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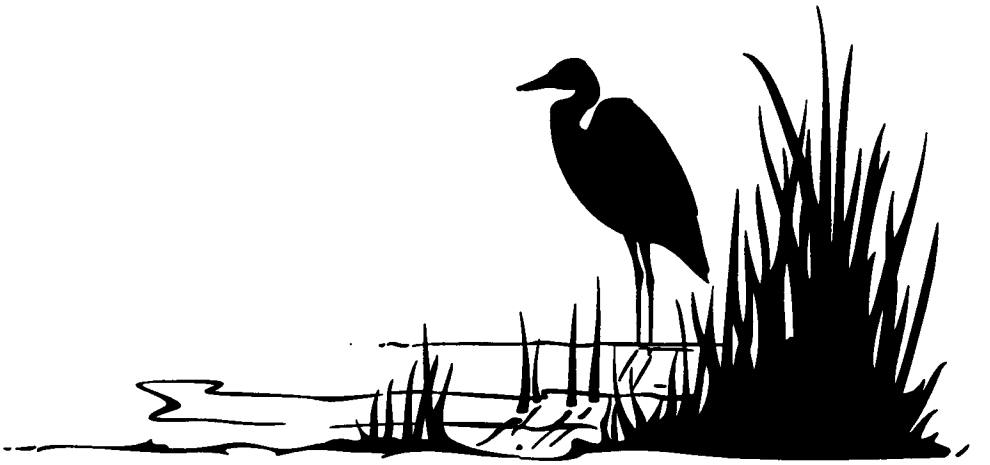
A Blueprint for Clean Water

Strategies to Protect and Restore Beaufort County's Waterways



The Final Report of the Clean Water Task Force
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For More Information

The CWTF did not formally elect officers. That said, Bill Marscher served as de-facto chairman. Sam Passmore, of the South Carolina Coastal Conservation League (SCCCL), served as de-facto co-chairman. Together, Bill and Sam set the task force agenda and closely coordinated all CWTF activities. In addition, Sam facilitated the scoping meetings and was principal drafter of the CWTF report. This was done utilizing the SCCCL facilities, for which we are particularly grateful to Dana Beach, SCCCL Executive Director. Any questions about CWTF, or about this report, should be directed to Bill (23 Big Oak, Hilton Head, SC 29926; 803-837-4388) or Sam (P.O. Box 1765, Charleston, SC 29402; 803-723-8035).

Acknowledgements

The Clean Water Task Force (CWTF) is a volunteer citizens group working to protect and restore the waterways of Beaufort County. To date, more than 50 public officials have assisted the Clean Water Task Force in its work, and the Task Force members are grateful to each and every one of them. In particular, the Task Force would like to thank the following individuals for their invaluable support: Governor David Beasley, DHEC Commissioner Doug Bryant, Beaufort County Administrator Mike Bryant, Town of Hilton Head Manager Steve Riley, and Beaufort County Councilman Tom Taylor. We also extend our heartfelt thanks to: Chris Bickley, Robert Boyles, Margaret Davidson, Alessandra Delfico, Rick DeVoe, Debra Hernandez, Bob Klink, Beth Partlow, Milt Rhodes, Summer Rutherford, Chester Sansbury, Paul Scholz, Dr. Geoff Scott, Steve Snyder, Dr. Bob VanDolah, and Ginny Wolfe.

Executive Summary

In the fall of 1995, 500 acres of shellfish waters in southern Beaufort County were closed to shellfishing because of high fecal coliform counts. We, a group of Beaufort County citizens, took this news as a wake-up call. Now the Clean Water Task Force (CWTF), we regard the shellfish as the canary of the lowcountry's waterways. If the shellfish is in trouble, we suspect that much more is awry, or soon will be.

The dual objective of the CWTF is to encourage the clean-up of polluted county waters and identify what must be done to prevent additional county waters from becoming polluted. While our original and guiding concern has been fecal coliform, our agenda has grown to include other potential forms of physical, chemical and biological degradation of the rivers and creeks.

To achieve our objective, we have spent the last year learning from, and consulting with, the best resource people South Carolina has to offer. In a series of meetings, we focussed on the web of regulation affecting different pollution sources of concern: stormwater, sewer plants, septic systems, boats, agriculture, forestry and development activities. We now realize that no single source accounts for all of our water pollution problems; instead, the "cumulative impact" of many pollution sources is usually the problem. More than fifty federal, state and local officials (both regulators and scientists) graciously donated their time to our process of inquiry and deliberation. Governor David Beasley and his staff have been especially supportive, for which we are deeply grateful.

This report is the result. We offer specific recommendations that, if implemented, will catapult our county into the vanguard of communities that are serious about protecting their natural environment. The fate of Broad Creek and the Okatie River was the origin of our concern, so the recommendations for the Town of Hilton Head (i.e., Broad Creek) and Beaufort County (i.e., Okatie River) are quite precise. That said, we are confident that many of the proposals are appropriate for, and will make sense to, the county's other municipalities: Bluffton, Port Royal, and Beaufort.

In developing these recommendations, we did our best to be pragmatic and reasonable in our expectations. Where enough is not known to act now, we call for additional study -- though we insist that such studies should be targeted for specific purposes and accomplished with all due speed. Where proposed actions are complex to implement, we establish an aggressive, but achievable, timetable. Thus, we organize our recommendations into three sections:

- *immediate actions* to be implemented within 3 months;
- *intermediate actions* which may take as much as a year to put in place; and
- *long-term actions* which could take up to three years.

While the CWTF is alarmed, we are not alarmists; we seek to practice the art of the possible.

Of the many recommendations contained in this report, there are ten that merit special attention. If the Beaufort County citizenry and our public officials -- at the municipal, county, state and federal level -- do not accomplish these "ten steps to clean water," we fear that the gradual decline of our near-pristine waterways is inevitable. In highlighting these ten steps, we in no way mean to diminish the other recommendations' importance; all are carefully explained, and given equal weight, in the body of the report.

We know that implementing the ten steps, let alone the remaining forty or so, will take great effort. Some believe that current state-level programs are sufficient, forgetting the fact that coastal waters are fundamentally different than most of the state's waterways. Small tidal creeks that flush poorly predominate along the coast. The ecological balance of such aquatic systems is much more easily disturbed than freshwater creeks and rivers that quickly flow in one direction. In tidal creeks, pollutants tend to accumulate, often taking days to wash out into deeper water. Arguably, Beaufort County's tidal waters are the most sensitive of all, because they are home to more than 40 percent of the state's shellfish waters. Given the unique character of coastal waters, and particularly those in Beaufort County, we feel that the recommended actions outlined in this report are actually quite modest.

Ten Steps for Clean Water

Step #1 *Beaufort County Citizens Should Become Stewards of the Waterways.*

Every day, Beaufort County residents make thousands of decisions that collectively affect the quality of their waterways. Attempting to regulate personal behavior down to the smallest detail is impossible and ill-advised. Instead, education programs are needed to clearly explain to the public the consequences of their actions. Public education efforts are recommended on several topics including: voluntary development design guidelines (p. 41); benefits of vegetative buffers and the details of the county's River Protection Overlay District (p. 42); proper operation and maintenance of septic systems (p. 43); responsible boating behavior (p. 46); and native landscaping and use of lawn chemicals (p. 52).

In addition to changes in personal behavior, citizens must work together to protect the waterways. In the absence of an educated and active public, we have no right to expect our officials to aggressively pursue a clean water agenda. In this report, we recommend that citizens get involved in the following ways: participating in the public permitting process for sewer discharges (p. 28); making use of stormwater monitoring data (p. 42); establishing a shoreline survey and other citizens monitoring programs (p. 47 & p. 64); and working with the timber industry to improve compliance with voluntary timber harvest best management practices (p. 52).

The CWTF is hesitant to recommend the formation of a new organization to oversee, and contribute to, these citizen-based activities. Rather, we propose that the energies of the many existing organizations be harnessed. A network of grassroots groups and quasi-public groups could help coordinate current activities and see to it that specific new tasks are accomplished (p. 36).

Step #2 *Beaufort County Should Establish Progressive Land Use Policies with Documented Water Quality Benefits.*

One of the best ways to control the cumulative impact of runoff is to limit the amount of polluted stormwater generated in the first place. More rooftops, more roadways and more parking lots (all "impervious surfaces") mean more runoff. Consequently, development practices that limit the amount of impervious surfaces are good for water quality. Beaufort County has an opportunity to promote such development practices through the adoption of progressive land use planning strategies in its new comprehensive plan. This set of land use policies should seek to reduce impervious surfaces at the watershed level by establishing a system of priority development zones and rural areas; on rural sites by promoting clusters of housing surrounded by open space; and along waterways through a system of vegetative buffers. Care should be taken to locate concentrations and clusters of development away from water quality sensitive areas, like the headwaters of small tidal creeks. As a general rule, the CWTF favors implementation mechanisms that rely on public investment policies and land owner incentives. (See pages 13-21.)

Step #3 *Beaufort County Should Improve Its Stormwater Standards for New Development.*

The state stormwater standards are designed so that, in a typical case, only 80% of some pollutants are captured before a discharge occurs. The state rules provide a floor of protection throughout the state, and any effort to rise above this floor will depend on local initiative. Because of the unique character of coastal waters, Beaufort County should do so. At Beaufort County's request, a state-level group, the "Zero Degradation Ad Hoc Advisory Committee," recommended that the county adopt a set of new stormwater best management practices (BMPs). Beaufort County should adopt these recommended standards, with

appropriate modifications, at least for the county's Outstanding Resource Waters (ORW) and Shellfish Harvesting (SFH) waters.[1] (See pages 37 & 40.)

Step #4 *Beaufort County, in Cooperation with the Town of Hilton Head and Other Municipalities, Should Establish a Stormwater Utility (or some equivalent institutional capacity) to Inspect, Maintain and Repair Stormwater Management Systems.*

The performance of stormwater management systems, just like the family car, will decline without regular inspection and maintenance. Under the current state program, only those systems permitted since 1992 are subject to annual inspection; repairs can be required when warranted. Any gains in better land use planning and better BMP design will be overshadowed by the poor performance of existing systems. Consequently, Beaufort County, the Town of Hilton Head and other municipalities must develop the institutional capacity, probably through a stormwater utility, to inspect, maintain and rebuild older stormwater systems. The local governments may wish to seek DHEC's advice on how to best proceed on this matter. (See page 38.)

Step #5 *Beaufort County, and the County's Municipalities, Should Require the Inspection and Maintenance of Septic Systems at Logical and Convenient Times; DHEC Should Approve System Repairs.*

Experts agree that even the best designed septic system built in the best of soils needs to be inspected and maintained on a regular basis. Beaufort County (and the county's municipalities as

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[1]Under the Clean Water Act, all waters of the state must be given a classification which establishes resource protection goals for each waterway. Waterways classified as "Outstanding Resource Waters (ORW) or "Shellfish Harvesting Waters" (SFH) receive the highest level of protection. Some waterways are given lower classifications, indicating that some degradation of the resource is acceptable.

appropriate) should begin modestly by requiring inspection at the most convenient times -- perhaps when property is sold or when a system owner requests a pump-out. The local governments should design the program in close consultation with DHEC officials. If the inspection indicates that system repairs are required, DHEC should be able to approve any proposed repairs. (See page 29.)

Step #6 *DHEC, DNR, the National Marine Fisheries Service (NMFS), Beaufort County and the Town of Hilton Head Should Contribute to the Performance of a Baseline Assessment of Broad Creek and the Okatie River.*

Much is known about the condition of Beaufort County's rivers and creeks with respect to fecal coliform, but little is known about other parameters of concern. In order to fashion a long-term protection strategy, we must understand the importance of different potential threats. A relatively modest baseline assessment of the physical, chemical and biological conditions of Broad Creek and the Okatie River would serve this purpose. CWTF members will work with the participating agencies to secure the necessary funding.(See pages 34, 47, and the draft Baseline Assessment Scope of Work in the Appendix.)

Step #7 *Town of Hilton Head Should Develop a Boating Impact Management Plan for Broad Creek.*

The CWTF suspects that boating activity in Broad Creek has reached the point where its cumulative effect is placing a stress on the ecological balance. Based on the baseline assessment of Broad Creek (described above), the Town of Hilton Head should develop a boating impact management plan for the creek. Potential components of the plan include: a no-discharge zone; a no-wake zone; and a cap on the number of permanent and transient boats moored in the creek. (See pages 32 and 45.)

Step #8 *Beaufort County -- in close cooperation with DHEC, the Town of Hilton Head, Other Municipalities, Jasper County, the Lowcountry Council of Governments, and DNR -- should initiate a Special Area Management Plan.*

During its deliberations, the CWTF identified many potential problems that will take further study and evaluation to address. In many cases, these problems are more complex to solve because they require a watershed level management response that extends across property lines and jurisdictional boundaries. Consequently, this longer term work must be accomplished within a framework that facilitates cooperation and problem-solving -- particularly among local governments like Beaufort and Jasper Counties. The Special Area Management Planning (SAMP) process, available under the Coastal Zone Management Act, is the best available vehicle for this purpose. The baseline assessment of Broad Creek and the Okatie will be the foundation for much of the work accomplished within the SAMP. (See pages 34 and 53.)

Step #9 *Beaufort County, DHEC and the Beaufort/Jasper Sewer & Water Authority Should Jointly Develop a Comprehensive Septic System Management Plan.*

As outlined in Step #5 above, the local governments should develop quickly a modest inspection and maintenance program for septic systems. In the long term, a Comprehensive Septic System Management Plan addressing the full range of issues will be needed. At present, there is an unacceptable level of disagreement among national, state and local officials on the adequacy of the DHEC's septic system program. The public will lack confidence in septic systems until all relevant parties agree to, and jointly implement, a program they all support. Potential elements of this plan include: new standards for conventional systems; the use of "septic friendly" household appliances; an extensive inspection and maintenance program; and provisions for the proper maintenance of "high-tech"

systems. Such a management plan will be a key component of the SAMP. (See page 60.)

Step #10 *Beaufort County, the Town of Hilton Head and Other Municipalities Should Address Water Quality Concerns When Improving Any Drainage Systems.*

Beaufort County and the Town of Hilton Head both intend to make major improvements to publicly owned drainage systems. By moving stormwater off the land more quickly and efficiently, the local governments may contribute to the degradation of the rivers and creeks. Increased stormwater flows present two separate problems: (1) additional freshwater discharges could decrease the salinity of small tidal creeks, contributing to the growth of fecal coliform and the decline of biodiversity; and (2) additional stormwater discharges could add chemical pollutants and bacteria to already stressed waterways. The Town of Hilton Head is moving on a rapid schedule to make major improvements to its drainage system; therefore, the town should adopt quickly policies designed to limit additional pollutants and freshwater from entering the island's tidal creeks. The other local governments should address these issues within the SAMP. (See pages 22 and 57.)

All of the recommendations, including the ten outlined above, are discussed in the body of the report. For a snap-shot view, refer to the summary table that follows the Executive Summary. To facilitate use of the summary table, Figure 1 lists the implementing agencies (and their abbreviations).

Implementing this report's recommendations will be yeoman's work, but it can be done. The CWTF will remain active to ensure that appropriate organizations take responsibility for each of the proposed actions. Three

Figure 1
Implementing Entity Key

Beaufort County Government	BC
Town of Hilton Head Government	HHI
Jasper County Government	JC
Beaufort/Jasper Water & Sewer Authority	BJWSA
Lowcountry Council of Governments	LCOG
SC Department of Health & Environmental Control	DHEC
SC Department of Natural Resources	DNR
SC Department of Transportation	DOT
SC Forestry Commission	FC
SC Sea Grant Consortium	SGC
Clemson University Pesticide Control	CUPC
Zero Degradation Ad Hoc Advisory Committee	ZDAC
U.S. Fish & Wildlife Service	FWS
U.S. Environmental Protection Agency	EPA
National Marine Fisheries Service	NMFS
Private Sector	PS
General Public	GP

mechanisms will help in the process of assigning these responsibilities. First, CWTF members will work with existing private and quasi-public community groups to find a sponsor for each of the citizen-driven action items. Second, the CWTF will help organize the SAMP management committee, which will oversee long-term study and action. Third, we propose that the implementing agencies (and particularly DHEC, Beaufort County and the Town of Hilton Head) agree to sign "willingness statements," which will specify the recommendations they are willing to embrace (and under what kind of conditions). Over the next few months, the CWTF will work to secure the willingness statements. Once each of the recommendations has found a home, the CWTF will reconstitute itself into an informal oversight committee and move to a quarterly meeting schedule. The group's sole purpose, at that point, will be to monitor implementation of this report's recommendations.

Conclusion

We all are taught from an early age that change is inevitable. That certainly is true in the case of Beaufort County. Our superior natural resources, ideal climate and vigorous economy attract new residents by the thousands. As a result, our population is expected to double over the next twenty years, with portions of the county experiencing much higher growth rates.

The CWTF welcomes the economic activity and cultural vitality that our new neighbors will bring. We are not willing to accept, however, that such growth

will inevitably degrade what we all love about our corner of the world, especially our near-pristine waterways. We doubt newcomers will be any less insistent on this point. Change, while inevitable, can be managed so that it serves the community's interests.

In reviewing the recommendations in this report, some may argue that they are too aggressive and too expensive. We disagree. As a community, we cannot afford to kill the goose that lays the golden egg. The cost of preventing problems before they happen and correcting modest problems before they balloon into massive crises is small, compared to the cost of restoring waterbodies once they are severely degraded.

This report is a challenge. We challenge the state and local officials who are responsible for conserving the community's natural assets to rise to the occasion and protect them. Similarly, we challenge the citizens of Beaufort County to become stewards of the waterways and support our officials in their important work. We must develop the capacity to anticipate the future, and the political will to act to ensure the future is one we would want for our grandchildren's children. To do otherwise would be morally irresponsible, for we would be spending their birthright, Beaufort County's natural bounty.

Summary Table of CWTF Recommendations

Source	Immediate Action/Implementation in 1-3 months				Intermediate Action/Implementation in 1-12 months				SAMP/Implementation in 1-3 yrs Coordinated Study & Action Issues to Consider
	Local	State	Local/State Combo	Education/Citizens	Local	State	Local/State Combo	Education/Citizens	
Cumulative Impacts/ Organizing the Response	1. BC, with HHI & DHEC, initiate SAMP Process 2. BC signs willingness statement 3. HHI signs willingness statement	1. DHEC signs willingness statement	1. DHEC/DNR (with HHI, NMFS, BC, ZDAC) establish scope of work for baseline assessment of Broad Creek & Okatie	1. CWTF helps form Clean Water Coordinating Council			1. Perform base line assessment of Broad Creek & Okatie (DHEC, DNR, NMFS, HHI, others)		
Stormwater	1. County establish progressive land use planning policies – growth & rural zones purchase strategies cluster in rural areas vegetative buffers coordinate GIS 2. HHI sets policy of treating stormwater from drainage improvements 3. HHI set management goal of no net increase of fresh water in dead end creeks	1. SCDOT seeks to limit water quality impacts 2. DHEC enforce stormwater rules on roads and bridges	1. DHEC & BC MOA requiring joint pre-application conference with applicant		1. BC revamp stormwater permit program, based on ZDAC guidance 2. BC, with HHI & other municipalities, establish stormwater utility 3. BC & HHI, with DHEC & DNR, develop and implement stormwater monitoring strategy -- based on ZDAC guidance			1. BC develop design guidelines for developers 2. BC educate citizens and staff on value of vegetative buffers & details of RPOD 3. Citizens analyze stormwater monitoring data	1. Watershed approach to stormwater management in Okatie Basin 2. Expand GIS capability 3. Delegation of stormwater program 4. Evaluate BMPs based on pollution control goals 5. County-wide pollution control of drainage improvements 6. Explore stormwater reuse 7. Improve treatment of bridge & road runoff
Central Wastewater	1. BC establish sewer service boundaries – implemented through BJWSA -- with concurrent commitment to OSDS outside boundaries 2. BJWSA endeavor to avoid sensitive areas when laying new lines 3. BJWSA favors high ground back up disposal sites	1. DHEC require best materials and construction practices for new lines in proximity to sensitive areas 2. DHEC re-opens administrative closures as appropriate		1. Citizens participate in wastewater permitting process					1. Re-evaluate permitting standards 2. Identify (a) future discharge points, and (b) future land application and back up disposal sites

Source	Immediate Action (1-3 months)				Intermediate Action (1-12 months)				SAMP (1-3 years) Coordinated Study & Action
	Local	State	Local/State Combo	Education/Citizens	Local	State	Local/State Combo	Education/Citizens	
Onsite Disposal Systems (Septic)		1. DHEC give notice & allow public comment (& appeal) of subdivision approvals	1. BC require I&M at point of sale & pump-out-- with DHEC approval of any system repairs 2. DHEC & BC coordinate issuance of septic and building permits		1. BC put pump-out reminder on tax bills	1. DHEC develop mechanism to notify public of individual systems abutting critical line		1. BC & DHEC develop homeowner OSDS education campaign	1. Comprehensive OSDS management plan for areas outside sewer boundaries -- new permit standards, rules on appliances, inspection & maintenance, innovative systems, wastewater management district
Boating Impacts	1. HHI requests DHEC & EPA to establish no discharge zone in Broad Creek, Calibogue Sound				1. HHI develops boating impact management plan for Broad Creek -- based, in part, on baseline assessment.			1. HHI, DNR, DHEC, marinas & boaters develop education campaign	1. County-wide boating impact plan, with special attention to dead-end creeks
Monitoring & Enforcement			1. HHI's Broad Creek study satisfies part of baseline assessment need	1. Shellfishermen organize association			1.DHEC commits more resources to investigation, possibly with cost-share arrangement with BC	1. Citizens establish shoreline survey of Broad Creek & Okatie	1. Formalize mechanism to coordinate monitoring activities 2. Enhanced monitoring activities by agencies and/or citizens
Timber Management					1. BC expand waiting period between logging & development 2. BC encourages use of BMP foresters & top loggers			1. Citizens work with timber industry to improve BMP compliance	
Chemical Use								1. BC, HHI, CUPC develop lawn chemical & landscaping education campaign for homeowners & lawn care companies	1. Establish hazardous waste drop-off site -- based on resource assessment results

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Introduction

Origins of the Clean Water Task Force

In the fall of 1995, the Department of Health and Environmental Control (DHEC) closed to shellfishing about an additional 200 acres of Hilton Head Island's Broad Creek waters and 300 acres of the Okatie and Chechessee waters. The reason: high fecal coliform counts. The news alarmed us, a group of Beaufort County citizens now called the "Clean Water Task Force." We became further alarmed when we discovered that over 31,000 acres of county shellfish waters were already closed, equally split between northern and southern Beaufort County. When we learned that the trend indicated more closures on the horizon, we knew it was time to turn alarm into action.

This led to several meetings with Columbia DHEC officials and preliminary research into the nature of the problem. Early on, we discovered several disturbing facts:

- Shellfish bed closures directly impact the commercial harvester. Additionally, restaurants and seafood businesses suffer from the public perception that shellfish consumption presents a health risk. Tourism is affected by negative reports concerning water quality, because many tourists are seeking water-related recreational opportunities. In short, declining water quality undermines the basis of important segments of the local economy.

- In the past, DHEC has been much better at closing shellfish waters (because of high fecal coliform counts) than at reopening the waters. To their credit, DHEC and the Department of Natural Resources (DNR) are now making an effort to correct matters.[2]

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[2]Recently, DHEC and DNR have established a Shellfish Restoration Committee, through a memorandum of agreement, with the goal of eliminating sources of fecal contamination and reopen Restricted and Prohibited waters in the state. The verdict is still out on this laudable effort.

- Shellfish are the canaries of the salt marsh. It doesn't take much pollution to close shellfish waters; in this sense, shellfish closures are an early warning signal.[3] If shellfish are in trouble, other estuarine organisms and animals may also be in trouble. Other than fecal coliform prevalence, very little is known about the quality of the Beaufort County estuarine system. Portions of the system could already be in serious condition. Fishermen have observed that fishing and shrimping are "not what they used to be."

- Closure due to high fecal coliform counts could be caused by any number of things: failed septic tank systems, misbehaving sewer treatment plans, boat discharges, and the biggest willow-the-whist of all, stormwater runoff. For instance, no single source of fecal coliform contamination has been identified as the cause of shellfish bed closures in Broad Creek.

- Stormwater runoff transports pollutants (including fecal coliform) into the salt water estuaries from many sources on the land. Because of the multiple sources, polluted runoff is often referred to as *nonpoint source pollution.* To the lay person, nonpoint source pollution really seems to be a catch-all phrase that means "we don't know where that pollution comes from."

- Recent studies in South Carolina indicate that, in addition to fecal coliform, stormwater deposits chemical contaminants such as *polycyclic aromatic hydrocarbons* (PAHs), trace metals and pesticides in coastal waters. A co-occurrence of high levels of PAHs and fecal coliforms indicates that PAHs may actually be a food source for fecal coliforms.

- Excessive *non-polluted* stormwater runoff (i.e., freshwater that carries no appreciable levels of conventional contaminants) reduces salinity which can reduce biodiversity and act as a catalyst to fecal coliform growth.

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[3]Based on the 30 most recent samples at each shellfish monitoring station, the geometric mean of the fecal coliform concentrations for approved waters cannot exceed 14 per 100 ml. By contrast, the fecal coliform standard for swimming waters is 200 per 100 ml.

- South Carolina studies also suggest that fresh water and chemical contamination in stormwater affect survival, reproduction, and densities of amphipods, copepods and grass shrimp, which are essential food sources for juvenile fish. This impacts recreational fishing, an important part of the local economy.

- Ineffective and poorly maintained best management practices (BMPs), ineffective and loosely enforced development regulations and poorly planned development patterns are the reason why there is excessive amounts of stormwater runoff, much of it polluted.

- As a result of development and timbering, wildlife concentrates in the remaining habitat which in turn leads to concentration of wildlife fecal matter. This may be contributing to the fecal coliform problem in Beaufort County.

- Very little is known about the cumulative impacts of the various pollutants, other than fecal coliform, transported into the estuarine system by stormwater runoff. A baseline assessment of Broad Creek and the Okatie River must be performed to determine the full scope of the problem faced by these and similar Beaufort County waterways.

- The responsibility for enforcing the regulations which protect the quality of the county estuarine system is split up between the US Army Corp of Engineers, the US Coast Guard, various state agencies (many divisions of DHEC, DNR, Clemson University Pesticide Control), Beaufort County, the Town of Hilton Head and the county's other municipal governments. Such balkanization of responsibility is not an effective way to protect water quality.

- Beaufort County, over the next several years, will develop at an unprecedented rate. Experts predict that Beaufort County's population will double over the next twenty years. Further deterioration of the county waters will occur unless there are changes in how we do business.

- Many of the long-term solutions will require a watershed level perspective, because "we all live downstream" -- our waterways do not recognize property lines and jurisdictional boundaries. In particular, Beaufort and Jasper Counties will need to work together to protect the waterways of southern Beaufort County.

A Commercial User's Perspective
byWoody Collins

Residents of South Carolina have been blessed with a really wonderful tidal estuary system. These estuaries are rich in seafood, beauty and wildlife. They provide us with a recreational resource that no tax dollars could buy.

South Carolina has long provided its citizens with ample access to these resources by means of its public boat landings and public piers. They are strategically located all over the coastal areas of our state. It is very obvious that the state recognizes the importance of these resources to its citizens.

The freedom and right to use these resources in a commercial and recreational manner is a legal right of every South Carolina citizen. It is part of our heritage, a generations-old tradition for many of us. Unfortunately, this heritage and tradition is being severely threatened.

As Pogo, of Pogo and Albert, once so profoundly said, "We have met the enemy and they is us." Our exploding population and the accompanying development, because it creates more drainage to our waterways, is the main part of our problem. Many of us feel our drainage plans are dated and we are not using the best available technology to deal with this problem.

The exploding use of the resource itself is another part of the problem. No part of this resource is untouched in a recreational manner. The citizens of South Carolina own the resources. It is the responsibility of our public servants at every level to insure that these resources are fully protected for current and future generations.

The continuing closing of shellfish beds to harvesting should be a wake-up call for everyone. South Carolina is currently importing thousands of pounds of oyster meat from other states that are taking better care of their resources. In fact, we should be exporting this product. Industry is reluctant to invest in a resource with such a bad track record. If the resource were stabilized, the money would come to develop the resource. The demand far exceeds the current supply.

These findings incited the Clean Water Task Force to adopt the duel objectives of ***encouraging the clean-up of polluted county waters*** and ***identifying what must be done to prevent additional county waters from becoming polluted.***

Governor Beasley became concerned about the Beaufort County pollution problem. At a meeting on Hilton Head, members of the CWTF explained the problem and its economic implications to Governor Beasley and DHEC Commissioner Doug Bryant. It was very gratifying when the governor endorsed the CWTF efforts. He designated Ms. Beth Partlow from his office, and Doug Bryant designated Chester Sansbury from DHEC as contact persons.

The CWTF Goes to Work

With the most essential governor's support, the CWTF was off and running. The basic strategy was to: (1) work with the state and local agencies to accomplish the CWTF objectives; (2) work within existing state laws and regulations; and (3) encourage straightforward discussion of the issues.

Four multi-subject *scoping meetings*, one per week in June and July, were held at the local DHEC headquarters in Port Royal. Sam Passmore, of the SC Coastal Conservation League, assisted in planning and conducting the meetings. Robert Boyles, of the SC Sea Grant Consortium, served as recorder. The meetings' purpose was to gather information and understanding about what should be done to clean up polluted county waters and to prevent additional county waters from becoming polluted. From the beginning, the ultimate goal was to make appropriate recommendations to state agencies and local governments.

In particular, the scoping meetings focussed on potential pollution sources and their regulation. Of major concern were stormwater runoff, central wastewater collection and treatment (sewer plants), on-site wastewater treatment (septic systems), marine sources (boats and marinas), agriculture, forestry and land development impacts. Appropriate personnel from various state and federal agencies, local governments and other organizations were invited to make presentations.

