Long-Range Dredged Material Management Plan for the Intracoastal Waterway in Flagler County, Florida

Final Report
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Long-Range Dredged Material Management Plan for The Intracoastal Waterway in Flagler County, Florida

Prepared for:

FLORIDA INLAND NAVIGATION DISTRICT

by:

R. Bruce Taylor
William F. McFetridge
Michael L. Cochrane

Taylor Engineering, Inc.
9086 Cypress Green Drive
Jacksonville, Florida 32256
(904) 731-7040

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EXECUTIVE SUMMARY

The identification and permitting of suitable dredged material management areas for the Intracoastal Waterway in Florida have become increasingly difficult. This has resulted from the nature of dredging, the requirements of handling and storing dredged material, and the environmentally sensitive and rapidly developing areas in which these operations are performed. In response to this situation, the Florida Inland Navigation District (FIND) initiated, in 1986, a program of long-range dredged material management. When fully implemented this program will provide a permanent infrastructure of management facilities for all maintenance material dredged from the 374 miles of Intracoastal Waterway channel connecting Fernandina Harbor in Nassau County with Miami Harbor in Dade County.

The FIND's program, executed in close cooperation with the Jacksonville District Corps of Engineers, comprises three main elements: (1) a two-phased plan development and property acquisition element, (2) a facility permitting and construction element, and (3) a facility operation element. Program execution begins with the development of long-range dredged material management plans for the Waterway on a county-by-county basis (Phase I of the planning and property acquisition process). Upon finalization of each plan, Phase II of the planning and property acquisition process begins with site boundary surveys. The process continues with detailed environmental site characterizations, soils testing, topographic surveys, preliminary facilities design and site plans, site operation and management plans, and a summary of expected costs for site development and operation. All of this information is then used for property acquisition and facilities permitting.

This report presents the Long-Range Dredged Material Management Plan for the Intracoastal Waterway in Flagler County. Similar plan documents have been completed and approved for the Waterway in Nassau, Duval, St. Johns, Brevard, and Palm Beach Counties. In addition, comparable plan documents are nearing completion for the Waterway in Volusia and Martin Counties. Phase II of the plan development and property acquisition program element will develop the site specific documentation described above for the recommended primary sites. Barring unforseen circumstances and changes in conditions at the time of this report, the FIND will then actively pursue acquisition of these sites during Phase II.

The methods used in the development of the long-range dredged material management plan for the Intracoastal Waterway in Flagler County are based on those used in the development of previous plan documents for the Waterway in Nassau, Duval, St. Johns, Brevard, and Palm Beach Counties. The major

tasks performed as part of the present effort were as follows: (1) establishment of the 50-year material storage requirement within the Flagler County project area based on historic maintenance dredging volumes and subsequent examination surveys; (2) evaluation of the remaining or potential storage capacity of existing easements and FIND-owned tracts within the project area; (3) development of a management concept or strategy appropriate to specific engineering and operational requirements, and environmental and land-use constraints; (4) identification of additional candidate sites consistent with the management concept; and (5) evaluation of all candidate sites based on a standard set of criteria. These criteria were developed within the framework of the management concept and reflect engineering, operational, environmental, and land-use considerations.

To begin this process, engineering records at the Jacksonville District Office, U.S. Army Corps of Engineers were reviewed and analyzed to develop estimates for the 50-year maintenance dredging and material storage requirements of the 18 miles of channel within the study area. The analysis showed a projected total storage requirement of 2,525,000 cubic yards of bulked material distributed over four channel reaches. Preliminary assessment was then made of the 40 tracts totalling over 1,600 acres the FIND either owns (six tracts, totalling 200.2 acres) or holds under perpetual easement (34 tracts, totalling 1408.08 acres). This assessment revealed that only 15 tracts met the most basic criteria of reasonable upland acreage and existing or potential road access and thereby showed potential for development and use as dredged material management areas. These 15 tracts, grouped into 11 separate sites, were retained as candidate sites for further evaluation.

Having established the maintenance characteristics and the projected 50-year material storage requirement of the Waterway within the Flagler County project area, a management concept was then developed to guide the identification and evaluation of alternative candidate sites consistent with the unique characteristics of the project area and the projected channel maintenance requirements. In this manner, unrealistic and impractical alternatives were eliminated so that the identification of more reasonable alternatives could proceed logically. The principles of the management concept adopted for Flagler County are as follows:

(1) All future placement and storage of dredged material will be confined to upland areas to the maximum extent possible as determined by site availability.

