



UNIVERSITY OF NORTH CAROLINA

SEA GRANT COLLEGE NEWSLETTER

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Ocean outfall:

The answer to coastal problems?

Winter moved slowly across the coast of North Carolina. At Nags Head, the wind whistled through rows of cottages that line the beach strand. They stood empty and ghost-like against the bleached sky.

Winter life was quiet in Manteo, too, where Joe Stokes works as Dare County sanitarian. But Stokes knows that the first warm breezes of spring have brought the tourists and summer residents who have made his county a thriving ocean resort. And the population will once again catapult from a winter average of 7900 to its peak summer total of 100,000.

The dramatic jump in population means prosperity for local merchants and developers. But for Joe Stokes it also means headaches. Not the least of Stokes' problems is the proper disposal of increasing amounts of human wastes.

Right now sewage is handled through domestic septic tanks—except in Manteo, where there is a municipal treatment plant. But Stokes foresees

that within five years the septic tanks will begin to tax the land's ability to purify. When that happens development may come to a grinding halt. In addition, occasional high tides associated with storms sometimes leave in their wake flooded septic tanks up and down the narrow 35-mile stretch of Dare County's Outer Banks.

Stokes knows that some type of municipal wastewater treatment plant is in the cards for Dare County. And, like a growing number of North Carolinians, he believes that the solution to the county's problems may lie in the very resource that draws the tourists: the ocean. He is convinced that one feasible alternative for handling wastes is an ocean outfall—a pipeline stretching from the shore into the ocean. It would dump treated wastewater from several communities.

Dare County's problems are not unique. Similar dilemmas, in some cases more acute, plague officials in other coastal counties. In Pender County's

(See "There doesn't," p. 2)





'There doesn't seem to be any easy answer'

(Continued from p. 1)

Surf City and Topsail Beach, for instance, problems of sewage disposal have reached critical stages. In these areas, poor soil conditions for septic tanks are coupled with a high water table. That creates the potential for effluent and drinking water to become mixed.

New and more stringent septic tank regulations were passed for Pender County last November in an effort to curtail contamination of nearby shellfish waters. Other coastal counties will have to comply with new statewide septic tank regulations which go into effect in July. But Pender County sanitarian Penny Whiteside believes the county regulation is only a temporary solution. "There just doesn't seem to be any easy answer to any of it," he said.

Everette Knight, director of the Division of Environmental Management within the Department of Natural and Economic Resources, is familiar with Pender County's problems. "There is sewage coming out on top of the ground. And there is contamination of the shellfishing areas to the extent that they are being closed," he said.

Ocean sewage outfalls are now being seriously considered for the North Carolina coast for the first time. But the outfall concept is not a new one. Publicly owned outfalls are used all over the world—extensively in Hawaii, Australia, New Zealand and parts of Europe. Municipal outfalls for domestic waste dot the West coast of the United States. In southern California alone, five huge outfalls produce a discharge of nearly one billion gallons of sewage effluent each day. On the East coast, outfalls operate in Rhode Island, New York, New Jersey, Maryland and Virginia. Ocean disposal (sometimes of raw sewage) has been used on the Florida coast for years.

Until recently the EPA took a hard line against outfalls as a solution to waste disposal problems. North Carolina law still prohibits construction of

ocean outfalls without the permission of the Division for Environmental Management. But, in a softening of attitude, director Everette Knight now endorses outfall research. "I think it's inappropriate to throw away any option that might work," he said.

But Knight believes that there are still many questions to be answered before any outfalls are actually constructed on the coast. A clearer understanding of the circulation patterns off the coast is needed to determine the destination of the sewage effluent once it is discharged into the ocean. Planners also want to know what effect the outfall discharge will have on marine life, commercial fishing and public health.

Debate on the subject of outfalls isn't limited to the hallowed halls of academia. It is an emotionally charged issue. Many coastal residents know of the problems created by outfalls operating in other states. Sewage effluent or sludge has washed ashore on many of the East coast's beaches.

Lucille Gore, mayor of Surf City, is one of those who is wary of the potential destructive power of outfalls. "The average individual is against it," she observed. "Lots of people around here are from other places, where they have seen dirty beaches.

Yet in the neighboring town of Topsail Beach, town councilman Mike Boryk expresses different views. "Our feeling here is that we ought to go to ocean outfall. The land surrounding us is not suitable for land disposal," he said.