At the conclusion of the four meetings in mid July, the CWTF realized that there were gaps in its understanding of the pollution problems and especially the regulatory programs. A creaking regulatory process is hard to understand! Thus, a series of *fill-in-the-gaps* discussions ensued, most in Charleston over the July-

August time period. The National Marine Fisheries Service was added to these discussions.

In late August, Beaufort County government was struggling with how to implement a *zero-degradation* requirement which was approved as part of a development adjacent to the Okatie River. At the CWTF's suggestion and with its help, the Beaufort County Council requested DHEC and the SC Sea Grant Consortium to convene an ad-hoc advisory committee to address the problem. The first meeting of the ad-hoc committee of regulators and scientists was held on October 3 with Rick DeVoe of Sea Grant and Chester Sansbury of DHEC serving as co-chairs. The committee completed its work in December.

Figure 2
The Appendices

CWTF Members & Biographies
DHEC's Beaufort County Shellfish Program
A review of the program with special attention to Broad Creek and the Okatie
Beaufort County Shellfish Waters Status
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Meanwhile, the CWTF assembled its recommendations to state agencies and local governments and began the process of reviewing and refining these recommendations with government representatives. The recommendations received final CWTF blessing in January. The body of this report contains those recommendations. The materials in the appendix, listed in Figure 2, fill out the Clean Water Task Force story and further substantiate the recommendations.

A Recreational User's Perspective
by David Harter

Just like the oyster, the fisherman is a good indicator of the health of an ecosystem. Whether recreational, charter or commercial, fishermen respond to the rules of supply and demand. We go where the fish are.

Surveys of long-time users of Broad Creek show that there has been a decline in its use as a fishery. They have noticed a slow decline over the last 10-15 years which they attribute somewhat to fishing pressure. However, over the last 5 years, there has been a more precipitous drop, indicating that the creek may be subject to more catastrophic influences. As recently as 5 years ago we were commonly reporting the tagging and releasing of as many as 50 fish in a day. A catch like that is unheard of now. It's been several years since good fishing reports have come in on Broad Creek. Knowledgeable fishermen do not waste their time with the creek unless the weather, winds or boat size gives them no other option.

The focus of the recreational fisherman has changed dramatically over the last 10 years. Because of the alarming degradation in our marine habitats and the depletion of fish stocks, more fishermen have joined or formed proactive organizations to reverse this trend. They are less concerned about stocking the freezer than they are about developing a sustainable fishery. An extremely important component of that sustainable fishery is the protection of our marine estuaries and wetlands as nurseries. These nurseries are the foundation of the entire food chain. As we destroy the effectiveness of these nurseries the ripple effect soon takes the marine fishery down with it. It happened in the Chesapeake and it is happening elsewhere. We cannot underestimate the contribution that Broad Creek, the Okatie River and other tidal creeks make to our local fishery.

Months of meetings with state wildlife, health and environmental agencies have shown us that there are no obstacles that we cannot overcome to reverse the trend in Broad Creek and elsewhere in the county. We need only the desire to do so.

The Recommendation Framework

Based on months of inquiry and discussion, the CWTF has arrived at a set of principles that influence and organize the recommendations presented in the following pages:

- First and foremost, the CWTF believes that any proposed action should have a realistic chance of being implemented; we seek to practice the art of the possible.

- Second, the CWTF embraces the vitality of Beaufort County's economy, and our recommendations are designed to protect the basis of that growth -- the county's unparalleled water resources.

- Third, the CWTF believes that any recommendation should be based on the best available information along with a healthy dose of common sense; we should be prudent, but not so cautious that the resource is lost before we find the will to act.

- Finally, the CWTF feels that the scale of any proposed action should take into account the level of certainty we have about the severity of the problem; in other words, we should look before we leap.

With these principles in mind, the CWTF is confident that enough is known about some pollution problems to recommend a set of specific actions now. At the same time, we need to know more about the condition of Broad Creek, the Okatie River and similar waterbodies to act in a comprehensive way at the watershed level. This is the direction we must move if we hope to effectively deal with the challenge of cumulative impacts.

Consequently, the recommendations outlined in the following pages are organized into three basic categories:

- Immediate Actions. Recommendations for immediate action are those that address a known need with respect to a specific pollution source and are relatively straightforward to implement. The CWTF expects that theses actions could be put in place by June 1, 1997.

- Intermediate actions. Recommendations for intermediate action are similar to immediate actions with one important exception: they will take more time to implement because they typically involve coordination between

different governmental agencies. For this reason, the CWTF expects that it may take as much as a year to implement the proposed intermediate actions, *assuming that work begins on them in short order*. The CWTF would be pleased if the recommended intermediate actions were in place by March 1, 1998.

- Long-Term Actions. The proposed long-term actions generally require more study and evaluation before the most appropriate management strategy could be developed. For this reason, one of the CWTF's most important recommendation is that a baseline resource assessment of Broad Creek and the Okatie River be completed as quickly as possible. With this data in hand, it will be possible to develop management strategies that address cumulative impacts at the watershed level. We suspect that most, if not all, of these management strategies will require a high level of inter-governmental cooperation. Therefore, more time must be allowed -- as much as three years in some cases. In reviewing all of the options, the CWTF has determined that the Special Area Management Planning (SAMP) process, available under the state's Coastal Zone Management Act, is the best available vehicle to organize the research and deliberations necessary to develop long-term management strategies. The SAMP process is fully explained later in the report.

Each of the three sets of recommendations is further divided according to pollution source, just as the CWTF scoping meetings were organized by source. For example, this report contains immediate, intermediate and long-term recommendations for stormwater management. This report has many different audiences: state agencies, local governments, the private sector and the general public. To account for this fact, immediate and intermediate action recommendations are keyed based on the primary implementing entity. (See Figure One in the Executive Summary.) The proper implementation strategy for possible long-term actions is less clear, so no key is provided in these cases.

One last note: The CWTF grew out of a concern for Broad Creek and the Okatie River, and the fate of these two waterways has oriented much of our thinking. Consequently, we have spent many hours with officials from the Town of

Hilton Head (Broad Creek) and Beaufort County (Okatie River), and our recommendations to these two units of government are quite precise. In contrast, our recommendations do not single out the county's other municipalities -- Bluffton, Port Royal and Beaufort -- because we are not as familiar with these town's pollution control programs and any special circumstances they may face. We believe, however, that most of the recommendations are appropriate for all of the county's municipalities, since Broad Creek (a developed watershed) and the Okatie River (an undeveloped watershed) are representative waterways. What works for Broad Creek or the Okatie should work for Broomfield Creek, Huspah Creek, Battery Creek and all of Beaufort County's creeks and rivers.

An Environmental Scientist's Perspective
(abridged*)
by Dr. Geoffrey I. Scott

Estuarine environments in South Carolina are among the most productive ecosystems in the biosphere and perform an important nursery ground function for fin fish and shellfish. These Spartina alterniflora estuarine systems are facing significant developmental pressures, mandating that local, state and federal agencies take more proactive management measures.

South Carolina's coastal estuaries vary greatly in size, hydrography (e.g., fresh water flushing characteristics) and amount of surrounding upland development. The smallest are high salinity estuaries without major rivers flowing into them. The largest estuaries are greatly influenced by freshwater flow from large rivers; the resulting salinities are lower than in the smaller "non-riverine" estuaries. Non-riverine estuaries are influenced primarily by land development directly adjacent to the estuary, while riverine estuaries are also impacted by development further inland.

In Beaufort County, large riverine estuaries lie at the county's borders -- St. Helena Sound to the north and the Savannah River to the south. The estuaries that lie in between -- Port Royal and Calibogue sounds -- are non-riverine estuaries draining many small tidal creeks and rivers of the region.

The impact of upland development has not been well studied in South Carolina. while several state and federal monitoring programs have chronicled the levels of selected chemical contaminants at long term monitoring stations, these efforts have generally not been focused on characterizing pollution sources in upland areas in a quantitative manner. Recent studies have attempted

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to derive quantitative relationships between coastal development and ecosystem health. The Urbanization in Southeast Estuaries (ECO) System (USES) study has examined the effects of coastal development on Murrells Inlet (MI). MI, at the southern end of the Grand Strand, is a non-riverine estuary that is highly urbanized with tourism-related development. Undeveloped North Inlet (NI) was used as a reference site.

USES Project results indicate significant nonpoint source (NPS) runoff loading of polycyclic aromatic hydrocarbons (PAHs) and coliform bacteria into watersheds adjacent to upland development. (PAHs are indicative of urban activities associated with fossil fuel combustion.) Highest PAH concentrations in sediments and oysters were found adjacent to transportation corridors and marinas. PAH pollution may adversely affect living marine resources of estuaries by directly (e.g., acute toxicity) or indirectly (e.g., sublethal affects on growth, development and reproduction) affecting resident fauna.

Major sources of coliform bacteria appeared to be related to remaining septic tanks within the estuary. Bacteriological "fingerprinting" indicated that E. coli bacteria (i.e., an indicator of human and other mammalian species) densities and prevalence rates were much higher in urbanized MI; estuarine regions free of coliform bacteria occurred at a rate six times higher in pristine NI.

Geographical information system mapping and spatial statistics indicated that the highest levels of PAHs and fecal coliform bacteria densities co-occurred at frequencies higher than would be predicted. This suggests that coliform bacteria may significantly interact with PAHs, possibly meaning that fecal coliforms use the carbon-hydrogen source of the PAHs as an energy source.

In MI, grass shrimp abundances were reduced by more than 85% estuary-wide. (The grass shrimp is the most abundant macro-pelagic (>15 mm) fauna found in tidal creeks, comprising more than 56% of total fauna on an annual basis.) These reductions in grass shrimp were highly correlated with sediment PAHs concentrations and salinity alternations associated with increased NPS runoff loading. In pristine NI, 85% of the estuary had grass shrimp abundances higher than the peak grass shrimp abundances measured in MI.

Urbanization must be viewed as a process in which there are both contaminant (e.g., PAHs, trace metals and pesticides) as well as noncontaminant (e.g., altered salinities, hydrography and habitat) stressors. These contaminant and noncontaminant stressors may interact to produce the observed impacts discussed above. Environmental scientists have the challenge to discern the causes of population declines/alterations and to develop appropriate management strategies to reduce the observed impacts of stressors. The USES Project has been an important beginning in this process. By beginning in a small, nonriverine estuary such as MI – with no point pollution sources and where urban nonpoint pollution sources ar e clearly defined, the hydrography is well

(Cont. on next page)

studied, and linkages with adjacent land use are clear -- it has been possible to develop models which are predictive of upland development impacts. This was an important first step before studying more complex riverine estuaries such as Charleston Harbor, ACE Basin/St. Helena Sound and Winyah Bay. These systems may have many different pollution sources including both point and nonpoint source pollution contributing the same pollutants or classes of pollutants, complex hydrography, and pollution sources from adjacent land uses and upriver sources which must be discerned.

The Tidal Creek Study conducted by the South Carolina Department of Natural Resources as part of the Charleston Harbor Project (i.e., Office of Coastal Resource Management) has focussed on the upland regions of Charleston Harbor, a riverine estuary. Among its major findings, the study found that alterations in dissolved oxygen dynamics may profoundly impact estuarine ecosystem health. Low dissolved oxygen levels are tolerated well by many juvenile fish and shellfish, while many of their predators avoid such conditions. This protective feature must be maintained for headwaters to function as nursery grounds. The Tidal Creek Study has also shown that urbanization can alter dissolved oxygen dynamics in the reaches of developed watersheds. Additionally, greatest chemical contaminant loading occurred in headwater streams of small tidal creeks and the major pollution sources were PAHs, chlordane (termaticide) and some trace metals (e.g., chromium and lead). Of particular importance was the finding that industrial discharges greatly increased PAH concentrations from suburban sources (e.g., housing, roadways).

Results from the USES and Tidal Creek Project have greatly added to our knowledge of the impacts of urbanization. It is now time to implement pilot demonstration projects which will translate this knowledge into management techniques. These pilot projects must include monitoring studies of "*Key Cornerstone Estuarine Ecosystem Health Parameters.*" Results from such studies could then be related to what is known from the USES and Tidal Creek Project to identify the pollution sources that pose serious risks to ecosystem health. Broad Creek and the Okatie River are good candidate sites for this type of risk assessment in Beaufort County.

The risk assessment will help evaluate and better define appropriate management techniques. Risk management of urbanization must be viewed as a "*Cumulative Risk Reduction Strategy.*" No one management step will be 100% effective. A combination of management strategies, each with incremental pollution reduction potential, will ultimately accomplish the cumulative risk reduction needed to protect the living marine resources of South Carolina's vulnerable estuarine ecosystems.

*See Appendix for unabridged version.

Recommendations for Immediate Action

1. Stormwater

1.1 *Beaufort County Should Establish Progressive Land Use Policies with Documented Water Quality Benefits*

The Land Use/Water Quality Connection. Since the early 1970's, when most of the major national environmental legislation was put in place, we have learned a very simple, but powerful, lesson: It is easier and more cost-effective to control pollution at its source than at the "end of the pipe." That is why, for instance, industry is typically required to modify its manufacturing practices to reduce the amount of toxics in a plant's discharge before it enters a municipal wastewater system. That is also why consumers are exhorted to reduce and reuse, before we recycle. The same principle holds true for stormwater management.

Hard, or "impervious," surfaces are the principle source of runoff pollution, particularly in a developed or developing watershed. In contrast, undisturbed forest land is the best land cover from the standpoint of water quality. Reducing runoff pollution at its source, then, means reducing the amount of impervious surface associated with new development. As a recent report notes, "Monitoring and modelling studies have consistently indicated that urban pollutant loads are directly related to watershed imperviousness."[4] Because imperviousness within a watershed is a function of the total amount of human settlement, one must wonder if there is a population level beyond which water quality will inevitably decline. At a minimum, efforts must be made to reduce the amount of impervious surface associated with each increment of population growth.

Managing the water quality impacts of stormwater is a relatively new field. Prior to the passage of the Stormwater and Sediment Reduction Act in 1991, South Carolina's efforts to control stormwater pollution were minimal at best. As in other states, South Carolina's current program focusses on end-of-the-pipe treatment and pays scant attention to source reduction strategies. As a result,

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[4]Tom Schueler, *Site Planning for Urban Stream Protection* (Washington, D.C., Metropolitan Washington Council of Governments, 1995), p. 24.

developers install best management practices (BMPs), like detention ponds, that typically are designed to capture 80% of some of the pollutants present in stormwater. Clearly, there are opportunities to improve the treatment efficiency of BMPs, but studies demonstrate that, alone, even the best BMPs will not protect water quality over time. A combined strategy of progressive land use planning strategies and BMPs may be sufficient.

Land use planning is the domain of local government, not the state, so any source reduction strategy to control runoff pollution will come at the initiative of local government. With the update of its Comprehensive Plan, Beaufort County has an opportunity to establish this type of progressive land use planning framework. As detailed below, such a set of land use policies should seek to reduce imperviousness at the watershed level, at the site level and along sensitive waterways.

1.1a *Beaufort County Should Direct the Bulk of New Development to Designated Areas.*

Key: **BC**

The conventional development pattern (typically called, "sprawl") is characterized by low-density residential subdivisions, shopping centers and office parks physically separated from one another and connected by major arterial roadways. Numerous studies document that such a dispersed development pattern generates more runoff pollution within a watershed than concentrated patterns of development -- largely because of the extensive road network needed to support far-flung development. A 1992 Chesapeake Bay study found that focusing growth in specific locations would help maintain water quality to the year 2020; in the absence of better land use planning, water quality will decline.[5] (See Figure 3.)

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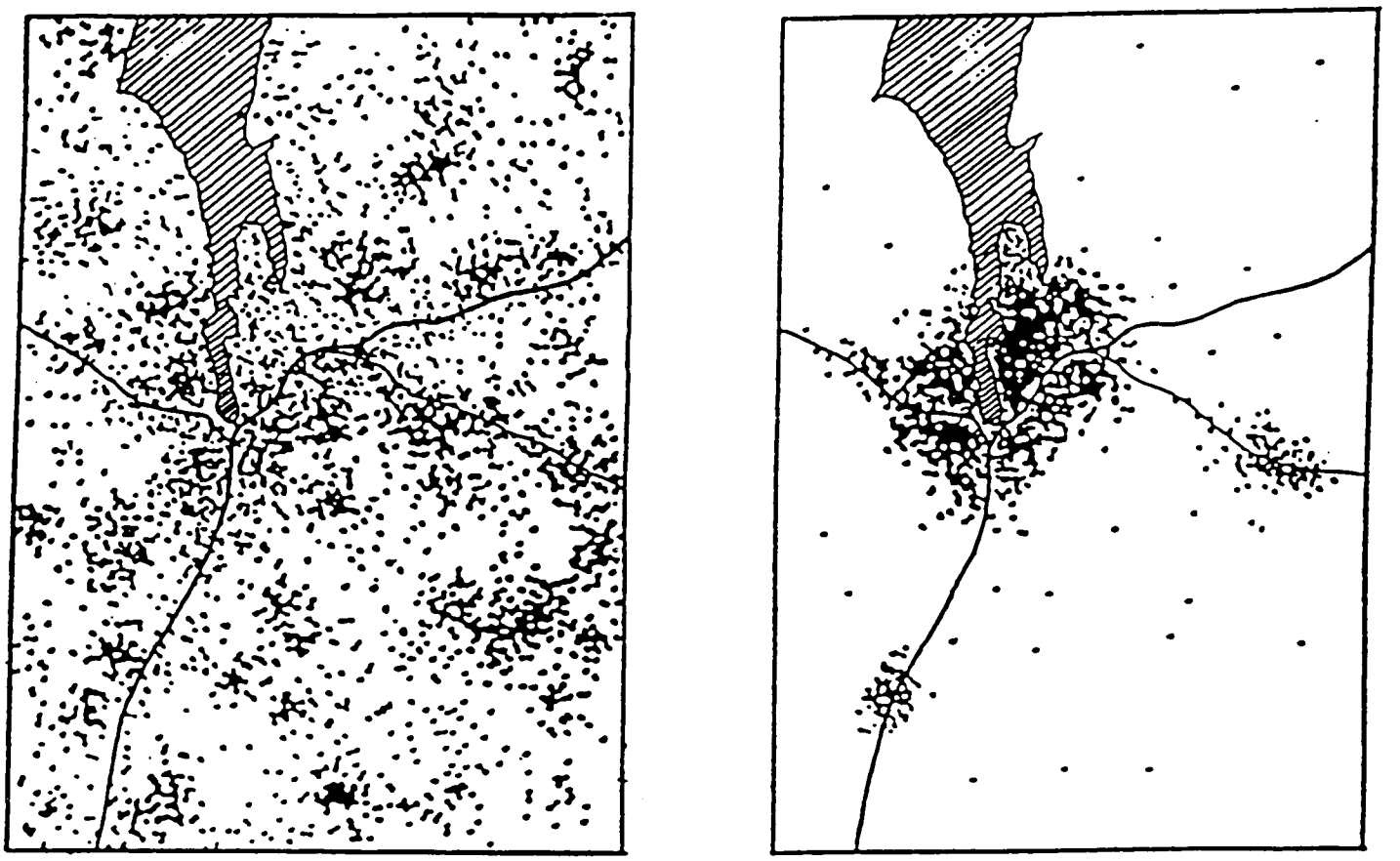
[5]Sandra M. Olsenholler, *Chesapeake Bay Basin Urban Nutrient Loadings and Reduction Estimates* (Washington, Metropolitan Washington Council of Governments, 1992), p. xi.

Figure 3

The Stormwater Paradox



The best way to minimize the creation of stormwater pollution at the regional scale is to concentrate much of the development in specific locations.

Water quality isn't the only reason Beaufort County might choose to concentrate the bulk of new development in priority locations. The unnecessary fiscal burdens generated by sprawl, for instance, are well documented.[6] The best location, number and size of priority growth zones may vary, however, depending on the objectives a community has. From a water quality perspective, it would be best to concentrate growth away from the headwaters of small tidal creeks, and other water quality sensitive areas, because the runoff volumes in the growth zones themselves can be relatively high. Also, the size of each growth zone should account for the assimilative capacity of nearby streams; if the creeks are small, the growth zone should be modest in size too. Imagine the historic Town of Beaufort in your mind's eye; this is a relatively large growth center located near the mouth of a relatively large river. Beaufort is, on balance, a good place for a town, though the on-site stormwater controls in this historic village undoubtedly could stand some improvement.

A range of public policies are available to encourage new development to locate within designated growth zones. In general, the CWTF favors strategies that use public investment policies and land owner incentives. The first step, however, is to establish a framework of growth zones and rural areas within Beaufort County's comprehensive plan. Appropriate and equitable implementation mechanisms can be formulated once such a framework is in place.

1.1b *Beaufort County Should Support and Contribute to the Identification and Protection of Critical Properties Outside of the Growth Zones.*

Key: **BC, DNR, FWS, PS**

Lands that harbor major freshwater wetland systems or lie adjacent to the headwaters of pristine tidal creeks perform very valuable water quality functions. Usually, they also are keystone properties that define the traditional rural landscape of Beaufort County. Every reasonable effort

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[6]See James Frank, *The Costs of Alternative Development Patterns* (Washington: Urban Land Institute, 1989).

should be made to protect such properties from future subdivision and development through: (1) the private donation of conservation easements; and (2) the public purchase of development rights.

In northern Beaufort County, the well-established ACE Basin Initiative is a highly successful partnership between private landowners and public agencies, including DNR and the U.S. Fish & Wildlife Service, to identify and protect critical properties. In southern Beaufort County, a similar effort -- the Savannah River Focus Area Initiative -- is underway. Beaufort County should become an active partner in both, directing available public funds to purchase jointly identified properties. Similarly, Beaufort County should take no direct action, like a major investment in road or sewer infrastructure, that would undermine these private landowners' efforts to maintain the rural landscape.

1.1c *Beaufort County Should Require Open Space Development Outside of the Growth Areas.*

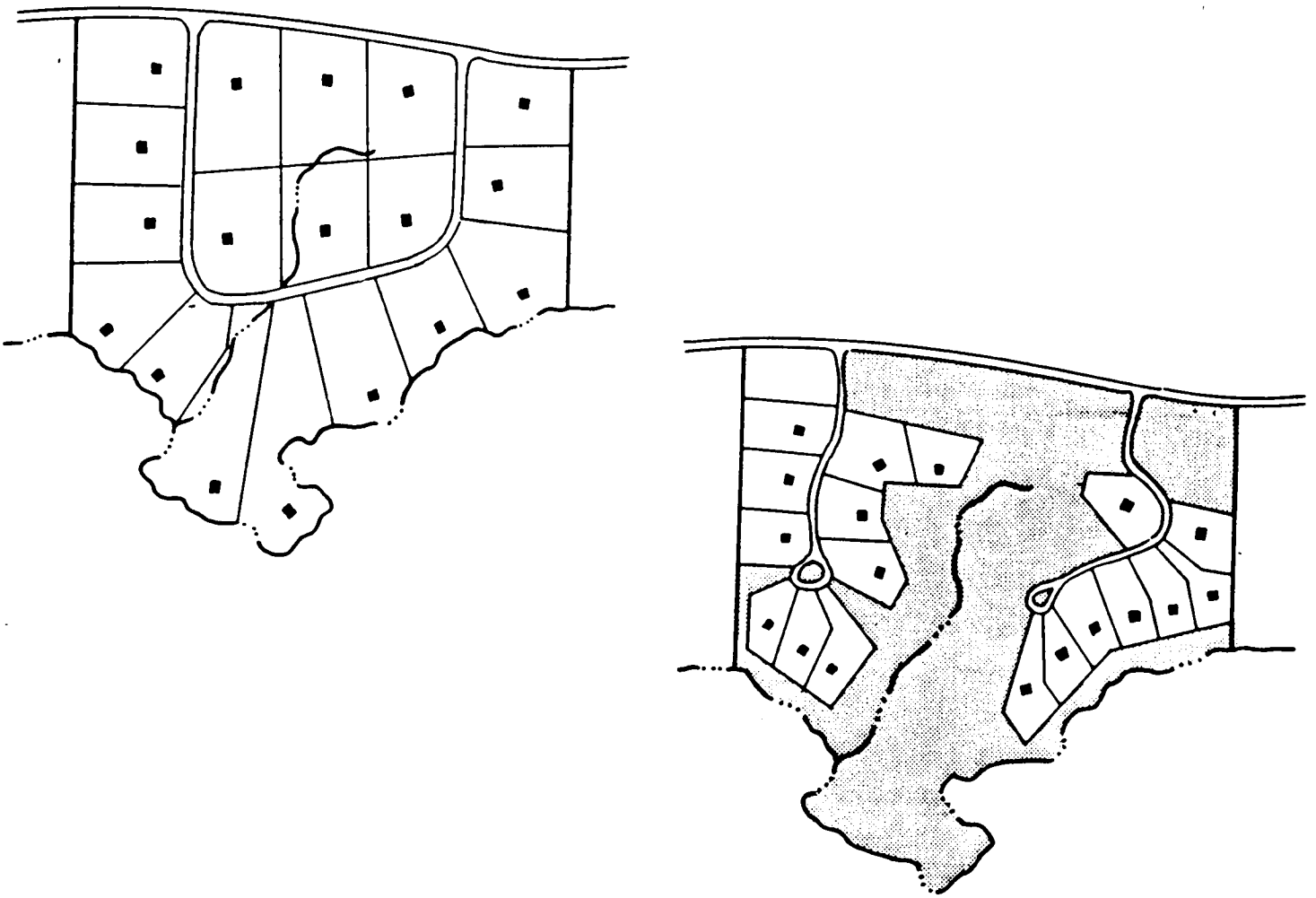
Key: **BC**

In rural areas, Beaufort County should require that new housing be clustered on a development site in order to maintain as much as the original site in natural open space as possible. (Land use planners, who have pioneered this "open space development approach" typically recommend that at least 50% of the original parcel, with an emphasis on the most environmentally sensitive high land, be permanently protected in open space.[7]) The open space development approach allows the developer to exercise his development rights while limiting impervious surface at the site level. Similar to concentrating development at the watershed level, such a site level approach has important water quality benefits. (See Figure 4.) A Charleston Harbor Project study of a Mt. Pleasant site found that leaving 70% in natural open space led to a 30% reduction in runoff volumes and a

[7]See Randall Arendt, *Rural By Design* (Chicago: Planner Press, 1995).

Figure 4

Rural Open Space Development



Clustering impervious surfaces on rural sites generates less runoff pollution.

three-fold reduction in sediment loading, as compared to conventional development.[8]

1.1d *Beaufort County Should Require Vegetative Buffers along all Creeks and Rivers.*

Key: **BC**

Vegetative buffers along urban and rural waterways filter and absorb runoff pollution before it reaches the waterbody. Under the right conditions, for instance, buffers can absorb up to 75% of the sediment, 50% of the nitrogen and 40% of the phosphorous washing off a developed site.[9] While more can be learned about the benefits of buffers under different circumstances, experts believe that natural vegetative buffers should be at least 50' in width and typically recommend a 100' minimum.[10] (See Figure 5.) Recognizing the substantial water quality benefits of buffers, Beaufort County should require a vegetative buffer along all of the county's waterways, with wider buffers established for the most sensitive creeks and rivers. Accordingly, the CWTF recommends that the county consider: (1) a 100' buffer above the tidal flushing point of all dead-end and poorly flushing creeks; (2) a 75' buffer along ORW and SFH waters, where the 100' buffer does not apply; and (3) a 50' buffer along all remaining creeks and rivers. Beaufort County's current River Protection Overlay District, which establishes a 50' buffer along ORW waters in southern Beaufort County, has a number of instructive features. The RPOD guarantees that waterfront property owners retain a view of the marsh; it allows the buffer to be modified on a site specific basis; and provides a variance procedure when the buffer rules cannot be applied because of a

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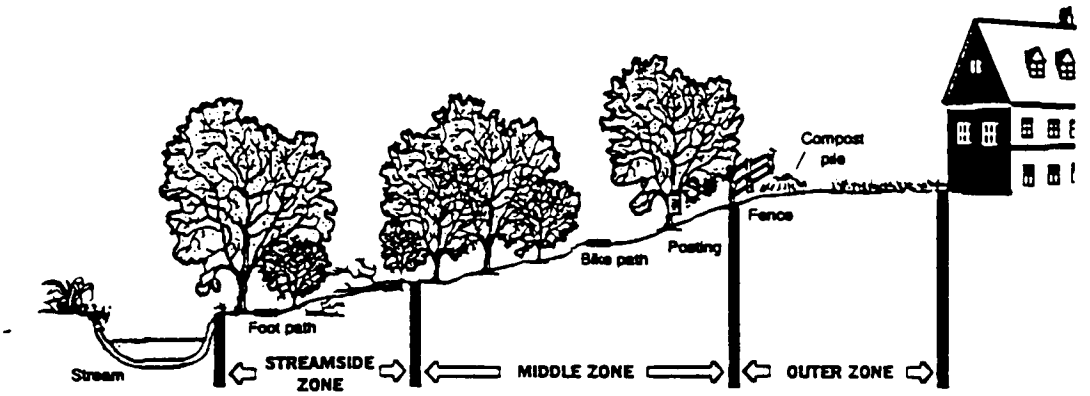
[8]James Hackett, "The Belle Hall Plantation Charette," *Land Development*, Winter 1997, pp. 26-29.

[9]*Site Planning for Urban Stream Protection*, p. 109.

[10]Ibid., p. 111; also see Rachel Warton, "The Benefits of Buffers," *Coastwatch*, July/August 1996, pp. 12-15.

Figure 5
An Urban Stream Buffer System



CHARACTERISTICS	STREAMSIDE ZONE	MIDDLE ZONE	OUTER ZONE
FUNCTION	Protect the physical integrity of the stream ecosystem	Provide distance between upland development and streamside zone	Prevent encroachment and filter backyard runoff
WIDTH	Min. 25 feet, plus wetlands and critical habitats	50 to 100 feet, depending on stream order, slope, and 100 year floodplain	25 foot minimum setback to structures
VEGETATIVE TARGET	Undisturbed mature forest. Reforest if grass	Managed forest, some clearing allowable	Forest encouraged, but usually turfgrass
ALLOWABLE USES	*Very Restricted* e.g., flood control, utility right of ways, footpaths, etc.	*Restricted* e.g., some recreational uses, some stormwater BMPs, bike paths, tree removal by permit	*Unrestricted* e.g., residential uses including lawn, garden, compost, yard wastes, most stormwater BMPs

The three tier system is one approach to establishing buffers along rivers and creeks. The details of Beaufort County's program would need to reflect local conditions.