(2) Centralized dredged material management areas will be established in a minimum number of locations per operating reach of Waterway as determined by the analysis of historic data.

(3) All dredged material management areas will be operated and maintained as permanent facilities.

Within this framework a total of 15 alternative candidate sites were identified. Each existing and alternative candidate site was then field inspected and evaluated under a standard set of criteria addressing engineering, operational, environmental and land-use considerations. By this process, eight sites were selected to form a site bank of three primary (first-choice) options and five secondary alternatives. Included among the primary options are two sites which incorporate four existing easements, with additional acreage as necessary to meet established capacity requirements. The third primary site consists of property not currently controlled by the FIND.

A vital element in the plan development process was the participation of key federal and state agency representatives, as well as representatives of local government and interested public citizens. At key points during Phase I of the project, a Technical Advisory Committee consisting of representatives from the FIND, the Florida Department of Natural Resources (DNR), the Florida Department of Environmental Regulation (DER), the Florida Department of Community Affairs (DCA), and the Jacksonville District, U.S. Army Corps of Engineers met with the contractor to monitor work in progress, review technical decisions, and establish project policy for the execution of future tasks. These meetings were supplemented with continuing dialogue with key agency personnel. In addition, a Citizens Advisory Committee appointed by the Flagler County Council periodically reviewed the specific plan as it developed. Finally, at key stages in the plan development process, the results of all efforts to that point were presented twice to the Flagler County Commission and twice to the general public at Public Information Workshops, held in City Hall, Flagler Beach. At the workshops, comment was actively solicited from representatives of local government, civic groups, and interested citizens. Input and guidance received from all those who participated in the committee meetings and workshops proved invaluable to the successful completion of the project.

Experience gained from the earlier long-range dredged material management studies completed for the Waterway in Nassau, Duval, St. Johns, Brevard, and Palm Beach Counties has demonstrated the importance of systematic documentation of dredged material management alternatives and the basis upon which these alternatives are evaluated. This Phase I report provides such information for the long-range dredged material management plan for the Intracoastal Waterway in Flagler County and documents all work performed under this contract. A companion set of 23 photobase engineering plans summarize pertinent channel and site information. Phase II of this project will develop all of the detailed engineering, environmental, and survey information necessary to design, permit, and construct permanent dredged material management facilities

on each of the primary sites selected. Phase II will also address cost considerations associated with these actions and will develop detailed site operation and management plans. A detailed scope of work for Phase II of the project is presented in Section 5.0 of this report.

1.0 INTRODUCTION

This report documents Phase I of a two-phased effort to develop a 50-year plan for the management of maintenance material dredged from Intracoastal Waterway (ICWW or Waterway) channels in Flagler County, Florida (Figure 1-1). Phase I focused on the development of basic plan concepts, the definition of long-term dredging requirements, and the identification of suitable management alternatives which satisfy preliminary environmental, engineering, and operational criteria. Phase II will focus on obtaining and documenting detailed site-specific information required for the preparation and submission of permit applications for the primary or first-choice sites identified in Phase I. In addition, Phase II will address the design of site facilities and the construction and continuing operation and maintenance of these sites as permanent dredged material management facilities.

