



COASTWATCH

Photo by Gene Furr



On the narrow and delicate barrier islands, it's a case of too little soil for too many gallons

A problem of plumbing

The reader was troubled: He and his wife had just been vacationing on one of North Carolina's barrier islands. "We asked two questions while we were there," he wrote. "One was, 'where does the drinking water come from?' The only reply we ever heard was, 'out of the ground.'"

His other question had to do with where the water had gone when he was through with it. He never did manage to get an answer for that one. If he had, it would likely have been, "right back into the ground." Or, "into the sound."

He had happened on what may be coastal North Carolina's nastiest problem. It's much more than a question of bad plumbing. It's more, also, than a problem of 316,858 acres of contaminated oysters and clams. It's more than a threat to the purity of drinking water. It's more than a stranglehold on new construction. In many places, it's getting worse. And, the authorities in charge can't agree on how to fix it.

There are no easy solutions to the problem of sewage disposal in coastal North Carolina. The environment here is fragile, the desire to build and live here is compelling. In this issue, *Coastwatch* examines the question: What do we do about the stuff we're flushing down our drains?

Ringside at the battle of The Loophole

The malady has been diagnosed, but some say the patient may expire before authorities stop feuding and agree on how to treat it. Much of coastal North Carolina is fouling itself with the flushing of its toilets.

There are no fewer than four heavyweight agencies in the fray: the N.C. Division of Environmental Management, the N.C. Division of Health Services, the Coastal Resources Commission and the U.S. Environmental Protection Agency. Each claims to champion the same cause: protecting the environment and ensuring the welfare of the population.

The main event has been billed as the "health departments versus the state." County health departments, under Health Services, are battling Environmental Management for the authority to govern sewage disposal in their communities. Presently, construction of a sewerage system with a capacity larger than 3,000 gallons a day requires a permit from Environ-

mental Management. Permits for smaller systems are let by local health departments.

Both sides are bitter over what editorial writers have described as "The Loophole." The Loophole allows some builders to skirt authority and construct waste-disposal systems.

State Environmental Management officials say The Loophole exists because local health departments don't stand up to local building interests. "Local health departments are a lot more subject to local pressures," says Stan Taylor, Environmental Management's acting coordinator for permits and engineering. "After all, many of these water-quality problems came about because they weren't handled locally."

Taylor says that in many growing coastal communities, condominium complexes and other developments are avoiding Environmental Management's structures by providing each living unit or building with its own

septic tank. Local health departments can issue permits for dozens of septic tanks in these cases, he says, since no one system exceeds 3,000 gallons. Environmental Management, he says, won't allow more than three living units or 1,200 gallons of septic-tank effluent per acre.

"We have a density requirement on septic tanks that is considerably less than what local health departments allow," Taylor says. He says that biological sampling in waters adjacent to concentrations of septic tanks almost always yields high levels of coliform bacteria, regarded by law as the indicators of health hazards in drinking water and shellfish.

"Wherever you have this rampant development with septic tanks, you're going to find closed shellfish waters," Taylor says.

Page Benton, chief of the division's environmental operations section, says the 3,000-gallon threshold represents an arbitrary attempt on the part of the

Photo by Neil Caudle



Alton Rouse and son

'You can't drain Water in water'

Few are closer to the soils of Carteret County than Alton Rouse and his son, Alton Rouse, Jr. Each year they install or repair several hundred septic systems on sands, clays and even dredge spoil. Too many of those systems, they believe, are bound to fail. They also believe that the public is not really aware of the problem.

"A lot of people come down here to live and don't even know they have a septic tank," Rouse, Jr. says. "You can ask them, and a lot of times they say, 'No, I don't have a septic tank.' But they do, most of them, and they need to know how it works."

With 12 years of experience in his father's septic tank service, Rouse, Jr. believes a properly sited septic tank is the best way to dispose of residential waste.

"You find systems that work thirty years without a minute's trouble," he says. "Some never work at all."

state legislature to define the responsibilities of the local health departments. New housing patterns in the coastal area, he says, are making the rules obsolete.

"There are places in the state where the interpretation is that you can have as many living units in an area as you like, so long as each unit doesn't exceed the 3,000 gallons," Benton says. "In some places on the barrier islands, there are fifteen to twenty living units per acre. That's up to fourteen thousand gallons per acre per day of untreated sewage."

Benton and others point out that because coastal sands are porous, sewage can drop through the soils so quickly that almost no treatment occurs. As long as the effluent doesn't rise to the surface, few people notice the system is failing. Finding out just how much sewage finds its way into drinking water in beach communities is extremely complicated.

Benton says his division's density guidelines are none too strict for the water-laden soils of barrier islands, where most of the drinking water

comes from the freshwater "lens" formed when rainwater is trapped underground in a dish-like container of heavier salt water.

"Twelve hundred gallons per acre per day of untreated sewage is equal to about half the amount of rainfall, per acre, that it takes to recharge the drinking water on the barrier islands," Benton says. "Do you want to drink one-third sewage and two-thirds water?"

Benton does not regard septic tanks on the islands as providing sewage treatment—only disposal. He says sewage in sensitive coastal areas should be fully treated before it is released from the system. And he criticizes the methods of some sanitarians, who approve the systems, he says, by "going out to the site, and stamping their feet in the dirt, and saying 'okay, this is approved.'"

