

COASTAL GEORGIA: RELATIONSHIPS BETWEEN WATER RESOURCES & DEVELOPMENT

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Abstract. The coastal area of Georgia is one of the most environmentally sensitive regions of the state and is rapidly developing. Much of this development is occurring in concentrated areas along coastal rivers, estuarine creeks, and tidal marshes, with great potential for deterioration of water quality. While all but one coastal county has a zoning ordinance, local governments are presently ill-equipped to measure, evaluate, or control the environmental effects of ongoing development. The following paper describes key indicators of coastal development, identifies activities having the greatest environmental risks (particularly to water quality), and makes recommendations for improving our ability to manage coastal resources. A primary conclusion is that more information and technical assistance are needed to ensure adequate management of resources.

INTRODUCTION

As fundamentally obvious as the linkage between development and water resources may seem, after further thought and research the interrelationships reveal themselves as far more complex. This complexity is created by a number of indirect and incremental effects and qualitative factors that combine to make water resource management a convoluted and entangled network of issues. For example, the location, rate, and design of development can greatly influence the impact that a given population has on water quality. Even if both communities in a hypothetical comparison practice the same water-using activities with the same level of conservation, each community could have significantly different influences on water resources depending on the type and condition of wastewater systems, extent of impervious surfaces, design and maintenance of drainage systems, implementation of flood control programs, and public awareness about water quality issues.

One major obstacle to building a more uniformly effective approach to community development on the basis of resource management is the lack of accurate and timely information feedback regarding the relative environmental impact created by various development patterns, as well as the general state of a community's environmental stability. Related to this information deficiency is the lack of an effective and efficient means for tracking such consequences and holding accountable those responsible for unacceptable land use and development practices on the basis of their environmental implications.

Local government's role in the development process, jealously guarded though it may be (especially in Georgia), is primarily limited to zoning as the conventionally accepted means for "managing growth." As many studies and planning courses have demonstrated, conventional "Euclidian" zoning is ineffective in controlling the environmental impacts of development, either during construction or in the long term. Zoning was created in the 1920s to separate land uses in attempts to prevent the intrusions (and threats to property values) caused by conflicting activities; classic examples are the pig farm or slaughter house next to a residential neighborhood. Laudable as these objectives may be, they are hardly equivalent to making worthy contributions to environmental management.

In fact, as these same planning studies and courses stress, the separation of land uses has contributed considerably to environmental decline through urban sprawl, with greatly and unnecessarily expanded developed areas, ever greater driving distances, growing dependence on cars, and associated pollution and visual blight. The experience of community itself has been seriously degraded through inappropriate application of ill-conceived zoning ordinances. The frustration many of us feel regarding the lack of control over development within our own communities as it affects "quality of life" applies with equal gravity and by natural extension to the effects of "growth" on environmental resources.

Unfortunately, one of the unintended but pernicious effects of zoning is that the public may mistakenly believe that government is adequately addressing the most threatening environmental problems. Inadequately enforced or coordinated state and federal programs can have a similar effect. Thus, the technical difficulties of information availability and regulatory enforcement are compounded by an ill-informed electorate and elected officials who establish the political context for resource management. Property-rights advocates, among others, object to further governmental intervention in the development process at least partly on the argument that various existing activities, including zoning, already over constrain the "invisible hand" of free enterprise. At the very least it would make our efforts less futile if those programs having governmental support were only the most effective, rather than those with the image and momentum of tradition but too often lacking in results.

Toward that end, the following information is presented in an endeavor to portray the conditions and trends of development in coastal Georgia, providing implications and

inferences about water resources (and other resources) where they are most revealing. Above all, what is most revealing (and troubling) is the patchy image of our understanding about the current condition of coastal resources and their local inter-relationship with development trends.

A brief list of the major water management concerns related to development include the following:

- * Increased runoff and erosion cause by land clearing, excavation, and construction of impervious surfaces
- * Higher levels of non-point source contaminants such as fertilizers, herbicides, pesticides, and petroleum-based substances
- * Increased loading of organic materials from wastewater/sewerage systems and septic tanks
- * Infiltration of surface contaminants into groundwater through aquifer recharge areas
- * Saltwater intrusion and seawater encroachment into the primary aquifer caused by concentrated withdrawal
- * Disturbance of marine, estuarine and upland habitat caused by docks, channel dredging, commercial fishing, forestry, and land clearing activities.