(Source: *Site Planning for Urban Stream Protection*)

property's unique attributes. Strong buffer rules, coupled with flexible implementation, strikes the right balance.

1.1e *Beaufort County Should Help Establish a Geographic Information System Users Group.*

Key: **BC, HHI, JC, LCOG, DHEC, DNR**

Geographic Information System (GIS) technology is a computerized mapping technique that can ease implementation of the progressive planning policies discussed above. Beaufort County, and many other governmental bodies, have GIS capability. Because GIS systems can be expensive to develop and maintain, every effort should be made to share resources. Other regions of the state have organized informal GIS users groups that provide a forum to share data and experience. Beaufort County should help institute a similar group for the county, neighboring jurisdictions and relevant state agencies.

1.2 *DHEC & Beaufort County Should Require a Joint Pre-Application Conference on Stormwater Management Plans.*

Key: **BC, DHEC**

Most regulated activities require a permit from the state or local government, but very few activities require a permit from both. Stormwater management is one exception. Traditionally, local governments have been concerned principally with the control of flooding and DHEC has been more concerned with environmental impacts. Practically speaking, however, the outcome of the two permitting programs are more similar than they are dissimilar.[11] Right now, there is some informal coordination

[11]Both DHEC and Beaufort County stormwater permitting programs typically lead to the construction of structural BMPS, like detention or retention ponds. This is largely due to the fact that both programs require that the post-development peak discharge rates for a design year storm do not exceed the pre-development discharge rates. DHEC uses a 2 and 10 year design year

between DHEC and Beaufort County staff, but a mandatory joint pre-application conference with the applicant could improve coordination, discover synergies between the two permitting programs, and streamline the permitting process for the applicant. To this end, DHEC/OCRM and Beaufort County should jointly prepare such procedures, perhaps adopting them as a memorandum of agreement. DHEC/OCRM and some local governments currently coordinate the permitting of marinas in a similar fashion.

1.3 *The Town of Hilton Head Should Include Stormwater Treatment Systems in Any Improvements to the Island's Drainage System.*

Key: **HHI**

The Town of Hilton Head Island intends to spend as much as $17 million dollars in the coming years on drainage improvements to address flooding problems on the island.[12] The CWTF is concerned that, in an effort to address flooding problems by moving more stormwater off the land more quickly, the town will contribute to the degradation of the island's tidal creeks. Such an outcome is particularly likely when the system in question drains areas with older stormwater management systems. Recognizing this potential problem, the Town of Hilton Head's Jarvis Creek drainage improvement plan includes the construction of a large freshwater lake that will detain stormwater before releasing it to the creek. This project sets an excellent precedent, and should become the standard for how Hilton Head handles future improvements to its drainage system.

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storm, and Beaufort County uses a 25 year design year storm. In addition, DHEC also requires developers to retain or detain the first 1/2" of runoff from an entire site or the first 1" of runoff from the built-up portion of a site -- whichever volume is greater. If the site is within 1,000' of shellfish beds, the developer must retain the first 1 1/2" of runoff.

[12]Beaufort County also has an ambitious drainage improvement plan, but available funding is limited so the pace of improvements is less rapid. Partly for this reason, the CWTF recommends that the county plan to address the water quality impacts of such improvements within the context of the SAMP process.

1.4 *Town of Hilton Head Island should establish, as a management goal, a standard of no net increase of freshwater discharges to "dead-end" creeks, like Broad Creek, Jarvis Creek and Old House Creek.*

Key: **HHI**

The Town of Hilton Head's drainage improvements could easily increase the amount of freshwater entering the island's waterways. The resulting impact of increased freshwater flows is an important concern, independent of the pollutants (e.g., sediments, nutrients, PAHs) that such stormwater may convey to the creeks. Decreasing the salinity of tidal creeks can increase the survival rate of fecal coliform and decrease biodiversity.[13] For this reason, the Town of Hilton Head should establish a management goal that its drainage improvements should not increase the amount of freshwater entering poorly flushing tidal creeks, like Broad Creek, Jarvis Creek and Old House Creek. The CWTF recognizes that achieving this goal will be more difficult in some cases than others, perhaps requiring innovative (and expensive) stormwater management approaches that redirect stormwater flows to deeper water. Indeed, there may be times when the goal is impossible to achieve. Nonetheless, the Town of Hilton Head should make every effort to conform to a policy of no net increase of freshwater, especially in the headwaters of tidal creeks.

1.5 *The South Carolina Department of Transportation Should Endeavor to Limit the Water Quality Impacts of New Transportation Improvements.*

Key: **DOT**

The transport system (roadways, driveways, parking lots) accounts for much of the impervious surface within a watershed. A 1994 study in Olympia, Washington, for instance, determined that transportation related land uses comprised as much as 70% of all impervious surfaces.[14]

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[13]Clean Water Task Force Fill-In-The-Gap Meeting, 7/18/96.

Lowcountry roadways inevitably cross, and run parallel to, major wetland systems and waterways -- putting these water quality sensitive areas at risk. The SCDOT should make every reasonable effort to avoid such areas when planning and designing transportation improvements. When roadways abut, and bridges cross, water quality sensitive areas (particularly those classified as ORW or SFH) the SCDOT should make every effort to treat roadway runoff prior to discharge.

1.6 *DHEC Should Uniformly Implement Existing Stormwater Standards on Road Projects.*

Key: **DHEC**

In the coastal zone, any land disturbing activity (with very few exceptions) are subject to the requirements of the 1991 Stormwater Management and Sediment Reduction Act.[15] These rules require measures to control erosion during construction (e.g., hay bales) and the design of stormwater management systems (e.g., detention ponds). When it comes to road construction, DHEC's Office of Ocean and Coastal Resource Management (OCRM) has been better at implementing its rules during the construction phase. Most roadways in the coastal zone being built today lack the stormwater management systems required by law. The reason is simple: much of the new road construction currently underway was planned and designed prior to passage of the 1991 law. Reworking these designs could delay projects and inflate construction costs. The CWTF appreciates the dilemma, but does not excuse the practice. OCRM must take aggressive steps to implement its rules uniformly, even when it creates difficulties for another state agency.

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[14]*Site Planning for Urban Stream Protection*, p. 19.

[15]All projects, regardless of size, which are located within 1/2 mile of a receiving water body are subject to the law's requirements. Single family homes that are not part of a larger subdivision are exempt, as are agriculture and forestry activities.

2. Central Wastewater Treatment

2.1 *Beaufort County Should Establish Sewer Service Boundaries Around the Growth Zones.*

Key: **BC, BJWSA, LCOG**

For reasons noted above (see page 14), concentrating the bulk of new development within a watershed pays handsome water quality benefits. Public investment policy, as opposed to land use regulation, is the most equitable (and arguably the most powerful) tool available to direct the location of new growth. And centralized sewer service is the most important of all growth-inducing public investments. Consequently, Beaufort County should arrange for centralized sewer service to be provided only within priority growth zones. This will require a formal agreement with the Beaufort/ Jasper Water and Sewer Authority (BJW&SA), probably in the form of a Memorandum of Agreement, which should be reinforced by the appropriate amendments to the 208 Plan.[16] The BJW&SA has consistently expressed interest in such a planning framework, because of the impossible fiscal burden of providing centralized sewer service throughout the entire county. A decision to limit sewer service to specific areas implies that onsite disposal systems (i.e., septic systems) will remain the preferred wastewater treatment technology in the county's rural areas. Recommendations regarding septic systems are discussed later in the report.

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[16]The 208 Plan is the regional wastewater treatment plan, prepared by the Lowcountry Council of Governments under an arrangement with DHEC. The 208 Plan formally distributes sewer service areas in the region among the various sewer providers. The BJW&SA is responsible for providing sewer service to the unincorporated areas of Beaufort and Jasper Counties.

2.2 *The Beaufort/Jasper Water & Sewer Authority Should Endeavor to Avoid Water Quality Sensitive Areas When Planning and Constructing New Sewage Transmission Lines.*

Key: **BJWSA**

In the Lowcountry, it is virtually impossible to completely avoid wetland systems, drainage ditches and stream crossings when laying new sewer lines. That said, a leaking or ruptured sewer line, or a pump station overflow, can do significant damage when the raw effluent reaches water quality sensitive areas. While the BJW&SA does its best to inspect and maintain the transmission system, the ideal solution is to have a transmission system that, by design, would have a minimal impact if an accident or failure were to occur. For this reason, the BJW&SA should endeavor to limit the exposure of new sewer lines to wetlands, waterbodies and drainage ways.

2.3 *DHEC Should Require the Use of the Best Materials and Construction Practices When Permitting New Sewer Transmission Lines Near Water Quality Sensitive Areas.*

Key: **DHEC**

The design, construction, operation and maintenance of centralized wastewater treatment facilities are probably the most closely regulated activity reviewed by the CWTF. While DHEC has considerable authority over these activities, DHEC also has considerable flexibility in what it requires of a wastewater treatment operator. In permitting new sewer lines, DHEC should be sure that the best materials and practices are used when a proposed line parallels or traverses major wetland systems, waterbodies or drainage ways.

2.4 *The Beaufort/Jasper Water & Sewer Authority Should Favor High Ground for Back-Up Land Application Disposal Sites.*

Key: **BJWSA**

In most parts of the country, treated wastewater effluent is disposed of by a direct discharge to a receiving waterbody. In Beaufort County, land application of treated effluent is the current trend and expected to be the trend of the future. Land application, if handled properly, puts less stress on the waterways of the county simply because no direct discharge is involved.

Treated effluent is often used to irrigate golf courses, but during the wet winter months golf course superintendents are reluctant to take their share of the effluent. For this reason, back-up disposal sites are needed. There are three options for back-up disposal: (1) off shore; (2) high ground; and (3) natural wetlands. The utility of these options is directly related to the level of treatment provided; higher levels of treatment create more options. For instance, the treatment standards required for wetlands disposal are higher than for high ground disposal. The CWTF generally favors high ground for back-up disposal sites, largely because this would be one way to make productive use of rural land outside the growth zones -- relieving pressure to subdivide for development. Wetlands disposal also raises the concern of altering the hydrology of the wetland system through "over-watering."

2.5 *DHEC Should Re-Open Closed Shellfish Beds When Monitoring Data Demonstrates that Water Quality Consistently Meets the Shellfish Standard.*

Key: **DHEC**

Shellfish harvesting (SFH) waters are closed when water quality fails to meet the shellfish standard or when certain activities -- like marinas and wastewater discharges -- pose a potential threat to water quality. This

latter cause is called, an "administrative closure." Much of Beaufort County's 31,000 acres of closed SFH waters is due to administrative closures, particularly in the Beaufort River. Many of the direct discharges that prompted the administrative closures have been consolidated or eliminated. As a result, water quality monitoring indicates that much of the Beaufort River could support commercial shellfishing. DHEC should re-open as much of these administrative closures as possible, in keeping with the procedures and intent of the October 1995 Memorandum of Agreement between DHEC and DNR.[17] In doing so, the shellfish standard itself should not be weakened and an adequate safety margin should be maintained around the direct discharges and marinas that still exist.

2.6 *Citizens Should Participate in the Process of Permitting Wastewater Treatment Facility Discharges.*

Key: **GP**

No sewer plant can discharge to the waters of the state without a permit, and the permitting process provides ample opportunity for public comment and appeal. Even those wastewater treatment facilities that are already in place must renew their discharge permits on a periodic basis. Engaged citizens of Beaufort County should follow these permitting processes so that they are assured that sewer plants are performing to their satisfaction.

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[17]In October 1995, DHEC and DNR signed a memorandum of agreement that coordinates the two agencies' efforts to re-open closed shellfish waters. Under the agreement, DHEC must develop written remediation plans for closed shellfish waters if not re-opened within one year. The agreement also establishes a joint committee of DHEC and DNR personnel to rank closed shellfish growing areas for remedial action and advises DHEC on the details of its remediation plans.

3. Onsite Disposal Systems (Septic Tanks)

3.1 *DHEC Should Issue Public Notices and Allow Public Comment and an Appeals Process for Subdivision Septic Tank Approvals.*

Key: **DHEC**

Unlike most other administrative actions taken by DHEC, the decision to approve a new subdivision for septic tank use is not placed on public notice and no public comment period is provided. Furthermore, DHEC does not regard the approval of a new subdivision tank use (an approval which is required by DHEC Regulation 61-57) as appealable because, according to DHEC, it is not a "contested case." The lack of public notice makes it very difficult for adjoining property owners and the public at large to participate in what may be the most critical decision for neighboring waterways. The lack of appeal for subdivision approvals forces multiple appeals of individual permits rather than allowing for overall review -- including analysis of cumulative impacts on ground and surface waters -- at the outset of development.

This system should be changed to allow for public notice, public comments, and an appeal system for all subdivision approvals. These changes would not alter the substantive rules regarding new septic systems. They would simply satisfy the public's right to know and the state's constitutional requirements of due notice and opportunity for hearing.

3.2 *Beaufort County Should Require the Inspection and Maintenance of Septic Systems at Appropriate and Convenient Times, When Real Estate is Sold or When Owners Initiate a System Pump-out; DHEC Should Approve System Repairs.*

Key: **BC, DHEC**

Experts agree that even the best designed septic system built in the best of soils needs to be inspected and maintained on a regular basis;

otherwise the system's performance will decline and may ultimately fail altogether.[18] A simple visual inspection is sufficient: measuring the depth of the scum layer, the depth of bottom solids and looking for cracks in the holding tank. (See Figure 6.) Routine maintenance is generally limited to pumping out the tank. Many communities around the country have uniform inspection and maintenance programs that require septic system owners to inspect and pump out their systems as frequently as once a year.

The CWTF firmly believes that inspection and maintenance of existing septic systems is a key component of any strategy to maintain public health and protect the county's waterways. Recognizing that this is no small undertaking, the CWTF recommends that Beaufort County begin modestly, by requiring inspection and maintenance at the most logical and convenient times. Possibilities include when property is sold, when a property owner seeks a building permit for any home renovations, or when a system owner requests a pump-out from a private contractor. The county's municipalities may wish to cooperate with the county government in this endeavor, or adopt a similar program on their own.

The CWTF does not envision local government personnel being directly involved in the inspection activity; rather, private contractors who build, repair and pump out septic systems should perform the inspection and undertake any necessary maintenance. A reporting requirement would be necessary so that local officials could track program implementation. If the inspection indicates that system repairs must be made, DHEC should have the opportunity to review and approve any proposed repairs -- an ability DHEC does not currently have.[19]

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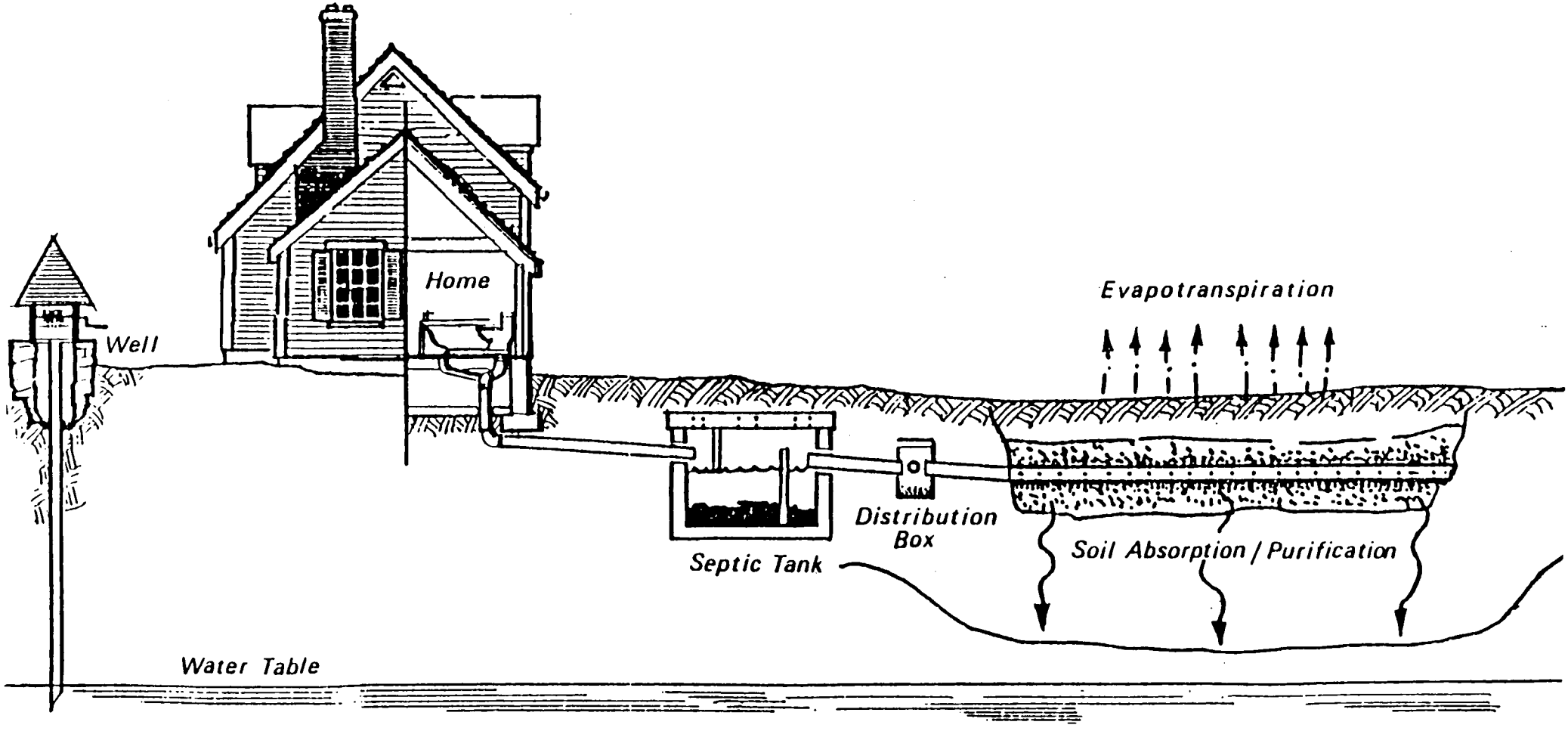
[18]State of Rhode Island, *Wastewater Management Districts: A Starting Point, December 1987*, p. 2-1.

[19]CWTF Fill-In-The-Gap Meeting, 7/26/96.

Figure 6

Diagram of a Typical Domestic Septic Tank System



3.3 *DHEC and Beaufort County Should Develop a Mechanism, Perhaps Through a Memorandum of Understanding, to Better Coordinate the Issuance of Septic System Permits with the Issuance of Building or Mobile Home Permits.*

Key: **BC, DHEC**

While DHEC does not have a minimum lot size requirement for new septic systems, many DHEC requirements do influence the size and configuration of the lot.[20] Property owners, therefore, often operate under the false impression that a lot that satisfies DHEC's septic standards will necessarily satisfy Beaufort County's zoning and subdivision standards. This creates administrative difficulties for the property owner and Beaufort County, headaches which could be avoided if there were some coordination between DHEC and the County. To this end, the CWTF recommends that DHEC and Beaufort develop a coordination agreement, perhaps through a memorandum of understanding, so that the two levels of government do not send mixed signals to the property owner.

4. Boating Impacts

4.1 *Town of Hilton Head Should Request the U.S. Environmental Protection Agency (EPA) to Establish Broad Creek, and possibly all of Calibogue Sound, as a No Discharge Zone for Boat Wastewater.*

Key: **HHI, DHEC, EPA**

If recreational boats have on-board toilet facilities, they are required to be a U.S. Coast Guard approved marine sanitation device (MSD). Most MSDs are one of two types: (1) a holding tank designed to be pumped out,

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[20]For conventional systems, for instance, DHEC requires: (1) a 50' setback from surface waters; (2) a 5' setback from all structures; (3) a 5' setback from all property lines; (4) a 25' setback from all drainage ditches; and (5) in many cases, a replacement area on the lot should the original system fail.

but can be discharged directly to the water; and (2) a smaller tank, with some holding capacity, that chemically treats the waste before discharging it to the water. Proper use of MSDs is largely dependent on the good intentions of the boating public, since identifying and penalizing a bad actor is akin to finding a needle in a hay stack. According to the EPA, poorly flushing tidal creeks that host substantial boating activity, like Broad Creek, are particularly sensitive to the cumulative effect of a number of boats releasing untreated, or poorly treated, human waste: "Studies conducted in Puget Sound, Long Island, Narragansett Bay, North Carolina and Chesapeake Bay have shown that boats can be a significant source of fecal coliform bacteria in areas with high boat densities and low hydraulic flushing."[21] Indeed, it would take as much as 750 million gallons of water -- enough to cover more than 2,300 acres under one foot of water -- to dilute one person's daily contribution of untreated waste down to the shellfish standard.[22]

To impress upon the boating public (particularly transient boaters) the vulnerability of Broad Creek, Hilton Head should work with DHEC to request that EPA establish a no discharge zone for Broad Creek. The application and review process is no simple matter, partly because enough pump-out facilities must be in place to make the no discharge zone workable. If it can qualify, all of Calibogue Sound should be included in the application. Once adopted, the no discharge zone will make it illegal to release any boat waste -- treated or otherwise -- but its greatest value may be how it changes boaters' attitude toward local waterways. Boaters should be more careful, knowing that the area is protected by a no discharge zone.

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[21]EPA, *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*, January 1993, p. 5-6.

[22]On a daily basis, every person generates as much as 400 billion colonies of fecal coliform. It would take 2,857,142,857 liters (or 754,799,582 gallons) of water to dilute that number of fecal coliform colonies down to a concentration of 14/100 ml. This volume of water is equivalent to 2,316 acre-feet of water.

5. Monitoring and Enforcement

5.1 *DHEC and DNR Should Establish a Scope of Work for a Baseline Assessment of Broad Creek and the Okatie River.*

Key: **DNR, DHEC, HHI, BC, NMFS**

Because of the DHEC Shellfish Program's Sanitary Survey, much is known about the condition of Beaufort County's rivers and creeks with respect to fecal coliform. Little is known, however, about other parameters of concern (e.g., PAHs) and living marine resources (e.g., grass shrimp). The CWTF assumes that the gradual rise in fecal coliform levels is an indicator that the rivers and creeks are in decline on a broad range of fronts, but we do not know this for a fact. In order to fashion a long-term strategy for the protection of the county's waterways, we must have a better understanding of the relative importance of different potential threats. In the absence of such information, it would be difficult to justify, both technically and politically, some of the far-reaching protection strategies proposed for the SAMP. For this reason, a resource assessment of Broad Creek and the Okatie River should be accomplished, with DHEC and DNR in the lead.

At the outset, a relatively minimal effort would be sufficient. The participating agencies and experts could then relate the local data to what is known in more detail about similar waterbodies along the South Carolina coast.[23] Based on this comparison, an assessment of risks to Broad Creek and the Okatie could be made. Similarly, what is learned about Broad Creek and the Okatie can be related to developed and undeveloped watersheds elsewhere in the county. In this way, it should be possible to avoid the expense and trouble of performing baseline assessments on all of

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[23]There are two studies that provide a great amount of detail about developed and undeveloped tidal creeks in South Carolina: the Urbanization and Southeastern Estuarine Systems study comparing Murrells Inlet and North Inlet; and The Tidal Creek Project comparing 30 tidal creeks in the Charleston Harbor watershed.

the county's waterways. This risk assessment will be the basis for identifying appropriate resource management strategies over the long term. (See Long-Term Study and Action recommendations beginning on page 53.) Dr. Robert VanDolah, with the help of DHEC and National Marine Fisheries Service personnel, have prepared an excellent draft scope of work for the baseline assessment (including cost estimates), which can be found in the appendix.

5.2 *Town of Hilton Head Should Coordinate Its Monitoring Program of Broad Creek with DHEC and DNR.*

Key: **HHI, DHEC, DNR**

The Town of Hilton Head plans to spend $40,000 to develop a pollution control strategy for Broad Creek. Much of this money will be spent on water quality sampling activities. The town should coordinate its monitoring plan with DHEC and DNR to make sure that there is a fit between the town's study and the larger need for a baseline assessment of Broad Creek and the Okatie River -- as discussed immediately above.

5.3 *Beaufort County Shellfishermen Should Form an Association, Possibly with the Help of the South Carolina Sea Grant Consortium.*

Key: **PS, SGC**

If the quality of the county's shellfish waters continue to decline, the shellfishermen will suffer the consequences most directly. The shellfishermen should organize themselves in order to protect their interests. The South Carolina Sea Grant Consortium helped crabbers form a similar association, and the shellfishermen might wish to seek the same assistance.

5.4 *The Clean Water Task Force Should Help Coordinate the Activities of Private Organizations that Care about Beaufort County's Waterways.*

Key: **GP**

This report includes recommendations that may not be implemented well, or at all, without the aid and support of citizen volunteers. The proposed citizen monitoring program (p. 47) and a range of proposed public education campaigns are examples. If at all possible, these responsibilities should be assumed by existing citizen organizations, rather than draining existing resources to form a wholly new institution. With this in mind, the CWTF proposes to help formalize the network of existing private and quasi-public organizations into something that might be called, the "Beaufort County Clean Water Coordinating Council." Our hope is that, within the framework of the Coordinating Council, different organizations would agree to take on specific actions outlined in this report. If no existing organization is prepared to accept important tasks, then it may be necessary to consider forming a separate organization.

Recommendations for Intermediate Action

1. Stormwater

1.1 *Beaufort County Should Improve Its Stormwater Standards for New Development.*

Key: **BC, ZDAC**

From a regulatory perspective, stormwater discharges are unusual. A permit from the state is required, but the discharge is not subject to the state's anti-degradation standard. (Most other permitted activities that lead to a direct discharge, like sewage treatment plants, must demonstrate that they will not keep the waterway from maintaining its water quality classification.) The state stormwater standards are designed so that, in a typical case, 80% of the pollutants in stormwater are captured before a discharge occurs. It is possible to imagine a scenario, then, where a combination of *permitted* stormwater systems discharging to the same waterway degrade water quality to the point that the water quality classification can no longer be met.

The state rules provide a floor of protection, and any effort to rise above this floor will depend on local initiative. Beaufort County should do so, by establishing a higher level of protection for ORW and SFH waters than currently provided by the state program.

In response to concern over the possible impact of stormwater discharges from new development along the Okatie River, a number of recent development proposals have included a "zero degradation" approach to stormwater management. Beaufort County Council sought the assistance of resource people within state and federal regulatory and research agencies to help evaluate the zero degradation approach. In a September 6 letter, Beaufort County Council Chairman Tom Taylor asked DHEC, the principal environmental regulatory agency, and the SC Sea Grant Consortium, the state agency that bridges the gap between the scientific community and coastal resource users, to organize and co-sponsor such a

working group. The two state agencies agreed, and the Zero Degradation Ad Hoc Advisory Committee (ZDAC) was born.

In December, the Advisory Committee delivered its report to Beaufort County, suggesting that it was not technically feasible to achieve zero degradation for a stormwater discharge. Instead, the committee recommended a set of design standards, largely based on Florida's approach to regulating stormwater systems that discharge to that state's outstanding resource waters (or "Outstanding Florida Waters").[24] Beaufort County should reform its stormwater rules, using the ZDAC's recommendations as a starting point. (A copy of the Advisory Committee's report is included in the appendices.)

1.2 *Beaufort County, in Cooperation with the Town of Hilton Head and other Municipalities, Should Establish a Stormwater Utility (or Some Equivalent Institutional Capacity) to Inspect, Maintain and Repair Stormwater Management Systems.*

Key: **BC, HHI, JC, BJWSA**

The performance of stormwater management systems, just like the family car, will decline without regular inspection and maintenance. Different stormwater BMPs have different maintenance requirements. Some should be inspected and maintained on a quarterly basis, and even

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[24] This approach is similar to South Carolina's heightened stormwater management standard for properties that are developed within 1,000' of shellfish beds. The purpose of this rule is to capture 95% of the pollutants present in stormwater, rather than only 80%. South Carolina's standard rule requires that: (1) the post-development peak discharge rate (for a 2 and 10 year storms) cannot exceed the pre-development discharge rate; and (2) a specified volume of runoff -- the larger of either the first 1/2" of runoff from the entire site, or the first 1" of runoff from the built-up portion of the site -- must be stored and released over a 24 hour period for projects within 1/2 mile of receiving waters. If the project is within 1,000' of shellfish beds, however, the developer must retain the first 1 1/2" from the built-up portion of the site.

low-maintenance systems need some regular attention.[25] This is as true of newly constructed systems as of systems built years ago without the benefit of a state or local permitting program. The current state program provides for an annual inspection and the ability to require maintenance as appropriate, but only for those systems permitted since 1992. Even so, the state does not have sufficient staff to routinely inspect even this small subset of systems. At present, no local government requires inspection and maintenance once it permits a stormwater management system.

It is impossible to understate the importance of developing an institutional capacity in Beaufort County to inspect and maintain stormwater management systems, particularly ones that have been in place for years. Any gains in better land use planning and better BMP design are likely to be overshadowed by the poor performance of existing systems that are not maintained properly. The county must have an institution that can chase down and correct these problem areas.

Maintenance of stormwater BMPs is rarely a technical challenge. It usually involves clearing undesirable vegetation out of retention and detention ponds, and removing the collected sediments so that the ponds' storage capacity is preserved. Repairing or replacing a stormwater BMP can be more complicated and expensive, but the technology is readily available. The difficult questions have to do with funding and institutional responsibility: Who does it and who pays?

South Carolina's Stormwater Management and Sediment Reduction Act provides a mechanism: the stormwater utility. The law enables local governments to establish stormwater utilities to address storwater concerns within its jurisdiction, including the ability to charge a fee to fund operations which is typically based on the amount of impervious surface present on each property owner's land. The fee is somewhat akin to a user fee in that those who contribute more to the problem (impervious cover generates runoff) pay more to address the problem. Other local

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[25] *Guidance Specifying Management Measures*, pp. 4.12-4.35.

governments in South Carolina, including Greenville County and the City of Charleston, have established stormwater utilities, but the control of flooding problems has been the principal concern in these locations. Local agencies in Beaufort County would be breaking new ground by using the stormwater utility mechanism to address water quality concerns.

