	-

Decentralized system #2: PremierTech Ecoflo

- Septic/Filter system
- Coconut husk filter
- Passive distribution
- Low O&M
- Cheaper than AdvanTex
- High level of treatment



Performance: PremierTech Ecoflow

System	Premier Tech Ecoflo Treatment System					
Wastewater Contaminant	CBOD ₅	TSS	Fecal Coliform	Total Nitrogen	NH ₃	Total Phosphorus
Average % Reduction	96	95	97	62	N/A	10
Meet Effluent Standards?	Yes	Yes	Yes	-	-	-

Decentralized system #3: Holding Tank

- Worst case scenarios
- Require intermittent pumping
- Lowest capital cost
- Potential to degrade/leak



Number of bedrooms	Minimum Capacity
Up to and including 3- bedroom homes	1,250 gal.
4-bedroom homes	1,500 gal.
5-bedroom homes	1,750 gal.
6-bedroom homes	2,000 gals.

*IDNR

Site A



Site A: Overview

- Compromise of 5 vacation homes on 229th Avenue
- Hard to get in contact with home owners
- Home on right has existing AdvanTex system
- Steep slope ~ 35%



Site A: Current Treatment

- Pre-existing cement or plastic septic tanks
- Not currently IDNR approved
- Will either have to be replaced or connected to proper treatment equipment



Site A: Feasible Treatment Locations



- Challenge of finding place not too steep
- 5 homes with 11 bedrooms total
- Assume 150 gpd/bedroom
- House 26527
- Estimated would need 1650 gpd system

Site A: Recommended Treatment

- 1650 gpd AdvanTex system
- Most effective treatment for large wastewater flow
- Require grinder pumps for wastewater conveyance
- Drip field of 1834 ft² plausible with slope regrading
- System could directly discharge into Lake Delhi (IDNR)

Site A-26527	AdvanTex	Eco-flow	holding tank
Effectiveness	1	2	5
Cost	4	3	2
O&M Requirements	3	2	4
Footprint	3	3	4
Design longevity	1	2	2
Installation Feasibility	1	2	4
Total	13	14	21

Site A: Cost Analysis

System Requirements	Equipment Selection	Capital Cost	Annual O&M Cost	Installation Cost	Total 20-year Lifecycle Cost
1650 gpd Peak Flow	(2) AX20, Duplex PF5007	\$ 24,739.00	\$ 2,358.77	\$ 22,265.00	\$ 94,179.40

- Cost estimate provided by manufacturer
- \$18,836 per homeowner
- Drip field would add roughly \$10,000

Site B



Site B: Overview

- 30 homes with 6 full time residents
- Two thirds of homes already approved
- Expecting number of full time to rise
- Public well on site



Site B: Current Treatment

- 5 homes deemed non-approved
- These houses have either
 - Old septic systems with no operational knowledge
 - No system knowledge



Site B: Feasible Treatment Locations



- Homes 26123 and 26133 will use combined systems
- Homes 26098 and 26090 will use combined systems
- House 22243, located directly uphill of the well will have its own system

Site B: Recommended Treatment (26123/26133 & 26098/26090)

- 900 gpd Ecoflo system
- Slope favors gravity drainage
- Limited space makes Ecoflo optimal
- Drip field of roughly 1000 ft² not plausible due to property limitations
- Could discharge directly into Lake Delhi

Site B-26123	AdvanTex	Eco-flow	holding tank
Effectiveness	1	2	5
Cost	4	3	2
O&M Requirements	3	2	4
Footprint	3	1	3
Design longevity	1	2	2
Installation Feasibility	2	1	3
Total	14	11	19

Site B: Cost Analysis (26123/26133 & 26098/26090)

System Requirements	Equipment Selection	Capital Cost	Annual O&M Cost	Installation Cost	Total 20-year Lifecycle Cost
900 gpd Peak Flow	(1) 900 gpd units	\$ 8,400.00	\$ 750.00	\$ 7,560.00	\$ 30,960.00

- Cost estimate provided by manufacturer
- \$15,480 per homeowner

Site B: Recommended Treatment (22243)

- 1500 gallon holding tank
- Requires pump
- Leach fields required to be >50 ft from public water wells (IDNR)

Site B-22243	AdvanTex	Eco-flow	holding tank
Effectiveness	1	2	5
Cost	4	3	2
O&M Requirements	3	2	4
Footprint	3	3	4
Design longevity	1	2	2
Installation Feasibility	1	2	4
Total	13	14	21

Site B: Cost Analysis (22243)

System Requirements	Equipment Selection	Capital Cost	Annual O&M Cost	Installation Cost	Total 20-year Lifecycle Cost
1500 gallons	(1) Septic Tank 1500 gallon	\$ 1,520.00	\$ 525.00	\$ 5,023.00	\$ 17,043.00

- Holding tank to be pumped out roughly once a year at the end of summer

Site C



Site C: Overview

- 25-30 homes located here
- Roughly 1/3 do not have proper waste water treatment systems
- Large \$40,000 septic system unused