In Dare County, sanitarian Joe Stokes contends that an outfall would be "like a spit in the ocean." Preliminary hearings have already been held on a proposed ocean outfall in his county. But Stokes expects a hew and cry from some local citizens once the plans are further developed. "I'm afraid we're going to have a mental block about the sewage going into the ocean," he said.

Dare County May Be N.C. Test Ground

Dare County may be the first testing grounds for an ocean outfall in North Carolina. Two years ago the Dare County Board of Commissioners began grappling in earnest with plans for a municipal sewage treatment plant for the larger communities in the county. In October 1976 a proposal to study the possibility of an outfall in the county was completed by Henry von Oesen Associates, a Wilmington engineering firm.

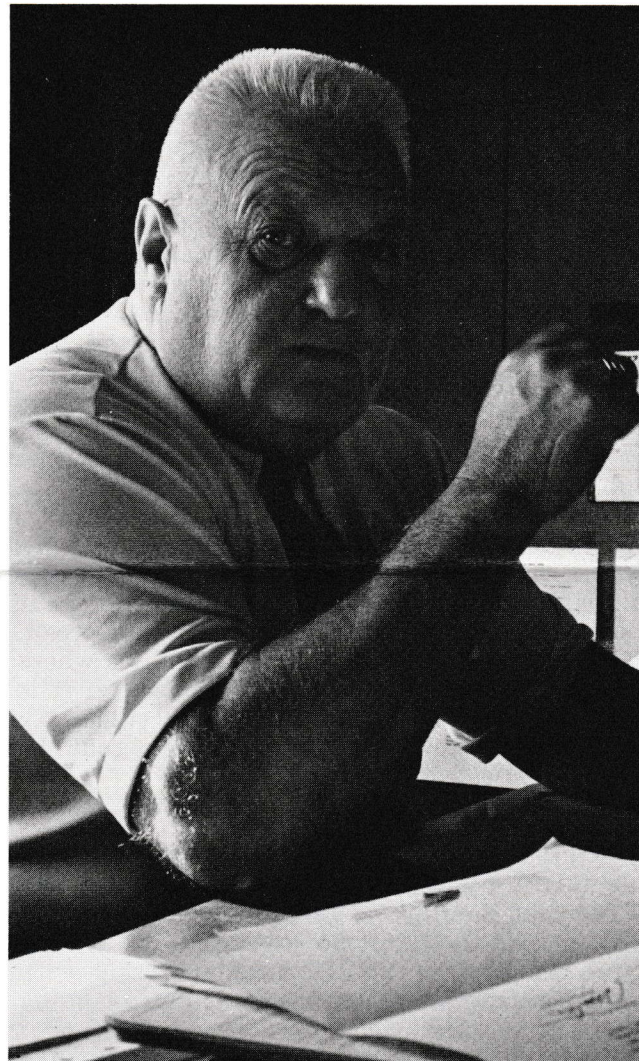
William E. Burnett, one of the firm's engineers, is convinced that Dare County is one of the best sites for an outfall in North Carolina. "There is no other way of disposing of the wastewater in Dare County that is environmentally sound and cost effective," he said.

The engineering firm's study plan has now passed the approval of the state's reviewing agency, the Division of Environmental Management of the Department of Natural and Economic Resources. Dare County officials are waiting for EPA approval before they proceed with the study. Once the final study is complete, approval of both agencies will be required before actual construction is begun.

The preliminary plan calls for construction of an outfall which would ultimately serve Kitty Hawk, Nags Head, Kill Devil Hills, Manteo and the Wanchese Harbor fisheries complex. According to Burnett, the outfall would be built either in Nags Head or Kill Devil Hills. The plan is based on a projected flow of 3.5 million gallons of treated wastewater per day for the year 1990. The outfall pipe would reach out into the ocean about a mile and discharge would be into 45 or 50 feet of water.

The tentative plan also proposes that domestic sewage be treated to a secondary level at a treatment plant located on about 15 acres of land near Kill Devil Hills. Secondary treatment removes about 90 percent of the suspended solids from the wastewater and the majority (but not all) of the bacteria and viruses.

In selecting an ocean outfall as the most promising plan for Dare County, the engineering firm rejected three other alternatives commonly used in the United States. One possibility would be to discharge the wastewater from a regional treatment plant into the estuarine waters of the Currituck, Albemarle or Pamlico Sounds. The water in those areas, Burnett points out, is shallow. Disposal of sewage into the sounds could eventually upset the balance of plant and animal life in the estuaries.



