

COASTAL CLIMATE ADAPTATION FOR DECENTRALIZED WASTEWATER SYSTEMS IN NORTH AND SOUTH CAROLINA

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Research conducted by:

NC STATE UNIVERSITY

Thank you for participating in this study conducted by North Carolina State University. The purpose of this study is to gain a better understanding of onsite wastewater technologies in the coastal Carolinas under different future conditions, for example, changes in groundwater depths or sea level rise. We want to learn about the types of septic systems and package plants you deal with, and what system changes might make them viable for extreme weather events like hurricanes and rising water table conditions. We also want to know about the costs of various systems and adaptations. We will do this through asking you to participate in an interview.

Coastal communities in North and South Carolina are concerned about the impacts of changing climate and extreme weather on onsite wastewater treatment system (OWTS) functionality. They want to learn about onsite wastewater treatment technologies and their capacities to handle weather fluctuations and shallow water tables from the men and women who specialize in operating and installing these systems.

Your answers in this interview will help coastal communities in North and South Carolinas learn how OWTS work to remove contaminants in different climate conditions and determine the costs of alternative systems. Your answers will also provide insight for how these communities may plan for effective onsite wastewater treatment in a changing climate and protect the people living on the coast from water contamination.

This study is funded by NOAA's Climate Program Office. A summary of results will be made publicly available and accessible to septic system experts, coastal community decision makers, and coastal residents. Your responses will be used to develop sustainable onsite wastewater treatment recommendations for the coastal Carolinas. Your responses will be used for research purposes only and will be confidential.

By initiating this interview, you indicate that you have read the consent form and voluntarily consent to participate in this research study.

Section I: Perceived vulnerabilities of septic systems to climate

I am going to ask you some questions about onsite wastewater treatment systems related to climate and weather. I would like you to think about coastal sites only, meaning sites located in the Outer Coastal Plain (like Barrier Islands) and sites near the coast on the mainland (also called Inner Coastal Plain and the Sandhills region).

In the following sections, there will be questions referring to onsite wastewater system malfunction. "Malfunction" refers to hydraulic overload, alarm activation, and needing repair (excluding end-of-life).

- 1) What site variables determine how well an onsite wastewater treatment system functions during heavy rainfall events?

- a) What site variables determine how well a system functions during frequent rainfall events (continual saturation)?

- b) What are the visible signs of failure during sporadic heavy rain or continual saturation?

- c) How does seasonal occupancy impact the functioning of a septic system at a vacation home site?

2) How is a system determined to need replacement?

Now I am going to tell you about three hypothetical weather scenarios in the coastal region. I want you to imagine the impacts these circumstances would have on the onsite wastewater treatment systems in the area. Assume the soils have a good percolation rate.

Example 1

Imagine that there have been dry conditions for a while, enough time to create very dry soils. After that time, there is an intense rainfall event that produces 2 inches of rain in one day.

3) Would you expect a conventional system (septic tank + gravel trench/drainfield) to malfunction or experience treatment failure in these conditions?

Yes

No

a) If yes, how long after the event would it take for the system to recover? Please give a typical range of days/weeks.

b) If not, under what rainfall conditions would you expect it to malfunction?

4) What maintenance would be needed to regain functionality after a heavy rain event like the one in this example?

- a) How do conventional systems (septic tank + drainfield) compare to advanced systems (that include pretreatment components) in terms of what is required to regain functionality? Please refer to the reference handout provided for a list of advanced systems.

- b) How do individual/ small-flow septic systems compare to package treatment plants/ large-flow systems in terms of what is required to regain functionality?

Example 2

Now imagine an inland coastal area that is more than 1 mile from the ocean. Soils are currently saturated from prior rainfall. Then there is a heavy rainfall event that produces 2 inches of rain in one day.

- 5) Would you expect a conventional system to malfunction or experience treatment failure in these conditions?

Yes

No

- a) If yes, how long after the event would it take for the system to recover? Please give a typical range of days/weeks.

b) If not, under what rainfall conditions would you expect it to malfunction?

6) What maintenance would be needed to regain functionality after a heavy rain event like the one in this example?

Example 3

In this last scenario, imagine a coastal area within 1 mile of the ocean. Soils are currently saturated from prior rainfall. Simultaneously, the area is experiencing a high/King Tide event, causing an exceptionally high tide 12 inches above the average high tide.

7) Would you expect a conventional system to malfunction or experience treatment failure in these conditions?

Yes

No

a) If yes, how long after the event would it take for the system to recover? Please give a typical range of days/weeks.

b) If not, under what high tide or storm surge conditions would you expect it to malfunction?