But the Division of Health Services and many local sanitarians blame Environmental Management for The Loophole. Joe Stokes, health director in Dare County, says that his county's sewage disposal laws are stricter and

He adds that it's easy to predict which system will fail: "You can tell sometimes before you ever start digging. If the lot is low and wet, it'll never work. You can't drain water in water. If you dig down and the water is down there, eight or ten inches, it'll never work. And that blue-looking stuff that they dredge up off the bottom, it's not going to work in that, either."

The problems are worst on the islands, he says, because of the small lots and high water tables there. "The worst are those lots on the canals. I can show you two trailer parks over on the island (Bogue Banks) where not a single system is working. When the tide comes in, and they flush the toilet, it just doesn't flush."

The Rouses will install, for the typical house, a 1000-gallon tank and 100 ft. of drain line for about \$650, the usual system for well-drained, sandy soils. On clay, which absorbs effluent much more slowly, the drain line is lengthened to about 210 ft. and the price rises to around \$900.

But in the developing beach communities near them, many of the lots are so small that the Rouses say they

can't always find room for the pipe required.

"You take a lot, five thousand square feet, put a house and a driveway on it, come back a hundred feet for the setback and ten feet from the lot boundaries, and there's just no place for the drain field," Rouse, Jr. says.

The Rouses don't lay all the responsibility for the failures of septic systems on the county health department.

"The sanitarians are under a tremendous pressure to approve these things," Rouse, Jr. says. "If a guy has had his lot for five or ten years, saving up to build, are you just going to tell him, 'Hey, you can't build here?'"

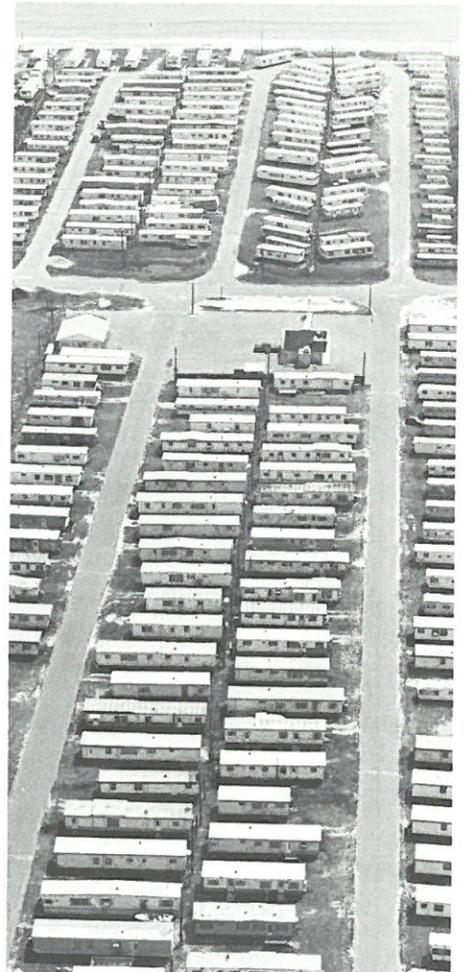
Permits have already been issued when the Rouses are called in, but they usually speak up when they see a site won't support the system.

Says Alton Rouse: "I tell the contractor, 'I don't know how you got your permit, but this ain't gonna work.' Then it's up to him, if he wants to go ahead."

—Neil Caudle

more effective than those of Environmental Management.

"How can somebody sitting up in Raleigh decide the best system for a site down here?" he asks. He cites the example of a sewage-disposal plan approved by Environmental Manage-



Density, with septic tanks

ment for a new condominium complex, near Nags Head. The complex's plan to pipe its 10,000-gallon-a-day sewage flow into the treatment plant of a neighboring community outraged some of the community's residents.

"When the lots were sold here, we thought our sewage plant was large enough to allow for some leeway," says Lourana Cowan, resident of the community. "But since then, they've added all these apartments and restaurants, and now, these condominiums. There have already been some problems with some sewage back-up here, so how can we handle more?"

Continued on next page

Stokes says his department would not have permitted the plan, had it fallen under his jurisdiction. "We would base our judgment on the potential use of the system," Stokes says. "The state just looks at the engineer's plans that say the system holds so many gallons, and that's how many they'll allow. We think there's too much going into that system now, and we believe there may be some risks to shellfish waters there. But it's very hard to prove. We've met numerous times in Raleigh with the powers that be, but our hands are tied."

Richard Koonce, sanitarian in Onslow County, says that developers in his area do occasionally try to use septic tanks to avoid the state's authority over larger treatment plants. But they often do so, he says, because they don't want the red tape of dealing with the state. He confirms that pressure for new buildings is intense in his county, but he points out that his office has turned down hundreds of lots because

ban the direct discharge of wastewater, even treated wastewater, into shellfish waters. The revision would permit some such discharges, but only if Shellfish Sanitation certified that the discharges did not jeopardize shellfishing. Environmental Management says the revisions demonstrate that the division is making an effort to tailor its rulings to local conditions. But Stan Taylor says the division may actually withdraw some of the proposed revisions, if the health departments manage to get their bill passed.

The Coastal Resources Commission, charged with protecting the environmental health of the coastal region, has also spoken up on The Loophole. The Commission supports the 3,000-gallon threshold, but recommends that developments like condominiums be treated as "design units" and therefore be required to meet the guidelines of Environmental Management. So far, this support has materialized as a letter to the feuding agencies.

"Wherever you have this rampant development with septic tanks, you're going to find closed shellfish waters" —Stan Taylor

the soils were inadequate for sewage treatment.