Joe Stokes, Dare County sanitarian

Burnett also fears that the discharge might aggravate the problem of milfoil, an aquatic plant whose rapid growth has clogged parts of Currituck Sound. And, finally, Burnett was concerned that pollution of the estuaries might mean the closing of more of the state's shellfishing waters.

A second alternative, land disposal, would involve spraying treated wastewater over about 900 acres of land. Peat soils and a water table that is almost at the soil's surface make the land on the mainland of Dare County unacceptable. About 85 percent of the land on Dare County's Outer Banks is environmentally sensitive park land. Burnett was unable to find a suitable area large enough for land disposal on the islands. He felt that using several smaller plots would have made the cost of the project prohibitive.

A third option which has been unsuccessfully tried once in North Carolina is deep well injection. It requires piping treated wastewater into wells drilled into the earth's surface. Since 1973, North Carolina law has prohibited deep well injection. "You really don't know what happens to the effluent and whether it might mix with drinking water," said Burnett.

Scientists tackle tough questions

Several Sea Grant researchers are among the North Carolina scientists who are taking a look at many of the tough technical questions that need to be answered about ocean outfalls.

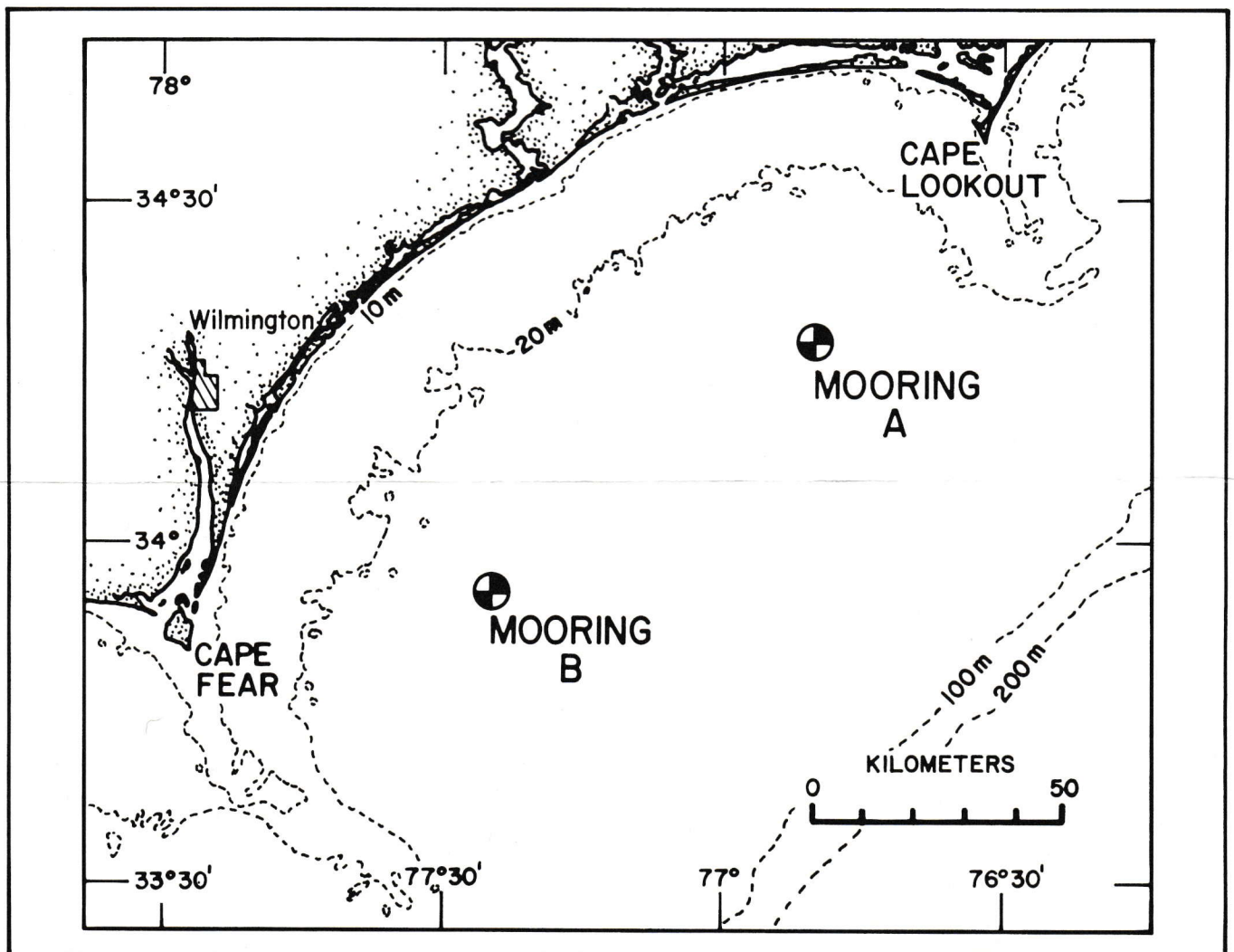
Sea Grant is funding three projects this year which are related to the issues of ocean outfalls. In a project supported by the EPA and the North Carolina Department of Natural and Economic Resources (through the Water Resources Research Institute), researchers will be looking at the options for water management in coastal North Carolina. One of the aspects of the study will be an analysis of the possibility of ocean disposal of wastewater. Studies will be made of population trends, available water resources, water requirements, and laws. Researchers will also be taking a look at the sociological and political problems involved with water management. The study will concentrate on the Dare County Outer Banks and Morehead City-Carteret County areas.