Largely because no other local governments have tackled the issue of BMP inspection and maintenance, the agencies in Beaufort County should take sufficient time to fully evaluate its options -- perhaps as much as a year. Beaufort County, the Town of Hilton Head and other municipalities are logical partners; also, there may be a role for the Beaufort/Jasper Water and Sewer Authority as well as Jasper County. The issues which should be evaluated include: (1) the potential usefulness and feasibility of a volunteer citizen monitoring program to assist in the inspection activity; (2) the precise activities of the stormwater utility; (3) the utility's funding needs and revenue sources; (4) the relationship between the various potential partner agencies; (5) the entity that actually implements the program; and (6) whether something other than a stormwater utility would be more appropriate to implement the required tasks.

1.3 *Based on the Zero Degradation Ad Hoc Advisory Committee's recommendations, Beaufort County, the Town of Hilton Head, other municipal governments, DHEC and DNR Should Jointly Develop and Implement a Stormwater Monitoring Strategy.*

Key: **BC, HHI, DHEC, DNR, ZDAC**

Given the potential impact of polluted runoff, the CWTF firmly believes that the public agencies charged with protecting the county's waterways need some way to track the impact of stormwater on the rivers and creeks of Beaufort County. This kind of capacity does not currently exist. The data could be used in many ways, from identifying specific pollution sources to tracking the overall health of the county's waterways. In the absence of such data, we will have no way to know whether past and

future investments in stormwater management systems are having the desired effect. It would be like assuming you are in good health without the benefit of an annual physical.

The first step would be for the logical data users -- Beaufort County, Hilton Head, other municipalities, DHEC and DNR -- to jointly determine how stormwater impacts should be monitored. The Zero Degradation Ad Hoc Advisory Committee, which involved most of the relevant agencies, recommended that such a strategy should combine a focus on the receiving water body (its chemical, physical and biological conditions) with the occasional evaluation of on-site BMPs' effectiveness.

The stormwater monitoring strategy would also need to identify the party, or parties, responsible for implementing the monitoring program, as well as sources of funding. The ZDAC recommended that a single public entity at the local level be given the responsibility, suggesting that the stormwater utility may be the most logical vehicle. The stormwater utility's monitoring activity could be funded in any number of ways: (1) from its general revenues; (2) through one-time development impact fees; or (3) on a contract basis with the stormwater dischargers.

1.4 *Beaufort County, in Consultation with DHEC, Should Develop a Set of Voluntary Design Guidelines for the Educational Benefit of the Development Community.*

Key: **BC, DHEC, PS**

Beaufort County should clearly explain any changes in its land use and stormwater management rules. Understanding the rationale behind required development practices would positively impact the design of projects long before they reach the permitting stage. Equally important, many developers will take additional voluntary steps to protect water quality if they knew precisely what is being asked of them. Accordingly, the county should develop a set of design guidelines, *addressing both land development practices and BMP design*, that seeks to inform the

development community on how such approaches protect water quality. Because DHEC has considerable experience in this area (e.g., DHEC/OCRM and the Charleston Harbor Project), the county should enlist the agency's help in preparing the guidance. Use of the guidance would be purely voluntary.

1.5 *Beaufort County Should Educate the Public and County Staff on the Benefits of Vegetative Buffers and the Details of the County's River Protection Overlay District.*

Key: **BC, GP**

The CWTF understands the tremendous water quality benefits of vegetative buffers along the county's waterways, and fully supports the county's efforts to establish buffers through the River Protection Overlay District (see page 19). But the general public, and many waterfront property owners in particular, do not fully understand the value of buffers. As a result, public support for buffers is not as broad as it could be. It does not help matters when a member of the regulated public calls to ask questions about the RPOD, and staff cannot clearly and accurately explain the details and rationale behind the RPOD -- as has happened on occasion. For this reason, Beaufort County should develop educational materials on the purpose and water quality benefits of vegetative buffers, and special efforts should be taken to acquaint all relevant staff with this information.

1.6 *Citizens Should Acquaint Themselves With, and Understand the Implications of, All Stormwater Monitoring Data.*

Key: **GP**

The public agencies charged with protecting Beaufort County's water resources will be the primary users of stormwater monitoring data. Engaged citizens, however, have a responsibility to educate themselves about the condition of the waterways and how those conditions may be changing over time. In the absence of an educated citizenry, there will be

little support for innovative approaches to managing the county's water resources. Conversely, an uneducated but passionate citizenry could prompt rule changes that burden the regulated community but yield few tangible results.

2. Onsite Disposal Systems (Septic Tanks)

2.1 *DHEC Should Develop a Mechanism to Notify Interested Public of Pending Permits for Individual Septic Tank Systems on Properties Adjacent to the DHEC/OCRM Critical Area Line.*

Key: **DHEC**

Unlike most of DHEC's administrative actions, the decision to grant individual septic tank system permits is not placed on public notice. It is possible to appeal such a permit, but citizen can only exercise that option if he learns of the permit in the first place. While any septic system may raise some questions, those immediately adjacent to the county's marshes and waterways are of special concern. Adjoining landowners and the public at large have a legitimate interest in such systems' potential impact on ground waters and nearby streams. Therefore, DHEC should develop a way to provide notice to the public on systems proposed for properties that abut the critical line. The CWTF recognizes that placing all systems on formal public notice may not be the most efficient way to accomplish this task, but feels certain that there is a practical way to get the job done. This may involve some coordination between DHEC/ Environmental Sanitation and DHEC/OCRM, and perhaps even with the Beaufort County government.

2.2 *Beaufort County and DHEC Should Develop a Homeowner Education Campaign on the Proper Operation & Maintenance of Septic Tanks.*

Key: **BC, DHEC, GP**

Many homeowners who are on a septic system do not realize there are simple steps that can be taken to maintain the performance level and

prolong the life of their system. As a result, the first time they realize something has gone wrong is when septage bubbles up at ground level or backs up into the house. Besides the obvious health risk, much damage may have been done to the ground water or surface waters by this late point. Many homeowners would willingly maintain their systems if they knew it were necessary and they knew precisely what to do.

To serve this need, Beaufort County and DHEC should jointly develop a public education campaign on the proper operation and maintenance of septic tanks. The campaign should feature: (1) the importance of regular inspections and pump-outs; (2) the value of water-conserving household appliances; and (3) the dangers of introducing toxics and unnecessary nutrients into a septic system. Careful attention should be given to how this information is delivered to the end user; pamphlets presently available at the local DHEC office would be a good start, but more will need to be done. Citizens should be consulted on the best methods to make such information available to the public.

2.3 *Beaufort County Should Put a Septic System Pump-Out Reminder on County Tax Bills.*

Key: **BC, GP**

Everyone reads their tax bill carefully. Beaufort County should take advantage of this fact by placing a brief reminder on citizens' tax bills that all owners of septic systems should pump out their systems at least every five years. The reminder should include a phone number to call in order to get the information packet described immediately above.

3. Boating Impacts

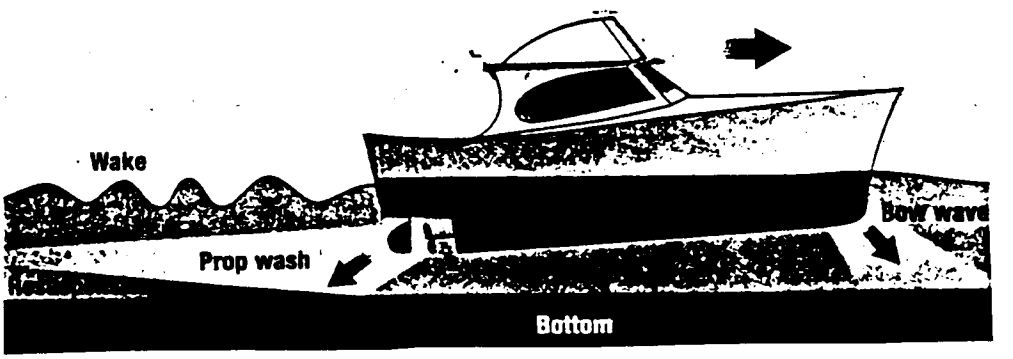
3.1 *Town of Hilton Head Should Develop a Boating Impact Management Plan for Broad Creek.*

Key: **HHI**

A single boat in a small and poorly flushing tidal creek, like Broad Creek, will have a negligible impact, but a multitude of boats can create serious difficulties. The no discharge zone, proposed previously (p. 32), will help address the boat waste problem. But boats can be a direct source of other pollutants like PAHs, oil, hydraulic fluid and other contaminants. Boat wakes can cause bank erosion, which can negatively affect intertidal oyster beds. Boating activity can stir up contaminated sediments which can pose a threat to a creek's biota. (See Figure 7.) We know that the cumulative effects of intensive boat use can be significant, and the CWTF suspects that boating activity in Broad Creek has reached the point where it is placing a stress on the ecological balance. For this reason, the Town of Hilton Head should seek to stabilize Broad Creek by not allowing the addition of new boating facilities in Broad Creek until a boating management plan can be developed and implemented.

The baseline assessment of Broad Creek, as described previously (p. 34), should be the basis for the management plan. An inventory of current boating activity in Broad Creek and a projection of future boating activity will be necessary also. In developing the management plan, at least the following potential actions should be considered: (1) in cooperation with DNR, the establishment of a no wake zone for all, or portions, of Broad Creek; (2) a permanent cap on the total number of boats moored in Broad Creek; (3) limits on the amount of transient boat traffic permitted in Broad Creek; (4) an on-going water quality monitoring program of Broad Creek; (5) a requirement that all marinas institute an on-going water quality monitoring program; (6) a requirement that all marinas institute a boater education program; and (7) the establishment of additional pump-out facilities.

Figure 7
Typical Wave, Wake & Wash Patterns



Boat wakes and propeller wash resuspend fine sediments that can clog fish gills, smother oysters and retard egg development.

3.2 *Town of Hilton Head, Beaufort County, DHEC, DNR, Marina Operators and Local Boaters Should Jointly Develop a Boater Education Campaign, Aimed Largely at Transient Boaters in Broad Creek.*

Key: **HHI, DHEC, DNR, GP, PS**

Direct enforcement of even modest and widely accepted boating regulations can be very difficult, especially when a large percentage of all boaters are just passing through. For this reason, boater education that prompts voluntary action is extremely important. To address this need, the Town of Hilton Head, Beaufort County's Department of Parks and Leisure Services, DHEC and DNR should jointly fund and develop a boater education campaign that encourages all boaters to think of themselves as stewards of the waterways. The proper disposal of human waste, solid waste and toxic materials should be emphasized. For the benefit of transient boaters, the education materials should explain the importance of maintaining the health and beauty of Broad Creek. Local boaters should be

involved in developing the campaign, because they best understand their fellow boaters. Marina operators should be involved, because marinas are one of the most logical distribution points for any education materials.

4. Monitoring and Enforcement

4.1 *DHEC, DNR, the National Marine Fisheries Service, and the Town of Hilton Head Should Perform the Baseline Assessment of Broad Creek and the Okatie River.*

Key: **DHEC, DNR, NMFS, HHI, BC**

Once the scope of work is completed for the baseline assessment, as described previously (p. 34), the participating federal, state and local agencies should work together to collect and analyze the data. The result will be an assessment of the risks facing Broad Creek, the Okatie River and similar waterbodies in Beaufort County. Each agency can perform part of the baseline assessment, so long as the individual components reinforce one another. For instance, the Town of Hilton Head's planned research on Broad Creek should serve the larger need for a baseline assessment (as explained previously, p. 35). Similarly, the National Marine Fisheries Service might be persuaded to perform bacterial "finger printing" studies in both Broad Creek and the Okatie River. If costs are shared in this manner, securing the necessary funding will become a doable task. CWTF members will assist in any necessary fund raising activities.

4.2 *Beaufort County Citizens Should Organize a Citizen Shoreline Survey for Broad Creek, the Okatie River, and other Waterbodies of Special Concern.*

Key: **GP, DHEC**

Citizen monitoring programs, which are becoming increasingly popular and successful across the country, have one thing in common. They all foster a deep community attachment to the waterbody being

monitored, which can translate into the commitment necessary to restore and protect the resource. Beyond that, each program is different, depending upon the data needs and the citizen group's level of sophistication. The citizens of Beaufort County should organize a citizen monitoring program for Broad Creek and the Okatie River, which could expand to other waterbodies of special concern. DHEC's Water Watch Program, a new project that supports community conservation efforts, should be enlisted to help design and implement the citizen monitoring program.

At the outset, the program should be limited to the most modest form of citizen monitoring -- a shoreline survey. Under such a program, a citizen "adopts a spot" along the waterway, and commits to visually inspect it on a regular basis. (To avoid trespass issues, the inspection is usually conducted from a boat on the water.) Participating citizens will need to be trained, in cooperation with DHEC, so that they can tell if something may be awry. When a potential problem is identified, the citizen monitors should have a logical means to notify the appropriate state or local officials. In this way, the shoreline survey will assist and compliment regular monitoring and enforcement activities. Once the shoreline survey is in place, an expansion to more complex types of citizen monitoring programs -- like water quality sampling or biological assessments -- can be considered.

4.3 *Beaufort County Should Request DHEC to Commit More Resources to Investigating Potential Water Quality Problems.*

Key: **BC, DHEC**

Ample authority exists under the Pollution Control Act and the Coastal Zone Management Act for DHEC to investigate potential pollution sources, particularly with regard to activities that do not require a permit (e.g., logging operations, application of lawn chemicals, agricultural operations). If an investigation demonstrates that a particular activity has damaged the aquatic environment, DHEC has sufficient authority to seek corrective action. Documenting the link between an action and a pollution

problem, however, can be complicated and expensive. Given the available resources, DHEC's Lowcountry Environmental Quality Control office, based in Port Royal, and the local Office of Coastal Resource Management, based in the Town of Beaufort, do a good job. There may be opportunities for cross-training local DHEC officials to improve performance within existing staffing levels. But, if more resources were available, the local DHEC officials could do a far better job of investigating and correcting pollution problems; moreover, the demand on these services is likely to rise once the citizen shoreline survey and shellfishermen association (discussed above) are established. Accordingly, Beaufort County should request that more resources be made available to the local DHEC offices for the purpose of expanding DHEC's investigative capabilities. In this regard, Beaufort County should be willing to explore the possibility of sharing the financial burden with DHEC.

5. Timber Management Recommendations

5.1 *Beaufort County Should Expand the Waiting Period Between Logging and Development.*

Key: **BC**

Beaufort County's tree protection ordinance applies to landowners who propose to cut trees on their property as part of a development plan. The ordinance encourages land owners to retain as many trees as possible on the site, which tends to mitigate the impact of development activities. Landowners who clear cut their property with the stated intention of replanting and continuing to manage the property for timber production are not subject to the county's tree protection ordinance. On occasion, landowners who do so have a rapid change of heart and apply for development permits in short order. To close this loophole, Beaufort County currently requires landowners to wait one year between an unregulated timber harvest and any application for development permits. The CWTF agrees that landowners who perform a "timber cut" should not be subject to the county's tree protection ordinance; on the other hand,

landowners who perform a "development cut" should follow the rules that all developers must follow. The one-year waiting period is not a sufficiently strong disincentive against pretending that a timber cut is underway when it is actually a development cut. The waiting period should be extended to six years.

5.2 *Citizens Should Work with the Timber Industry to Improve Compliance with Voluntary BMPs.*

Key: **PS, GP**

Timber harvesting practices, which can pollute nearby waterways with silt and nutrients, are not regulated in South Carolina. Instead, the SC Forestry Commission has a set of voluntary best management practices (BMPs) for timber harvesting. Forestry Commission studies demonstrate that the water quality of nearby rivers and creeks are not damaged by timber harvesting *when the recommended BMPs are followed.* Fortunately, compliance with the BMPs is relatively high in the coastal plain (about 90% of all cuts) as compared to upland areas of the state.[26] Even so, steps should be taken to improve compliance further.

About seventy percent of all South Carolina timberland is held by private landowners -- not large industrial landowners like Union Camp and Westvaco that are quite vigilant about following the state's voluntary BMPs. The timber industry, however, has some leverage over how private landowners manage their land, because timber companies often have management contracts with private landowners, the right of first refusal on private timber sales, and operate the mills where most private timber is sold. Citizens should work with the industrial timber companies active in Beaufort County to identify ways that compliance with voluntary BMPs might be improved.

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[26]Clean Water Task Force Presentation, 7/2/96.

5.3 *Beaufort County Should Expand the Logging Reporting Requirement.*

Key: **BC, FC**

Beaufort County currently requires land owners who intend to log their property as a "timber cut" to notify the county at least seven days in advance of the operation. No formal public notice is issued and the county does not impose any restrictions on the timber operation.

At the same time, two state-level programs are in place to encourage the use of voluntary timber BMPs. First, the SC Forestry Commission has a "courtesy exam program" which provides a free consultation to timber owners who are preparing to cut their property. At the land owner's request, a "BMP Forester" inspects the property and makes site specific recommendations on how it should be logged to protect water quality. (Because every site is different, proper management measures vary from site to site.) The second program, run by the SC Forestry Association, trains loggers on how to implement the state's set of recommended BMP's. Graduates who complete the course become certified "top loggers."

Beaufort County should expand its logging reporting requirement to encourage the use of these two services. When landowners report their intention to log property, Beaufort County should notify the region's "BMP Forester," who is located in Walterboro. The BMP Forester could then contact the landowner to offer a free on-site consultation. (If the current seven days is insufficient time for the BMP forester to get out to most properties, the county should consider increasing the notice period.) In addition, the county should also require the landowner to demonstrate that a certified top logger will perform or oversee the logging operation. These are two reasonable and measured steps that Beaufort County should take to encourage compliance with the state's voluntary timber harvest BMPs.

6. Chemical Use Recommendations

6.1 *Beaufort County, Town of Hilton Head and Clemson University Should Develop an Education Campaign on Native Landscaping and the Use of Lawn Chemicals.*

Key: **BC, HHI, CUPC**

Chemicals that are toxic to aquatic life are used on the land by many people for many purposes. Ideally, the use of these chemicals should be limited to the barest necessity, and in all cases they should be used in strict conformance with their labels. Experts agree that the average homeowner is the most likely user to apply toxic chemicals where they are not needed and in concentrations that are unnecessarily high.[27] While it would be impossible and inappropriate to closely regulate the lawn care activities of thousands of homeowners, much could be done on the education front. Beaufort County, the Town of Hilton Head and Clemson University should jointly develop an education campaign on lawn care practices, targeted at homeowners and lawn care companies. Landscaping that uses native plants (which do well without as many chemicals) should be emphasized, as well as the proper use of toxic chemicals.

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[27]Ibid.

Long Term Study & Action: The Special Area Management Plan

What Is a SAMP and What Is It For? The Special Area Management Plan (SAMP) process is only available in the coastal counties of South Carolina under the state's Coastal Zone Management Act. The basic purpose of a SAMP is to provide a framework for the management of cumulative impacts that pose a threat to a specific waterbody or geographic area. Implementing such a management strategy invariably involves different agencies and levels of government, so the SAMP process also provides a way for all interested parties to jointly analyze and determine how to best manage cumulative impacts. The SAMP process is extremely flexible, allowing the participating agencies to focus on the resources, and the threats to those resources, in the area of special concern. As a result, every SAMP is different, tailor-made for the area in question.

A SAMP can be initiated by any governmental body, but DHEC should endorse and participate in the effort since it is the state agency that oversees implementation of the Coastal Zone Management Act. Logical partner agencies include: DHEC, DNR, the local governments within the area of special concern as well as the associated council of governments (COG). A number of SAMPs have been completed in South Carolina or are underway, including the Ashley River SAMP and the Charleston Harbor Project SAMP.

A SAMP is a plan that, in itself, does not expand the scope or authority of the participating agencies. Typically, implementation of the plan's recommendations is achieved through the existing authority of the participating agencies and local governments. If a SAMP were to identify an action that lies beyond a governmental body's existing authority, those new powers would have to be sought through the normal process -- new legislation and regulation at the state level, or new ordinances at the local level. In most cases, as with the Ashley River SAMP in Charleston County, implementation measures are limited to those that can be taken within existing authority.

How Would Beaufort County's SAMP Work? Think of the SAMP, at its inception, as a shell document. Over three years or so, that shell would be filled

with chapters dealing with specific components. The CWTF recommends that the Beaufort County SAMP include at least five separate components: (1) stormwater management; (2) central wastewater treatment; (3) onsite wastewater disposal system (e.g., septic tanks) management; (3) boating impacts; and (5) monitoring and enforcement. Each component could be completed on slightly different schedules, since the necessary funding may become available at different times. The geographic focus may vary from component to component. For instance, it may be important for the stormwater management component to consider issues that cross the line that separates Beaufort and Jasper Counties, but the boating impact section may deal only with Beaufort County waters. Similarly, the partner agencies may also vary. Take the Department of Natural Resources for an example. It may have no role in the stormwater section, but DNR would play a large part in the boating impact portion. The agencies involved in each component of the SAMP would develop the management strategies and, as appropriate, take responsibility for implementing them. In every case, DHEC and Beaufort County should be involved in developing each component of the overall SAMP.

Getting the Beaufort County SAMP Started. A SAMP is a major undertaking: the process itself must be organized; funding must be sought; once underway, the planning process must be kept on track; and after the plan is completed, implementation of the recommended strategies must be secured. While there will be many partners involved, one entity must take primary responsibility for, and ownership of, the SAMP effort.

Beaufort County is the logical governmental body to initiate and help shepherd the SAMP process from beginning to end. Therefore, the CWTF recommends that Beaufort County -- in close consultation with the Town of Hilton Head, other municipalities and DHEC -- appoint a management committee of citizens, elected officials and staff to spearhead the effort. In addition to these entities, Jasper County, Town of Hilton Head, the Beaufort/Jasper Water & Sewer Authority, the Lowcountry Council of Governments, and DNR should appoint representatives. The management committee's first tasks will be to: (1) formalize its work program, based on this report; and (2) secure initial funding. The committee should complete these tasks within three months of its first meeting.

Commitments of staff to participate in the SAMP process should be secured from all participating governments and agencies. But the SAMP itself will need a small core staff to coordinate the activities of all of the participating entities. The timing is fortuitous in this regard. The Charleston Harbor Project is nearing completion, and its staff has considerable experience and credibility in conducting such a process. The management committee should take advantage of this opportunity, by exploring ways to shift Charleston Harbor Project staff to the task of developing Beaufort County's SAMP.

Even this early organizational work will take time. Ideally, the basic SAMP process will be organized about the time that the baseline assessment of Broad Creek and the Okatie River are completed. The results of baseline assessment will help focus the SAMP partners on the resources and threats of greatest concern. In the absence of the baseline assessment, it is difficult to predict with absolute certainty the likely management strategies recommended by the SAMP. *Despite this uncertainty, the CWTF believes that it is possible, and appropriate, to identify at least some of the management strategies that should be considered.* They are outlined below.

1. The Stormwater Component

1.1 *A Watershed Approach to Stormwater Management in the Okatie Basin*

At present, local and state stormwater permitting programs are exclusively focussed at the site level. Each proposed development project that requires stormwater permits is evaluated in relative isolation of all other projects -- those in place now or those that may come in the future. If we planned our road systems in this manner, we would allow a developer to build public roads on his property without knowing how they would connect to the current road system or future roads on adjacent properties. Such an approach makes as little sense for stormwater management planning as it does for road construction. Watershed level management of stormwater can create opportunities to make better use of natural drainage

ways and consolidate stormwater management systems. The water quality benefits can be significant and engineering and management costs can come down over time.

All of the scientific literature sings the praises of managing stormwater at the watershed level, but it is not a common practice. Much will need to be learned, so it may be best to start small and expand the practice as local skills and knowledge develop. The Okatie Basin would be the best place to institute such an approach, because it is relatively small and undeveloped but it extends across a county line. Since the basin extends into Jasper County, proper management will require close cooperation across jurisdictional lines. Besides Jasper and Beaufort Counties, DHEC and LCOG are logical partners for this enterprise.[28]

1.2 *Expansion of Geographic Information System (GIS) Capabilities*

As noted previously (p. 21), GIS is a powerful planning tool that is very expensive to put in place and maintain. The CWTF believes that new GIS capabilities should be developed on an as-needed basis, and it may be that the SAMP process identifies such needs. For instance, a more detailed set of digitized data may be required to develop a watershed level stormwater management plan for the Okatie Basin. Any expansion of GIS capabilities should be accomplished in a logical and efficient fashion. The LCOG, in cooperation with Beaufort County, may be the appropriate agency to assume such responsibilities.

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[28]The Stormwater Management and Sediment Reduction Act includes a section that allows for the establishment of "designated watersheds." The section establishes a formal procedure to coordinate the development of a plan to manage new stormwater discharges at the watershed level. It may be that this enabling legislation should be used to develop such an approach for the Okatie Basin. The designated watershed process, however, is limited to only "new land disturbing activities," so any measures that address existing stormwater discharges would need to be implemented outside of this section of state law.

1.3 *Evaluation of Growth Zone Boundaries*

Under state law, local comprehensive plans must be reviewed and updated on a regular basis. Assuming that Beaufort County adopts some system of growth zones and rural areas in its comprehensive plan, it would be appropriate to review the boundaries as part of the SAMP. Such an evaluation could precipitate modifications to the growth zone designations during future updates of the county's comprehensive plan. If the county does not adopt the growth zone concept in its comprehensive plan, then the SAMP should resurface this basic planning approach.

1.4 *Stormwater BMP Efficiency and Performance Evaluation*

There is a wide range of stormwater BMPs, and each has its own attributes and deficiencies. For instance, detention ponds are thought to control nutrients well, but not do as good a job with bacteria. Sand filter systems, on the other hand, seem to control fecal coliform well. Also, some BMPs have higher maintenance requirements than others, requiring vigilant inspection and maintenance programs to keep performance levels up.[29] Once the primary pollution controls goals are established as part of the SAMP, some effort could be made to identify those BMPs that are best able to achieve the goals. These BMPs could then be favored (or required) over others. Before any particular set of BMPs are selected, however, mosquito control experts should be consulted so that no proposed stormwater solution inadvertently contributes to the propagation of mosquitos.

1.5 *Extension of Policies Regarding Drainage Improvements*

As discussed with respect to Hilton Head Island, drainage improvements can have negative, and unintended, consequences on receiving water bodies. Increased pollutant loads and excessive levels of

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[29]*Guidance Specifying Management Measures*, pp. 4.12-4.35.

freshwater can be detrimental to the health of poorly flushing tidal creeks (p. 22 and p. 23). Beaufort County has a multi-million dollar plan to improve the county's drainage systems. As part of the SAMP process, Beaufort County should prioritize the proposed drainage improvements. In addition, the county and other municipalities should: (1) consider establishing policies that limit the increase of freshwater in the upper reaches of tidal creeks; and (2) treat additional stormwater flows generated by drainage improvements.

1.6 *Capitalize on Opportunities for Stormwater Reuse*

Thirty years ago, few people would have predicted that today we would use treated wastewater for irrigation purposes. Thirty years from now, people may be shocked to learn that in the late 1990's stormwater was discarded, rather than turned to a productive use. The SAMP partners, particularly Beaufort County and the proposed new stormwater utility, should make an effort to identify ways to reuse stormwater -- rather than finding the quickest way to discharge it to a receiving waterbody.

1.7 *Improve Standards of Treatment for Bridge & Road Runoff*

South Carolina currently has a protective standard for bridge runoff when the bridge crossing lies within 1,000' of a shellfish bed.[30] Bridges that cross ORW or SFH waters, but do not lie within 1,000' of shellfish beds, are not subject to this high standard. The SAMP partners should consider implementing a more protective standard for runoff from new bridges or bridge replacements when they cross ORW or SFH waters -- irrespective

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[30]Under current state law, any new bridge crossing ORW waters and within 1,000' of a shellfish bed, or any large bridge crossing SFH waters and within 1,000' of shellfish beds, must be designed to collect and route the first 1" of runoff to an on-land stormwater management system. Bridges crossing ORW waters but not within 1,000' of shellfish beds, smaller bridges crossing SFH waters and within 1,000' of shellfish beds, or any bridge crossing SFH waters but not within 1,000' of shellfish, are not required to collect and treat bridge runoff; scupper drains are permitted, but over-treatment of the runoff from the bridge approaches may be required.

of where the closest shellfish bed may lie. Similarly, the SAMP partners should review and consider strengthening standards for road runoff to all waters.

1.8 *Delegation of State Stormwater Program*

The Stormwater Management and Sediment Reduction Act creates a means of delegating all, or portions of, the state program to local governments. As Beaufort County takes a more active and aggressive role in regulating the quality of stormwater, it would be natural to consider whether or not the state's sister program is needed. Delegating the state program to Beaufort County would simplify and streamline the permitting process.

2. The Central Wastewater Treatment Component

2.1 *Re-Evaluate Permitting Standards for Direct Discharge and Land Application of Treated Wastewater*

During its deliberations, the CWTF did not become alarmed about the permitting standards for wastewater treatment. That said, a thorough review of the standards, and how their application in Beaufort County, would be appropriate as part of the SAMP. In particular, the SAMP partners should consider a requirement that wastewater effluent meet the shellfish standard when land application is proposed near SFH or ORW waters.[31] Furthermore, we understand that pollution from nutrients, like

[31]The typical fecal coliform standard for land application effluent is 200 colonies/100 ml, but the shellfish standard is 14/100ml. When land application is proposed adjacent to waterbodies of special concern -- those classified as SFH or ORW -- the effluent could be required to meet the shellfish standard. This would ensure that land application would not contribute to the degradation of these near-pristine waterways. Beaufort County's River Protection Overlay District (RPOD) applies to properties in southern Beaufort County within 1,500' of SFH and ORW waters. DHEC should work within this 1,500' framework, if for no other reason than to avoid massive confusion.

nitrogen, is a growing concern. The advisability of a general shift to advanced secondary or tertiary treatment should be studied.