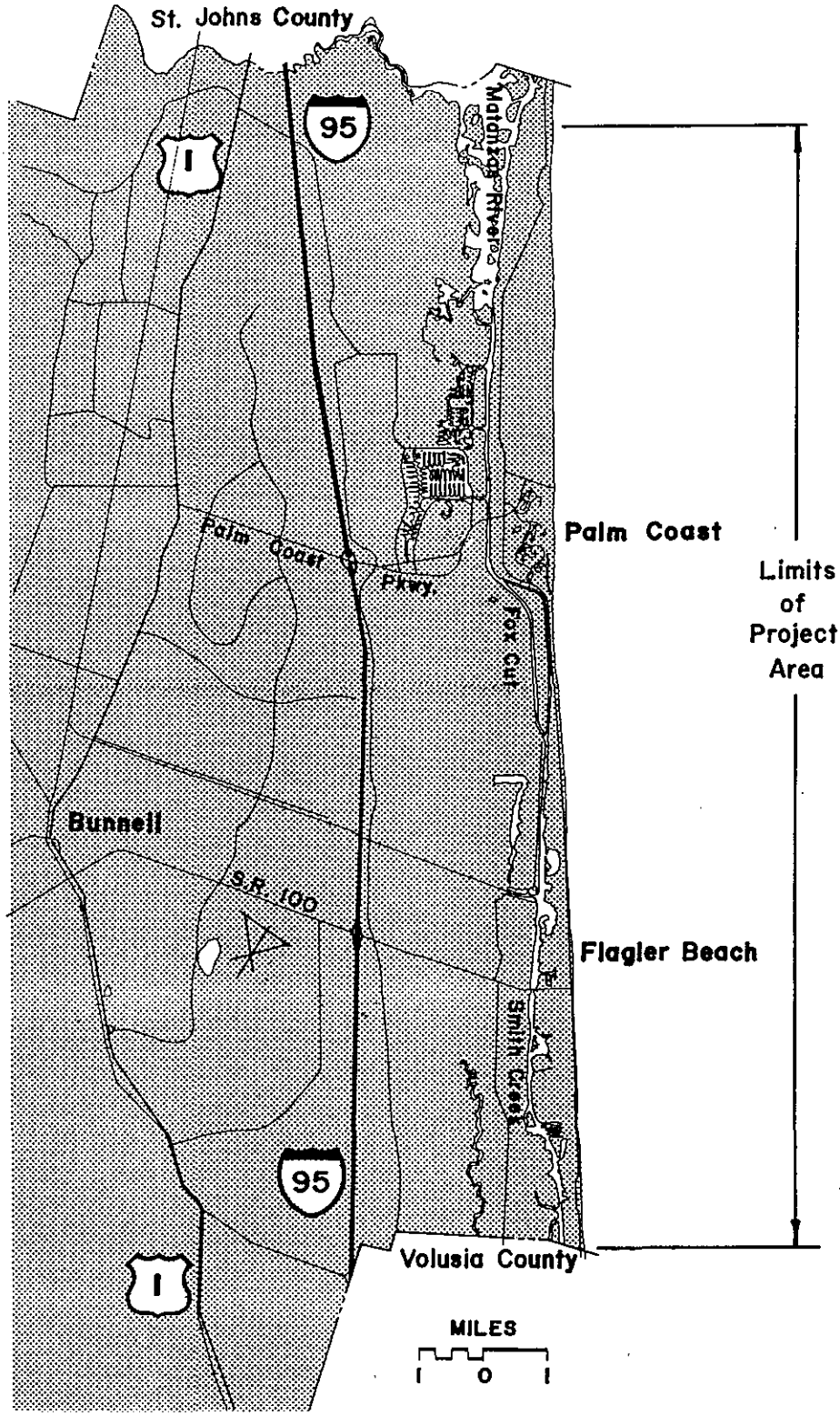
The methods used in the performance of the work reported herein are based on a study (Taylor and McFetridge, 1986) which addressed similar needs of the ICWW within Nassau and Duval Counties, Florida. This earlier effort, performed under the sponsorship of the Florida Inland Navigation District (FIND), served as a pilot study for the FIND's 15-year Atlantic Intracoastal Waterway Maintenance and Management Plan. Phase II of the Nassau-Duval study is now near completion. With the acquisition of seven upland sites, the FIND will construct dredged material management facilities intended to serve the needs of the ICWW within Nassau and Duval Counties for a minimum of 50 years. With minor modification, the same method has more recently been applied to St. Johns, Brevard, and Palm Beach Counties. Phase II is also nearing completion in these counties as well.

Experience gained from these earlier projects has demonstrated the importance of documenting the evaluation process used to identify management alternatives. This report provides such documentation for the long-range dredged material management plan for the ICWW in Flagler County.

1.1 Background

Since its formation in 1927, the FIND has served as the state governmental body responsible for maintaining the ICWW channel along Florida's east coast between Fernandina Harbor and Miami. As such, the FIND must provide the U.S. Army Corps of Engineers (COE) with sites suitable for placing material dredged from the authorized federal navigation channel.