DEVELOPMENT TRENDS

The most common measure of an area's growth is population. By this measure alone coastal Georgia is burgeoning, but this is only one of many factors that are indicators of the area's development trends and their environmental implications. The most rampant growth has been in the communities serving as host areas for military installations and as suburbs for Savannah. As rapid as overall growth has been and is projected to be, the vast majority of the region is still undeveloped or developed at a very low density.

Growth trends in coastal Georgia are of potentially significant environmental consequence not so much because of the overall rate (about 20% increase in population per decade) or due to extensive urbanization, but because of the tendency for concentration of growth in or near environmentally sensitive areas. These areas are found throughout the coastal counties, where tidally influenced estuarine eco systems lie adjacent to upland tracts that are among the choicest development sites. It is also likely that due to the sheer rate of development in many areas, at least during construction there are greater risks of environmental contamination caused by removal of vegetation, excavation, and the use of heavy equipment.

Moreover, the vast areas of wetlands (about one third of the total) in combination with a high proportion of state, local or federally owned or managed lands (almost another third of the total) put uplands at a premium in marshfront and waterfront areas. In some instances, these factors also undoubtedly work with market forces to push uplands into higher development densities (structures per acre), further threatening water quality and estuarine habitat through non-point source pollution.

A prime case in point is McIntosh County, which is both

rural (population about 8,600) and suffering a high rate of poverty (22.3%), but which had some 1,000 subdivided lots on record in 1991 when the Coastal Georgia RDC prepared the county's comprehensive plan. Most of these lots are on the eastern rim of the county, along marshes, estuaries, and rivers. County building permits are issued for development within the eastern corridor at a much higher rate than for the remaining three-quarters of the county.

The same is true in Bryan County, where the City of Richmond Hill and vicinity in the southeastern end of the county serves as a suburb of Savannah, and in the 1990-95 period is growing at a rate about double that projected in 1992 for the comprehensive plan. At least 80% of the growth is occurring in less than 20% of the county, pressing the capacity of water and sewer systems and other public services to keep up. If building permits issued are used as an indicator of actual population increase, Richmond Hill has grown by about 60% since 1990, more than six times the regional average rate.

The military communities centered in Liberty County (Ft. Stewart) and Camden County (Kings Bay Submarine Base) have been undergoing similar rapid growth. From 1970 to 1980 Liberty County's population more than doubled, and it is still burgeoning. In the 1980's Camden County was the among the fastest growing counties in the country and remains a high-growth area.

**Table 1. Population Growth
For Coastal Georgia Counties (1980 - 2000)**

County	1980	1990	2000	%Increase 1980-2000	% of Total by 2000
Bryan	10,175	15,438	20,656	103.0%	4.2%
Camden	13,371	30,167	41,986	214.0%	8.5%
Chatham	202,226	216,935	244,684	21.0%	49.2%
Effingham	18,327	25,687	35,887	95.8%	7.2%
Glynn	54,981	62,496	70,055	27.4%	14.1%
Liberty	37,583	52,745	65,537	74.4%	13.2%
Long	4,524	6,202	6,769	49.6%	1.3%
McIntosh	8,046	8,634	11,091	37.8%	2.2%
Totals	349,233	418,304	496,665	42.2%	

Source: U.S. Bureau of Census (historic data), Georgia's State Data Center (projections) and CGRDC staff (computations).

**Table 2. Residential Units Permitted
in Coastal Georgia Counties (1985 -1990)**

County	1985	1986	1987	1988	1989	1990	Total	% of Total Increase
Bryan	172	316	240	179	204	182	1,293	6.2%
Camden	334	751	442	736	781	454	3,498	16.6%
Chatham	2630	2446	1730	838	1521	548	9,713	46.3%
Effingham	113	155	275	384	193	156	1,276	6.1%
Glynn	667	368	431	355	374	365	2,560	12.2%
Liberty	262	504	290	329	302	198	1,885	9.0%
Long	--not available--				(Estimate)	500		2.4%
McIntosh					(Estimate)	250		1.2%
	20,975							

Source: *The Georgia County Guide* (1992)

Other factors related to housing and demographic trends are also worth noting as they may affect environmental quality. For example, the trend toward smaller household size means that more housing units (apartments, condos, houses) are needed by a given population than in the past. More housing units means more land disturbing activity (excavation, removal of vegetation), greater areas of impervious surfaces, as well as more cars and car trips per day, with related pollutants. Thus, smaller households may lead to a cumulative environmental burden that increases at a greater rate than population growth itself.