Site C: Current Treatment

- Concentrated on six homes deemed noncompliant to Iowa DNR
- Old septic tanks which lack information about operation



Site C: Feasible Treatment Locations



- Houses 25863 and 25852 will combine into one system each
- Houses 21666 and 21661 will combine into one system each
- Houses 21650 and 21630 due to their location shall each have their own systems

Site C: Recommended Treatment (25863/25852)

- 600 gpd AdvanTex system
- Slope favors gravity flow
- Drip field of roughly 670 ft² not plausible due to property limitations
- Could discharge directly into Lake Delhi

Site C	AdvanTex	Eco-flo	holding tank
Effectiveness	1	2	5
Cost	4	3	2
O&M Requirements	3	2	4
Footprint	3	3	4
Design longevity	1	2	2
Installation Feasibility	1	2	4
Total	13	14	21

Site C: Cost Analysis (25863/25852)

System Requirements	Equipment Selection	Capital Cost	Annual O&M Cost	Installation Cost	Total 20-year Lifecycle Cost
600 gpd Peak Flow	(1) AX25RT, Duplex PF3005	\$ 15,787.33	\$ 1,960.59	\$ 4,208.50	\$69,207.63

- \$34,604 per homeowner

Site C: Recommended Treatment (21666/21661)

- 600 gpd Ecoflo system
- Ecoflo preferred for space limitations
- Pump required for 21666
- Drip field of 670 ft² not feasible due to property limitations
- Could discharge into Lake Delhi

Site C	AdvanTex	Eco-flo	holding tank
Effectiveness	1	2	5
Cost	4	3	2
O&M Requirements	3	3	4
Footprint	3	1	3
Design longevity	1	2	2
Installation Feasibility	2	2	3
Total	14	13	19

Site C: Cost Analysis (21666/21661)

System Requirements	Equipment Selection	Capital Cost	Annual O&M Cost	Installation Cost	Total 20-year Lifecycle Cost
600 gpd peak flow	(1) 600 gpd units	\$5,600.00	\$ 560.00	\$ 5,040.00	\$ 21,840.00

- \$10,920 per homeowner

Site C: Recommended Treatment (21650/21630)

- (2) 1250 gallon holding tanks
- Small homes with infrequent use
- Require pumps

Site C-21650/21630	AdvanTex	Eco-flo	holding tank
Effectiveness	5	5	3
Cost	4	3	2
O&M Requirements	3	3	4
Footprint	5	4	3
Design longevity	1	2	2
Installation Feasibility	3	3	2
Total	21	20	16

Site C: Cost Analysis (21650/21630)

System Requirements	Equipment Selection	Capital Cost	Annual O&M Cost	Installation Cost	Total 20-year Lifecycle Cost
1250 gallons	(2) Septic Tank 1250 gallon	\$ 1,235.00	\$ 525.00	\$ 5,023.00	\$ 16,758.00

- Cheapest design alternative
- \$8,379 per homeowner
- Lacked considerable site information for further analysis

Disclaimer (Drip Fields)

- IAC 567-69.4(455B) states that discharges from private sewage disposal systems which are discharged into, or have the potential to reach, any designated waters of the state or subsurface drainage tile shall be treated in a manner that will conform with the requirements of NPDES General Permit No. 4 issued by the department of natural resources.
- AdvanTex/PremierTech systems meet effluent requirements for direct discharge into class A1 waters for strong domestic wastewater.

Effluents Discharging To	E. coli cfu/100 mL	CBOD ₅ mg/L	TSS mg/L
Class "A1", "A3" waters	235	25	25
Class "A2" waters	2880	25	25

Conclusion

- Total 20-year Lifecycle cost estimation: **\$297,706.03**
- Require more homeowner information/cooperation for more accurate cost estimate

	Homes	System	Total Lifecycle Cost	Cost per homeowner
Site A	26507, 26511, 26527, 26535, 26539	1650 gpd Advantex System	\$ 94,179.40	\$ 18,835.88
Site B	26123, 26133	900 gpd PremierTech System	\$ 30,960.00	\$ 15,480.00
	26098, 26090	900 gpd PremierTech System	\$ 30,960.00	\$ 15,480.00
	22243	1500 gallon holding tank w/ pump	\$ 17,043.00	\$ 17,043.00
Site C	25863, 25852	600 gpd AdvanTex System	\$ 69,207.63	\$ 34,603.82
	21666, 21661	600 gpd PremierTech System	\$ 21,840.00	\$ 10,920.00
	21650	1250 gallon holding tank w/ pump	\$ 16,758.00	\$ 16,758.00
	21630	1250 gallon holding tank w/ pump	\$ 16,758.00	\$ 16,758.00

Special Thanks

- Dennis Lyons
- Delaware County
- Rebecca Mattson
- Tim Mattes

An aerial photograph of a large lake. In the upper right, a dam with multiple spillways is visible. The shoreline is lined with several houses and buildings, some with docks extending into the water. The water is dark blue, and there are several small boats scattered across the surface. The surrounding area is densely forested with green trees. The word "Questions?" is overlaid in the center of the image in a large, black, sans-serif font.

Questions?