2.2 *Identify Future Direct Discharge Points and Preferred Sites for Land Application and Back-Up Disposal*

At present, it appears unlikely that any new direct discharge points for treated wastewater will be proposed in Beaufort County; indeed, the trend is toward consolidating and eliminating existing discharge points and disposing of new wastewater flows by land application. This as a positive trend that should continue.

The CWTF is concerned, however, that the number of sites suitable for land application will decline as development occurs. A considerable amount of land is needed: for an 83 acre subdivision of 1/4 acre lots, 50 acres of open space is needed for land application.[32] High and dry sites are best for land application, but raw land of this type is already scarce in Beaufort County and will become more rare as development occurs. The SAMP partners should anticipate this fact and identify the sites in Beaufort County that should be used as future land disposal and back-up disposal sites. Purchase, easement and other strategies should be evaluated to protect such lands from alternative uses. Recognizing that land disposal sites will become a diminishing resource over time, the SAMP partners should also identify locations where new direct discharges to the County's waterways would be most acceptable.

3. The Onsite Disposal Systems Component (Septic Tanks)

3.1 *Comprehensive OSDS Management Plan*

By establishing sewer service areas, Beaufort County will make an implicit commitment to onsite disposal systems (OSDS), or septic tanks, in

[32]Clean Water Task Force Presentation, 6/19/96.

the county's rural areas. The CWTF believes this is the correct course of action, as explained earlier (p. 25). The CWTF is concerned, however, that current programs for permitting new septic systems and managing existing systems may not be sufficiently protective of human health and water quality. There is considerable controversy, for instance, over the state's current standards for new systems. Some experts insist that they are adequate while others argue that they are woefully deficient. In the course of its research, for instance, CWTF members have reviewed some other state's permitting programs for septic systems; on their face, other state programs seem light years ahead of South Carolina.[33] When experts sharply disagree, however, the CWTF finds its difficult to recommend steps for immediate implementation. Therefore, the CWTF believes very strongly that the appropriate SAMP partners -- Beaufort County, DHEC, and the Beaufort/Jasper Water and Sewer Authority -- should commit themselves to resolving all conflicts and developing a coherent and comprehensive OSDS management plan for the county's rural areas. Until such a plan is developed, which all SAMP partners support and agree to help implement, the citizens of Beaufort County will lack confidence in the effectiveness of onsite disposal systems. At a minimum, the SAMP partners should address the issues outlined below.

3.1a *Standards for New Systems*

South Carolina's current standards for new septic systems have come under much criticism from federal agencies, national experts, and state agencies.[34] The single most hotly debated point is South Carolina's six inch separation distance between the bottom of a system's drain field and the groundwater's seasonal high water mark. (See Figure 8.) Critics

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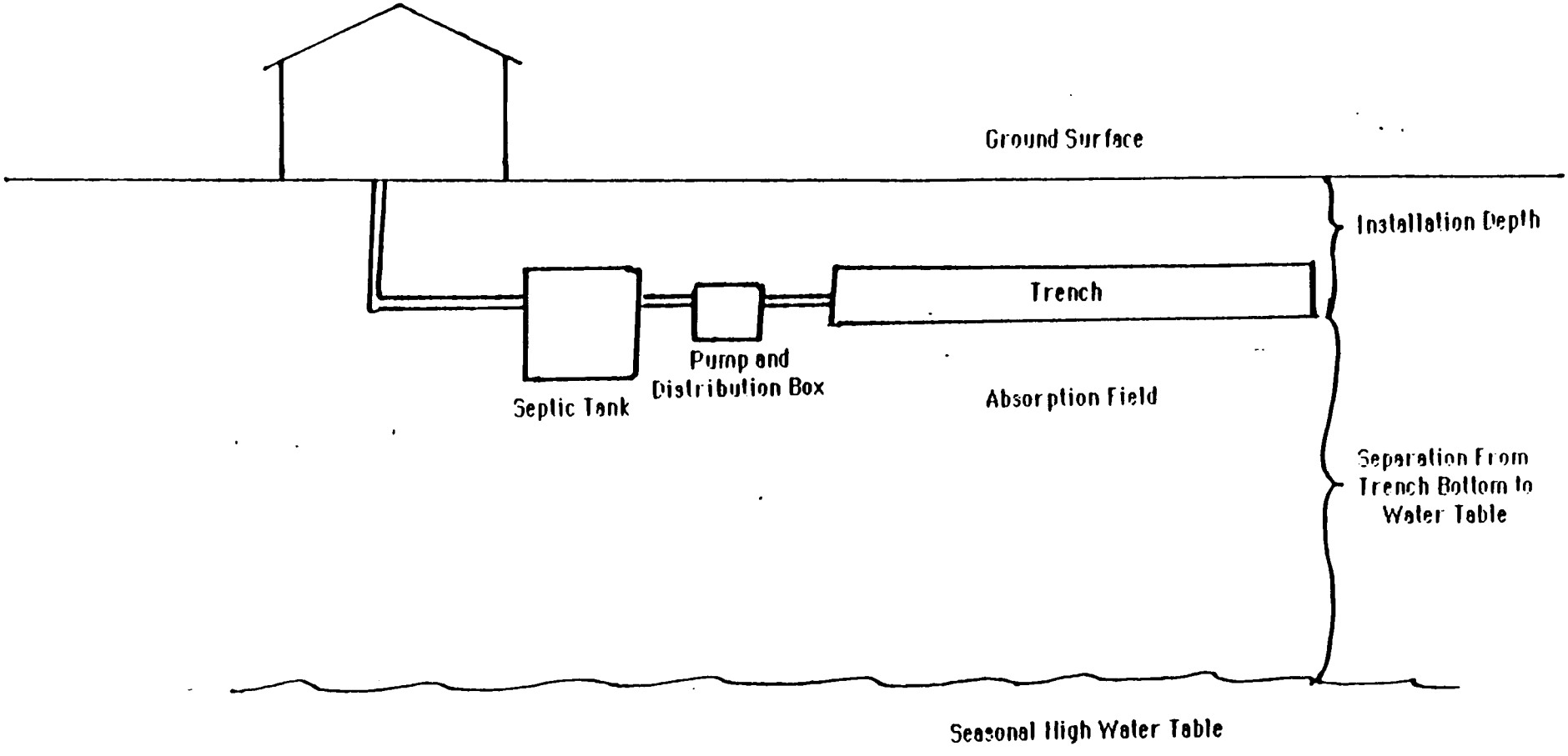
[33]See, for example, the State of Massachusetts Regulations 310 CMR 11.00-17.00.

[34]EPA/NOAA Threshold Review Document of South Carolina's proposed 6217 Program, December 1993; B.L. Carlile & Associates, 11/20/93 correspondence with S.C. Coastal Conservation League; DHEC/OCRM Assessment of Septic Tank Regulations, August 1994.

Figure 8
A Conventional Domestic Septic System



South Carolina's six-inch separation distance is one source of controversy.

point to national guidance that recommends a 24" minimum separation distance, particularly for coastal areas.[35] In its defense, DHEC argues that the six inch separation distance is sufficient because: (1) the seasonal high water mark is measured, not the mean high water mark; (2) South Carolina uses a "soil mottling" technique to determine the seasonal high water mark, which provides some confidence that groundwater will not flood the system; and (3) no conclusive evidence exists that demonstrates that the six inch separation distance poses a risk to human health or causes water pollution problems.[36]

A second area of contention has to do with the density of septic systems. Critics argue that in low-lying coastal areas with marginally suitable soils, communities run a great risk when a number of septic systems are allowed to concentrate in any one area. The consequences of one septic system failing may not be great, but the cumulative effect of many failing in a small area can be great. EPA guidance notes that requirements for conventional systems often limit system density to one per five acres, and the density standards for marginal soils can be more restrictive.[37] South Carolina currently has no density limitation for septic systems.[38]

In reviewing, and possibly improving, current permitting standards for new systems, the SAMP partners should evaluate carefully the issues of separation distance and density limitations. In addition, the SAMP partners should review: (1) current setback requirements, particularly from

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[35]*Guidance Specifying Management Measures,* p. 4-101.

[36]Clean Water Task Force Fill-In-The-Gap Meeting, 7/26/96.

[37]*Guidance Specifying Management Measures*, p. 4-103.

[38]Regarding septic systems, the Charleston County zoning ordinance requires a minimum lot size of 12,500 sq. ft. for lots with public water and a minimum lot size of 30,000 sq. ft. on lots with private wells. This is the only local ordinance in South Carolina that directly links septic systems and density.

waterbodies and drainage ditches; and (2) requirements to retain sufficient undisturbed land on a site for a replacement field in the event that the original system fails. If the SAMP partners determine that the standards for new septic systems in Beaufort County should be changed, careful consideration should be given to which level of government establishes the new rules and which level of government implements them. In the CWTF's view, the most logical arrangement would be for Beaufort County to adopt the rules and existing DHEC personnel implement them, but this approach may present some difficult legal hurdles.

3.1b *Household Appliance Standards*

Wastewater treatment is a biological process, which can be thrown out of balance by a number of factors: the volume of wastewater entering the septic system can be too high; the level of nutrients entering the system can exceed its treatment capacity; and foreign materials, like washing machine lint, can clog the tile field. Many states and localities attempt to limit these inputs by controlling the type of plumbing and household appliances that can be used in new homes on septic. Typically, these controls include: (1) low-volume, but high pressure, plumbing fixtures to control the volume of water entering the system; (2) a prohibition on garbage disposals to limit the unnecessary introduction of nutrients to the system; and (3) a requirement that washing machines include a filter. The SAMP partners should consider such controls on new construction in Beaufort County.

3.1c *Inspection and Maintenance Program*

As discussed previously (p. 29), even the best designed system in the best of soils should be inspected and maintained on a routine basis. Some coastal communities that have a preponderance of septic systems have instituted inspection and maintenance programs that apply to all

homeowners on septic.[39] This program is typically accomplished through a wastewater management district, which can be an independent unit of government with its own taxing authority or a function of an existing governmental body. Programs vary: the public agency can do the work itself or can require the homeowner to certify that their system has been inspected and pumped out at regular intervals. The SAMP partners should consider instituting a program of this type, perhaps by establishing a wastewater management district. The program could address all septic systems in the county, or focus on some subset of septic systems (e.g., commercial uses on septic, or systems in those areas of the county that are known to be problematic).

3.1d *Innovative Systems Operation & Maintenance*

If the SAMP partners determine that the standards for conventional septic systems should be strengthened, many landowners will find that they are unable to get a permit for a conventional system. Alternatives will need to be provided so that these landowners have the ability to develop their property in some fashion. DHEC currently provides some alternatives, but is generally reluctant to approve the full range of alternative systems that are available in other states. The performance of some of these alternative, or "high-tech," systems is questionable, and those that do work well tend to have high operation and maintenance requirements.[40] (The same is true of group, or shared, systems that may be necessary to allow for the clustering of residential development in the county's rural areas.) Understandably, DHEC officials are concerned that the average homeowner will not have the interest or understanding necessary to operate and maintain high-tech onsite disposal systems. The SAMP partners should give careful consideration to this challenge of providing landowners a wider range of

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[39]See State of Rhode Island, *Wastewater Management Districts*; also see Ordinance No. 197, Town of Charlestown, Rhode Island.

[40]Clean Water Task Force Fill-In-The-Gap Meeting, 7/18/96

alternative systems without saddling them with systems they cannot adequately maintain or operate. One possibility is the public operation and maintenance of high-tech and group systems, perhaps accomplished by the wastewater management district.

4. The Boating Impact Component

4.1 *County-Wide Boating Impact Management Plan*

Experts predict that the population of Beaufort County will double over the next twenty years, and some areas of the county will grow even faster. Southern Beaufort County, excluding Hilton Head Island, is predicted to grow from 7,000 people in 1990 to 47,000 in 2020.[41] This increased population will bring a predictable increase in boats and boating impacts on the county's waterways. The SAMP partners -- particularly Beaufort County, DHEC and DNR -- should plan for these impacts, just as the Town of Hilton Head should develop a boating impact management plan for Broad Creek (p. 45). Possible outcomes of a county-wide boating impact management plan include: (1) policies on siting marinas, mooring fields and private docks; (2) restricted access of jet skis and/or all motorized boat traffic from particularly sensitive areas; (3) establishing no wake zones or restricting motor size in some locations to control boat wakes; (4) creating no discharge zones in some areas besides Broad Creek and Calibogue Sound; (5) a comprehensive boater education campaign; and (6) making additional pump-out facilities available. Water quality and aquatic resources should be the main focus of the boating impact management plan, but aesthetic issues may also be of some concern. The lessons learned in developing the boating impact management plan for Broad Creek, should inform the county-wide plan.

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[41]Lowcountry Council of Governments, *Population Trends in the Lowcountry*, October 1993.

5. The Monitoring and Enforcement Component

5.1 *Coordination of All Monitoring Activities*

At present, many federal, state and local agencies monitor the water quality and biotic conditions of Beaufort County's rivers and creeks. Surprisingly, there is no central clearinghouse for this information. If the CWTF's recommendations are followed, the range of monitoring activities and the number of entities involved will grow. It is absolutely essential that these current and future activities are coordinated to avoid duplication of effort and provide easy access to all of the data collected. The SAMP partners should evaluate the best way to coordinate all of the monitoring activities, and adopt a formal mechanism to do so if it is deemed appropriate.

5.2 *Enhanced Monitoring Activities by Environmental Agencies and Citizens*

Once the baseline assessment of Broad Creek and the Okatie River (p. 47) is completed, it should be possible to identify any additional data needs. If additional monitoring is needed, the SAMP partners should identify any functions that could be performed by volunteer citizen monitors. Expanding the role of citizen monitors from a simple shoreline survey (p. 47) would help cut costs and increase the public's commitment to restore and protect at-risk waterways.

6. Chemical Use

6.1 *Household Hazardous Waste Drop-Off Site*

The baseline assessment of Broad Creek and the Okatie River may indicate that pollutants typically associated with household hazardous wastes are entering the county's waterways at unacceptable levels. If this proves to be the case, the SAMP partners should consider the establishment of a household hazardous waste drop-off site. Currently, DHEC and Beaufort County hold an occasional "amnesty day" when

householders can drop off waste products. While a good first step, many householders find it difficult to participate on special days because of competing demands on their time. A regular drop-off site, though more expensive to develop and operate, would be more convenient to householders so the level of participation would increase.

Implementation

The Clean Water Task Force is a loosely organized group of volunteers without a board of directors, administrative procedures and funding sources. We have never intended, and do not intend now, to become a formal organization. Beaufort County's waterways do not need a new organization; instead, they need an expanded and focussed effort by the existing private and public entities. This report describes the agenda that these organizations, and individual citizens, should pursue.

We propose three mechanisms that will ensure our recommendations do not gather the proverbial dust on the shelf. Two are described in the body of the report. First, we expect existing citizen groups in the county to assume responsibility for the citizen-based action items, like the citizen monitoring and public education programs (p. 36). Second, the SAMP Management Committee, hopefully with the able assistance of the Charleston Harbor Project staff, should take on the task of organizing, funding and implementing long term action strategies (p. 54). Members of the Clean Water Task Force expect to contribute to both efforts.

The third mechanism deals with immediate and intermediate recommendations addressed to public agencies at the local and state level. The CWTF proposes that these entities each adopt a "Willingness Statement." Tailored specifically for each agency, a willingness statement would enumerate what the agency is willing to do in response to the CWTF's recommendations. A willingness statement is not an agreement between two parties, since only the implementing agency in question signs the document. Instead, the organization makes a commitment to itself, and the public at large, to do what it says it will do. While it will take some time to work out the fine points of each willingness statement, the CWTF is confident that most of the report's recommendations can be adopted in this manner. Because the bulk of our recommendations affect DHEC, Beaufort County and the Town of Hilton Head, we will work with them first on their willingness statements.

Over the next few months, then, the CWTF will seek a home for each of our recommendations. Our job will be done once the network of citizens groups is organized, the SAMP process is underway, and the initial willingness agreements are signed. At that point, the CWTF will reconstitute itself into an informal oversight committee that will meet on a quarterly basis. The sole purpose for meeting will be to track implementation of this report's recommendations. Thus, members of the CWTF will have the time and energy to work with the organizations that take on the tasks this report helps spawn.

Appendices

Clean Water Task Force Members & Biographies

DHEC's Beaufort County Shellfish Program

Beaufort County Shellfish Water Status

An Environmental Scientist's Perspective (unabridged)

Governor Beasley's March 6 Letter

Scoping and Fill-In-The-Gap Meeting Participants

Scoping Meeting Summaries

Clean Water Task Force Bibliography & Documents List

Zero Degradation Ad Hoc Advisory Committee Members

Zero Degradation Ad Hoc Advisory Committee Report

Baseline Assessment Scope of Work

Clean Water Task Force
Sept 3, 1996

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Roddy Beasley Maggioni Seafood Co. Eddings Point Road Beaufort, SC 29902 838-2860 **Pres. of Maggioni Seafood (lease holder)**	Clark Lowther Lemon Island Seafood 310 Okatie Hwy. Okatie, SC 29910 **Owner and oysterman (lease holder)**	Sam Passmore SC Coastal Conservation Lg PO Box 1765 Charleston, SC 29402 803-723-8035(O) 803-723-8308(F) **Ex-Officio**

Clean Water Task Force Biographies

Thad Bailey
A native of Jasper County, Thad lives at Bailey's Circle on the Okatie River. He is a lifelong commercial oysterman, holding large Okatie River oyster leases. His son is also in business with him.

Roddy Beasley
A resident of Savannah, Roddy is president and owner of the L.P. Maggoni Seafood Company, a Beaufort County firm dating back to early in this century. His firm holds oyster leases throughout Beaufort County with company headquarters on Lady's Island.

Russell Berry
A long time resident of Beaufort County, Russell was educated at Beaufort Academy and at the Citadel in Charleston. He was a commercial shrimper and then joined South Carolina DHEC in 1978. He has worked in many of DHEC's environmental programs: Wastewater, Shellfish, Solid and Hazardous Waste and Air Quality. He is the Director of the DHEC Low Country Environmental Quality Control District, leading a team of 13 environmental professionals, and is responsible for shellfish and other local environmental monitoring.

Woody Collins
A life long resident of Beaufort County, educated in Beaufort County public schools. Woody is an active commercial fisherman and has been in the seafood industry, both harvesting and processing of shrimp, clams and oysters for 25 years. He currently holds oyster leases in Hilton Head's Broad Creek and also owns and operates a 50 foot shrimp boat. Woody possesses an acute understanding of the problem of maintaining clean water and is very eloquent on the subject.

General Howard Davis
Originally from Ohio and a graduate of Miami University of Ohio and the Harvard Business School, General Davis retired from the Air Force in 1970, having served as a bomber pilot in World War II. He moved to Hilton Head and entered the land development business being responsible for the development of Hilton Head Plantation and also several other off-island projects. He is active in the Rotary Club and is chairman of the Greater Island Committee of Hilton Head.

Beth Grace
A native of Tennessee, Beth moved to South Carolina in 1973. She is a graduate of Emory University and did graduate work at Georgia State University. She worked for the Georgia Department of Social Services and Department of Mental Retardation. In Beaufort she is active in numerous religious, civic and service organizations. She has been a member of the Beaufort County Council for seven years and is was vice chairman for four years.

David Harter
A resident of Hilton head since 1979, David is owner of Hilton Head Glidden and Beaufort Glidden Paint companies. He is board chairman and volunteer for Big Brothers/Big Sisters of Beaufort County, president of the Hilton Head Sportfishing Club, and a member of the Greater Island Committee.

Clark Lowther
A native of Ridgeland in Jasper County, Clark has, for 18 years, owned and operated the Lemon Island Marina, located at the Chechessee River Bridge in Beaufort County. The marina sells seafood, wholesale and retail. He is active in the County Crabber's Association and has provided valuable advice to the CWTF.

Bill Marscher
A Beaufort County native, Bill lives in Bluffton Township. A graduate of Clemson and Massachusetts Institute of Technology, he was employed by General Electric and MIT. He returned from Boston in 1969 to Beaufort County. He served on SC Beach Front Management Blue Ribbon Committee, Hilton Head Town Council as Mayor as pro-tem. for four years and was active in the drafting and adoption of Hilton Head's Land Management Ordinance and the Island's first beach front nourishment program. His son and two of his grandsons live on Hilton Head and thus his interest in clean water.

Emmett McCracken
A Bluffton Native, Emmett attended Clemson University, graduated from the US Military Academy and the University of Wisconsin. He served 30 years with the US Army, seeing service in Korea and attained the rank of colonel. He returned to Bluffton in 1990. He was elected to Beaufort County Council in 1992 and currently serves as chairman.

Laura McIntosh
A Savannah native, Laura moved to Bluffton's Pinckney Colony in 1977. She has been active in many environmental organizations, having served as a director in the SC Coastal Conservation League, SC Environmental Law Project, SC Wildlife Federation, Okatie Colleton Association and Bluffton Area Community Association. She received numerous awards associated with environmental protection: F. Bartow Culp Award-1988, South Carolina Water Conservationist of the year-1984, and Theodore Roosevelt Conservation Award-1990, and National Presidential Recognition (by President Bush) of outstanding achievement in areas of conservation and wise stewardship of natural resources.

Sam Passmore
A Pennsylvania native, Sam is Director of Land Use Programs for the South Carolina Coastal Conservation League (SCCCL) In this capacity Sam focuses his attention on land use and infrastructure issues along the South Carolina coast. Prior to Joining SCCCL in 1992, Sam was assistant Director of Policy at Save The Bay in Rhode Island. Sam holds a BA in English and Environmental Studies from Oberlin College and a Masters in Public Affairs from Princeton University.

David Payne
A native of New York, David attended NY State College and graduated from College of Charleston with a degree in Marine Biology. He then worked for a commercial shrimp aquaculture firm and in 1990 joined DHEC. In 1995 he transferred to Beaufort to become shellfish manager for DHEC's Lowcountry Environmental Control District. David is responsible for the district's shellfish testing program. David's home is in Walterboro.

Tom Peeples
A native of Ridgeland in Jasper County, Tom attended the University of South Carolina. He has resided on Hilton Head for 25 years where he owns and operates a successful construction company. He is currently Mayor of Hilton Head, having served on Town Council for eight years.

DHEC's Beaufort County Shellfish Program

David Payne, Shellfish Sanitation Program, DHEC/Lowcountry EQC

Shellfish Program Basics

The South Carolina Department of Health and Environmental Control (DHEC) implements its Shellfish Sanitation Program, which is part of the National Shellfish Sanitation Program (NSSP) administered by the U.S. Food and Drug Administration. Unlike other surface water quality monitoring programs that DHEC conducts, the primary focus of the Shellfish Sanitation Program is public health.

Shellfish -- specifically oysters, clams, and mussels -- are filter feeders, having the ability to concentrate contaminants. Shellfish are sometimes eaten raw; therefore, the bacteriological standards for shellfish harvesting waters are very restrictive.

Water samples are collected monthly from established monitoring stations in each of the 23 growing areas of the state. The samples are analyzed for fecal coliform, which are bacteria found in the intestines of all warm-blooded animals. The presence of fecal coliform is an indicator that pathogenic (disease causing) organisms may be present. Based on the 30 most recent samples at each monitoring station, the geometric mean of the fecal coliform concentrations for Approved waters cannot exceed 14 per 100 ml. By contrast, the fecal coliform standard for swimming waters is 200 per 100 ml.

The classification of Shellfish harvesting waters at each sample station is updated on an annual basis as part of the Sanitary Survey report for each growing area. The four basic classifications are Approved, Conditionally Approved, Restricted and Prohibited. Conditional approval allows limited harvesting in areas where a correlation between fecal coliform concentration and a predictable pollution event, such as runoff from rainfall, is established. Restricted classification allows (through a special permit) shellfish to be moved to Approved waters or mechanically cleansed (i.e., "depurated") for a period of time before they are allowed to be marketed. No harvesting of shellfish is allowed from Prohibited waters. Areas around marinas and wastewater treatment plant outfalls are classified as administratively Prohibited to protect public health.

Currently in Beaufort County, the only waters classified as Prohibited based solely on water quality sampling data is the headwaters of the Okatie; all others are administratively Prohibited. DHEC is assessing a size reduction of these administratively closed areas. Additionally, DHEC and DNR, through a memorandum of agreement have established a Shellfish Restoration Committee whose goal it is to eliminate sources of fecal contamination and reopen Restricted and Prohibited waters in the state.

Related DHEC Programs

The Shellfish harvesting classifications (Regulation 61-47) and South Carolina's water quality classification system (regulation 61-68) are two separate programs. Water quality classifications are used to define and protect the intended use for a body of water. Existing classifications for coastal waters include SFH (Shellfish Harvesting), ORW (Outstanding Resource Waters), SA and SB waters. In addition to fecal coliform, each waterbody classification has numerical standards for physical and chemical parameters, that must be maintained to protect the intended use. Thus the water classification program is more focussed on environmental parameters, than strictly on public health as is the Shellfish program.

The Okatie River is classified as ORW and Broad Creek is SFH. The ORW classification is applied to waters that are determined to have outstanding ecological and recreational quality. No point source (i.e., wastewater treatment plant) discharges are allowed in ORW waters. Wastewater discharged into SFH waters has to meet the 14/43 fecal coliform standard for Approved shellfish harvesting waters.

Besides its Shellfish Sanitation program and its sampling based primarily on fecal coliform, DHEC implements one the best ambient water quality monitoring programs in the nation. Water and sediment samples are collected from established stations and are analyzed for a multitude of parameters. Data is analyzed to determine trends in water quality and to identify areas not meeting the standards for that waterbody classification. Sample stations are mainly land-based (from bridges) but are also located in lakes and coastal rivers. For the most part, these stations are located in the larger rivers and sounds and not in the tributaries like the Okatie and Broad Creek.

The CWTF has requested that DHEC and DNR conduct a water quality assessment of the Okatie and Broad to determine the present state of water quality and to provide baseline data for comparison with future sampling results. The proposed study will include water and sediment sampling and a biological assessment of these estuaries. Recent studies, such as the Urbanization and Southeastern Estuarine Systems (USES) and the Tidal Creeks Project, have indicated that in addition to fecal coliform, stormwater deposits chemical contaminants, such as Polycyclic Aromatic Hydrocarbons (PAH), trace metals, and pesticides into coastal waters. PAH, which are the byproducts of petroleum combustion, have been found in higher concentrations near road crossings. A co-occurrence of high levels of PAH and fecal coliforms has been shown which indicates that the PAH may actually be a food source for fecal coliforms. In addition, the USES study indicates that fresh water and chemical contaminants in stormwater have been shown to affect survival, reproduction, and densities of amphipods, copepods, and grass shrimp, which are essential food sources for juvenile finfish.

Broad Creek in Detail

The Sanitary Survey for Area 20, which includes Broad Creek and the Hilton Head Island area, published on July 26, 1995 resulted in the classification of the headwaters of Broad Creek as

Prohibited. Between August, 1995 and January, 1996 a study to assess impact from nonpoint source pollution in Broad Creek was conducted. During an 8 week period from October to December, 1995, shellfish monitoring stations in Broad Creek were sampled once a week. The Sanitary Survey published on July 30, 1996 resulted in the upgrading of the classification of the headwaters of Broad Creek to Restricted.

Broad Creek is a large tidal creek which runs in an east to west direction, nearly bisecting Hilton Head Island. Over the last several years, land adjacent to Broad Creek has experienced a substantial amount of residential and commercial growth. Most of these activities have been concentrated on the south side of Broad Creek. Commercial businesses, malls, marinas, multi- and single family residential development characterize this development. The north side of Broad Creek is predominantly composed of residential areas that includes permanent and mobile homes.

No single source of fecal coliform contamination has been identified as the cause of shellfish bed closures in Broad Creek. Rather, it appears that a variety of potential sources exist and cumulatively have degraded water quality in the creek. Stormwater form a large portion of the island is discharged into Broad Creek and includes stormwater form road surfaces and well as golf course lagoon systems. Fecal coliform concentrations are higher and survival is longer in this fresh water. Septic tanks are utilized by waterfront homes and businesses on most of the northern shore, around the headwaters, to a point ending at Shelter Cove on the southern shore. Boating impacts, such as discharges from marine toilets and boat wakes re-suspending fecals in sediments, may be contributing. Sewage spills have on occasion allowed raw sewage to enter ditches leading to the creek. There are not direct discharges of treated wastewater into the water on Hilton Head. Treated effluent is typically sprayed on golf courses. Land clearing and development can cause wildlife to become concentrated in remaining undisturbed wetland areas which drain to the creek.

The Okatie River in Detail

The Sanitary Survey for Area 18, which includes the Okatie and Colleton Rivers, and Chechessee Creek, published on July 26, 1995 resulted in the classification of the headwaters of the Okatie and an additional area in the Chechessee Creek as Restricted. The updated Sanitary Survey published on August 8, 1996 resulted in the downgrading of the classification of the headwaters of the Okatie to Prohibited. The portion closed has not yet reached the area from which leaseholders harvest. Also, the area closed is usually low in salinity and doesn't support a large amount of shellfish resource.

Broad Creek and the Okatie River are similar waterbodies. They are both small, long, poorly flushing tidal creeks with freshwater input at the headwaters. The major difference is the amount of development along the shoreline of Broad Creek.

The area along the Okatie is in the early stage of development. A single source of the fecal contamination that has lead to the recent Prohibited classification in the headwaters has not been found. It has not yet been determined whether the fecal contamination is from human or animal

sources. A cattle farm has been in operation for a number of years near the headwaters and is being evaluated as one of the potential sources. In the near future, DHEC will be using a method of "genetic fingerprinting" which can identify the particular species of animal (i.e. raccoons, deer, or waterfowl, etc.) from which the fecals originate. The USES study compared an urbanized waterbody, Murrells Inlet, to an isolated pristine area in North Inlet. It should be noted that even in the pristine, undeveloped area, there were areas where the fecal coliform concentrations exceeded the standard for Approved waters.

Certain types of soil bacteria can also give false positive results in the first fecal test. Fecal coliforms can survive in soils and sediments and, as stated earlier, are usually found in higher concentrations in fresh water. One possible explanation is that land clearing activities may be responsible for increasing runoff, re-suspending fecals and soil bacteria.