Stan Taylor denies that Environmental Management imposes a burden of red tape on builders. "We've got to approve the request or deny it within ninety days," he says. "The plans and specifications have to be done by an engineer, but the requirements are simple."

Various drafts of legislation aimed at closing The Loophole have come to grief in the state legislature. One of those still kicking is a measure drafted on behalf of local health departments, and was inspired by the problems in coastal counties. The measure, if passed, would put all decisions on sub-surface sewage disposal under the jurisdiction of the local health departments.

Environmental Management officials are battling the plan. They say that proposed changes in their own regulations would help close The Loophole. One of the changes would allow the use of innovative new systems employing low-pressure pumps and mounds. The proposals would also relax regulations that now

The commission recently beat a hasty retreat from its "30-inch separation" rule, which governed the vertical distance between septic systems' drainlines and the seasonal high water table in soils near estuaries. The rule was withdrawn, little over a month after it took effect, when the commission decided it did not have the facts it needed in order to defend it. The rule would have stopped much of the development in places like West Onslow Beach, where the water table is often only about a foot under the surface. According to Liz Lance, the commission's information officer: "We thought it was a good rule, but when it came down to it, we didn't have the hard data we needed to support it."

(A current Sea Grant project by Bobby Carlile, Craig Cogger and Mark Sobsey is designed to help determine vertical and horizontal separation requirements for the state's barrier islands. See page 7.)

But few are betting the commission will stay on the sidelines. Rob Moul, field consultant for the commission at Wrightsville Beach, says his agency is waiting to see if Health Services and

Environmental Management can resolve their differences and close The Loophole.

"We're hoping they can find their own solution," Moul says, "one that protects the shellfish waters and water quality of the area. If they don't, I have enough faith in the commission to believe we will step in."

As if the ring weren't crowded enough, the U.S. Environmental Protection Agency is there too, mustering evidence for its environmental impact statement for the state's barrier islands. The agency announced in 1980 that six major sewage plants planned for the state's barrier islands would require the agency's impact statements. All of the six proposed plants, which are integral to their counties' "201" plans, would depend heavily on federal funds. (The plants are planned for Dare, Carteret, Onslow and Brunswick Counties.)

But recently the agency has abandoned the idea of individual impact statements in favor of a single, statewide study grafted onto the agency's barrier islands impact statement, which is keeping various consulting firms busy investigating everything from coastal construction to waterbird populations.

Meanwhile, the treatment plants are waiting, and so are most of the communities, many members of which have long viewed central sewage disposal as the neat way to clean up the septic-tank mess.

One of these plans, which would serve Atlantic Beach and Pine Knoll Shores, carried an \$8 million price tag a year ago, a price that doesn't include an expensive ocean outfall for offshore disposal, through submerged pipes, of treated wastewater.

While construction is delayed, large sections of Pine Knoll Shores are being developed with new land-based "cluster systems," and some residents of the area predict the community may now elect not to use the central system, if and when it is built.

Environmentalists have objected to central treatment systems because, they say, they concentrate huge quantities of wastes into a single system that could, if it broke down, produce disastrous levels of contamination. But they also object on the grounds that the systems encourage high-rise resort development, along beaches, with the attendant problems: contaminated

rainwater run-off from pavements and buildings, hurricane hazards, overcrowding, noise and air pollution, and the destruction of natural landscapes and wildlife habitats.

Bob Benton, head of Shellfish Sanitation, also has his doubts about central sewers on the islands. "I think central sewers will increase density," he says. "It may be a self-defeating thing."

In response to such criticisms, the EPA has dictated that 201 plans in areas defined as "areas of environmental concern"—including much of the state's coastline—be only large enough to solve existing problems and allow for 10 percent growth.

Says LaDane Bullington, mayor of Ocean Isle Beach: "We've already grown more than that since the 201 plan was approved last year. Then what do you do?"

Some coastal residents have pointed out, in EPA workshops conducted this spring, that even when and if the new plants are built, they will almost immediately operate at capacity. And then, they say, communities will be right where they started: what do you do about septic tanks?

The agency's consultants are using computers to analyze and map the state's barrier islands, delineating areas suitable and unsuitable for septic tanks and other land-based treatment of sewage. Their report on these "alternatives" is due in September.

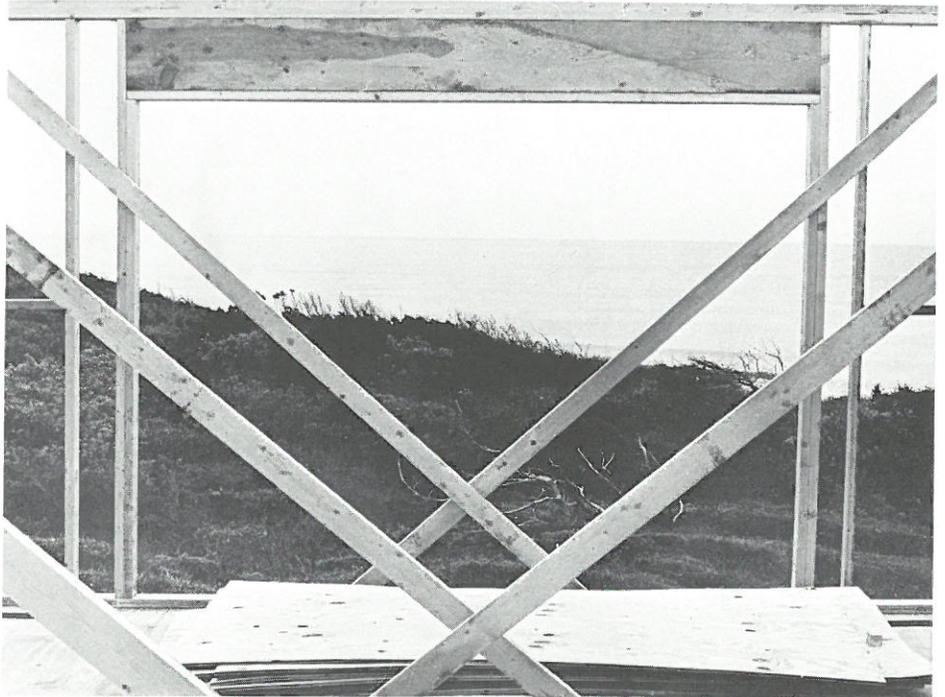
But state officials wonder how the agency can recommend land-based alternatives for the islands, when such issues as vertical separation, density and ground-water contamination are largely unresolved.