Prior to the increased environmental awareness of the 1970's and the recognition by various federal and state regulatory agencies of the value of estuarine wetlands, a short-term economic approach guided



TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	Figure 1-1 Project Area, Long-Range Dredged Material Management Plan, Intracoastal Waterway Flagler County, Florida	PROJECT REVISION SHEET DATE

management of dredged material. Engineering, cost, and operational considerations determined the design and execution of channel maintenance projects. To this end, the Trustees of the Internal Improvement Trust Fund (hereafter referred to as Trustees) granted to the FIND perpetual easements to significant acreage along the Waterway. A majority of these easements were located entirely within the sovereign waters of the state and included both open water areas and expanses of pristine salt marsh. Additionally, many landowners with holdings adjoining the Waterway sought to improve the development potential of wetlands by granting disposal easements and allowing the unconfined placement of maintenance material. This approach, combined with the desire of the dredging contractor to maximize operational efficiency, resulted in the proliferation of numerous small spoil mounds and islands lining the Waterway.

As a result of society's increased environmental awareness and the scientific knowledge supporting it, the unconfined placement of dredged material within wetland areas is no longer a responsible approach to the maintenance of the ICWW. Neither is it a realistic approach given present-day agency imposed permitting constraints. Current state and federal legislation mandates that all dredging and dredged material management activities satisfy a spectrum of environmental requirements dealing with water quality, habitat protection, threatened and endangered species, and the filling of wetlands. Specific prohibitions against the unconfined placement of dredged material in wetlands are contained in Sections 301 and 404 of the Clean Water Act (33 U.S.C. 403) administered by the U.S. Environmental Protection Agency, Section 10 of the Rivers and Harbors Act administered by the U.S. Army Corps of Engineers, Chapter 403 Florida Statutes and Chapter 17-4 of the Florida Administrative Code administered by the Florida Department of Environmental Regulation, and Chapters 253 and 258 Florida Statutes and Chapters 18-20 and 18-21 of the Florida Administrative Code administered by the Florida Department of Natural Resources. In addition, local county and municipal governments typically address dredge-and-fill issues in local comprehensive planning documents within guidelines established by state regulation. The long-range implications of these constraints have become more apparent in the ensuing years as existing sites reach capacity and the identification and permitting of dredged material management sites become increasingly difficult. Moreover, the intensive development pressure being experienced throughout coastal Florida has made the acquisition of additional sites an ever more expensive proposition.

In order to secure its ability to maintain the ICWW within the existing framework of engineering, operational, and environmental constraints, the FIND initiated a 15-year program of long-term planning and site acquisition to provide a means for accommodating all maintenance material dredged from the Waterway during the next 50 years and beyond. The first program element addressed the needs of the Waterway

within Nassau and Duval counties, as discussed in Section 1.0. The program continues, now guided by a prioritization of Waterway segments, county by county, based on each county's need for immediate channel maintenance and on the difficulty of providing appropriate sites within each county. This prioritization, jointly decided upon by the FIND and the Jacksonville District COE, identified three counties — St. Johns, Brevard, and Palm Beach — as the second group of counties in need of long-range dredged material management plans. As this Phase I report documents, work is well underway on the third group — Flagler, Volusia, and Martin Counties.

1.2 Project Overview

Phase I development of the long-range dredged material management plan for the ICWW in Flagler County consists of four components: (1) the determination of projected 50-year channel maintenance and dredged material storage requirements; (2) the formation of an appropriate management strategy or concept for satisfying these requirements; (3) the identification of candidate sites designed to meet the projected storage requirements within the framework of the management concept; and (4) the evaluation of each site based on a set of criteria consistent with the management concept. This report documents each of these plan components.

1.2.1 Advisory Committees and Public Workshops

The prosecution of this project included, by design, a four-tiered involvement of outside reviewers and interested members of the public who commented on the long-range dredged material management plan as it was being developed. These four sources of input consisted of (1) a Technical Advisory Committee comprising representatives from the Florida Inland Navigation District staff, the Jacksonville District Corps of Engineers, the Florida Department of Environmental Regulation, the Florida Department of Natural Resources, and the Florida Department of Community Affairs; (2) a Citizens' Advisory Committee, comprising community representatives appointed by the Flagler County Commission; (3) the Board of Commissioners for the FIND; and (4) the general public. The manner in which these groups were involved in the development of the long-range dredged material plan is described below.