One positive aspect is that land clearing and development activities in the Okatie area will be subject to the requirements of the Stormwater Management and Sediment Reduction Act of 1991. Most of Broad Creek was developed prior to the existence of these regulations.

Potential Resource Impacts

Shellfish bed closures obviously have a direct economic impact on the commercial harvester. Additionally, restaurants and seafood business suffer from the public's idea of shellfish consumption as a health risk. Tourism is affected by negative press concerning water quality in an area they choose to visit because of its water-related recreational opportunities.

It should be noted that the term, "pollution," is applied indiscriminately when describing shellfish bed closures. These waters still support all of their other intended uses, such as swimming, crabbing, and fishing. They just don't meet the restrictive standards required for consumption of shellfish.

If the proposed resource assessment of Broad Creek and the Okatie River (described above) may yield results similar to the USES Study and the Tidal Creek Project. These studies have documented pollution sources that impact recreational fishing, an important part of the local economy, and recreational fishermen, who are a substantially larger user group than recreational or commercial shellfishermen.

Beaufort County Shellfish Waters Status (based on recent undated single sheet status report by DEHEC)

Draft #3

Note: Acreage is measured from shore to shore and should not be used for a direct measure of the impact of prohibiting or restricting shellfish harvesting. SC Wildlife and Marine Resouces Dept. keeps that data.

Compiled by WFM 9/19/95

Shellfish Area	Location	Water Class	Acreage	Area Description	Shellfishing status	Pollution Source	Reason
14	St. Helena Sound	SFH	52,076	incl. Combahee R. & Coosaw R.	A		
14	Whale Branch	SFH	6925		A		
14	Beaufort R.	SFH	6600	Ballast Cr. to Port Royal Sd	A		
15	Chowan Cr.	SFH	4835	Entire Creek	A		
15	Archer Cr.	SFH	1927	1000' above P.I.Bridge to Port Royal Sd	A		
16	Morgan R.	SFH	56420	Estuary incl Harbor R., Trenchards In., Station Cr., St.Helena Sd to Fripp Isl	A		
16	Lucy Point Cr.	SFH	866		A		
17	Broad R./ Port Royal Sd	SFH	67736	inc Chechessee R.	A		
18	Colleton R.	ORW	19325		A		
19	May R.	ORW	10649		A		
19	Cooper R.	SFH	4352		A		
19	New R. & Wright R.	SFH	17911		A		
20	Calibogue Sd.	SFH	19920		A		
20	Broad Cr.	SFH	246		A	NPS	FC
		total A	**269,788**				
14	Campbell Cr.	SFH	217	Entire Creek	Pr	PS	PA
14	Halfmoon Cr.	SFH	393	Entire Creek	Pr	PS	PA
14	McCalley Cr.	SFH	2303	Entire Creek	Pr	PS	PA
15	Brickyard Cr.	SFH	1612	Entire Creek	Pr	PS	PA
15	Albergotti Cr.	SA	1142	Entire Creek	Pr	PS	PA
15	Beaufort R.	SA	8160	Albergotti Cr. to Ballast Cr.	Pr	PS	PA

15	Battery Cr.	SFH	2455	Two Hdwaters to 1000' below confluence	Pr	PS	PA
15	Battery Cr.	SA	1061	Two Hdwaters confluence to Rabbit Isl. Confluence	Pr	PS	PA
15	Archer Cr.	SA	65	Battery Cr. to P.I. Bridge	Pr	PS	PA
15	Archer Cr.	SFH	102	P.I.Bridge to 1000' above	Pr	PS	PA
16	Morgan R.	SFH	7		Pr	Marina	PA
17	Broad R./ Port Royal Sd	SFH	17	Laurel Bay Water treatment	Pr	PS	PA
17	Hazzard Cr.	SFH	935	upper reaches	Pr	NPS	FC
19	Cooper R.	SFH	65	Landing	Pr	Marina	PA
19	Sav. R.& Fields Cut	SFH	1539		Pr	PS	PA
20	Broad Cr.	SFH	287	Five marinas & Lawton Cr. sewer	Pr	Marina	PA
20	Baynard Cove	SFH	834		Pr	Marina & PS	PA
20	Skull CR. & Mackey Cr. &	SFH	est. 300	Six marinas & Dredged cr.	Pr	Marina	PA
20	Harbour Town & South Beach creeks	SFH	est. 100	entire	Pr	Marina & NPS?	PA
20	Fish Haul Cr.	SFH	est. 50	entire	Pr	NPS	FC?
		total Pr.	**21194**				
14	Ashepoo R.	SFH	1500		R	NPS	FC
14	Whale Branch	SFH	692	Campbell Cr. to Hamilton Cr.	R	PS-NPS	FC
14	Huspa Cr.	SFH	1609	Entire Creek	R	NPS	FC
14	Middle Cr.	SFH	810	Entire Creek	R	NPS	FC
16	Jenkins Cr.	SFH	1244	1.5 mi. from Morgan R. to Hdwaters	R	NPS	FC
16	Village Cr.	SFH	1866		R	NPS	FC
16	Rock Spring	SFH	132		R	NPS	FC
16	Fripp Isl Canal	SFH	265		R	NPS	FC
16	Edding's Cr.	SFH	364	upper reaches	R	NPS	FC
18	Chechessee Cr.	ORW	169		R	NPS	FC
19	New R.	SFH	6854		R	NPS	FC

19	Wright R.	SFH	9282		R	NPS	FC
20	Broad Cr.	SFH	892		R		
		total R	25679				

	Shellfish Acres
Bft. Cnty. Total	316,661
So. Car. Total	631,856
Bft. Cnty Pr & R	46873
Rest of state Pr & R	159,373
North Bft.Cnty Pr & R	26,016
South Bft. Cnty Pr & R	20,857

Shellfish Status %			
	A & AC	Pr (all)	R
Bft. Cnty.	85.20%	6.69%	8.11%
So. Car.	67.40%	13.20%	19.40%

Water Class Abbreviations
ORW-Outstanding Resource Waters.
SFH-OK for shellfish Harvesting.
SA-Swimming but not shellfishing.
SB-No swimming, no shellfishing, OK to fish.

Shellfishing Status Abbreivations
A—Approved
AC--Approved Conditionally(temporary conditions)
R—Restricted (slightly polluted-cleanse shellfish)
Pr-Prohibited
Pr-PA—Prohibited (see PA)
Pr-PWQ—Prohibited (PWQ-poor water quality)
Pr-PA & PWQ--Prohibited (PA & PWQ)

Pollution Source Abbreivations
PS—Point source
NPS—Nonpoint source
Marina--

Reason Abbreviations
FC—Fecal coliform
PA—Administrative closure(marina or sewer outfall)

Additional Closures according to DEHEC Areas 18 & 20 Sanitary Survey Triennial Reviews (data through, Jan,95 and March,1995 respectively)

Shellfish Area	Location	Water Class	Acreage increase	Area Description	Shellfishing status	Pollution Source	Reason
18	Chechessee Cr.	ORW	Doubled to approx. 340 acres	between Callawassie and Mainland	R	NPS	FC
18	Okatee R.	ORW	New approx. 120 acres	Head waters next to Sun City	R	NPS	FC
20	Broad Cr.	SFH	New approx. 200 acres	headwaters	Pr	NPS	FC
20	Broad Cr.	SFH	reduced Lawton Cr. Pr by 3/4 to 100 acres	Lawton Cr. area	Pr & R	PS	PA

Corrections to Beaufort Pollution Table

First page
Parts of shellfish area 14 (St. Helena Sound) are in Colleton County.
Shellfish area 19 (New R. & Wright R.)is in Jasper County.

Second page
Shellfish Areas 17 (Hazzard Cr.)and 19 (Sav.R. & Fields Cut) are in Jasper County.
Shellfish area 19 (New R.) is half in Beaufort County and Half in Jasper County.

Third Page
Shellfish area 19 (Wright R.) is in Jasper County.

The Status of Environmental Quality in Estuaries of South Carolina, An Environmental Scientist Prospective

Dr. Geoffrey I. Scott, Chief Marine Ecotoxicology Division, NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Charleston Laboratory

Estuarine environments in South Carolina are facing significant developmental pressures which mandates that local, state and federal environmental agencies must take more proactive management of upland development to protect these important ecosystems. These *Spartina alterniflora* estuarine ecosystems are among the most the most productive ecosystems in the biosphere and are of particular importance in terms of their nursery ground function for fin fish and shellfish. Currently, >75% of all fin fish and shellfish species are estuarine dependant, using estuarine environments for one of more of their life history stages for development. The dynamic nature of these estuarine environments is matched by the dynamic nature of the life history/development stages of the many species of fish and shellfish utilizing these environments.

Coastal estuaries in South Carolina vary greatly in size, hydrography (e.g. fresh water flushing characteristics) and the amount of terrestrial upland development surrounding each watershed. The smallest estuaries are generally located in the northern third of South Carolina (north of Georgetown-Winyah Bay) and are generally small, high salinity estuaries, which do not have major river flowing into each system. Rather, these are non-riverine, tidally influenced estuaries with extremely high salinities (>35 ppt during dry weather periods) and are diluted only by runoff from rainfall. As a result of these geographic characteristics, small high salinity estuaries are influenced by land development directly adjacent to the estuary rather than development further inland.

The largest estuaries in the state are located south of Georgetown and include Winyah Bay, Charleston Harbor, and St. Helena Sound (e.g. ACE Basin). These large estuaries are characterized by large rivers which flow (e.g. riverine estuaries) and generally have substantial urban and industrial development in the surrounding upland terrestrial watersheds. In addition to impacts from adjoining land development within the proximate watershed, these riverine estuaries are greatly influenced by freshwater flow from rivers within each system and resulting salinities are lower then in non-riverine, high salinity estuaries. Additionally, several of these riverine estuaries (e.g. Winyah Bay, Charleston Harbor, and the Savannah River) are ports of commerce, with extensive commercial fleets as well as recreational boating activities. Conversely, non-riverine estuaries are surrounded primarily by urban (roadways, infrastructure) and suburban (e.g. housing, service/tourism industries, and marinas) upland development and are generally lacking in industrial development and contain marinas which house primarily recreational boating.

The impact of upland development has not been well studied in South Carolina. While several state and federal monitoring programs have chronicled the levels of selected chemical contaminants at long term monitoring stations, these efforts have generally not been focused on characterizing pollution sources in upland areas in a quantitative manner. Marcus and Scott

(1988) summarized data from the SC DHEC trend monitoring data on chemical contamination of sediments and biota (oysters and blue crabs) in 16 estuaries with varying degrees of urban development. Polycyclic aromatic hydrocarbons (PAHs) were the contaminants chosen for study, since they are indicative of urban activities associated with fossil fuel combustion (e.g. marinas, automobile discharge on roadways, etc). Results indicated that a significant increase in total PAH sediment concentrations was observed in association with increased amounts of urbanization. Concomitant increased uptake of PAHs was observed in oysters and blue crabs which was associated with urban runoff. Large metropolitan urban complexes, such as Charleston Harbor and Winyah Bay, had the highest PAH concentrations in sediments and biota measured, where as small high salinity estuaries, such as North Inlet, a NOAA National Estuarine Research Reserve and Sanctuary (NERRS) site, had the lowest PAH concentrations measured. Also suburban areas such as in Beaufort County were generally found to have low-moderate PAH concentrations.

PAH pollution may adversely affect living marine resources of estuaries by directly (e.g. acute toxicity) or indirectly (e.g. sublethal affects on growth, development and reproduction) affecting resident fauna. Additionally, estuarine organisms may bioconcentrate PAHs which may cause induction of certain detoxification pathways (e.g. mixed functions oxidase enzymes = MFOs) in the liver or hepatopancreas of estuaries organism, which detoxify PAHs to water soluble forms which may be excreted. While these detoxification pathways may prevent toxicity, they are not without metabolic cost to the organisms such as decreased or altered growth, development and reproduction, as energy may be shunted away from these essential biological activities and channeled into inducing these detoxification pathways. Decreased reproductive potential may be directly related to "ecological death", since reduced offspring production may ultimately affect population size - structure within a given species and may alter food chain trophic structure for dependent species. Other contaminants associated with urban development such as PCBs, persistent pesticide (e.g. chlordane = termiticide) and trace metals (e.g. Cu = bottom fouling paint in boats) are also of a significant concern.

More recent studies have attempted to derive more quantitative relationships between land-use and coastal development on estuaries ecosystem health. The Urbanization in Southeast Estuaries (Eco) System (USES) study has studied the effects of coastal development on Murrells Inlet (MI). MI is located on the southern end of the Myrtle Beach Grand Strand and is highly urbanized (>625 people square mile which is 5 times the state average for SC). There are no Standard Industrial Code industries in MI, rather the estuary is developed for tourism including roadways, marinas, residential housing, restaurants and other tourism/service industries. Pristine undeveloped North Inlet (NI), a NOAA NERRS site was used as a reference site to compare with urbanized MI. The primary difference between NI and MI was the extensive upland coastal development in MI. The goal of the USES Project was to establish a Geographical Information System (GIS) based land use models which is linked with fishery based population models to identify urban, nonpoint source (NPS) loading regions within estuaries and to measure resulting effects on living marine resources of commercial, recreational and ecological importance.

The USES Project established a randomly selected grid of 30 sites (Inner = land-estuarine interface; mid-mid estuary; and Outer = estuarine-ocean interface) in each estuary where a number of parameters were measured to assess coastal ecosystem health including: 1) chemical contaminant levels of trace metals, PAHs, pesticides and PCBs in sediments and oysters; 2) fecal coliform bacterial densities in surface water and oysters; 3) nutrient dynamics in surface water at ebb and flood tides; 4) general physicochemical water quality (temperature, salinity, dissolved oxygen, and pH); 5) oyster (*Crassostrea virginica*) survival, growth and spat settlement; and 6) grass shrimp (*Palaemonetes pugio*) abundance and biomass. In addition, GIS characterizations of land use in the estuary and adjoining upland areas was conducted along with chemical contaminant monitoring of urban NPS runoff. Laboratory toxicity tests were conducted to determine the toxicological sensitivity of a variety of marine organisms (grass shrimp, copepods, oysters) to selected urban NPS runoff contaminants (PAHs and pesticides).

Results of the USES Project have indicated that significant NPS runoff loading of PAHs and coliform bacteria occurred in watersheds adjacent to terrestrial upland areas. Major sources of PAHs included runoff from parking lots and roadways and discharges from marinas while major sources of coliform bacteria appeared to be related to remaining septic tanks within the estuary. Bacteriological "fingerprinting" of coliform positive bacteria clearly indicated that *E. coli* bacteria (e.g. an indicator of human and other mammalian species) densities and prevalence rates were much higher in urbanized MI and that estuarine regions free of coliform bacteria occurred at a rate 6 times higher in pristine NI. Similarly highest PAH concentration in sediments and oysters were found adjacent to transportation corridors (US Highway #17 and Garden City Beach Causeway) and marinas. Highest coliform bacterial densities were found in the Inner (Murrells Inlet) and outer (Garden City Beach) regions of MI, adjacent to areas of significant suburbanization (e.g. residential housing and service industries). GIS and spatial statistical analysis indicates that highest levels of PAHs and fecal coliform bacteria densities co-occurred at frequencies higher than would be predicted from random, chance occurrence. This suggests that coliform bacteria may significantly interact with, possibly suggesting that fecal coliform bacteria may degrade PAHs in sediments, using the carbon-hydrogen source of the PAHs as a energy source. Marcus and Scott (1989) reported that in laboratory bioassay, fecal coliform were able to use low concentrations of PAHs as an energy source.

Perhaps the greatest impact found from urbanization by the USES Project is the reduced grass shrimp abundance found in MI. The grass shrimp, *Palaemonetes pugio*, the most abundant macro-pelagic (>15mm) fauna found in tidal creeks in terms of abundance, comprising more than 56% of total fauna on an annual basis. In MI, grass shrimp abundances were reduced by >85% estuarine-wide. These reductions in grass shrimp populations were highly correlated with sediment PAHs concentrations and salinity alterations associated with increased NPS runoff loading. Sediment PAH concentrations were inversely related to changes in salinity (e.g. highest PAH concentrations were found in areas with lowest salinities, indicative of urban NPS runoff loading). GIS Modeling indicated that grass shrimp abundances were most affected in estuarine regions of MI which were adjacent to public boat landings and marinas, areas receiving runoff from urban residential areas, areas with extensive docks and bulkheading, and areas adjacent to

transportation corridors. In the southern region of MI, the estuary is undeveloped and grass shrimp abundances there were somewhat similar to North Inlet. In pristine North Inlet, 85% of the estuary had grass shrimp abundances higher than the peak grass shrimp abundances measured in MI. In addition, grass shrimp reproduction was altered in MI. Normally, grass shrimp reproduction is driven by two cohorts of gravid females -- Overwintering Gravid Females -- which appear gravid in early March and dominate reproduction through June, and Young of the Year gravid females dominate reproduction from July-October. In urbanized MI, overwintering gravid females dominate reproduction from March-August, with Young of the Year Females not appearing until late August rather than early July. This alteration in reproduction has been statistically correlated with high sediment concentrations of PAHs, dissolved oxygen concentrations and temperature. These reductions in grass shrimp populations may have profound impacts on estuarine ecosystem health including reduced food availability for many of the juvenile fin fish and shellfish species which rely on grass shrimp as a staple of their diet. Also, grass shrimp, as their name implies, graze on marsh grass (*Spatina alterniflora*) and convert it to detritus, which is the base of the detrital food webs in estuarine ecosystems. The absence of grass shrimp in urban areas may result in greater bacterial conversion of marsh grass to detritus, adding to the bacterial water quality problems observed in urban estuaries.

Urbanization must be viewed as a process in which there are both contaminant (PAHs, trace metals, and pesticides) as well as noncontaminant (e.g. altered salinities, hydrography, and habitat) stressors. These contaminant and noncontaminant stressors may interact to produce the observed impacts discussed above. Environmental scientist have the challenge to discern the causes of population declines/alterations and to develop appropriate management strategies to reduce the observed impacts of stressors. The USES Project has been an important beginning in this process. By beginning in a small, nonriverine estuary such as Murrells Inlet with no point pollution sources, rather where urban nonpoint pollution sources are clearly defined, the hydrography is well studied, and linkages with adjacent land use are clear, has it been possible to develop models which are predictive of upland development impacts. This was an important first step before studying more complex riverine estuaries such as Charleston Harbor, ACE Basin/St Helena Sound and Winyah Bay, which may have many different pollution sources including both point as well as nonpoint source pollution contributing the same pollutants or classes of pollutants, with complex hydrography, and where pollution sources from adjacent land-use as well as upriver sources must be discerned.

The Tidal Creek Study conducted by the South Carolina Department of Natural Resources as part of the Larger Charleston Harbor Project conducted by the Office of Coastal Marine Resource Management has focused on the most upland regions of large riverine estuaries such as Charleston Harbor. The small headwater tidal creeks within each river system of the Charleston Harbor estuary have been studied and compared with the larger river/harbor regions of the Charleston Harbor estuary in terms of benthic and pelagic community structure, chemical contaminant loading, nutrient dynamics, toxicological screening, and physicochemical water quality. Major findings of this study which are just being published include the finding that: 1) Greatest chemical contaminant loadings occur in the headwater streams of small tidal creeks and

that major pollution sources from urbanization include PAHs, chlordane and some trace metals; 2) Point source pollution is an additive input to the urban NPS runoff loading pulse; 3) PAH concentrations, which were the dominant urban pollutant found in MI< are greatly increased in regions receiving additional industrial discharges; 4) Some industrial discharges have caused pollution of both tidal creek as well as river reaches of Charleston Harbor (e.g. Shipyard Creek); 5) Alter physicochemical water quality, in particular alterations in dissolved oxygen dynamics, were observed in developed watersheds; 6) Grass shrimp abundances were significantly reduced in monthly monitoring of selected watersheds; 7) Overall pelagic community structure was not altered in comparisons of developed and undeveloped watersheds; 8) Similarly, benthic community structure was generally not altered, although some slight changes were observed in some selected watersheds; and 9) Reduced immune function was observed in mummichogs (*Fundulus heteroclitus*) in selected watersheds. Alterations in dissolved oxygen dynamics may have profound impacts on estuarine ecosystem health. Under normal conditions, dissolved oxygen concentrations may vary from supersaturated conditions (>8 mg of oxygen/L) to hypoxic conditions (< 1 mg of oxygen/L). The hypoxic conditions, while stressful to endemic fauna, are an important feature of true estuarine nursery grounds. Low dissolved oxygen levels are tolerated well by many of the juvenile stages of fish and shellfish species using these areas, while many of the predators of these juvenile species avoid hypoxic conditions. This hypoxic protective feature must be maintained in a tidal creek in order for it to function as a nursery ground. Urbanization has been shown to clearly alter dissolved oxygen dynamics in certain reaches of some of the developed watersheds studied by the Tidal Creek Study. In addition, results from the Tidal Creek project will enable scientist to better discern impacts from coastal development on complex riverine estuaries, such as Charleston Harbor estuary, as GIS Models are developed by the Charleston Harbor Project to overlay the different data layers into a complex matrix to elucidate interactive effects from multiple stressors.

Results from the USES and Tidal Creek Projects have greatly added to our knowledge of the impacts of urbanization. Sustainable coastal development can only be realized when we are able to protect our natural resources from impacts of development by appropriate management techniques. With the knowledge gained from the USES and the Tidal Creek Studies, we are now at a cross roads in terms of scientific study. While we have identified impacts from coastal development and identified potential management strategies, it is now time to implement pilot demonstration projects which will translate this knowledge in techniques which will reduce and better manage impacts from coastal development. These pilot projects must include appropriate monitoring studies of ***"key cornerstone estuarine ecosystem health parameters"*** to evaluate and better define these management techniques for controlling impacts from urban development. Risk management of urbanization must be viewed as a ***Cumulative Risk Reduction Strategy***. While no one management step will be 100% effective, rather a combination of management strategies each with incremental pollution reduction, will ultimately effect the cumulative risk reduction needed to protect living marine resources of our vulnerable estuarine ecosystems of South Carolina.

State of South Carolina

Office of the Governor

DAVID M. BEASLEY
GOVERNOR

POST OFFICE BOX 11369
COLUMBIA 29211

March 6, 1996

Mr. Bill Marscher
23 Big Oak
Bluffton, SC 29910

Dear Mr. Marscher:

I enjoyed meeting with you several weeks ago in Hilton Head to discuss contamination of shellfish waters. Since that time, I understand that you have been in contact with members of my staff and that DHEC has worked closely with you and others on this issue.

As you know, I share your concern about the number of shellfish harvesting beds that have been closed because of pollution in the last few years. Shellfish harvesting plays a vital role in both the local and state economies. In addition, water quality directly affects our state's ability to attract tourists to our coasts. If not addressed in a timely manner, a contamination problem can even threaten the health of our citizens and our communities. Our stewardship of these resources will influence our quality of life and our children's future.

I applaud your effort to set up a citizen task force whose goal is to reopen closed shellfish areas by identifying the sources of contamination and seeking to remedy them. Since these activities are likely to impact local land use planning decisions, it is essential that the effort be locally-based. I urge you to continue to involve a broad cross-section of the community interested preserving the unique heritage of Beaufort County and securing its future.

To assist your Task Force in obtaining information and assistance you may need from various state agencies, I have assigned Ms. Beth Partlow to serve as your point of contact in my office. You may reach Ms. Partlow at (803) 734-9864. In addition, I have asked Doug Bryant, Commissioner of DHEC, to assign a member of his staff to work directly with the Task Force. I believe that by working together we can make a difference.

Again, I applaud your initiative and look forward to working with you and the Task Force.

If I may be of further assistance to you, please feel free to call me.

Sincerely,

David M. Beasley

cc: Douglas E. Bryant

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CLEAN WATER TASK FORCE

12 June, 1996
Meeting Highlights

The first of four scoping meetings was convened by the Clean Water Task Force (CWTF, the Task Force) at the Lowcountry District office of the S. C. Department of Health and Environmental Control's Environmental Quality Control section. The purpose of the meeting was for the task force to receive information from state and local agencies on matters related to stormwater management, including permitting and compliance programs. Participants included:

Russell Berry--DHEC
Tom Bolin--DHEC/OCRM
Don Campbell--DHEC
Rob Dunlap--DNR
Beth Grace--CWTF
Debra Hernandez--DHEC/OCRM
Bob Klink--Beaufort County
Emmett McCracken--CWTF
David Payne--DHEC
Summer Rutherford--Beaufort Co.
Bob Van Dolah--DNR
Carol Tank--Beaufort Co.
Sam Passmore--SCCCL
Chris Bickley--LCOG
Robert Boyles--Sea Grant
Woddy Collins--CWTF
Joe Fersner--DHEC/OCRM
David Harter--CWTF
Flint Holbrook--DHEC
Bill Marscher--CWTF
Laura McIntosh--CWTF
Milt Rhodes--NOAA
Steve Snyder--DHEC/OCRM
Matt Hayes--Beaufort Co.
Rob McGarry--DNR

The moderator pointed out that the goal of the task force is to come up with feasible, doable actions which would achieve two things: clean up already degraded surface waters of Beaufort County and protect county waters from further degradation. The task force welcomed the participants to the meeting and thanked them for their time and efforts on behalf of the task force.

An overview of the issues that led to the present conditions of Broad Creek and the Okatie/Chechesse/Colleton Rivers was presented. A number of points were made, including: there are a number of potential sources on both waterways which may have led to the closure of shellfish harvesting areas there. In order to help determine the sources of the pollutants in these waters, DHEC has increased its sampling frequency from 6 times a year to monthly.

Presentation topics and highlights:

Stormwater management--

Review of the 1991 S. C. Stormwater Management and Sediment Reduction Act, including the designated watershed program.

Highlights: (1) the need for enforcement of inspection, maintenance and monitoring provisions for stormwater systems once they are built; (2) the merits of stormwater management through the designated watershed program versus site level permitting; (3) the specifics of a stormwater utility; (4) the need to address the issue of cumulative impacts of stormwater; and (5) the need for baseline data (where the critical areas are, define specific problems in those areas, and the impacts of stormwater runoff on the resources of particular concern).

Beaufort County and Hilton Head Island stormwater plans,
--Planned Unit Developments (PUDs) such as Willow Run and Indian Hill.
different site design and development standards for different activities.
zero degradation standard proposed by the developer of the Indian Hill PUD.

--Hilton Head has examined the issue of a stormwater utility
Town of Hilton Head decided not to pursue the establishment of stormwater utility because they did not have a billing procedure already in place. If the county were to pursue a stormwater utility, they would not have to "gear up" like Hilton Head (the county already is capable of collecting fees).

--Stormwater management plans are designed as drainage plans,
primary objective: to remove surface water from the land as quickly as possible.

Highlights: (1) Hilton Head and Beaufort County are dealing with stormwater, but from the standpoint of flooding, and are only now beginning to deal with the issue of water quality (the town of Hilton Head Island is particularly concerned with retrofitting existing stormwater structures; (2) the distinction between the results using Best Management Practices (BMPs) for stormwater management systems (design standards) and actual water quality monitoring standards, illustrated by the precedent set by the Indian Hill PUD; (3) the issue of inspection, operation & maintenance, and enforcement of already-permitted stormwater systems; (4) the need for a standardized program to collect baseline data; (5) the different, often conflicting, objectives of different jurisdictions within a watershed; and (6) the lack of water quality standards on stormwater outfalls.

State Coastal Zone Planing/Management Activities:

Activities of interest to the CWTF
--Assisting localities with local planning activities
--Special Area Management Plans (SAMPs) designed to address a particular set of issues (such as historic preservation or dredge spoil disposal);
-- A proposed EPA-funded project to develop a Wetland Management Plan for the New and Broad River watershed with a particular emphasis on the role of wetlands in habitat and water quality;

--A joint project with the Palmetto Conservation Foundation to develop a greenway system in conjunction with the city of Beaufort;
--A proposed NOAA-funded sustainable development demonstration project to be piloted in the Beaufort-Colleton-Hampton-Jasper area.
--Passage of a bill giving municipalities extraterritorial jurisdiction with the power to enforce local ordinances out to the mean low tide mark.

Highlights: (1) the ability of planning tools to help optimize the location of new development (from a water quality standpoint); (2) the use of mitigation money to protect important sites and the recently signed memorandum of understanding for mitigation banking; (3) the use of greenways and open space planning to protect sensitive areas; (4) the potential for municipalities to use the new tool of extraterritorial jurisdiction to manage water quality; (5) the need for linkages between the OCRM watershed plan, county plans, Lowcountry Council of Government water quality activities, and DHEC activities (perhaps a GIS system might the be "glue" that binds all these activities together?).

Beaufort County comprehensive planning process.
Plan will be completed by year's end
--zoning ordinance to carry out the provisions of the plan will be rewritten during the period January-June 1997.

River Protection Overlay Districts,
--special setback rules and BMPs are required to protect the integrity and viewshed of the county's nine designated Outstanding Resource Waters (ORWs).

Highlights: (1) the idea of exploring a citizen's monitoring program to help enforce standards/BMPs in areas such as the River Protection Overlay District; (2) the possibility of expanding the requirements/standards of the River Protection Overlay District to all of Beaufort County, and extending requirements to single family homes will be most controversial aspect; (3) the difficulty of determining a single, agreed-upon standard for buffer width, with some discussion on the issue of measuring buffer width; and (4) the need to communicate with and educate the public on the need for these different performance standards and water quality protection measures.

Alternative planning approaches to protect coastal water quality.

Differences in traditional and neo-traditional town planning and design approaches,

Highlights: (1) the benefits of concentrating development density away from sensitive areas (both at the site level and at the watershed level) and the added of benefits of combining this siting decision with BMPs; (2) the utility of performance zoning and growth boundaries in minimizing the impacts of development on water

resources; and (3) the need to ensure an adequate return on the investment for the developer by using these different planning/siting tools.

SUMMARY OF AFTERNOON DISCUSSION TOPICS

The following issues were discussed during the afternoon discussion period:

1. Water quality standards for stormwater

   --what about baseline data to help set those standards?
   who would collect/monitor/process this data?