"We desperately need to know the carrying capacities for these soils, based on adequate, valid research," says Steve Steinbeck, soil specialist in charge of the septic tank program for Health Services. "Until we have that knowledge, we can't endorse these alternatives."

Bowman Crum, who is directing the preparation of EPA's impact statement from his Atlanta, Georgia office, says he's aware of the quarreling among the state's authorities over The Loophole. But as yet, his study hasn't taken up the problem. "That's something we're going to have to deal with," he says. "As soon as we figure out how."

—Neil Caudle

Photos by Neil Caudle

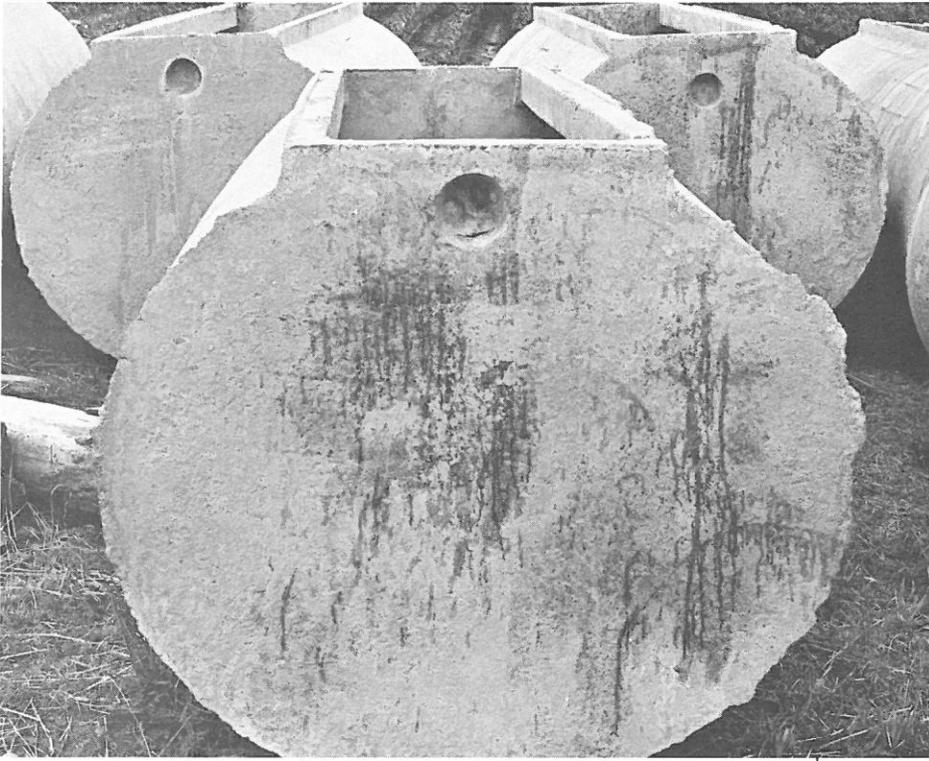


Framing the seascape

On Bogue Banks, workmen hammer together condominiums for several hundred new residents. Sewage disposal for the complex will be handled by a new "package" system (below), which chemically treats wastes and then releases them into the soil. Several acres of maritime forest were cleared for the drain lines.



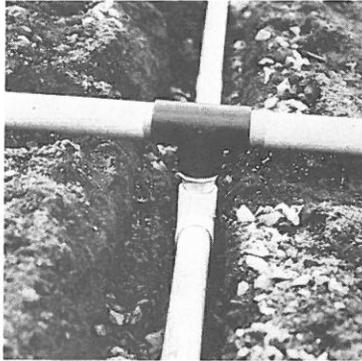
Photo by Neil Caudle



Tools and materials

1000-gallon septic tanks, an efficient "V-trench" from Carlile and Osborne's design, a low-pressure system being installed, and a joint in the distribution lines.

Photo by Dennis Osborne



Research: beachhead for an underground revolution

There are over two million septic tanks in North Carolina, with some 50,000 new ones each year. Nowhere do they fail with more consequence than along the coast, where half a million residents use them, and where an estimated 70 to 90 percent of the soils are now thought to be unsuitable for conventional, on-site sewage disposal.