A second problematic trend is the proliferation of mobile homes, especially in rural areas. Whatever can be said about the aesthetics of "manufactured housing," the mobility of such housing enables their owners to bring them to sites that are ill-suited or poorly prepared to support residential land use. In an unknown number of cases, where local building inspection offices are often understaffed, sites may be cleared and illegally occupied for long periods before corrective action is taken, if it ever is. Use of shallow wells and septic systems on such sites may not comply with public health standards, and abandoned sites may continue to be a potential source of water contamination.

ENVIRONMENTAL INDICATORS

The 1994 *Georgia County Guide* reports several indicators of the environmental burden being carried by the state's 159 counties. This information is presented here for the eight Coastal RDC counties for discussion purposes. The long-term implications of these factors are undoubtedly worthy of further investigation.

Water Use

The lion's share of water use in the coastal area is for power generation and industrial production that is water-intensive-- namely pulp and paper manufacturing. Those counties with conspicuously high per capita water consumption (Camden, Chatham, Effingham, Glynn, and Liberty) are those with one or more such manufacturer. Due to limitations on further concentrated withdrawal of groundwater (because of saltwater intrusion) and the high cost of treatment and distribution of surface water, it is generally recognized that there can be no new locations or major expansions of such industries along the coast unless alternative sources of water are used, presumably surface water. A significant indication of the region's concentrated water demand is that almost 16% of the total water withdrawn in Georgia is used within the eight coastal counties, where only 6.6% of the state's population lives.

Over four-fifths of the water used, and nearly all drinking water, is withdrawn from the ground, primarily from the Floridan aquifer which is recharged at the "fall line" further upstate, where the Piedmont geophysical region ends and the coastal plain begins. A secondary source of water for smaller domestic systems, used more frequently in rural areas, is the Miocene aquifer, with recharge areas throughout the coastal region. Relatively little monitoring of the Miocene is presently being done, but there is growing belief that the

shallower Miocene is interconnected with the deeper Floridan aquifer, suggesting the need to take measures to better monitor and protect Miocene recharge areas. This need will be especially critical if the Miocene is used as a supplemental source of public water supply, and as reduced artesian pressure within the Floridan becomes more prone to exchange with the Miocene. Similarly, there are many abandoned well-heads throughout the region which are a potential source of ground water contamination, but little is being done to address this problem. These should be identified and properly closed and protected.

**Table 3. Coastal Georgia Counties
Water Withdrawals & Use for Industry/Power (1990)**
(Millions of Gallons Per Day)

County	Surface Water	Ground Water	Total	Industrial & Power
Bryan	.01	1.47	1.48	.01
Camden	6.18	38.28	44.46	38.35
Chatham	87.90	428.22	516.12	445.22
Effingham	5.87	115.59	121.46	118.71
Glynn	59.67	84.89	144.56	125.21
Liberty	.07	20.52	20.59	10.48
Long	.07	.46	.53	-0-
McIntosh	-0-	1.10	1.10	-0-
Totals	161.03 (18.9%)	690.53 (81.09)	851.56 (100.0%)	737.98 (86.7%)

Source: *The Georgia County Guide* (1994)

Forestry

A tremendous area of coastal Georgia is used for forest land, and the vast majority of this is commercial timberland for the pulp and paper industry. While urban land uses typically have far more destructive environmental consequences than forestry, contrary to the common opinion there can be significant environmental impacts from forestry. For example, commercial forests are typically monocultures, where nearly all other vegetation is removed, or destroyed through "controlled burning." Forestry monocultures are essentially agricultural activities producing a "cash crop," resulting in the destruction of natural habitat and the ecological balance that may be critical to natural water filtration. Furthermore, the planting, maintenance, and harvesting activities of forestry can result in radical changes in hydrology and increased soil erosion.