The Technical Advisory Committee met with members of the Taylor Engineering staff a total of four times during the course of the project to monitor work in progress, review technical decisions, and establish project policy for the execution of future tasks. The first meeting of the Technical Advisory Committee was

held August 13, 1992, at the offices of Taylor Engineering. At this meeting, the Committee reviewed long-term Waterway requirements, the inventory of existing easements and their ability to meet these requirements, the development of the management concept, the preliminary identification of alternative candidate sites, and the establishment of a preliminary site bank consisting of both existing easements which demonstrated some potential for continued use and newly identified alternative sites. The second meeting of the Technical Advisory Committee was held October 7, 1992, at the offices of the DNR in Tallahassee. At this meeting, the Committee reviewed the results of the field inspection of all sites within the preliminary site bank, as well as the preliminary assessment of the preferred alternative sites for each reach of the project area. The last two meetings of the committee were held March 18, 1993, at Taylor Engineering, and on April 16, 1993, at the DER offices in Tallahassee. In these meetings the committee reviewed the results of the site evaluation process and the selection of the site bank of primary and secondary alternatives. The plan presented in this report reflects the valued contribution of this group.

Immediately following each Technical Advisory Committee meeting a meeting was held with the Flagler County Citizens' Advisory Committee. The material discussed and reviewed at these meetings paralleled that covered in the Technical Advisory Committee meetings. Most importantly, input was received from the members of the Citizens' Advisory Committee regarding the relative practicality and desirability of developing specific candidate sites as permanent dredged material management facilities. As a result, many valuable suggestions were received, and in many cases acted upon to the betterment of the final plan document. The contributions of these individuals were a key factor in the successful completion of the project.

In addition, a series of presentations and workshops were carried out to inform both the citizens of Flagler County and their elected officials. To begin, two presentations to the Flagler County Commission were made by the staffs of FIND and Taylor Engineering. The first of these was made on July 20, 1992 to introduce the FIND program of long-range dredged material management for the Intracoastal Waterway, and to inform the Commission that a planning effort for the Waterway in Flagler County was being initiated. A second, similar presentation was made at the Council's regularly scheduled meeting on March 1, 1993 to inform the newly elected members of the Council of the ongoing plan development process.

To inform the citizens of Flagler County and to receive additional input, two Public Information Workshops were held. These two workshops, held November 16, 1992 and April 27,1993, in Flagler Beach, presented the work accomplished to date and set forth the direction of the plan at that time. Input received

from both the Technical Advisory and Citizens' Advisory Committees was incorporated in the information presented and discussed at the public workshops.

Finally, progress made in the development of the Long-Range Dredged Material Management Plan for the Intracoastal Waterway in Flagler County was discussed at the regularly scheduled public workshops and Board meetings of the Florida Inland Navigation District. These public meetings are held monthly on a rotating basis in each of the 11 Counties comprising the District. During Phase I of the Flagler County project, progress reports and updates were presented and discussed by the FIND Board at seven public meetings and workshops. These included the FIND public workshops held in Fernandina Beach (Nassau County) on October 24, 1992, in Stuart (Martin County) on February 20, 1993, and in Ft. Pierce (St. Lucie County) on April 24, 1993, as well as the FIND Board meetings held in Miami (Dade County) on September 17-18, 1992, in Palm Coast (Flagler County) on January 22, 1993, in Jacksonville (Duval County) on July 23-24, 1993, and finally in Ft. Lauderdale (Broward County) on September 9-10, 1993, at which time the plan was formally adopted by the Board.

The constructive and valuable input received from each of the above described sources contributed greatly to the successful completion of the Long-Range Dredged Material Management Plan for the Intracoastal Waterway in Flagler County.

1.3 Plan Document

The entire process is documented in the remaining sections of this report. Section 2.0 describes the establishment of 50-year material management requirements for various reaches of the Waterway. This was accomplished by the use of historic data, and the comparison of projected dredging locations and material storage requirements with the capacities of existing disposal easements. Section 3.0 discusses the management concept, the identification of alternative sites, and the field inspection and initial evaluation of all candidate sites, comprising both existing easements and alternative sites. Section 4.0 describes the final site evaluation process and includes the evaluation criteria used and the formation of the site bank of first- and second-choice options from the list of candidate sites. Finally, Section 5.0 presents a specific scope of work for plan implementation in Phase II.