Because the stakes were so high, and the alternatives to septic tanks so limited and expensive, Sea Grant began funding research into coastal septic systems in 1977. The research, led by Bobby Carlile of North Carolina State University (NCSU), inspired an underground revolution in on-site sewage disposal. What Carlile discovered was that many of the septic tank's limitations could be overcome if the flow of effluent from the tanks into distribution lines was controlled in even "doses." This he managed with low-pressure pumps, which periodically filled each distribution line, along its entire length, and used the greatest possible area of soil for treatment. For marginal soils, especially dense clays with moderately high water tables, the distribution lines could be laid 12 inches deep. The cost remained low, about \$800 for gravel, pipes and pumps (labor was additional).

For very severe cases, on sites with impermeable clays or very high water tables, Carlile built his low-pressure systems into mounds of soils layered to percolate the wastewater safely. Since

the mound was essentially a distribution field construction above ground, soils had to be moved to the site, and costs ran into several thousands of dollars.

On test sites along the coast and inland, Carlile built these systems and tested them. Around them he dug sampling wells, where he measured water quality in the surrounding soils. The systems worked; wastewater was contained and treated. On test sites near estuaries, sampling showed that the new systems could operate without raising the level of contaminants in the water.

With the designs thoroughly tested, Carlile and his research associate, Dennis Osborne, took them directly to county health departments, workshops, conferences and training sessions, where the team schooled sanitarians and contractors on how the system worked. Half of the state's coastal counties wrote the new "alternatives" into their sewage-disposal guidelines. New construction valued well into the millions of dollars began on sites once classified as unsuitable for development. But just as importantly, dozens of failing septic systems were replaced with the new designs.

It was something of a renaissance for the lowly septic tank, and demand for Carlile's help began to reach him from the Piedmont, the mountains, and from other states. But the real frontier turned out to be back home, along the state's barrier islands.

There, the antagonists were named

Corolla, Leon or Duckston, the wet sandy soils so vastly different from the clays just a short drive inland. On the islands, growth was explosive, and most of it still depended upon septic tanks.

Bob Rubin, an NCSU extension specialist who has often worked with Carlile applying the new designs, says that "about fifteen percent of the land on our barrier islands is suitable for conventional on-site sewage disposal, and much of that is in maritime forest."

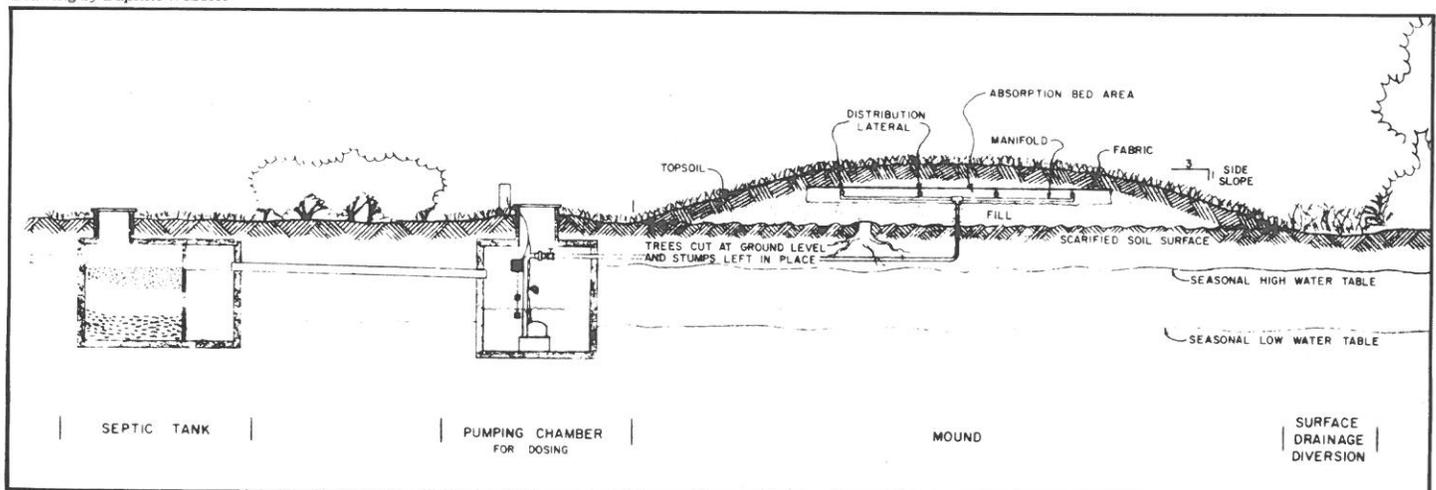
Of course, much more than that amount of property is being developed, often with septic tanks. Are they all failing?

"Until relatively recently, most people on the barrier islands did not know they had septic-tank problems," Rubin says. "Those sandy soils are so porous that the effluent doesn't rise to the surface. But it's usually not being treated either. Very often, you can't tell a system's failing, and most people don't try to find out. You know, 'out of sight, out of mind.'"

But many acres of valuable shellfish waters were closing along such places as Atlantic Beach and Surf City, and the blame was laid on septic tanks. Carlile sampled dredge-and-fill sites along finger canals at Atlantic Beach and found coliform bacteria counts 10 times higher on some sections developed with conventional septic tanks than he found on undeveloped

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Drawing by Daphne Webster



A mound system, designed for high water tables and poor soils

areas. Meanwhile, health officials began to call the risk of contaminated drinking water in some areas "acute."

Agencies began to crack down. New "teeth" in the Ground Absorption Act made permits harder to come by, and applications for new construction were turned down by the hundreds. But there was no hard evidence about either the flow of wastewater from septic tanks into estuaries, or about the contamination of groundwater.