Since many acres of forestland are also freshwater wetlands, there is concern among environmental interests that forestry practices degrade the functional value of these wetlands by altering hydrology and thereby destroying or degrading natural habitat. Forestry is exempt from routine, site-specific wetland permitting under Section 404 of the Clean Water Act through the issuance of a nationwide permit.

Through voluntarily adopted "Best Management Practices," (BMPs) the Georgia Forestry Association attempts to reduce and control the extent of these effects, reporting a 95% compliance with these standards. There are no known independent studies that confirm this level of compliance or the effectiveness of the best management practices in protecting water quality.

Table 4. Forest Land in Coastal Georgia Counties - 1989

County	Acreage of Forest	% of Total Land Area	% Gov't Owned	% Forest Industry
Bryan	233,918	82.8%	43.9%	22.2%
Camden	309,104	74.4	2.7	45.3
Chatham	95,926	33.8	17.3	39.5
Effingham	244,154	79.2	3.2	26.3
Glynn	158,235	60.0	4.8	69.8
Liberty	246,273	74.5	42.8	25.9
Long	233,951	90.9	10.5	55.1
McIntosh	174,204	64.0	9.0	72.4

Source: *The Georgia County Guide* (1994)

Hazardous and Toxic Waste

Again, the coastal region registers a disproportionate share of the state's total environmental burden as measured in terms of the release of toxic chemicals. In proportion to population, this rate is over four times higher than the state average. The source quoted does not provide further information about the types of toxins released or their sources, but it is assumed that these are industrial effluents released in accordance with permits issued by the Environmental Protection Division of the Georgia Department of Natural Resources, meaning that they are within the limits of the federal Clean Air Act and the Clean Water Act. The consequences of these concentrated releases (in certain counties) for the vitality of human and non-human communities are not obvious, but clearly concern is justified.

The number of "hazardous waste dumps" alone is an inconclusive indicator of environmental risk, since some of these sites are undoubtedly far more hazardous than others. In terms of the number of sites, the coast does appear to be under a greater burden than the rest of Georgia. The degree of risk is dependent on the type of material disposed, the methods of disposal, and the natural conditions of the site(s) in question. Additional information is needed upon which to base decisions regarding what should be done with these sites. Furthermore, provisions for meeting the considerable recovery costs for the most hazardous sites must be ensured.

Table 5. Coastal GA Counties Hazardous Waste Dumps (1994) and Toxic Chemical Release (1992)

County	Number of Haz-Waste Dumps	Pounds Per Day of Toxic Chemical Release
Bryan	2	-0-
Camden	4	2,386,092
Chatham	44	7,247,637
Effingham	2	383,620
Glynn	17	5,053,333
Liberty	3	857,655
Long	1	-0-
McIntosh	1	-0-
Totals	74	15,928,337
Georgia Total	913	55,415,685
Coastal % of State	8.1%	28.7%

Source: *The Georgia County Guide* (1994)

Solid Waste

The projections below were made using a modified "straight-line" method based on population forecasts; these

figures indicate total waste generated, and do not reflect the reduction in waste disposed in landfills that may be obtained by recycling. If recycling reaches its expected levels, the total waste volume being disposed in landfills may increase by as little as 20% by 2002 (or about 15% lower than the total shown) while population grows by the same proportion. This means that recycling may compensate for increasing amounts of waste generated to keep the average per capita amount of waste at about the same level.

Properly managed, theoretically solid waste introduces minimal environmental risk. However, there may be considerable distinction between proper management and actual practices that result in significant exposure to such risk, typically through contamination of ground water in the vicinity of landfills. Efforts to reduce these risks have been made through more rigorous federal requirements under "Subtitle D" regulations implementing the Resource Conservation and Recovery Act (RCRA). These risks are especially troubling in the coastal area where high water tables, vast areas of wetlands interlacing uplands, and numerous abandoned wells present considerably higher potential for contamination of both ground and surface water.

