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A Regional Waterway Systems Management Strategy for Southwest Florida

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EXECUTIVE SUMMARY

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1. Background

Inland coastal waterways of the United States, since 1960, have been transformed along much of their length by recreational boating and fishing, and by accompanying tourist and residential uses. Florida's coastal population has increased 169 percent since 1960, from 4.8 to 12.8 million, four times the national rate. Seventy-nine percent of Florida's population lives within this coastal zone. The number of recreational boats in Florida, between 1973 and 1989 grew by 176 percent. Today (1995) there are an estimated 750,000 registered vessels in the state, and tourists pilot or trailer another 300,000 into the state each year. In southwest Florida, the number of boats has increased by three times the national rate. Coastal population pressures and unprecedented boating intensities are stressing these water bodies. The region's near-pristine baywater environment is now ecologically threatened by the continuing wave of development.

A unique element of the coastal development process has been the creation of thousands of miles of dredged canals, basins and access channels. These waterways were dredged to provide waterfront access for residential developments. In many instances, the original dredged depth depended on the amount of borrow material required, and not on the provision of adequate channel depth for navigation. Finger canals were dredged deep, but entrance channels were minimally improved or left in a natural state. Over time, these waterways have either silted in by storm water runoff or shoaled from boat wake and storm fetch. Maintenance dredging has been piecemeal and projects have targeted segments of the waterways. Criteria for improving water depth have been based either on the historic dredged depth or an arbitrary depth. Neither approach has produced satisfactory results.

Waterways include arterials, collectors and residential canals and basins. In barrier island coastal locations, waterway boat traffic is governed by the relationship of boat draft to water depth. Boat access is by ramp, private dock, marina or permanent mooring. Unrestricted access from trip origin to open water is uncommon. Source areas of boats -- trafficheds -- are connected to bays by access channels, which may pass through ecologically sensitive grass and hard-bottom areas. Boat traffic adjoining these habitats may create management problems. Issues of special concern are channel siltation, boating safety, wildlife protection, and habitat restoration.

There is a need to maintain a viable waterway system in the face of mounting shoreside and boating pressures. Recreational boating and fishing make significant contributions to the Florida economy, but these activities are dependent upon a healthy, high quality environment. This report presents a

geographic information system (GIS)-based method for planning and managing regional waterway systems. A pilot application of the methodology, carried out in Sarasota Bay, provides an example of how boat traffic can be managed in ways that reduce stress on surrounding natural habitats and waterfront communities. The methodology is consistent with prevailing state and federal coastal policy initiatives and offers an integrated, place-based approach to boat traffic management which may be applicable in other coastal areas.

2. Waterway Analysis

The GIS analysis is undertaken at large-scale, small-area and high-resolution in order to provide sufficiently detailed results for regional analysis and local community applications. Section aerials at 1:1,200 scale are used to locate boats, facilities, signs and channel centerline. Two types of habitat information -- seagrass and mangrove -- are incorporated into the GIS analysis. Boat draft and water depth information are collected to the nearest foot resolution.

The USGS 7.5' digital shoreline is updated by photo interpretation methods. Bathymetry includes NOS digital files at 1:10,000, COE centerline field surveys at 1:1,200 - 1:24,000, and centerline boat channel field surveys at 1:1,200 scale. Project maps portray depth in two ways: as arcs showing centerline controlling depths at 1 ft. increments representing waterway boat channels; and as polygons corresponding to bay-wide depth areas. The polygon topology is compiled by two methods: a bay method, which processes the 1:10,000 scale digital NOS depth information from open bay locations where most water depths exceed boat draft requirements, and where channel depth constraints to navigation are minimal; and a trafficshed method, which processes the 1:1,200 scale field survey information for residential canals, basins and access channels, and where minor variations in bathymetry translate into serious navigation problems.

Boat and facility information from an on-the-water census is compiled into GIS coverages. Boat information includes type, length, age and draft; facilities are described by accessibility, type, berthing, and services. All boating-related signs are located by GPS methods and inventoried in a GIS coverage.

The geographical analysis evaluates the relationship between boat draft and channel depth for each vessel in each trafficshed in order to measure boat accessibility and channel restrictions. An examination of the results of this trafficshed analysis provides a strategy for evaluating the functionality of the regional waterway system and for prioritizing maintenance and remediation of system channel components.

Boat accessibility is a five step evaluation: (1) a network of boat traffic paths is created in all the trafficheds; (2) the water depth of each path segment in the network is entered into the channel data base as an attribute of that segment; (3) a boat path is traced representing the most likely route each boat would travel from its point of origin to the open bay; (4) the water depth of each segment is noted, and the shallowest depth that each boat would traverse is recorded, and becomes an attribute of each individual boat in the data base; (5) the shallowest depth is compared to the draft of the boat. As a result of this boat accessibility evaluation, if the boat draft is less than the shallowest depth, then the boat is considered not restricted. If, however, the shallowest depth is equal to or less than the boat draft, then, the boat is considered restricted according to the systems' design criteria. The accessibility rating for each boat is plotted on maps.