   --how would standards be implemented?
   for new development?
   for retrofitting existing systems?

   --how might we structure state/local partnerships?

   --the designated watershed approach is the way to approach this issue in a comprehensive fashion

   --in the interim, the county could pursue the approach established by the Indian Hill PUD precedent, with performance standards and a monitoring program required for any major rezoning

   --also in the interim (and in the future), OCRM should be brought in earlier in the development permitting process so that they can identify potential BMP design solutions that are better than the minimum standards established in the state's regulations

   --regarding the retrofitting of stormwater controls by local government, the local government could get help from OCRM and/or DNR in designing the systems (for water quality considerations) and the local governments could establish on-going monitoring programs of the retrofit's performance

2. Enforcement of standards
   --who would do this?

   --who would pay for this

   --how might we develop state/local partnerships to accomplish this?

   --generally, the authority to get folks to clean up problems already exists

--bigger problem is identifying the problems in the first place (inspection and monitoring, which is related to available staff resources at both state and local level)

--larger development projects (e.g. Del Webb) are not the biggest concern because agency staff are more heavily involved with those projects

--real problem is the cumulative impact of the many smaller projects around the county, there just isn't time enough to inspect the BMPs put in by all of the smaller projects

--there is a lot of informal cooperation now between the state and local folks, more staff time would even improve on this

--there is some potential for citizen monitoring (visual surveys), but mostly as a watchdog function because the government could not rely on citizen monitoring data to make an enforcement case

3. From a water quality standpoint, where should the bulk of new development be directed?

--can the state help answer this question?

S. C. Department of Natural Resources is obvious partner
county has some (but not all) GIS coverage
need to begin modeling non-point source impacts of specific developments, and Charleston Harbor Project's models should be available within the next year

--the designated watershed process (perhaps linked to OCRM's wetlands project) is the most comprehensive way to address this question

--in the interim, it might be helpful to pull together all of the available GIS information and organize a meeting for all relevant local planners and state agency people (DHEC, Archives & History, etc.) to get together and brainstorm about this broad location issue

--LCOG may have a role in helping implement these locational decisions, particularly when they extend across jurisdictions

--there is also a need for technical resources to make these locational decisions at the site level--models from the Charleston Harbor Project, OCRM's wetlands project, or from consulting firms would be very useful.

CLEAN WATER TASK FORCE
19 June, 1996
Meeting Highlights

The second of four scoping meetings was convened by the Clean Water Task Force (CWTF) at the Lowcountry District Office of the S. C. Department of Health and Environmental Control's Environmental Quality Control section. The purpose of the meeting was for the task force to receive information from local and state agencies on matters related to wastewater management. Participants included:

Bill Marscher--CWTF
Summer Rutherford--Beaufort County
Emmett McCracken--CWTF
Penny Cornettt--DHEC
Robert Boyles--Sea Grant
Catherine Speth--SCCCL
Dean Moss--BJWSA
Beth Grace--CWTF
Howard Davis--CWTF
Debra Hernandez--DHEC/OCRM
Anthony James--DHEC
Laura McIntosh--CWTF
Bob Latimer--DHEC
Bob Klink--Beaufort County
Sandy Ward--LCOG
Brian Matthews--LCOG
Dick Hatfield--DHEC
Alessandra Delfico--Hilton Head
Lisa Hajaar--DHEC/OCRM
Russell Berry--CWTF
Woody Collins--CWTF
Mike Montebello--DHEC
Milt Rhodes--NOAA
Sam Passmore--SCCCL
Carol Tank--Beaufort County

The moderator pointed out that the goal of the task force is to come up with feasible, doable actions which would achieve two goals: clean up the already degraded surface waters in Beaufort County; and protect county waters from further degradation. Members of the task force welcomed the participants to the meeting and thanked them for their time and efforts on behalf of the task force.

An overview of the issues that led to the present conditions in Broad Creek and the Okatie/Chechessee/Colleton Rivers was presented. A number of points were made, including a discussion of the economic and ecological value of shellfish resources.

Presentation Topics and Highlights

Regional Water Quality Planning
Introduction to Section 208 of the Clean Water Act, which provides for the development of regional water quality plans (208 Plan). Primary purpose of a 208 Plan is to guide the location of wastewater treatment plants and to allocate wastewater service areas.

Highlights: (1) the need to manage at the watershed level, using tools such as 208 Plan (though there is a need for an "interim" measure) and the designated watershed approach and the absolute necessity of intergovernmental cooperation in watershed-level management; (2) issues surrounding criteria for setting sewer service boundaries, including the guidance from 208 Plans and strategies for

eliminating discharges by developing alternative disposal strategies; (3) the potential for secondary growth impacts from extending sewer service to new areas; (4) the need for baseline data and a GIS system capable of manipulating that data; (5) the need to determine the assimilative capacity of particular waterbodies; and (6) the issue of water quality standards and whether the task force might recommend upgrading standards for some waters.

Wastewater Permitting & Compliance
Overview of Clean Water Act and the South Carolina Pollution Control Act. Description of the various programs and policies established by these two pieces of legislation, and the authorities granted to DHEC by each. Review of wastewater facility permitting process, including regulations for land application of wastewater. Overview of wastewater facility monitoring program, including overviews of the National Pollutant Discharge Elimination System (NPDES) and No Discharge (Land Application) monitoring programs.

Highlights: (1) Provided that good judgement is used, permit standards for point sources and no discharge (land application) systems: (a) are sufficiently protective, (b) have a good bit of flexibility in setting performance standards, and (c) allow for significant public involvement; (2) pretreatment may be an issue on the horizon; (3) with respect to compliance, inspections occur frequently and the larger facilities generally do well; (4) overflows and other problems are generally dealt with well now; (5) new lines in sensitive areas can be constructed with high quality materials and with a great deal of oversight; (6) gravity sewer systems are often installed parallel to drainage ditches, and there needs to be some consideration given to the risks involved with siting lines by ditches and in sensitive areas in order to reduce risk of spreading pollutants in case of a break; (7) combined sewer overflows are not a problem in Beaufort County; (8) inflow and infiltration may have some influence on the problem, though infiltration seems to be a bigger problem than inflow; (9) there is some question about the effectiveness of closing areas based on (a) fecal criteria, and (b) administrative policies (e.g. around outfalls, marinas, etc.)

Local Sewer Service
Introduction of the management of local sewer services, including the policy of the county providing direction to the service provider as to where to locate new sewer service areas (if the county doesn't want sewer service extended to a particular location, the sewer provider will not put in lines there against the county's wishes). Reminder that the initiative for development comes not from the county, but from the individual landowner. Also, land application of wastewater makes Beaufort County a national leader, and officials in the area are targeting 100% wastewater reuse.

Highlights: (1) the county's comprehensive plan will define rural and urban areas, with rural areas to be served by on-site disposal systems (OSDSs) and urban areas served by sewer systems; (2) in areas with high concentrations of failings OSDS (likely to be considered urban), "retro-sewering" might be used to serve future

wastewater processing needs; (3) in more rural areas, alternative treatment systems will be needed to replace failing OSDSs, with the possibility of establishing a wastewater management utility to take care of these failing systems; (4) inflow/infiltration (I/I)--infiltration is a bigger problem than inflow, and problems are generally dealt with on an "exception basis"; (5) leakage/exfiltration is not a real problem; (6) need for back-up disposal alternatives, such as wetlands disposal, offshore disposal, or need for more open space (for non-recreation purposes) for land application (e.g. for 83 acre development, need 50 acres of open space for spray field); (7) location of spray fields brings up questions of standards for siting these facilities (e.g., suitability for wastewater disposal is not generally a criteria when designing golf courses); (8) in some instances agencies have required effluent used in land application near sensitive areas to be treated to a higher fecal standard (14 per 100 ml as opposed to 200 per 100 ml).

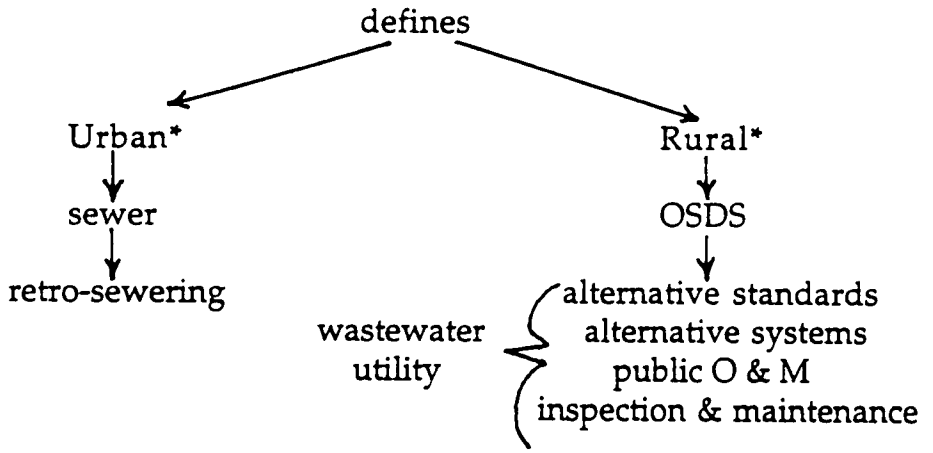
Septic Tank Permitting, Performance, Operation and Maintenance
Introduction to OSDS permitting (Beaufort Co. processes 800 ODSD permits/year, with a 4-5% denial rate). Overview of statewide survey (results showed OSDSs responsible for only 4% of statewide water quality problems). DHEC/OCRM is currently supporting 4 research projects looking at various OSDS issues.

Highlights: (1) need rationale for determining density limits for the county (accomplished through minimum lot sizes and/or setback requirements); (2) may need for new standards for new OSDSs, including design standards (new separation distance) and minimum lot sizes/setbacks); (3) standards are passed at the local level, but at what level is this program implemented?; (4) there may be a need for innovative/high-tech systems for marginal sites, including the possibility of public operation and maintenance programs and a wastewater utility; (5) the question of how to deal with inspection and maintenance of existing OSDSs, again with the possibility of a public wastewater utility (would participation be mandatory or voluntary?) (6) the 6" separation distance for OSDSs, while perhaps not perfect, enjoys much public support, and increasing the requirement for separation distance would lead to substantially higher OSDS permit denials.

SUMMARY OF AFTERNOON DISCUSSION

The afternoon discussion can be summarized by the following schematic diagram:

Beaufort County Comprehensive Planning Process



OCRM/DHEC/DNR/Sea Grant are resources, and there needs to be better cooperation between county and state in order to effect positive change in wastewater management

*Keep in mind the transition from rural to urban over time

There are large policy questions which must be answered in order for this schematic to work, such as:

who comes up with alternative policies?
who implements this grand plan?
who would pay for this plan?

Also, how do we relate land use, zoning/subdivision standards to septic standards?

perhaps digitize the BJWSA map and depict

--areas served by existing sewer systems

--existing buildings

CLEAN WATER TASK FORCE

26 June, 1996
Meeting Highlights

The third of four scoping meetings was convened by the Clean Water Task Force (CWTF, the Task Force) at the Lowcountry District office of the S. C. Department of Health and Environmental Control's Environmental Quality Control section. The purpose of the meeting was for the task force to receive information from state and local agencies on matters related to marine sources of pollution and nonpoint source pollution management programs. Participants included:

Russell Berry--DHEC
Colton Bowles--DHEC
Don Campbell--DHEC
Howard Davis--CWTF
Rob Dunlap--DNR
Linda Fagan--USCG
Beth Grace--CWTF
David Harter--CWTF
Debra Hernandez--DHEC/OCRM
Bill Marscher--CWTF
Steve Moore--DHEC/OCRM
Sam Passmore--SCCCL
Paul Scholz--NOAA
Maurice Ungaro--Beaufort County
Chris Bickley--LCOG
Robert Boyles--Sea Grant
Woody Collins--CWTF
Alessandra Delfico--Hilton Head
Doug Fabel--DHEC
Rheta Geddings--DHEC
David Graves--DHEC
Matt Hayes--Beaufort County
Bob Klink--Beaufort County
Laura McIntosh--CWTF
David Payne--DHEC
Milt Rhodes--NOAA
Carol Tank--Beaufort County.
Bob Van Dolah--DNR

The moderator pointed out that the goal of the task force is to come up with feasible, doable actions which would achieve two things: clean up already degraded surface waters of Beaufort County and protect county waters from further degradation. The task force welcomed the participants to the meeting and thanked them for their time and efforts on behalf of the task force.

An overview of the issues that led to the present conditions of Broad Creek and the Okatie/Chechesse/Colleton Rivers was presented. A number of points were made, including: there are a number of potential sources on both waterways which may have led to the closure of shellfish harvesting areas there. In order to help determine the sources of the pollutants in these waters, DHEC has increased its sampling frequency from 6 times a year to monthly.

Presentation topics and highlights:

Water Quality Impacts from Boating
An overview of the relationship between boating and the coastal environment was given. This presentation touched on a number of direct, secondary and cumulative impacts from boating activities in coastal waters, including the impacts to water quality from boat wakes, the introduction of greases and oils from boat docking

facilities, the potential for impacts from marinas, and the proliferation of docks and other "aesthetic intrusions" in the coastal environment.

Highlights: questions about controlling the impacts to shoreline from boats, who regulates boat traffic, and the establishment of boat wake regulations and no wake zones.

State Programs to Control Boating Impacts
Presentation on OCRM programs to deal with marine sources of pollution and other environmental impacts, including a discussion of OCRM's marina permitting process and some of the problems in the current regulation of marinas. These problems include: the ambiguity of what constitutes a marina, the lack of coordination between state and local governments in marina permitting, and the failure of current programs to manage cumulative impacts. In addition, the water quality certification program and Section 401 of the Clean Water Act were discussed, with some emphasis on the water body classification scheme.

Highlights: Cumulative impacts and the difficulty in identifying these impacts simply through science–zoning ordinances are an expression of what a community wants to be (not grounded in science but in public choice), and some kind of zoning scheme might be a way of addressing aesthetic, cultural, and environmental concerns of uses of both upland shorelines and waterbodies. The need for better coordination between state and local government (perhaps modeled after OCRM's MOA with local governments laying out the sequence of decisions for marina permitting). The usefulness of the designated watershed approach and special area management plans to address environmental degradation. The need for coordinated and shared information on resources (perhaps an integrated GIS might be a mechanism to achieve coordination/opportunistic monitoring). Boat no wake zones are a way to minimize impacts to shorelines from boats, though these zones have traditionally been established for safety concerns, and enforcement of these no wake zones has been problematic. The problems associated with the ambiguous (and inconsistent) definition of marinas. The important role of DNR in determining which shellfish waters have true shellfish potential and DNR's role in permitting marinas in shellfish growing waters. The need to forecast and plan for increased boating activity.

Federal Efforts to Manage Boating Impacts
Overview of U. S. Coast Guard regulations concerning discharge of marine sanitation devices (MSDs); the provisions of the international treaty to control marine pollution (MARPOL); and regulations under the Oil Pollution Act of 1990.

Highlights: there exists the authority for the regulation of boat waste (particularly from MSDs), but there is a tremendous lack of inspection/enforcement of those regulations; EPA is responsible for establishing the no discharge zones, and this is indicative of the larger problems of holes in and confusion over enforcement jurisdiction; also, there are questions whether state agencies can enforce local

ordinances/regulations if those ordinances/regulations are more stringent. The issue of educating the boating public on the impacts of boat waste on the environment.

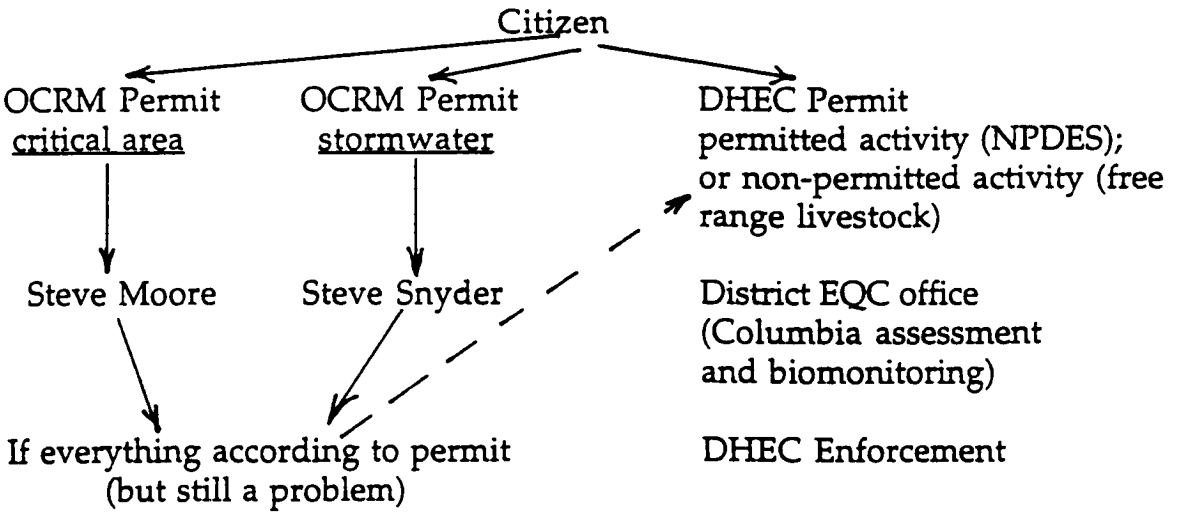
Coastal Zone Non-Point Source (NPS) Program
Overview of Section 6217 of the 1990 reauthorization of the Coastal Zone Management Act, highlighting South Carolina's efforts in controlling coastal NPS. OCRM is expecting comments from the NOAA/EPA review of the proposed program for South Carolina within a few weeks.

Highlights: there is a need to sharpen the focus in the meaning of NPS; need to measure what's happening at both the stormwater outfall AND the receiving waterbody; the cumulative impacts of NPS are poorly understood and even more poorly addressed within the current program; enforcement and monitoring of coastal NPS is difficult with current resources; EPA may have some concerns about the state's program to manage non-point source pollution from agriculture, forestry, on-site disposal systems, and retrofitting urban stormwater sources.

Non-Point Source Pollution Grant Program and Assessment/Enforcement Activities
Presentation on DHEC's approach to watershed management, including the division of the state into 5 watersheds and the NPS planning/assessment/ remediation process. The identification of problem water bodies within each watershed. The Section 319 (of the Clean Water Act) grant program administered by DHEC, including proposal process and eligible activities.

Overview of DHEC's activities in assessing NPS in particular waterbodies and their response to problems (via citizen complaints and public input). Problems associated with rectifying problems with non-permitted activities.

Highlights: Path of action for assessment/enforcement can be described by the following schematic diagram:



Citizen monitoring might be helpful in identifying problem areas.
The state would need to verify data or at least have an approved Standard Operating Procedure for handling data from citizens.
The "water watch" program might serve as an opportunity to incorporate citizen monitoring.
There is a tremendous need for background/baseline data.
NPS prevention is best done at the local level, but there is a great need for education and outreach programs to implement this.

The summarizing question: with the proposed investment in relying on volunteer monitoring, how much of an improvement will there be (in water quality) over the status quo? Challenge: Citizens might be better served to work to change local policy to help prevent problems rather than expend their limited resources on aiding enforcment in a more reactive mode. The best way to remedy water quality problems is to develop good working relationship with the potential violators.

There are limits to science's ability to support policy making process; if we wait to conclusively proof that some unregulated activities are causing the problems, the resource will be lost.

CLEAN WATER TASK FORCE

2 July, 1996
Meeting Highlights

The last of four scoping meetings was convened by the Clean Water Task Force (CWTF, the Task Force) at the Lowcountry District office of the S. C. Department of Health and Environmental Control's Environmental Quality Control section. The purpose of the meeting was for the task force to receive information from state and federal agencies on matters related to forestry and agricultural sources of pollution. Participants included:

Tim Adams--SCFC
Chris Bickley--LCOG
Woody Collins--CWTF
Alessandra Delfico--Hilton Head
Walter Early--NRCS
Jason Gilespie--DHEC
David Harter--CWTF
Bob Klink--Beaufort County
Von McCaskill--Clemson
Barbara Neale--DHEC/OCRM
Sam Passmore--SCCCL
Catherine Speth--SCCCL
Maurice Ungaro--Beaufort County
Russell Berry--DHEC
Robert Boyles--Sea Grant
Howard Davis--CWTF
Rob Dunlap--DNR
Bob Eddleman--NRCS
Beth Grace--CWTF
Matt Hayes--Beaufort County
Bill Marscher--CWTF
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Presentation topics and highlights:

Forestry/Silviculture Best Management Practices (BMPs)
Introduction to forestry practices, with particular emphasis on effects of timber harvest on water quality. Overview of S. C. Forestry Commission's study of effectiveness of BMPs for timber harvesting operations. Monitoring and compliance with timber BMPs. Industry's role in the "top logger" program.

Highlights: With respect to forestry impacts to water quality, voluntary operational standards (BMPs) seem to be working; the timber industry's "sustainable forestry initiative" seems to work too -- and establishes higher standards in some cases than the SC Forestry Commission's voluntary BMP program. Compliance with BMPs is high, particularly in the coastal plain (about 90%). For the most part, the large timber companies follow BMPs and encourage independent loggers to participate in the state's "top logger program." Enforcement against the "bad apples" may be a weak link. DHEC can use the Water Pollution Control Act to "enforce" BMPs. DHEC uses macroinvertebrate monitoring, and the Forestry Commission uses it too to determine general levels of compliance and performance of the BMPs. Also, who notifies authorities about problems? Timber harvest followed by conversion of timberland to urban uses is a weak link. The stormwater act apparently does not cover this, and Beaufort County only requires that they be notified of any logging operation planned in the county. This provides a loophole for getting around stormwater regulations; compliance with BMPs may be an issue.

Two Compliance Pathways

Mandatory (not current practice)	Voluntary (current practice)
How: expand county notification rule to require compliance	Based on industry self-compliance Union Camp, other mills & timber buyers could help improve compliance

Agricultural BMPs and Confined Feeding Operations

Introduction to the Natural Resources Conservation Service (formerly the Soil Conservation Service) and the assistance (financial and technical) available from NRCS. Eligibility requirements for financial assistance through NRCS. DHEC's regulations for the management of confined animal operations, and the steps necessary to fix water quality problems traced to these operations.

Highlights: In southern Beaufort County, agricultural sources of water pollution are limited in number and likely to decline over time. Services of NRCS are at the invitation of the landowner and are applicable to both row crop and range livestock (horse farm) operations. There are several inducements to minimizing impacts from agricultural sources: (1) avoid enforcement action under the Pollution Control Act; (2) financial/cost-sharing available from NRCS; (3) market demands for "clean" produce; and (4) demands from "market integrators," similar to how it works in the timber industry.

Confined feeding operations are not a problem in Beaufort County, in part due to the fact that no "market integrator" is located close-by. The definition of a confined feeding operation is based on density of animals and proximity to waterbody. Zoning could be used to rule out the possibility of confined feeding operations, but you may run into some equal protection concerns. Aquaculture is

covered by general NPDES permit below a certain size; above that size, aquaculture operations are permitted as confined feeding operations. The use of incentives and education (instead/alongside of regulations) at the local level to help manage agricultural operations is recommended.

Pesticide Regulation

Introduction to Clemson University's role in regulating fertilizer and pesticide use in the state. Overview of Pesticide impacts to water quality, with emphasis that homeowner application of pesticides to lawns and gardens is the biggest pesticide problem in Beaufort County. The innovative role of the Coastal Pesticide Advisory Committee (CPAC) in reducing pesticide impacts to water quality. The significance of household hazardous chemicals and the problems of disposing of them properly.

Highlights:

Acute problems event-related PCA can regulate	vs.	chronic (sub-lethal) problems long-term impacts not permitted & difficult to enforce under PCA

Pesticides are less of a problem, though there are problems where they are applied along rights of way. Homeowners and golf courses can be the major source of fertilizer problems, and there is a problem in reaching homeowners. There is no provision for local pre-emption of state pesticide/fertilizer regulations. There is a need for an on-going household hazardous waste disposal program --as opposed to the occasional "day.". Clemson is available to assist the task force; one potential idea was to spend a day with all of the golf course superintendents to review their management practices. Need to worry about nitrates, problem pesticides, and then do bioassays for pesticide impacts, and need to focus on source reduction (rather than stormwater treatment).

Concluding Discussion

Question: What would you do if you were working full-time on the Okatie River? What new tools or policies, if any, would you like to have?

Answers:

1) a complete source assessment survey, and then figure out how to improve management/control of each identified source
2) education -- need to convince people that they are part of the problem before regulating them or asking for money
3) monitor stormwater outfalls for discharge of specific pollutants; require retrofits when standards are not met
4) use fatty acid profiling to fingerprint sources
5) pre-development monitoring to establish a baseline
6) establish policy that no one's drainage will affect neighboring property
7) remember that timber is the best land use from a water quality perspective

8) make better use of existing timber program, with the help of Union Camp, Forestry Commission, others
9) never abandon science as the principal basis for public policy
10) balance need for good science and the need to eventually act to save the resource
11) be careful of the scale of action before you can prove something is a problem

Clean Water Task Force Review Document List

10/1/96

No.	Subject and Title	Author	Date	Comment
	Agriculture			
1	Wetlands Reserve Program Brochure	National Association of Conservation Services	March, 1995	Explains program
2	Conservation Choices Booklet	USDA	1994	30 conservation and environmental choices for Farmers
3	Conservation Practices Protect Water	USDA	Sept.1993	Various conservation Practices that protect Water quality
4	Wetlands: Facts, Regulations and responsibilities Brochure	USDA	Undated	
5	Summary of 1996 Farm Bill Conservation Provisions	USDA	April, 1996	
6	People in Partnership for a Healthy Land	USDA	March, 1995	Promotional
	Boating Impacts			
10	Marine Sanitation Device	USCG		Regulation for boat toilets and refuse
11	Waste Woes	Island Packet	May 9, 1996	Story of impact of boat waste and associated problems
12	The Role of Boat Wakes in Shore Erosion	Maryland Coast Report #5	May, 1981	Posted 6 knots maximum boat speed causes maximum wake. Near shore high frequency passage causes most problem
13	Boat Wakes Impact Creeks	Page 4 of ?	?	New research send wake-up call.
14	Environmental Impact of Small Boat Navigation	Coastal Zone (Magazine?)	1993	Sufficient information exists to address problem of boat wakes. Long list of literature cited.
	Citizen Involvement			
20	South Carolina Water Watch Program	DHEC		Outline of program to involve citizens in protecting water resources
21	Creek and Beach Watch	OCRM		Help catch violators who harm creeks and rivers
22	Stewardship Development Program	DNR	1995	Recognition of appropriate projects
	Drainage Projects—Local			
28	Summary of 1996/97 Hilton Head Drainage Projects	Town of Hilton Head	April 16, 1996	Projects and costs
29	Beaufort County Stormwater Drainage Management Plan	Beaufort Engineering Services for Beaufort County Council	September, 1994	Essentially a get-the-water-off-the-land plan

	Forestry			
34	SC's Best Management Practices for Forestry	SC Forestry Commission	March 1994	Guide for forest landowners. Suggested, not mandatory.
35	Effectiveness Monitoring of Silvicultural BMPs in SC	Tim Adams, et. al.-SC Forestry Commission	SJAF 19(4) 1995	Determined that BMPs are adequately protecting State's streams.
36	Implementation Monitoring of BMPs on Harvested Sites in SC	SC Forestry Commission sponsored	Sept. 1994	BMPs are 89.5% effective.
	Golf Course Impact			
37	Greening up Greens	David Salvesen inb Planning Mag.	August, 1996	Chemicals on golf courses
38	Toxic Fairways	Dennis Vacco for EPA	Dec, 1995	Ground water contamination by golf courses
39	Audubon Article			
	Land Planning and Water Quality			
40	The Cip: A Planning Commission's Powerful Tool	The Commissioner	Spring 96	The capital improvements program as a powerful tool
41	Community Planning that Works	Anne Tate & Joel Russell	Jan/Feb 93	Story of Brunswick, Maine planning in Planning Comm's Journal
42	Current Zoning Raping the Dutchess Countryside	Joel Russell in The Voice Newspaper	6/13/90	True rural zoning is possible. Clustering is an answer.
43	Follow Europe's Lead on Zoning	Joel Russell in The Voice Newspaper	1/3/91	Sucessful zoning in Europe
44	Development Plus Conservation Add up	Joel Russell in The Voice Newspaper	9/10/89	Hudson Valley experience
45	Zoning Codes More Critical than Master Plans	Joel Russell in The Voice Newspaper	11/30/88	The devil is in the zoning details
46	Residential Development of St. Helena: An Analysis of Options	SC Coastal Conservation League	Dec. 1994	In consultation with residents, options are suggested.Based on numerous consu;tations with
47	Emerging Trends in Community Planning and Design	Livable Places Update	Jan./Feb. 1995	As titled
48	Surburban Life Losing Luster to Ctrime and DEcay	Nation Public Radio	3/15/95	Radio Discussion
49	Rethinking Conventional Zoning	Joel Russell in Planning Commissioners Journal	Summer 1994	AS titled.