2.0 50-YEAR MATERIAL STORAGE REQUIREMENT

2.1 Historic Analysis

2.1.1 Methodology

Fifty-year dredging and material storage requirements for the Flagler County segment of the Waterway were projected from historic shoaling rates in the Waterway channel. Baseline shoaling rates, in turn, were determined from a detailed analysis of Jacksonville District COE archival records, engineering plans, and survey data related to channel maintenance. These records represent the only available information on patterns of sedimentation within the project area.

Baseline shoaling rates for the various segments of the Waterway in Flagler County were derived from two estimated quantities: (1) the estimated volume of material removed from the Waterway channel in all maintenance dredging operations since the present channel project depth was established, and (2) the estimated volume of shoaling which has occurred since the last maintenance operation or which has occurred in areas not covered by later channel maintenance.

The first quantity, the volume of historic maintenance dredging, is derived from COE records, as previously stated. The estimated quantity is based on the analysis of all plans and supporting documents for channel maintenance performed in the Flagler County segment of the ICWW since the channel was deepened to its present project depth of 12 feet below Mean Low Water (MLW). Within Flagler County, the deepening of the channel was performed in two phases — south to S.R. 100 in late 1951 and from S.R. 100 southward in early 1952.

The volume of material dredged in previous channel maintenance operations is expressed in two forms in the archival records. The first is the pre-dredging estimate, or the design volume, of required dredging. This estimate is obtained by comparing the results of a detailed pre-dredging examination survey of the authorized channel to the project design depth, plus the required advanced maintenance or overdepth dredging. The plan for the dredging operation and the bids of the dredging contractors are based on this estimate. The second estimate is recorded as the pay volume. This estimate determines the amount the dredging contractor is paid for the work. It is based on the comparison of detailed pre- and post-dredging examination surveys, and therefore closely corresponds to the actual volume of material removed from the

channel. Because of past contracting and recording procedures, pay volumes do not always link dredging quantities to specific dredging locations. In those maintenance operations for which the pay volume is unavailable, the pay volume was estimated by multiplying the design volume by a correction factor. The correction factor represents the ratio of pay volume to design volume in those channel maintenance operations for which both quantities are known. The correction factor applied to the Flagler County dredging data is 1.1905.

In addition, a second quantity, the estimated volume of recent shoaling, was derived to provide a more complete indication of the patterns of sedimentation. Over an adequate period of record during which channel maintenance is performed regularly or on an "as needed" basis, historic dredging volumes provide a reasonable and reliable indication of sedimentation patterns. In addition to shoaling rates, other unrelated factors often determine the scheduling of channel maintenance. These include contracting procedures, the availability of funding and equipment, and most relevant to the present study, the availability of suitable dredged material management sites. Here, Flagler County has benefitted from existing easements that have provided adequate material storage capacity for channel maintenance operations up to the recent past. Nevertheless, the calculation of future dredging and material storage requirements includes estimates of current shoaling volumes based on the most recent COE channel centerline survey. Performed in October, 1987, this survey reflects shoaling in the northern portion of the county which has occurred since the last maintenance operation in that area in the fall of 1986. Thus, the period of record on which the historic rates of shoaling are based is late 1951 to late 1987, or 36 years.

The development of plan elements which address the needs of the ICWW in Nassau, Duval, St. Johns, Brevard, and Palm Beach Counties has demonstrated that a necessary first step in the analysis of dredging records and survey data is to establish an accurate and consistent system for cross-referencing a particular location along the ICWW to both cut and station (sta), and channel mile. Moreover, such a system must resolve inconsistencies between project descriptions found in older engineering records and those of more recent origin. These inconsistencies were resolved by adopting current designations of channel cut and station and referencing them to ICWW channel mileage. The system is therefore derived from the original navigation project record document which accompanied the establishment of the 12-foot MLW project depth in 1951-52 and modifications to that document which appeared in succeeding maintenance plans. Consistency with the previous plan elements was maintained by measuring channel mileage from the southern boundary of the Jacksonville Harbor project (ICWW mile 0.0). This system,

presented in Table 2-1, was used throughout the remainder of the study. Inspection of Table 2-1 shows that the ICWW within Flagler County comprises 32 straight line segments, or cuts, totalling 18.43 miles.