In response, Sea Grant funded another Carlile project, this time geared to the islands. Craig Cogger of NCSU is conducting most of the studies while Carlile is on loan to Texas A & M University. Cogger recently completed research on a project conducted for the N.C. Division of Health Services and funded by the Coastal Plains Regional Commission. The study surveyed 17 sites in coastal North Carolina and found that 16 of the septic systems did not have a minimum 12-inch vertical separation from the seasonal high-water table.



Bobby Carlile with mound system

Many of the systems, he found, were saturated almost all year, with the effect of releasing raw sewage into groundwater and estuaries. But the study did find that low-pressure systems in the group performed much better than conventional ones in marginal soils, although they also performed poorly on sites saturated most of the year.

For his Sea Grant project, Cogger is setting up test sites at West Onslow Beach. There, he will operate model septic systems, including conventional septic tanks and the low-pressure alternatives. Using various loading rates, dosings and separation distances, Cogger will study each combination for the movement of effluent through the soil.

Cogger will also use "tracer" compounds to monitor the flow of wastewater horizontally through water-saturated ground. The studies are designed, he says, to show just how far contaminants travel in each direction, and how complete is the treat-

Sticking up for the lowly septic tank

The very words have a malodorous, subterranean tone: septic tanks. But are they really so villainous as their reputations?

Dennis Osborne, a Sea Grant researcher and member of the NCSU Soil Science Department, says no, they aren't.

"The ones that work, work beautifully," Osborne says. "It's the best, low-cost, natural treatment system there is."

Osborne says that in conventional septic systems, working properly, things happen this way: Waste collects in the septic tank, where it decomposes through the anaerobic action of bacteria. From there, liquids containing nitrogen and phosphorus are released into perforated drain lines, laid in gravel-lined trenches about three feet under ground. The lines are laid so that gravity disperses the liquids through the absorption field, which is usually planted with grass. As liquid passes through the soil, some of its suspended substances are digested by microbes, and others attach themselves to particles of soil, until the wastewater is thoroughly filtered and treatment is complete. The only maintenance normally required is to pump solids from the tank every three or four years.

But things can go wrong. If lines are laid in wet soils, there is little or no treatment, and raw sewage seeps out of the system. Or, if lines are laid in impervious clay, very little of the wastewater will be absorbed. Instead it rises to the surface.

Osborne says the new alternative systems he's been working with overcome some of these limitations by dos-

ing the soil under pressure. The controlled dosing means that drain pipes can be installed in trenches as shallow as 12 inches, well within the "dry" range of many coastal soils. Also, the shallow lines can be snaked into wooded areas, avoiding the need to clear-cut trees.

But Osborne cautions that these new systems require maintenance, and that they can be misused. "We require a



Osborne

back-up pump on the systems we install, and an alarm to warn you of a breakdown," he says. Distribution of the effluent must be checked in standpipes attached to the lines. And, the system must be protected from grease.

"Fast-food restaurants produce a lot of grease," Osborne says. "They use water at a hundred-and-eighty degrees, and at that temperature, the grease is emulsified. It just bypasses the grease trap and winds up in the lines, where it sort of coagulates and seals everything up."

Osborne nevertheless prefers, for many sites, a well-designed septic system to the "package" treatment plants that chemically treat wastes and serve multiple buildings.

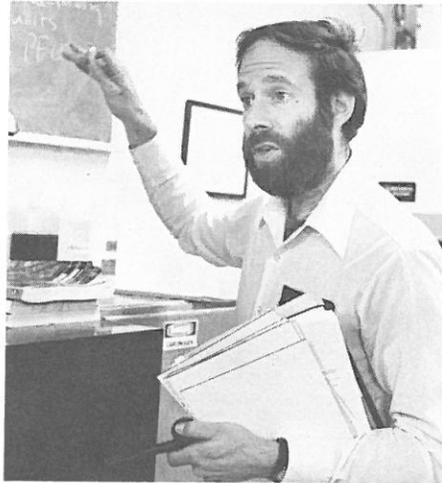
"The cluster systems, I've seen work fine, when they're designed adequately," he says. "But they can also impose an unnecessary cost. You pay a lot to simulate what happens naturally in the soil."

ment along the way.

Mark Sobsey of the University of North Carolina at Chapel Hill, an associate on the project, will track the microbiological pathogens in the effluent flow and compile water-quality data for the sites. In another Sea Grant study, Sobsey has already upset some long-held notions about "safe" water. Sobsey found that the coliform bacteria long thought to be reliable signals of contaminated water are not completely reliable. Current standards for water quality, he found, do not accurately indicate the presence of or absence of enteric viruses, the tiny pathogens, often carried by sewage, that infect people with viral hepatitis and viral gastroenteritis.

Cogger believes the results of the study will supply officials with facts they can apply to several of their most critical problems: How much vertical separation should be required from drain lines to water tables? How far must systems be set back from estuaries in order to protect fishing

Photo by Neil Caudle

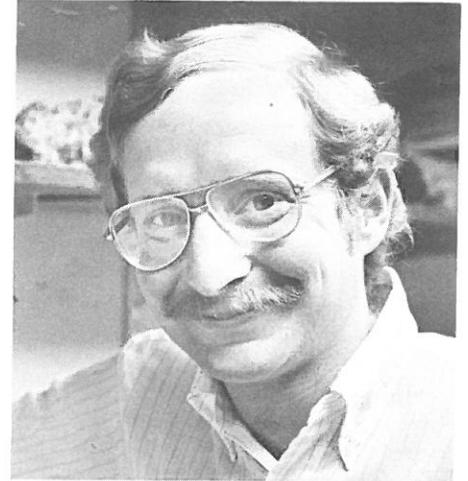


Mark Sobsey

there? How well do the low-pressure alternatives work in the sandy soils of barrier islands? And, how much effluent flow, or density, can these soils take before the effluent overcomes their capacity to treat it?