Table 6. Coastal Georgia Counties Solid Waste Generation (1992 - 2002) Tons Per Year

County	1992	1994	1996	1998	2000	2002	% Incr.
Bryan	12046	12548	13043	13544	14046	14675	21.8%
Camden	30603	32453	34727	36135	36823	37366	22.1%
Chatham	401748	416478	431304	446163	460990	475874	18.5%
Effingham	17227	18146	19090	20057	21025	22076	28.1%
Glynn	66280	73577	78592	81325	84058	86384	30.3%
Liberty	29452	34071	36381	38690	41000	43310	47.1%
Long	2600	2659	2710	2753	2796	2839	9.2%
McIntosh	11291	11535	11657	11779	11900	12162	7.7%
Totals	571247	601467	627504	650446	672638	793686	23.2%

Source: *Coastal Georgia Regional Solid Waste Management Plan*, 1994

Water Access, Boating, and Commercial Fishing

Recreational use of coastal waters for boating and fishing appears to be increasing at a much faster rate than population growth. There are various reasons why these activities may compromise the condition of environmental resources, including contamination from motor lubricants and fuels, as well as increased shoreline erosion caused by vessels and by construction and use of dock facilities, resulting in disturbed or destroyed marine or estuarine habitat.

According to the staff of the Coastal Resources Division of the Georgia Department of Natural Resources, from 1988 to 1992, there was a 48% increase in the number of recreational boat licenses issued within the six coastal counties. As of 1990, there were 36 marinas and 34 boat ramps among these same six counties. The Corps of Engineers, which issues permits for construction of private docks as part of their function in maintaining navigable waterways, reports that between 75 and 100 permits have been issued annually for building and replacing such docks along coastal rivers and creeks in recent years. While there is some interest in promoting the use of community docks to reduce the

proliferation of private docks that accompany the rapid growth in residential development of waterfront areas, no official state or federal policy has been adopted. Policies being considered under the Georgia Coastal Zone Management program include measures to address this issue.

Commercial fishing activities, primarily shrimping, disturb water bottoms in near-shore areas by using "trawl nets" that destroy vegetation and increase turbulence. Compared with channel dredging and maintenance, these effects are considerably less significant.

Ports and Channel Maintenance

Shipping channels and harbors serving the "world-class" ports in Savannah and Brunswick require extensive dredging in order to maintain the depths required to accommodate ocean-going vessels. The millions of cubic yards of material removed in these operations are placed in "spoil areas" approved by the Corps of Engineers. Conditions for carrying out dredge operations and for disposing of dredge material are permitted and monitored by the regulatory branch of the Corps.

Over the years, dredging and depositing discarded dredge material have raised concerns over various environmental consequences, especially because of toxic industrial pollutants that are sometimes found in the sediments collected in dredging. Also debated are the effects of significantly deepened channels on adjacent shores and water-bottom. Some argue that rapidly increasing rates of erosion and associated costs of shoreline stabilization are a direct result of channel dredging. Water movement changes created by dredging are alleged to cause significant increases in "scouring effects" that produce erosion of both shorelines and the bottoms of nearby rivers and creeks. Of course, associated changes in water movement and salinity can also affect marine and estuarine habitat as well. In any case, dredging for harbor and channel maintenance is essential to ensuring the great economic benefits of coastal ports.

Shoreline Protection and Floodplain Management

Georgia enforces provisions of its Shoreline Protection Act by reviewing permit applications for new development or significant alteration of existing development along oceanfront areas. In effect, this law only influences development on Jekyll Island, St. Simons Island, Sea Island, and Tybee Island. A building "set-back" line established under the law is determined by the height of naturally occurring vegetation. In an attempt to reduce hazards to dunes and shorefront vegetation, no development may occur "oceanward" from this line.

Under the Federal Emergency Management Agency (FEMA), in order for residents of a community to be eligible for federally subsidized flood insurance, the community must enforce minimum elevations for inhabitable space constructed after adoption of the FEMA program. Nearly all coastal Georgia cities and counties have adopted and are enforcing FEMA standards. While these standards are intended to reduce risk of flood damage to life and property, in some cases they may also reduce the destructive effects of building "on grade."

Even so, it is argued that the effect of federal insurance subsidies is to encourage development in areas where flood risks would otherwise preclude or greatly reduce the market for development. Although most of coastal Georgia is within the 100-year flood plain, those areas not within the flood plain, would be more intensively used if there were no FEMA insurance program. Conversely, the market for low-lying areas along marshes and shorelines, many of which are now in high demand for residential use, would diminish without low-cost property insurance.