Channel restrictions is a three step evaluation: (1) all boats are linked with each segment in every pathway leading from each boat trip's origin to the open bay exit of the traffiched; (2) the drafts of all those boats is noted, and the maximum draft of that group is recorded for each channel segment; and (3) the maximum boat draft is compared to the depth of the corresponding channel segment. The difference between the deepest draft boat and the depth of the segment -- referred to as channel restriction -- identifies the depth of dredging required for that segment to accommodate the deepest draft boat that would traverse it. As a result of this channel restrictions analysis, if the draft of the deepest draft boat is less than the depth of the channel segment, then, that segment is classified as not restricting any boats. If, however, the draft of the boat is greater than the segment's depth, then, that segment is deemed as restricting that boat. The rating for each restricted channel segment is plotted on maps.

Alternate scenario methods are used to assess a range of decision options influencing waterway management. One method is an accessibility index which evaluates the ratio of boat draft to channel depth. Each boat's accessibility is classified relative to the shallowest segment of its access channel leading to the open bay. A boat may be: (1) somewhat restricted, if its access channel depth (ACD) = vessel draft (VD); (2) restricted, if its ACD \geq 1 ft. shallower than VD; (3) severely restricted, if its ACD \geq 2 ft. shallower than VD; or (4) blocked, if its ACD \geq 3 ft. shallower than VD. Evaluation of a traffiched's boat population by accessibility classes uncovers boat-channel relationships that affect the magnitude and geographic extent of channel improvement needs.

A second analysis provides for evaluating boat accessibility under normal or below normal tidal conditions. An additional foot of clearance is added to take into account "below normal" tidal conditions (there were only 16 daily occurrences of this condition in 1995).

Map products are presented in four ways: (1) regional characterization, 1:24,000 scale, showing color-shaded bathymetry (as 15 zones, 1 ft. resolution), seagrass, mangrove, boats, facilities, and signage; (2) detailed inventory, 1:4,800 scale, including color-shaded bathymetry (1 ft. resolution), supplemental 3 ft. contours, centerline controlling depth, boats, facilities, signage, seagrass, and mangrove; (3) neighborhood boat accessibility, 1:4,800 scale, showing levels of boat accessibility to open bay; and (4) neighborhood channel restrictions, 1:4,800 scale, showing the location and extent of channel depth restrictions at 1 ft. intervals.

3. Regional Results

Sarasota Bay is a 35.3 sq.mi. area consisting of 32.5 sq. mi. of open bay and 2.8 sq. mi. of trafficsheds. Twenty-three percent of the open bay is < 3 ft. deep; another 20 percent is 3 to 6 ft. deep. Fifty-seven percent of the open bay is relatively deep water (≥ 6 ft.) which is adequate for all boating activities. There are over 8 sq. mi. of seagrass meadows and about 3 sq. mi. of mangroves. Trafficsheds represent only 8 percent (2.8 sq. mi.) of the bay, but their shoreline locations and close proximity to mangrove and seagrass make these boat source areas of special environmental concern. Much of the boating activity which takes place on the bay comes into direct contact with these sensitive bay habitats, due to the locational geography of the trafficsheds and the origin-destination pathways of the boats. Five percent of the seagrass in the region (0.4 sq. mi.) is situated in these trafficsheds, and 28 percent of the mangroves (0.8 sq. mi.) is located there as well.

There are 5 types of trafficshed systems in the bay: (1) finger canal or basin with one access channel; (2) multiple finger canals and/or basins with one or more access channel(s); (3) shoreline channel with one or more access channel(s); (4) shoreline channel linked to multiple finger canals, basins, streams and/or creeks, with one or more access channel(s); and (5) natural stream or tidal creek with one access channel. Simple shoreline canals have the largest proportion of sensitive habitat areas, followed by complex shoreline canal systems and multiple finger canals. Both natural creeks and single finger canals contain negligible natural habitat areas. Trafficshed channels, on the average, have relatively deep water: 12 percent are ≤ 3 ft., 37 percent are 4 - 5 ft., and 51 percent are ≥ 6 ft. Boat accessibility problems are due to limited channel segments with restricted depths.

Restricted boats are evaluated under normal tide (0 mllw datum, Option A) and below normal tide (-1 ft. mllw, Option B) conditions. There were 4,552 boats using Sarasota Bay in 1992. Most boats have unrestricted access (87 percent,

Option A., 73 percent, Option B). There are 532 restricted boats under A, and roughly double the number, 1,213, under B. This doubling of the restricted boats, from A to B, is reflected by the two lower index levels (≤ 1 ft. difference between draft and depth), but there are four times the number of restricted boats under B at the higher index levels. Restricted boats are clustered spatially: three trafficsheds account for 38 percent; eight others represent 40 percent; and 23 to 26 additional locations include 22 percent, under both Options A and B.