"We suspect that the twelve-

Photo by Cassie Griffin



Craig Cogger

hundred-gallon number (Environmental Management's density guidelines) errs on the side of allowing too much density, if anything," Cogger says. "But we just won't know for sure until we have the data."

—Neil Caudle



Bob Rubin, Al Harris and Joe Rose with blueprints

Craven County: A green light

Five men are huddling together in the rain to dig a hole in the sandy, side lot of an abandoned store near New Bern. One of them lets a fistful of damp soil slide through his fingers to test its composition.

In Craven County, or most anywhere else, this is where new construction begins. Here, Joe Rose, a New Bern engineer, is trying to get a permit for his client, who wants to renovate the empty building and open a large grocery. But there are complications. The grocer will use much more water than the previous tenant; there is no public sewer to the site; space is limited, and the soil is not the best.

"A few years ago, we would have had to turn this man down," says Al Harris, sanitation supervisor for the Craven County Health Department. "The soil here is not, as it is, suitable for this kind of volume."

But Harris says that innovative new designs in on-site septic systems have made building on marginal sites prac-

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tical. For Joe Rose and his client, that means a low-pressure mound system and a green light for the grocery.

"The first septic tank was made in France in the seventeen-hundreds," Harris says, "and nothing much had been done to improve it until just recently. Because of the interest Sea Grant and North Carolina State have taken in these new designs, we can give people a quality installation. If it weren't for them, we'd still be handing out eighteenth century technology."

Harris' department has approved about 75 alternative systems, based on Carlile and Osborne's designs. Most of these have been installed in the last two years, many for businesses. Harris tells the story of a textiles firm that wanted to build near Vanceboro. It promised 80 badly needed jobs. But the soils on its building site were poor. Carlile, Osborne and Bob Rubin designed the low-pressure mound system for the plant, and specified water-stingy plumbing fixtures.

"No problems at all," says the plant's mechanic, Jerry Somers, of the system. "We just check it once in a while and keep the grass mowed."

Harris says the alternative systems have helped his county substantially broaden its tax base, while easing some health and environmental risks. But using the new systems, he says, incurs some stiff responsibility, not only for his department, but for the property owner.

"We've had to become educated in these designs," Harris says. "And they require some management. We are establishing a checklist for alternative systems, and we'll conduct regular inspections."

The checklist includes the alarm system, the levels in riser pipes, the sequence of the pumps and the condition of the grass over the absorption field.

"They've done a good job using this technology in Craven County," says Bob Rubin of Harris' department. "They've got a qualified staff and they're not afraid to learn new things and examine the alternatives."

Such close supervision of the new installations, Rubin says, is crucial to ensure the technology is not misused. "These things are not a panacea for every sewage-disposal problem," Rubin says.

Osborne and Craig Cogger say that there are already cases of mounds that

Photo by Neil Caudle



Jerry Somers, with alarm and timer

have been installed improperly. Some of these have failed. One of the most notorious examples is the mound system for a fast-food restaurant in Shallotte. The mound was built by a private firm, and did not provide adequately for the huge quantities of grease the restaurant produces.

Bob Benton says the shoreline surveys his staff at Shellfish Sanitation has conducted have also found mounds failing.

Cogger and Osborne say these failures are due to inadequate maintenance and design. But not every county health department, they say, is as well-versed in the new alternatives as the one in Craven County.

"You have to have some kind of management framework to handle these problems," Cogger says. "And you need education and extension for the health departments; they really need the support of trained experts."

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Coastal property owner yes no Boat owner yes no

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454).



North Carolina eel fishermen are upset. In 1979 and 1980, eels were bringing fishermen \$1.00 to \$1.25 per pound and, with these prices, more fishermen began cashing in on the eel fishery. But this year, early spring prices began around 90 cents per pound and rapidly plummeted to 45 and 50 cents per pound. Now, most dealers aren't even buying eels.

Fishermen wanted to know what happened to the market, so two Sea Grant Marine Advisory Services agents got on the telephone to find out. Bob Hines and John Foster contacted East Coast eel buyers and fisheries export officials in the U.S. Department of Commerce. They found that the reasons for the price drop appear to include a glut of small eels in the European market, a decline in demand caused by PCB-contaminated eels appearing in Europe, red sore disease showing up in North Carolina eels, a shift in the monetary exchange rate, and an unreasonably high price paid to fishermen in the two previous years.

"There is still a market for large eels over three-quarters of a pound," Hines says. "But the fishermen are not catching enough of those large ones to justify fishing." Hines says the larger eels may have moved further inland, out of coastal fishing waters, due to unusually high salt content in the water this year. He also says that there might be too many fishermen in the business.

Foster and Hines say the future

price is expected to stabilize at a lower level. Prices are expected to range between \$.50 and \$.75 per pound, depending upon supply and demand, for at least the rest of 1981.