Monitoring

Except for routine review procedures for local building permits, state marshland protection permits, and federal Section 404 permits, there are no processes for monitoring the impacts of development as it occurs. Once built, the environmental effects of new development are not well documented and only erratically and indirectly measured through water-quality testing. According to the staff of the Coastal Resources Division of the Georgia Department of Natural Resources, only 14 stations along the coast are monitored quarterly to determine the presence of some 160 different substances that have been listed by the federal EPA. These alone are far short of an adequately comprehensive monitoring system. Similarly, although the Coastal Resources Division of DNR does extensive sampling under its shellfish program, this is only for the purpose of testing for fecal coliform and no other contaminant. Groundwater, primarily the Floridan aquifer, is sampled by the U.S. Geological Survey using various test wells throughout the region.

Clearly, in order to improve our ability to manage coastal resources, a more comprehensive monitoring program is needed. Such a program should be capable of screening for a wide variety of contaminants at enough locations to enable the source(s) of pollution to be located. More reliable information about site-specific and cumulative effects of development and other land-disturbing activities is essential to improving the management and protection of coastal resources. This is needed not only for technical reasons, but also to provide the documentation that is vital to building political support in justifying and establishing more effective publicly sponsored environmental programs.

SUMMARY OF APPROACHES TO LOCAL PROTECTION OF ENVIRONMENTALLY SENSITIVE AREAS

Following are brief descriptions of alternative methods for protecting environmentally sensitive areas within the existing constitutional authority of local government. For various reasons, including administrative costs and political acceptability, some or even most of these methods may not prove feasible in any given jurisdiction. All of these approaches require administration by qualified staff who are capable of analyzing, interpreting, and enforcing legally adopted requirements.

Zoning ordinances--set-backs/variances, lot size, lot coverage and density trade-offs. Conventional zoning done primarily for the purposes of separating uses has very limited potential for improving or protecting environmental quality, as already noted. However, specific provisions that have been amended to zoning ordinances can provide added control over environmental quality. For example, by requiring development to occur at a limited density (expressed as units per acre or building size in ratio to lot size), the extent of impervious surfaces can be restricted, promoting more effective drainage control and greater capacity for on-site retention and absorption of stormwater. Similar benefits can be achieved with increased set-backs from lot lines, especially if these areas are landscaped with appropriate vegetation.

However, it should be noted that there are limits beyond which lower density may actually have the effect of reducing environmental quality by disturbing more land for development and by inducing greater use of vehicles, the construction of paved surfaces (road, parking lots), and the intrusion of inappropriate land uses into environmentally sensitive areas. Density trade-offs are one means used to rationally adjust the intensity of land use to the suitability of the land areas in question. Under this arrangement, a developer is granted "bonuses" to allow more units per acre on the portions of a tract most capable of supporting it, with the provision that environmentally sensitive areas of the site are left undisturbed.

Subdivision regulations--lot layout, density averaging, and site preparation. Similar benefits can be gained using subdivision regulations that allow building site designs to be modified to accommodate resources and conditions. For example, sites having wetlands should be laid out so that each lot has enough upland area to support proposed uses without endangering wetlands functions. In any given subdivision, the average development density can be used rather than strictly enforcing a uniform lot size to that site variations can be accommodated. Subdivision regulations are also typically used to require certain components of infrastructure (water, sewer, stormwater collection), water retention/detention, and other site preparations that can greatly reduce the environmental burden of new development.

Buffers--appropriate space and vegetation between developed areas and sensitive areas, especially water resources. In addition to specific set-back requirements for various zoning districts, some ordinances require buffer areas that serve to reduce the environmental impacts of development on adjacent areas that are especially environmentally valuable. Typically buffers must be vegetated with appropriate plant materials and have enough depth and density of vegetation to properly function. Buffers may also serve as habitat that complements the environmentally sensitive areas they protect.

Vegetation and tree protection--maximum building coverage, minimum vegetation coverage, inventories, and site design. Increasing numbers of communities are adopting measures to protect vegetation, most often large trees.