One other project now in the works is a comprehensive study funded by the Coastal Plains Re-

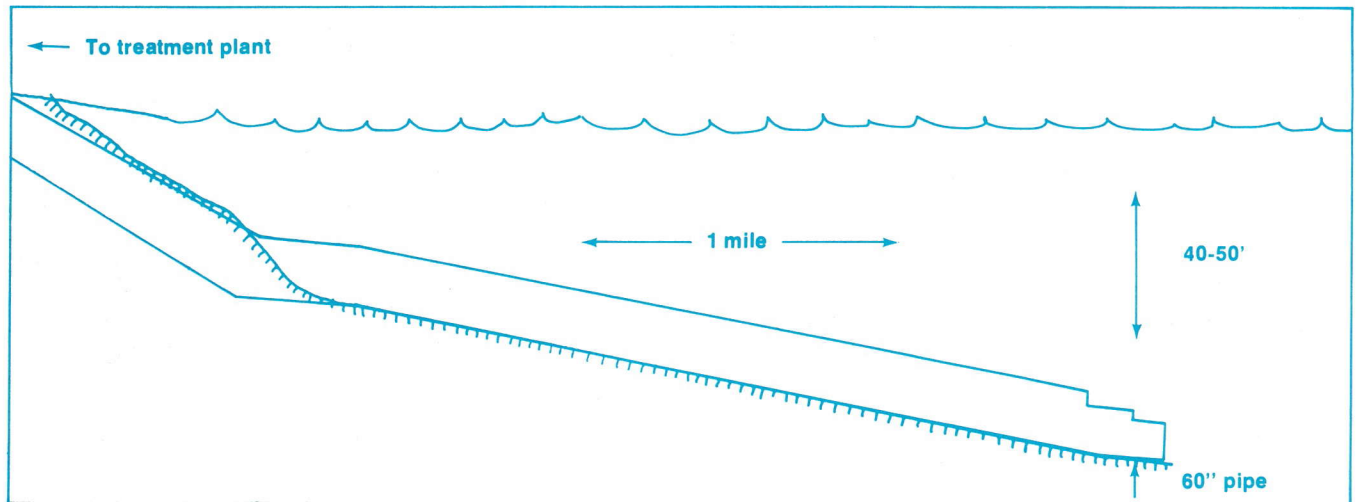
gional Commission (CPRC) and the Department of Administration's Office of Marine Affairs (OMA). The two year project, which got underway in January, is a landmark study of the East coast. Scientists working on the project will be taking a general look at the feasibility of placing an ocean outfall off the North Carolina coast. They will study the engineering of outfalls and their potential effect on marine life and public health.

One of the first questions to be answered about outfalls is how the sewage effluent will be mixed in the ocean waters and where it will go. With the aid of Sea Grant funding, Dr. L. J. Pietrafesa of NCSU has been studying the circulation patterns of the North Carolina continental shelf for the past three years. Pietrafesa has stationed complex moorings 40 to 150 miles out in the ocean to collect data on water temperature, salinity, currents and winds. He is doing intensive studies of the circulation in Onslow, Raleigh and Long Bays.