Sea Grant became active in the development of the North Carolina eel fishery in 1973, when most of the eel harvest was used locally for bait. Since then, the fishery has grown rapidly on the strength of exports to Europe and Japan. Landings in the 950,000-pound range were reported in both 1979 and 1980, according to the N.C. Division of Marine Fisheries. The 1980 harvest brought a record value of \$1 million.

Sea Grant is still active in developing the fishery and ready to answer questions for and offer advice to eel fishermen. For names of eel buyers or suggestions for holding eels, contact Bob Hines at the N.C. Marine Resources Center/Bogue Banks, P.O. Box 896, Atlantic Beach, N.C. 28512, or call (919) 726-0125. For information on eel aquaculture, contact John Foster at the NCSU Aquaculture Demonstration Project, Route 2, Box 305, Aurora, N.C. 27806, or call (919) 322-4054.



It may be water, water everywhere along coastal North Carolina, but the problem comes in how to manage North Carolina's sounds, rivers and estuaries. Fishermen want to fish from them, farmers want to drain their fields into them, industry wants to draw from them. It seems everyone has a use for North Carolina's coastal waters, and management is a big job.

That's why a task force has been gathered by the Department of Natural Resources and Community Development to study the problems of water management on the peninsula between Albemarle Sound and Pamlico Sound. Joe Phillips of the NCSU Soil Science Department will chair the group. B. J. Copeland, UNC Sea Grant's director, is also on the task

force. The group will combine the views of scientists, management officials and water users like fishermen, farmers, foresters and industry representatives as they try to reconcile differences and optimize the uses of coastal waters.



Director of UNC Sea Grant's Marine Advisory Services, J.C. Jones, has announced his retirement from North Carolina State University, effective June 30.

Jones is subsequently stepping down from his Sea Grant post. Jones has directed advisory services programs since July, 1979, and has been instrumental in coordinating the work of Sea Grant with the extension and education programs of the N.C. Agricultural Extension Service and the three N.C. Marine Resources Centers.

Jones will remain director of the Department of Administration's Office of Marine Affairs.

Randy Rouse has joined John Foster and Roberta Kincheloe at the NCSU Aquaculture Demonstration Project in Aurora. Rouse will be working with Foster and Kincheloe to develop and perfect culturing methods for the American eel.



Each year, several fishermen who trawl or dredge in North Carolina's offshore fishing grounds bring up an unexpected harvest—explosive ordnance.

As a result of military training, sea dumps and combat operations, both explosive and nonexplosive ordnance can be found along the eastern U.S. continental shelf. Sea Grant has a new publication out to aid fishermen with bottom-tending gear in the identifica-

Continued on next page

tion and disposal of these unwanted harvests.

A Fisherman's Guide to Explosive Ordnance has been prepared in cooperation with the U.S. Naval Explosive Ordnance Disposal Technology Center. Included in this booklet are photographs and illustrations of the more common types of ordnance occurring off our coast. Fishermen are also given instructions for safe disposal of ordnance recovered in nets or dredges.

A copy of this booklet is available free to any interested fishermen. Write Sea Grant, Box 5001, Raleigh, N.C. 27650 and ask for UNC-SG-81-05.

Two new Sea Grant publications on aquaculture have arrived from the printers. *A Discussion of Aquaculture Candidate Species for Eastern North Carolina*, by former UNC Sea Grant associate director William L. Rickards, evaluates the feasibility for commercially culturing various species of finfish and crustaceans in the fresh and brackish waters of eastern North Carolina. For a copy of this publication, send 50 cents to UNC Sea Grant. Ask for publication, UNC-SG-WP-81-2.

Teaching Young American Eels to Consume Prepared Feeds, by John E. Foster and William L. Rickards, is a discussion of methods used by the NCSU Aquaculture Demonstration Project for teaching elvers or baby eels to feed on commercially prepared feeds. For a copy of this publication, send 50 cents to UNC

Sea Grant. Ask for publication, UNC-SG-WP-81-3.

Sea Grant in North Carolina, 1979-1980, by Neil Caudle, is a report on two years of Sea Grant research, education and advisory services activities. For a free copy of the 31-page report, write UNC Sea Grant.



Long exposures to the sun can cause skin cancer. Jim Patterson, a dermatologist at the University of North Carolina, says a lot of the patients he treats for skin cancer and sun-related skin damage are farmers and fishermen who spend long hours under the sun's rays, away from shelter. Fishermen may be even more susceptible, he says, since they get double doses of sun from rays bouncing off the water.

North Carolina fishermen have an added problem because many of them are fair-skinned. Much of coastal North Carolina has a western European heritage and their skin doesn't take the sun well, Patterson says. "They burn, freckle and generally don't tan well," he says.

To learn more about the problems fishermen have with the sun, write for UNC Sea Grant's latest Blueprint, "Fishermen and Skin Cancer." To receive this free leaflet, write UNC Sea Grant, Box 5001, Raleigh, N.C. 27650. Ask for publication number UNC-SG-BP-81-6.



North Carolina's seafood industry is one subject student Michael A. Blake has added to his curriculum. Blake, an economics major at North Carolina A&T

State University, has been awarded a Sea Grant Fellowship to work with researchers, Nozar Hashemzadeh and Michael Simmons, from the university's economics department.

A native of the Virgin Islands, Blake will be compiling information gathered from the state's fishermen, seafood processors and marketers. The goal of Hashemzadeh and Simmons' project is to determine the manpower needs of the seafood industry. The information will help in the development of training programs for skilled and technical workers. The team is also devising a model which will help predict future manpower demands of the seafood industry.

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