Although the intent may be to preserve aesthetic quality, the effect can be to enhance environmental stability by providing habitat, soil and water retention, and protection from flooding and wind damage. These measures usually require a share of the increased administrative costs to be carried by the developer, who then passes them on to property buyers.

Drainage plans-- require all development proposals to provide drainage plans, including collection points (catch basins), and retention ponds with outflow controls.

Although nominal drainage planning provisions are required under the state's Soil Erosion and Sedimentation Control Act, these are not uniformly administered and implemented. Furthermore, development on large sites often justifies more elaborate efforts to control stormwater run-off both during and after construction. More concentrated efforts to manage water quality through design and implementation of drainage plans can make considerable difference in the environmental impacts of development.

Mitigation-- implemented under a management plan that considers systemic effects over the long term. Using procedures under Section 404 of the federal Clean Water Act as a model, some areas have adopted measures that require a "mitigation plan" when development significantly disturbs environmentally important resources. Under these arrangements, a developer (usually using an environmental consultant) proposes a method for compensating for resources that will be unavoidably damaged by a proposed project, usually by replacing them in other nearby locations or upgrading the environmental value of a marginally functional area on site. The problem with this approach is that it is costly, both to administer and to implement, and the net long-term benefits justifying trade-offs are hard to document.

It is probably most efficient to administer this kind of program through a regional authority capable of supporting a qualified staff by sharing costs over many projects and multiple jurisdictions.

Regional Plan for "Special Area" Management-- This plan is based on: which areas are significant, sensitive, and/or threatened; which areas are most suitable for development; where other "new" or upgraded environmentally managed areas should be located; and how these areas should be managed under a strategic plan.

"Special management areas" were first established in the public sector under the federal Coastal Zone Management program, and have since been applied in a number of other publicly sponsored resource management programs, including watershed management. The process for determining special management area boundaries and implementing management plans vary, but usually include at least the above four elements, which logically follow one another.

In distinguishing between areas suitable and unsuitable for development, participants in the process must reach a basic consensus about appropriate criteria in making such determinations. Once these are adopted and applied, responsibilities and functions under a proposed management strategy are more readily negotiated. "Regionally Important Resources" (RIRs) under the Georgia Planning Act are an

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example of special management areas, requiring the establishment of "resource management strategies" that may be carried out by a number of interested parties. As yet there is very little experience with the application of this procedure in Georgia, but it is expected to become more common.

Sometimes the sheer number of interested parties (property owners, local governments, state and/or federal agencies, public interest and environmental groups, etc.) greatly complicates the task of establishing and implementing a special area management plan. From an environmental management standpoint, this approach is most comprehensive because, when properly used, it takes in a broad enough area to ensure long-term viability of key resource systems with more consistent management practices throughout. Being complex to develop and implement, and requiring high levels of coordination among multiple interests, this approach is usually expensive initially. Once established, however, the long-term costs of special area management and its effectiveness can prove to be very practical. Political obstacles and coordination problems may be insurmountable, however.

CONCLUSIONS

Despite the historically pristine quality of coastal Georgia's environment, there are disturbing indications that a number of factors may be contributing to its decline, and such effects may increase without intervention. Among these are the rate, location, quality and intensity of development; the level of toxic emissions from industry; the number and toxicity of hazardous waste sites, with potential for contamination of water resources; the concentrated withdrawal of ground water from the principal aquifer, and associated saltwater intrusion and seawater encroachment; rapidly increasing recreational use of coastal waters; ongoing channel dredging in maintaining and expanding port operations; lack of proactive environmental management efforts and deficiency of monitoring information.

In order to ensure adequate protection and management of critical resources, more accurate and timely information is needed about their existing condition and the effects of ongoing development and other activities. Further, more qualified professional technical assistance is needed at the local level to provide cities and counties with guidance in making decisions affecting the long-term use and condition of coastal resources.

Although there are a number of potentially effective means for reducing the environmental burden of further development, their use will require greater investment in local monitoring, review, and analysis. The Georgia Planning Act provides a foundation for a program of local environmental planning and its implementation but most cities and counties lack the resources needed to effectively carry it out. Unless a greater deal of management capability can be ensured at the local level, there may be need for more state authority over critical coastal resources, which may include activities that reduce the extent of local autonomy in controlling development.