50	The Opportunities and Risks of Developer Easements	Joel Russell in Land Trust Alliance Exchange	Winter, 1993	Conservation easements
51	Lot Sizes and Residential Density	Joel Russell in Planning News	Spring, 1994	A discussion
52	Zoning for Traditional Neighborhoods	Duany, Plater-Zyberk & Shearer In	Land Development Mag. Fall, 1992	How to.
53	Conservation Subdivision Design	National Land Trusts Mag.	Feb. 1995	Conservation Easements how to.
54	With Zoning, You Get What You Ask For	Joel Russell in Pougekeepsie News	Oct. 1990	A discussion
55	Principles of Rural Zoning	Joel Russell-Woodlea Associates	?	Principles outlined
56	Maintaining Small Town Character (book exerpt)	Rural by Design (book) Randall Arendt	1996	Down-zoning discussion
57	Rural Development Guidelines	Dutchess County Planning Dept. by Russell, Chellman & Tate	Oct. 1994	How to guidelines
58	Regulatory Techniques for Preserving Open Space	Joel Russell in Land Trust Alliance Exchange	Fall, 1990	Discussion
59	Heritageb Landscape's Survival May Depend on Public Purse	Sam Passmore-SC Coastal Conservation League	Recent	A collection of short discussions of Lexington, Kentucky and other communities planning efforts
60	Roots and Wings-Building Sustainable Communities	Lamont Hempel of Center for Politics and Economics	Jan., 1996	For League of Women Voters, a broad discussion
61	Land Trusts and Community Planning: Reaching a BroaderConstituency	Joel Russell in Land Trust Alliance Exchange	Winter, 1995	Communities need therapists rather than planners
62	Curbing the Surburb's Voracious Sprawl	Maryland Business Record Newspaper	Sept. 16, 1996	Discussion of Maryland's problem.
63	Home From Nowhere	Howard Kunstler in Atlantic Monthly Mag.	Sept., 1996	Can Momentum of sprawl be halted?-a 20 page discussion with numerous pictures.
64	Getting the Rein on Runoff: How Sprawl and Traditional Town Compare	SC Coastal Conservation League Bulletin	Fall, 1995	Sprawl produces almost twice the pollution as traditional towns
65	Site Planning for Urban Stream Protection	Washington Council of Governments	Dec. 1995	

	Laws, Ordinances and Regulations			
	Federal			
75	Federal Clean Water Act	DHEC slide prese	N/A	Overview of the 1987 Federal Water Quality Act impact on SC and resulting state programs
76	Water Quality Certification State Regulation 61-101	DHEC	June 23, 1995	Management Programs Can Help Small Communities
	South Carolina			
77	South Carolina Water Pollution Control Act	SC Legislature Law 48-1-10, 1976	1976	need copy
78	The Stormwater Management and Sediment Reduction Act (State) [SMSRA]	SC Legislature	Most recent version of 1991 Act	State response to Federal Clean Water Act. Establishes statewide stormwater management program. Delegates coastal county regulation to OCRM
79	Standards for Stormwater Management and Sediment Reduction (State Regulations)	State Land Resources Conservation Commission published in SC Register Vol. 16, Issue 6	June 26, 1992	Statewide Regulations encouraging Watershed approach, designated watersheds and allowing local governments to apply for local programs
80	Water Classification Standards Regulation 61-68	DHEC	As of May 15, 1995	Rules for managing and protecting the quality of surface and ground water, both fresh and salt
81	Classified Waters-Regulation 61-69	DHEC	?	Classifies all State fresh and salt water bodies as ORW (Outstanding Resource Waters), SFH (Shellfish Harvesting Waters), TN (Trout-Natural) and TPGT (Trout-Put, Grow & Take)
82	Water Classification and Standards-Regulation 61-68	DHEC	4/27/90	Standards including antidegradation rules which state that "existing water uses and level of water quality...shall be maintained."
83	Individual Waste Disposal Systems-Regulation 61-56	DHEC	June 27, 1986	The septic tank regulations!
83A	NPDES General Permit for Stormwater Discharges for Construction Activities (State)	Don't have Copy		
83 B	Information and Criteria for Section 319 Mini-Grant Proposals	DHEC	undated	How local governments and other organizations can apply for a portion of $100,000 nonpoint source money.

	South Carolina—OCRM			
84	OCRM Guide to Important Coastal Programs (includes SAMPS)	OCRM	August 2, 1993	Excellent summary of regulations for coastal wetlands, docks, stormwater management, mitigation, special area management plans (SAMPS) and appeals.
85	OCRM Regulations	OCRM/DHEC	June, 1995	Deals with project standards for tidelands, coastal waters beaches and dunes. Does not include stormwater management
86	OCRM South Carolina Stormwater Management and Sediment Control-Handbook for Land Disturbance Activities	OCRM/DHEC	September 1995	Compilation of SC stormwater management regulations. Sets forth standards and design specs. Based on Stormwater Mgt. & Sed. Reduct. Act and NPDES General Permit for Construction Activities. Includes additional coastal zone regulations
	Local			
95	Stormwater Management Ordinances for Local Governments	EPA	Dec, 1990	General discussion
96	Local Ordinances, A users Guide (excerpts)	Terrene Institute for EPA	1995	Chap.1-Regulating Runoff, Chap.2-Controlling Onsite Disposal Systems, Chap.3-Maintaining Vegetative Buffer Zones, Chap.4-Establishing Wildlife Corridors, Chap.6-Protecting Wetlands, Chap.7-Planning Docks and Other Water Dependent Structures
97	Beaufort County Development Standards Ordinance Article V-Site Design Development Standards	Beaufort County	Current	Includes Section 5.4. Stormwater Management Standards
98	Beaufort County Development Standards Ordinance Section 4.25-River Protection Overlay District	Beaufort County	Current	Applies only to ORW in Southern Beaufort County.
	Lowcountry Council of Governments (LCOG)			
105	Lowcountry Areawide Water Quality Management Plan-Draft	LCOG	June 7, 1996	Not sure how this fits in, however LCOG approves Wastewater treatment facilities?
	Miscellaneous			
108	Del Webb 401 Certification	DHEC	December 21, 1993	By DHEC

	Nonpoint Source Pollution			
115	Nonpoint Source Management Program (State)	DHEC-OCRM & EQC	October, 1995	Describes how State will address NPS pollution problems from agriculture, forest, urban, marinas & boating, hydrologic/wetland modification, mining and solid waste. An excellent overview. Statewide program is funded
116	6217 Coastal Nonpoint Source Pollution Program Facts at a Glance (State)	DHEC-OCRM-Hernandez	undated but recent	Authorized under the Federal Coastal Zone Management Act Section 6217. Program is unfunded. Seems to overlap Statewide program.
117	NPS Proposed Study Plan-New River	DHEC-Sasnett, et. el.	December 13, 1995	Four page internal DHEC letter
118	Testimony on Section 6217	SCCCL/Passmore	September 14, 1993	On SC plans to implement 6217 especially watershed mgt and septics
	Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters	US EPA	January, 1993	Issued under Section 6217 of Coastal Zone Management Act.
120	Controlling Urban Runoff: Designing a Nonpoint Source Management Program	Chapter 2 of A Guide to Protecting Urban Environment.	undated	As titled
121	Nonpoint Source News-Notes	Terrene Institute	April/May, 1996	Variety of Articles
	SAMPs			
128	Ashley River Special Area Management Plan	OCRM and SC Dept. of Archives and History	Feb., 1992	Presentation of plan
129	Charleston Harbor Project Brochure	OCRM	undated	Summary
	Shellfish Pollution			
135	Beaufort County Shellfish Water Status	Marscher based on undated DHEC single sheet status report	September 19, 1996	Shows that out of 316,661 acres of Beaufort County shellfish waters 46,873 acres are either prohibited to shellfishing or severely restricted.
136	Shellfish Restoration Efforts in Beaufort County	David Payne/DHEC presented at Scoping meetings	June 1996	Overview of efforts to determine source of pollution in Broad Creek and Okatie River.
137	Summary of Saltwater Bacteria Data 1990-1994 (Trends 1980-1994)	David Payne/DHEC	August 8, 1995	Charleston to Savannah River
138	Bacteria found along some beaches in SC	Island Packet news article (AP)	July 1, 1996	Stormwater discharged in ocean producing high oceanfront bacteria counts

	Stormwater Management			
145	Some Water Management Requirements	Handout at scoping meeting by ??	?	A summary of requirements imposed by six county governments, suggestion by Land Ethics and Advanced Technology Systems.
146	Storm Treat Systems	Storm Treat Systems Inc.	1995	A patented approach to treating stormwater
147	Constructed Wetlands are Big in Small Communities	Green-Water Environment and Technology	February, 1994	It works
148	Use of Belowground Storage Tanks to Manage Stormwater	Nedrow-Hydrocarbon Processing	January, 1996	Example of doing so
149	Novel Drainage System Saves Lake	Billings-Public Works Magazine	October, 1996	Example and explanation
150	New Stormwater Management Technology	Public Works Magazine	June, 1993	Explains SAGES System
151	Detention Ponds: The Positive and Negative	Silver-Public Works Magazine	April 1986	Discussion
152	Stormwater System Uses Underground Chambers	WATER/Engineering Management	May, 1995	System stores runoff from 117,163 sq. ft. bldg.
153	Highway Design Considers Stormwater Drainage and Treatment Options	Romero-Lozana-Public Works Magazine	January, 1995	Discussion of options
154	Stopping Stormwater Pollution At Its Source at	Roesner & Hobel-Public Works Magazine	December, 1992	Discussion of Problem and solutions
155	Stormwater Treatment with Alum	Harper & Herr-Public Works Magazine	September, 1992	Discussion
156	The Effects of Continuous Application of Aluminum Sulfate to Lotic Benthic Invertebrates	Barberio-Lake and Reservoir Management	1988	Are effected
157	Long Term Evaluation of Three Alum treated Lakes	Garrison & Knaur-Lake and Reservoir Management	1982?	Short live benefits
	Stormwater Management-Chesapeake Bay			
175	Chesapeake Bay Basin Urban Nutrient Loadings and Reduction Estimates- Executive Summary.	Report to EPA by Metropolitan Washington Council of Governments	August, 1992	Strongly indicates need for better planning for growth to avoid pollution of Chesapeake
176	Chesapeake Bay CommunitiesMaking the Connection	EPA for Chesapeake Bay Program	April, 1996	Summary of stormwater programs in various communities
177	Controlling Urban Runoff	Thomas Schueler	July, 1987	Manual for designing urban BMPs
178	Urban Stormwater Runoff Contamination of Chesapeake Bay: Sources and Mitigation	Natural Resources Defense Council	Nov. 6, 1991	As titled

179	A better Way to Grow	Chesapeake Bay Foundation	1996	A guide to responsible growth
180	The State of the Chesapeake Bay 1995	EPA Chesapeake Bay Program	1996	Status report
	Wetland Buffers			
190	Wetland and Stream Buffer Requirements- A Review	Castelle in Journal of Envirinmental Quality	1994	As titled
191	The Benefits of The Buffer	Rachel Wharton in Coastwatch Mag.	July, 1996	As titled
192	Riparian Buffer Strategies for Urban Watersheds	EPA by Herson-Jones	Dec., 1995	As titled
193	Vegetated Buffers in the Coastal Zone: A Bibliographt	Rhode Island Sea Grant	July, 1994	Bibliography
194	Vegetated Stream Riparian Zones: Effects on Nutrients, Sediments and Toxic Substances Bibliography	Smithsonian Envir. Research Center	May, 1996	Bibliography
	Wastewater—Centralized Treatment Systems			
200	Hilton Head Area/Beaufort County Discharges		June 19, 1996	Details of Hilton Head and Calliwassie discharge permits
201	List of Treatment Facilities in Beaufort, Jasper, Colleton, and Hampton Counties	DHEC presented at CWTF scoping meeting		List of Facilities, Watershed, County Mgt. Agency, MGD effluent, Permitted effluent and Permit number.
202	Facility Monitoring Program	DHEC presented at CWTF scoping meeting	June 19, 1996	Summary of self monitoring program
	Wastewater—Onsite Treatment Systems			
208.9	Assessment of Septic Tank Regulations in SC and SE States and Their Potential Cumulative and Secondary Impacts to Coastal Waters	DHEC/OCRM	August, 1944	In preparation for implementing CZMP projects. Critical of SC regulations. Presents eight recommendations which caused much controversy.
209	Evaluation of Individual Sewage Disposal Systems in Bft. County SC	Soil and Materials Engineers Inc.	December 27, 1985	Study based on Soil Conservation Service Soils map. Very controversial conclusions
210	1995 Systems Performance Survey	Richard L Hatfield-Onsite Wastewater Management Bureau	July 19, 1995	Inspection of 720 septic systems
211	Letter re SC septic regulations as apply to 6217 management criteria	B.L. Carlile and Associates	November 20, 1993	Critical comments about SC regulations
212	Septic System Project Overview	Presentation slides by LISA Hajjar-DHEC/OCRM	June 19, 1996	Status report of project to determine if current onsite regulations protect water resources in coastal SC.

213	South Carolina Threshold Review (excerpt)	EPA/NOAA	December, 1993	Comments on new onsite provisions of Proposed Coastal Nonpoint Program
214	Advancing the Development of Decentralized Wastewater technology	Nelson in Land Development Mag.	Spring. 1996	innovation and research
215	Ultra-Shallow Placement with Fill Cap Individual Systems	DHEC	Sept.1991	Survey of systems
216	A Private Market Approach to Onsite Wastewater Treatment Maintenance	Herring in The Small Flows Journal	Winter, 1996	A new approach
	Wastewater Management Districts			
220	Waste Water Management District- A Starting Point	The Sate of Rhode Island	Dec., 1987	Discussion
221	Management Programs Can Help Small Communities	Pipeline-National Small Flows Clearinghouse 800-624-8301	Spring, 1996	Small Communities Wastewater issues explained to the public.
	Water Quality Assessments—State			
225	Statewide Water Quality Assessment-86/87	Environmental Quality Control Bureau-DHEC	FY 1986-87	Section 305(b) Fed. Water Quality Act
226	Statewide Water Quality Assessment-92/93	Environmental Quality Control Bureau-DHEC	FY 1992-93	Section 305(b) Fed. Water Quality Act
227	SC Water Quality Assessment	Environmental Quality Control Bureau-DHEC	March 1996	Section 305(b) Fed. Water Quality Act
228	State of South Carolina Monitoring Strategy for Fiscal Year 1996	DHEC	current	Includes stations in Beaufort County monitored for various contaminants other than Coliform.
	Water Quality Studies			
233	Broad Creek Non-Point Source Pollution prevention Project Application for Mini-grant	Town of Hilton Head	8/6/96	Contact Town of Hilton head for more information
234	Potential Sources for NPS Introduction of E.coli to Tidal Inlets	Geo. Simmons, Dept. of Biology, VPI	very recent	Discusses fatty acid profiles as means of determining if E.coli source is animal or human.

235	Urbanization and SE Esturine Systems (USES) Volumes I & II	NOAA sponsored by School of Public Health USC, Belle Baruch Institute USC and NMFS Charleston-- Geoff Scott and Al Fortner	February 9, 1995	Study of stormwater runoff effects on biomass of estuaries. Polycylic aromatic Hydrocarbons (PAHS) concentration is significant. PAHS seemed to cause increased growth of coliform. PAHs also seemed to cause a decrease in grass shrimp and copepods
236	Survival of Fecal Coliform and Streptococci in Storm Drain Sediment	Marino & Gannon- Univ. of Michigan	March, 1991	Applicable scientific report.
237	Role of Bacteria and Protozoa in removal of E-coli from Esturine Waters	Enzinger & Cooper Univ. of California/Appli ed an Environmental Health Sciences	May, 1976	Protozoa predators do not effect E-coli
238	Separate and Combined Effects of Solar Radiation, Temperature, Salinity. and	Solic & Krstulovic- Marine Pollution Bulletin, Vol.24	1992	Points out that subjects do effect Coliform
239	Nonpoint Pollution from Animal Sources and Shellfish Sanitation	Stelma & McCabe-Journal of Food Protection	August, 1992	Do not allow more lenient standards until more is known, although no evidence that animal pollution causes sickness
240	Treatment of Solids and Petroleum Hydrocarbons in Storm Runoff with Onsite Detention Basin	Latimer, Mills, Hoffman Quinn- Univ. of R.I.- Bulletin of Contam. Toxicol.	1986	70% suspended solids, 65% suspended hydrocarbons settled in 32 hours. Use of detention basins is effective way to reduce pollutant impact on receiving waters.
241	Detection and Disinfection of Pathogens in Storm-generated Flows.	O'Shea & Field- EPA	October 23, 1991	Today's fecal based indicators provide no information on risks resulting from body contact with certain nonenteric pathogens. Reviews development of current standards.
242	Methodologies and Mechanisms for Management of Cumulative Coastal Environmental Impacts	Marine Law Institute-Univ. if Main sponsored by NOAA	September, 1995	A broad document including background, issues, assessment and management methodologies programs and, legal issues.
	Watershed Quality Management			
248	Designation of Certain Beaufort County Waters as Designated Watershed	Barry Connor	April 12, 1996	Discusses title subject and attaches State regulations as to how to accomplish.
249	Watershed Water Quality Management Strategy (Savannah-Salkehatchie Watershed	DHEC	Reprinted August, 1994	DHEC response to Section 208 of Federal Clean Water Act

250	Water Can Unite Us	New Jersey Future	November/December 1995	Finding common ground in watershed based management.
251	Coastal Watersheds Are Important to Counties	County Environment Quarterly	Spring, 1996	About the National Association of Counties' Coastal Watershed Advisory Committee activities.
252	Watershed Water Quality Management Strategy Program Description (State)	DHEC	Undated	Discussion of State Watershed Water Quality Management Strategy Components
253	Port Royal Sound Environmental Study	SC Water Resources Commission	November, 1972	Result of BASF. Very Comprehensive.
254	Broad and New River Watersheds Wetland Conservation and Management Plan Project	OCRM	1996	Single page map sowing boundaries
255	Watershed Paradox	Reed Holdman in California Coast and Ocean Mag.	Summer, 1996	Why watersheds are a hot topic

Zero Degradation Ad Hoc Advisory Committee Members

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December 18, 1996

The Honorable Thomas C. Taylor, Chairman
County Council of Beaufort County
Post Office Drawer 1228
Beaufort, SC 29901-1228

Dear Chairman Taylor:

In response to your request of September 06, the SCDHEC and the S.C. Sea Grant Consortium organized an ad hoc committee to evaluate what you referred to as the "zero degradation" approach to stormwater management. Your request included a list of questions you hoped to have answered.

Staff from the SCDHEC (the Bureau of Water and the Office of Ocean and Coastal Resource Management), the S.C. Sea Grant Consortium, the NOAA/National Marine Fisheries Service-Charleston, the U.S. Environmental Protection Agency Regional Office in Atlanta, the Lowcountry Council of Governments, and the Marine Resources Division of SCDNR participated as Committee members. Several observers participated in discussions. They included staff from Applied Technology and Management (ATM), the S.C. Coastal Conservation League, members of the Beaufort County Clean Water Task Force, the Beaufort County Engineer, and others. These observers were able to provide detailed information concerning questions from Committee members.

The Committee met at length three times in Charleston, and initially focused on clarifying your list of questions. Each Committee member was asked to develop written responses to the questions for consideration by the entire Committee. Based on those responses, additional questions were developed for response by Committee members. All the questions and responses were discussed in open meetings and answers refined through a process aimed at achieving group consensus. Responses obtained from Committee members and others are attached for your information.

The report and recommendations of the Committee are described below and contain specific suggestions for a Beaufort County stormwater management program. They are organized by the list of questions proposed in the attachment to your letter.

1. Is the "zero degradation" model theoretically sound?

The concept of preventing all pollutants contained in stormwater runoff from development activities from reaching adjacent natural waterbodies is not feasible (if the model intent of "zero degradation" is 100% removal of pollutants in runoff). None of the Committee members knows of any program nationally with such expectations. Florida probably has the most stringent development criteria, which includes a requirement for removal of 95% of pollutants for projects adjacent to their "Outstanding Resource Waters". Another term, such as, "antidegadation model", would be more appropriate for use since "zero degradation" implies post-development runoff quality identical to pre-development

quality. The term "antidegradation" also relates better to terminology used in State and Federal regulatory and planning programs.

In general, we agree that a feasible concept for a stormwater management model is one which 1)sets treatment targets or standards for post-development stormwater runoff, 2)implements monitoring projects which demonstrate that a selected system of best management practices achieves those targets, 3)monitors the effectiveness of those BMPs in protecting instream water quality and associated biological health, and 4)implements an enforcement program which evaluates compliance with goals and requires corrective action as needed.

In addition to new development design standards, other local activities are needed to ensure long-term prevention of the decline in the quality of waterbodies and to maintain ecologically healthy hometown rivers. Examples of such activities include land use controls that limit the volume of runoff at the source (for example, reduction in amount of impervious surface in individual projects and within the watershed), retrofitting existing development which contributes to polluted runoff, and implementing public education programs.

The criteria for design standards described in the attached written comments from the DHEC Office of Ocean and Coastal Resources Management is an excellent example of an approach we consider feasible and encourage you to consider.

The issue of how to pay for implementation of the anti-degradation model was discussed. The Committee agreed that some sort of fee system based on one or a combination of the amount of impervious surface, total project size, and proximity to water would be appropriate.

2. What Parameters should be monitored?

The selection of water quality parameters for monitoring should be based on a clear purpose for use of the results. It is not practical to expect to compare, via water quality monitoring, site specific pollutant loadings in pre- and post-development runoff. Costs for this would be prohibitive. A combination of monitoring which includes measurement of parameters in the receiving water body and its sediments, biological condition in receiving waters, and periodic sampling of the effectiveness of the on-site BMPs at developments is recommended. The County should assume responsibility for this program and should consider a development fee system to pay for it.

Monitoring parameters in water should be site specific, but generally should include:

> Fecal coliform bacteria, total suspended solids, nutrients, polycyclic aromatic hydrocarbons (PAHs), total organic carbon, pesticides, biochemical oxygen demand, dissolved oxygen, salinity.

In addition, rainfall measurements should be made as well as measurements of the volume of runoff from project sites where feasible. Sediments in receiving waterbodies at or near project discharges should also be monitored for contaminants accumulation.

SCDHEC staff are available to review and comment on any proposed monitoring strategy.

3. How should discharge limits be set?

Discharge limits which specify concentrations for parameters should not be set. Emphasis should be placed on meeting design criteria and ensuring their implementation and maintenance. As stated previously, demonstration that selected BMPs work as expected should be initiated in the County. See response to question 1.

4. How, and how frequently should the stormwater discharge be monitored?

It is not practical to monitor discharges at developments at a frequency to precisely determine performance of each stormwater management plan under all types of storm events. If monitoring adjacent to the development indicates degradation of the water body, investigations to identify and correct the source should be initiated.

Periodic monitoring of runoff from developments to estimate effectiveness of BMPs, at least once or twice a year during appropriate storm events, should be required, combined with a complete inspection and evaluation of the required BMPs. This should be combined with less frequent assessments of receiving water body conditions (1-2 year intervals). Costs for this should be the responsibility of the development or the County.

5. Is an "end of pipe" monitoring program sufficient?

No. If a monitoring program is limited to only "end of pipes", it will not be sufficient to determine adverse effects on receiving waters and whether degradation is occurring. The SCDHEC's trend

monitoring program is not specific enough to detect individual project impacts and more specific assessments mentioned in question #4 above would be needed.

6. Should provisions be made for repairs and retrofits?

Yes. Some entity must assume responsibility for ensuring adequate maintenance of BMPs and retrofitting if it is determined that the BMPs are not preventing degradation of receiving waters. One possible option is to establish a County stormwater utility which collects fees and assumes responsibility for stormwater management systems and/or the evaluation and enforcement of development stormwater management plans. This would likely be more cost effective overall. If developments accept responsibility for their stormwater management systems the details of this responsibility should be included in county approval of initial plans which are legally binding and enforceable. The county should have primary responsibility for enforcement.

We hope this report is useful in your deliberations. We applaud your efforts to protect your hometown waters and are ready to assist you further in any way possible.

Sincerely,

Chester E. Sansbury, Assistant Chief
Bureau of Water
SC Dept. Of Health & Environmental Control

M. Richard DeVoe, Executive Director
SC Sea Grant Consortium

CES:MRD:pgl
Attachments:
Ad Hoc Advisory Committee
Responses from:
1. DHEC Office of OCRM
2. SC Dept. Of Natural Resources, Marine Resources Division
3. SC Dept. Of Health & Environmental Control, Bureau of Water
4. National Oceanic & Atmospheric Administration, NMFS
5. Applied Technology & Management, Inc.

cc: Committee members and staff
Douglas E. Bryant, SCDHEC

bc: Sam Passmore

Recommended Sampling Program to Evaluate Habitat Quality In the Broad Creek and the Okatee/Colleton Drainage Systems

Introduction:

This document has been prepared in response to a request by the Beaufort County Clean Water Task Force to evaluate the quality of the Broad Creek and Okatee/Colleton estuarine drainage systems. Broad Creek is surrounded by a watershed that is extensively developed for urban and suburban land use. The Okatee/Colleton River is a relatively undeveloped watershed compared to Broad Creek, but development pressures may significantly alter the character of this drainage system in the future. The purposed scope of work would provide useful data on the physical and biological condition of various estuarine habitats within each of these drainage systems using a variety of physical and biological measures that are recommended by the South Carolina Department of Natural Resources, Marine Resources Division (SCDNR-MRD) and the South Carolina Department of Health and Environmental Control, Environmental Quality Control (SCDHEC-EQC).

General Sampling Strategy:

Due to the diversity of habitats in each area and the likelihood that some habitats are more impacted by land use activities than others, we recommend that each drainage system be divided into discrete sections (strata) for sampling. At least three strata are recommended for Broad Creek and four for the Okatee/Colleton River. The strata include a section representing the headwaters of each drainage basin, and 2-3 additional strata located progressively downstream along the length of each system. Within each strata, samples will be collected in both shallow tidal creek habitats and deeper open-water habitats in each drainage system. Sampling in the tidal creeks will be aimed at assessing those creeks that are likely to be most impacted by various upland developments. Sampling of the open water habitats will concentrate on subtidal bottom areas that are likely to be depositional, with sediments consisting of relatively high silt/clay content. Since each stratum is likely to contain multiple sites that are suitably representative, the sites would be randomly picked from the suite of those available based on analysis of aerial photographs, existing land use data, and/or preliminary sampling.

The recommended sampling effort will include at least two stations representing each habitat type (tidal creek and open-water subtidal bottom areas) in each strata (28 stations total). Based on data collected by the SCDNR-MRD, sampling in the tidal creek systems will be concentrated in the upper portions of each creek since this is where the maximum adverse effects have been observed in creeks sampled in the Charleston Harbor system. Additional stations adjacent to various point source discharges or other potential contaminant sources may also be included after a preliminary inspection of each system. All sampling will be restricted to the summer months to maximize comparison with existing data bases.

Sampling Components:

Sampling at each site would include measures of sediment quality (composition, contaminant load), water quality, and biological condition/response. While the recommended sampling effort does not include the most comprehensive assessment possible, it will provide sufficient data to characterize the conditions in each system while minimizing the expenses required for this study. The listing of recommended data or samples to be collected at each site is provided as a summary only. The specific sampling protocols can be provided at a later date, but will generally follow standardized guidelines recommended by the SCDNR, SCDHEC, USEPA or other relevant federal agencies.

Sediment Quality: Several measures of sediment quality are recommended for this study since sediments are very useful in providing information of historical contaminant loading to the system, and other measures that may adversely affect bottom-dwelling communities inhabiting the sediments. Sediment parameters that should be measured at each site include:

- *Composition* (percent silt/clay, sand, calcium carbonate, total organic carbon)
- *Priority Contaminants* (metals, PAH's, PCB's, and pesticides recommended by federal agencies plus selected pesticides commonly used in SC that are not on the recommended list. Detection limits should be at or below known threshold bioeffects levels)
- *Porewater Ammonia*
- *Acid Volatile Sulfides and Simultaneously Extractable Metals*

Water Quality: Several measures of basic water quality are required to assess the condition of each river system. Many of the recommended measurements should also include at least a 48 hr record to evaluate variability and maximum/minimum values obtained. Recommended measures include:

- *Salinity, temperature, pH, dissolved oxygen* (near bottom, and near surface for deep water sites, where feasible).
- *Turbidity*
- *Nitrate/nitrite, total Kjeldahl nitrogen, and ammonia*
- *Total Phosphorus*
- *Biological Oxygen Demand (BOD)*
- *Fecal coliform concentration and classification* - Lipid profile, DNA protein typing, API

DHEC has already conducted an extensive assessment of fecal coliform levels in Broad Creek and that agency's Shellfish Sanitation Program has an ongoing assessment of coliform levels in both estuarine systems as part of their state-wide assessment. Analysis of fecal coliform bacteria in this study will concentrate on evaluating the probable source of this contamination.

Biological Measures: Assessment of the estuarine biota in each system is critical to the overall evaluation of habitat quality. Rather than attempting to evaluate all biological assemblages, it is recommended that sampling be limited to the benthic (bottom dwelling)

communities living in the sediments, oysters, and grass shrimp populations. Sampling of finfish and crustacean populations are not recommended since data obtained from previous assessments have indicated that it is very difficult to interpret habitat quality based on trawl sampling of these assemblages.

Benthic macrofauna: These assemblages should be sampled at all locations (tidal creek and open water areas) using standardized grab (subtidal) or core (intertidal) sampling procedures. Various benthic metrics should be compared with other data collected in the state to evaluate whether the benthos are degraded.

Oyster Reefs: Oysters should be sampled to evaluate tissue contaminant levels and oyster condition (i.e. disease, condition, physiology indices). Where feasible, oysters should also be deployed to obtain growth measurements that can be compared with data collected elsewhere in the state. It is likely that the assessment of oyster reefs will be limited to the open water habitats (reefs along the shoreline) since oyster reefs are rarely present in the upper reaches of tidal creek systems.

Grass Shrimp Populations: Sampling conducted by NMFS have found that grass shrimp can provide a useful index of estuarine condition. Populations should be sampled using standardized procedures developed by NMFS to evaluate size structure, abundance, biomass, sex ratio, and reproductive output in existing populations.

Toxicity Assays: It is recommended that at least one bioassay be completed on composite sediment samples collected at each site. Based on data collected by the SCMRD, a bioassay using juvenile hard clams is recommended. This assay has proven to be the most sensitive of several bioassay protocols tested and it provides a measure of both acute (lethal) and chronic (effects on growth) stress.

Estimated Costs of the Study:

The total estimated costs to assess the 28 sites in both drainage systems using all of the measurements identified above is approximately $112 thousand. This does not include additional costs that would be matched by each agency with respect to professional time and some laboratory expenses. This represents an approximate cost of $4,000/station if all recommended parameters are measured. However, it should be realized that a reduction in the number of sites assessed would not necessarily result in a proportional decrease in study costs. A more detailed cost estimate can be provided by the SCDNR, SCDHEC and NMFS should Beaufort Countly desire to procede with this study.

END

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