Results of Pietrafesa's 1975 study of Onslow (See "Circulation, design," p. 5)



Two mooring locations being used in Pietrafesa's circulation studies of Onslow Bay



Ocean outfall: one design being considered

Circulation, design, impact scrutinized

(Continued from p. 4)

Bay indicate that there is a strong onshore flow which could bring effluent to the beaches of the area. Because of strong wind forces, the shape of the bay and shallow water, Pietrafesa feels that it will be difficult (but not impossible) to predict the exact flow of outfall effluent. "On a coastline like this, it has to be handled gingerly," he said. Pietrafesa's early results from Raleigh Bay show that there may be a predominant northeast flow.

Pietrafesa is sharing data with scientists from the University of Miami and Skidaway Institute of Oceanography, who are now studying circulation off the coasts of Georgia and Florida. Information from an intensive research project in the Virginia Beach, Virginia, area is also proving to be valuable to North Carolina researchers. An ocean outfall for the Virginia Beach area is now in the design stages.

Yates Sorrell, a mechanical and aerospace engineer at NCSU, is heading the engineering and dispersion modelling section of the CPRC/OMA project. Sorrell is trying to determine the most effective means of pumping treated wastewater and the best system of dispersing the effluent into the ocean waters. He and several other scientists will be attempting to come up with a method of analysis that can be used to determine whether an outfall will be acceptable.

Sorrell is also working on a Sea Grant project this year which includes an analysis of the hydraulics of an outfall and diffuser. The information gathered will be used to develop criteria or requirements for outfall locations and diffuser designs. Sorrell will be considering the chances of outfall discharge returning to the beaches along the coast.

There are present in treated wastewater pathogenic bacteria and viruses which could affect marine life and public health. Dr. William Queen

of East Carolina University is heading the CPRC/OMA project's biological studies. During the first year, biologists will take stock of the literature that is already available on the effect of ocean outfalls on marine biota and public health.

Dr. Mark Sobsey, a virologist at UNC-CH, points out that sea water is a hostile environment to many of the microorganisms and viruses in sewage. The rate at which the harmful organisms die off depends upon the water's temperature, salinity and type of marine life present. In order to determine the die-off rates, Sobsey will select water from several locations off the coast. During the first year of the study die-off studies will be confined to the laboratory. Water collected at several locations off the coast will be contaminated with known quantities of sewage and sediment. The laboratory results will be tested in the sea water environment the following year.

Sobsey is collaborating with Dr. Bobby Carlile and Dr. L. D. King of NCSU to develop alternative on-site septic waste disposal systems that can be used in the coastal area. This Sea Grant project, headed by Carlile, is in its second year. Two alternative systems are now being used experimentally in several coastal counties.

(See "Effects on," p. 6)

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Effects on ocean life also examined

(Continued from p. 5)

Scientists are concerned about the effect of sewage on the economically important shellfish industry in North Carolina. At the present time, nearly one quarter of the state's shellfishing waters are closed because of high levels of contamination. With Sea Grant funding, Sobsey will be working with Dr. Marvin Speck of NCSU and the N.C. Shellfish Sanitation Laboratory to determine what impact sewage might have on shellfish. They will be experimenting with oysters and clams collected from 12 locations off the coast. Sobsey is developing and evaluating more effective methods for detecting enteric viruses in shellfish.

Also of interest to the biologists connected with the CPRC/OMA project are the effects of an outfall on fish in their larval stages. Queen points out that many species of fish spawn in the ocean. Their larvae move back into the estuaries where they mature before returning to the sea. If it is found that the larva are particularly vulnerable to outfall contaminants, fish populations could be adversely affected.

Continental Shelf symposium set

The first Continental Shelf Symposium will be held at NCSU March 30 through April 1. Dr. Ernie Knowles of NCSU is collaborating with other Sea Grant-supported scientists in planning for the symposium.

The conference is a cooperative project being sponsored by Sea Grant, the NCSU Center for Coastal and Marine Studies and the Coastal Plains

Off the presses

A Flow Study of Drum Inlet, N.C.
by Paul R. Blankinship

A Very Special Fish: American Shad
by Joyce Taylor

Fishery facts at your fingertips
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The Dune Book: How to plant grasses for dune stabilization
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Center for Marine Development Services.

Twenty-five invited papers will give a state-of-the-art explanation of all the natural processes on the Continental Shelf. Development pressures for sewage outfalls, nuclear power plants, deep sea oil terminals and dumping have centered on the Continental Shelf. But it is still one of the least understood areas.

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