Restricted channels also are evaluated under Options A and B. Ten percent (28,680 ft.) of the waterway system restricts boat traffic under Option A; the length of restricted channels is four times this amount (117,829 ft.) under Option B. There are significant differences in these results. Twenty percent of all trafficsheds under A have no restricted segments; that declines to 5 percent under B. The number of trafficsheds with low and medium (≤ 9.9) percentages of restricted channels doubles from A to B; conversely, locations with a high (≥ 10) percentages of restricted channels decline to half from B to A. Relatively few trafficsheds require channel improvements under Option A, while many more locations do so under B.

Maintenance dredging under Options A and B reflect relative amounts of dredged material that must be removed to provide unrestricted access. Under Option A, a 1 ft. cut will satisfy 70 percent of the dredging requirement; 2, 3, and 4 ft. dredging depths satisfy 14, 11 and 4 percent of the needs, respectively. Conversely, a 1 ft. cut satisfies only 23 percent of the Option B; deeper dredging is required to satisfy most boat access needs.

4. Community Waterway Management

A community application in Bay Isles, Longboat Key, illustrates how project results can be transformed into action projects at the local level. This 680 acre community includes 1,267 dwelling units, a 27 hole golf course, and a resort marina. A 3.6 mi. boat channel parallels the perimeter of the community and is connected to the marina. There are 437 boat slips and in 1992 there were 252 boats. There is transient boat traffic throughout this waterway, due to the resort marina and restaurant, and the natural attractiveness of the perimeter canal as a nature preserve and prime fishing locale. The outer mangrove buffer which originally protected the perimeter channel has been depleted and this has led to shoaling of the waterway. Other landside pressures have created additional problems that are reflected in water quality and habitat conditions. Boat wake is washing away soil, and contaminants from boats accumulate because of the low tidal exchange within the canal system. The management needs include: habitat

restoration; channel maintenance; traffic management (signage); and public education.

Florida Sea Grant is providing project data and technical support to the community to evaluate present waterway conditions. A local demonstration project is being developed to restore critical areas of the mangrove buffer. The project's channel restrictions analysis provides data on the extent and location of required dredging; this will be initiated once the restoration work stabilizes the vegetative buffer. Sarasota County has designated and posted the waterway as an idle speed, no wake zone. The community intends to remove abandoned signs and pilings. Work is underway to remark the perimeter channel with navigation day beacons. Community leaders acknowledge that education benefits could be achieved by publishing and distributing a map of the Bay Isles waterway based on project information, which would advise boaters of channel depths, seagrass areas, signs, and shore facilities.

5. Management System

A regional waterway management system is proposed, the long-term goal of which is to preserve the ecological and recreational values of southwest Florida waterways in a manner that maintains the widest possible degree of freedom for users. In order to attain this goal, the following supporting objectives are proposed: (1) fit channel maintenance to boat draft requirements; (2) minimize impacts on surrounding bay habitats; (3) prioritize and evaluate management alternatives on a regional basis; (4) develop map and other information products for boaters and shore residents to encourage environmental awareness and stewardship by users of the neighborhood waters and boat access channels; and (5) empower waterway communities and boating organizations to take an active role in managing their waterways. These objectives can be pursued through a combination of management tools, with a focus on: (1) acquiring the necessary information on waterway and user characteristics in order to map and evaluate boat access needs; (2) providing waterway communities with technical support to develop local management implementation strategies; and (3) disseminating map and guide products to waterway residents which foster stewardship and environmentally responsible boating practices.

Development and implementation of these management tools can be a joint effort between the West Coast Inland Navigation District (WCIND), the Florida Sea Grant College Program (FSG), the Florida Department of Environmental Protection (FDEP), and the Florida Cooperative Extension Service (FCES). Local

governments, local waterway communities and boating groups are recognized as critical players and are encouraged to participate.

6. Recommendations

1. Disseminate findings through presentations and workshops to the state regulatory agencies (FDEP, Florida Department of Community Affairs), local governments, and to residential waterfront homeowner associations and boat clubs in the region.
2. Design channel maintenance projects based on boat draft requirements for normal tide conditions (0 ft. mllw datum). This approach provides reasonable access while minimizing impacts on surrounding bay habitats.
3. Address boat access and channel restriction problems in the priority problem trafficsheds: Bowlees Creek, Trailer Estates West, Mt. Vernon/Coral Shores, Tarawitt, and Bay Isles/Longboat Key Moorings. These areas account for 44 percent of the access-problem boats and 65 percent of the restricted channel segments.
4. Incorporate waterway management into the state, region, county and local planning process by designating marine use areas and recognizing maintainable navigation access as a valuable and high priority requirement for water dependent activities.
5. Encourage the State to revise the present permit review process by allowing for the joint and concurrent evaluation of multiple requests for channel maintenance and habitat restoration in a given region, for those permit applications which adhere to rigorous waterway management systems criteria as described in this report.
6. Provide local staff with GIS training and equipment so that they may service local trafficshed planning and management needs.
7. Sponsor changes in the Florida vessel registration data base in order to transform this information into an effective waterway planning and management resource.
8. Publish and distribute information contained in the atlases which accompany this report into maps, photomaps and nature-tourism

brochures, in order to promote stewardship through a better understanding of environmental history and boating geography of the region.



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