- 8) What maintenance would be needed to regain functionality after a high tide event or storm surge like the one in this example?

Thinking of all three of these hypothetical examples...

- 9) How would system malfunctions caused by extreme weather events such as these impact the life expectancy of a system?

Now we're going to talk about how changes in the groundwater table impacts onsite wastewater treatment systems. In some coastal communities there is evidence that the groundwater table is rising...

- 10) In low-lying areas where the groundwater table is shallow, do you notice more problems with onsite system functionality?

Yes

No

- a) If yes, what types of problems?

- b) Are these problems typically event-based, occurring for several days after major precipitation events (> 2 inches) or are they chronic problems that occur for longer durations (>several days)?

Section II: Adaptation strategies to hazards posed

We have been talking about how septic systems function in various weather conditions and scenarios. Now I am going to ask you some questions about adaptation measures that are being used or could be used to increase the resilience of onsite wastewater treatment systems to flooding and extreme weather events.

11) Are you currently taking any measures to adapt onsite wastewater treatment system operation or installation to weather extremes, sea level changes, and/or shallower water table conditions (which is related to increased groundwater depths)?

Yes

No

a) If so, what are you doing?

b) If so, what prompted the change/action?

12) Can you tell me about septic or package plant technology changes that could improve their functionality during extreme weather, higher sea level, and/or shallower water table conditions?

13) Which advanced treatment systems would you recommend for handling extreme weather events like the examples we discussed earlier? Please refer to your reference handout for a list of advanced treatment systems.

a) Under what conditions would you recommend these?

Section III: What are the costs?

Finally, we are going to talk about the costs associated with onsite wastewater treatment systems.

I am going to tell you about three hypothetical properties in the coastal region. Assume these properties are within 1 mile of the ocean and/or other surface waters. I want you to imagine the costs associated with installing and operating onsite wastewater treatment systems on these properties. If you don't have experience or knowledge about a specific property type, let me know and we can skip that one.

Example 1

Imagine a property that is a standard home: 2,000 square feet, 4 bedrooms, 2.5 bathrooms on a ¼ acre lot. The soils have a good percolation rate, requiring a 480 square foot drainfield (3 trenches, each 3 ft x 53 ft).

14) What type of system would you expect to install for this home?

15) What would be the approximate installation cost, including the system, drainfield, and labor?

16) What would be the approximate maintenance/operational cost of that system each year?

Example 2

Next imagine a property that is a vacation home with heavy seasonal occupancy between May and September: 4,000 square feet, 8 bedrooms, 7 bathrooms on a ½ acre lot. The soils have a good percolation rate, requiring a 960 square foot drainfield (4 trenches, each 3ft x 80 ft).

17) What type of system would you expect to install for this home?

18) What would be the approximate installation cost, including the system, drainfield, and labor?

19) What would be the approximate maintenance/operational cost of that system each year?

Example 3

Now imagine a property that is a commercial building: an office building with an average sewage wastewater flow of 1,200 gallons per day. The wastewater is high-strength.

20) What type of system would you expect to install for this type of commercial property?

21) What would be the approximate installation cost, including the system, drainfield, and labor?

22) What would be the approximate maintenance/operational cost of that system each year?

Example 4

Finally, imagine a housing development with 100 homes and an average sewage wastewater flow of 45,000 gallons/day. You have been asked to install a package treatment plant to serve as a neighborhood-scale wastewater treatment facility.

23) What type of advanced treatment components would you expect to include in the installation of a package treatment plant like the one in this example? Please refer to your reference handout (pg. 2) for examples of advanced treatment components for large-flow (>1,500 gal/day) systems.

24) What would be the approximate installation cost of the facility, including the systems, drainfield, and labor?

25) What would be the approximate maintenance/operational cost of that system each year?

a) What would be the approximate cost to each homeowner connected to the treatment facility each year?

Now I am going to ask you a general question that applies to any type of onsite wastewater treatment system.

26) What would be the approximate cost to add a pretreatment component/technology to a site that already has a system installed? You may choose one type of pretreatment to use as an example. Refer to the reference handout for a list of common pretreatments.

a) How would the cost of that pretreatment addition compare to the cost of including the same type of pretreatment in the initial installation of the system? What would be the difference in cost?

Finally, I would like to ask you a couple of questions about financing onsite wastewater treatment systems.

27) What are the public financing options (grants or loans) available to build or repair individual/small-flow onsite wastewater treatment systems?

28) What are the public financing options (grants or loans) available to build or repair package treatment plants/large-flow onsite wastewater treatment systems?