Within this framework, a comprehensive analysis was then conducted of all maintenance dredging occurring in the ICWW in Flagler County since 1951. All available sources of dredging information within the Jacksonville District COE were consulted to ensure accuracy, consistency, and completeness. Preliminary sources included the annual Office of the Chief of Engineers (OCE) Reports, previous COE summaries of maintenance dredging within the project area, and interviews with COE personnel. The primary sources of information, however, were archival maintenance plan documents and examination surveys.

The compilation and reduction of historic dredging information from the various preliminary sources was a difficult task. No single source had complete information, and the resolution of inconsistencies among sources was necessary prior to locating dredging plans. This task accomplished, the records then had to be physically located under several filing systems within the district office archives and missing plans recalled from inter-division loan or from alternate storage at the Jacksonville District Dredge Depot. All relevant dredging information was verified by reference to the original plan sheets or microfiche versions of the original engineering drawings. Additional information contained in the dredging plans included shoaling areas and limits of planned dredging (referenced to the existing longitudinal stationing), the estimated dredging volume for each shoal, and in many cases, the location of material placement. Through this procedure, it was determined that maintenance within the study area since the establishment of the present 12-foot MLW project depth consisted of four separate events. The results of this analysis are summarized in Table 2-2.

Table 2-2 also includes estimates of shoaling which has occurred since the last channel maintenance. These estimates are based on the results of the most recent channel centerline survey. For consistency, corresponding pay volumes for each area of shoaling are projected from the same design volume to pay volume ratio used in the analysis of historic dredging. This measure of recent shoaling was combined with historic dredging volumes to determine projected dredging and material storage requirements. Segments of the ICWW within Flagler County which have historically required maintenance or which have recently experienced shoaling are identified in Figure 2-1.

TABLE 2-1 INTRACOASTAL WATERWAY

FLAGLER COUNTY, FLORIDA[1]

	End Station (ft)	Length (mi)	MILEAGE 0.0 @ Cut F-1 Sta 0+00	MILEAGE ICWW Mileage 0.0 @ DU-1	MILEAGE 0.0 @ FHP AIWW Cut 34
Cut SJ-64	36 + 59.2			55.42	77.80
Cut F-1	15 + 07.4	0.29	0.29	55.71	78.09
F-2	37 + 30.5	0.71	0.99	56.41	78.79
F-3	21 + 88.7	0.41	1.41	56.83	79.21
F-4	32 + 35.0	0.61	2.02	57.44	79.82
F-5	71 + 87.7	1.36	3.38	58.80	81.18
F-6	23 + 42.2	0.44	3.82	59.24	81.62
F-7	11 + 13.0	0.21	4.03	59.45	81.83
F-8	11 + 25.5	0.19	4.23	59.65	82.03
F-9	13 + 42.4	0.25	4.48	59.90	82.28
F-10	12 + 52.5	0.24	4.72	60.14	82.28
F-11	28 + 02.0	0.53	5.25	60.67	83.05
F-12	24 + 99.4	0.47	5.72	61.14	83.52
F-13	15 + 53.2	0.29	6.02	61.44	83.82
F-14	15 + 81.7	0.30	6.32	61.74	84.12
F-15	31 + 07.2	0.59	6.91	62.33	84.71
F-16	28 + 19.5	0.53	7.44	62.86	85.24
F-17	9 + 83.1	0.19	7.63	63.05	85.43
F-18	34 + 44.9	0.65	8.28	63.70	86.08
F-19	12 + 87.8	0.24	8.52	63.94	86.32
F-20	86 + 61.0	1.64	10.16	65.58	87.96
F-21	18 + 13.7	0.34	10.51	65.93	88.31
F-22	40 + 82.9	0.77	11.28	66.70	89.08
F-23	27 + 58.5	0.52	11.80	67.22	89.60
F-24	14 + 07.2	0.27	12.07	67.49	89.87
F-25	48 + 65.5	0.92	12.99	68.41	90.79
F-26	72 + 51.7	1.37	14.36	69.78	92.16
F-27	31 + 30.0	0.59	14.96	70.38	92.76
F-28	22 + 97.6	0.44	15.39	70.81	93.19
F-29	42 + 54.7	0.81	16.20	71.62	94.00
F-30	34 + 32.4	0.65	16.85	72.27	94.65
F-31	33 + 20.3	0.63	17.48	72.90	95.28
F-32	50 + 02.6	0.95	18.43	73.85	96.23
TOTAL	**97,281.8 ft**		18.43 mi		

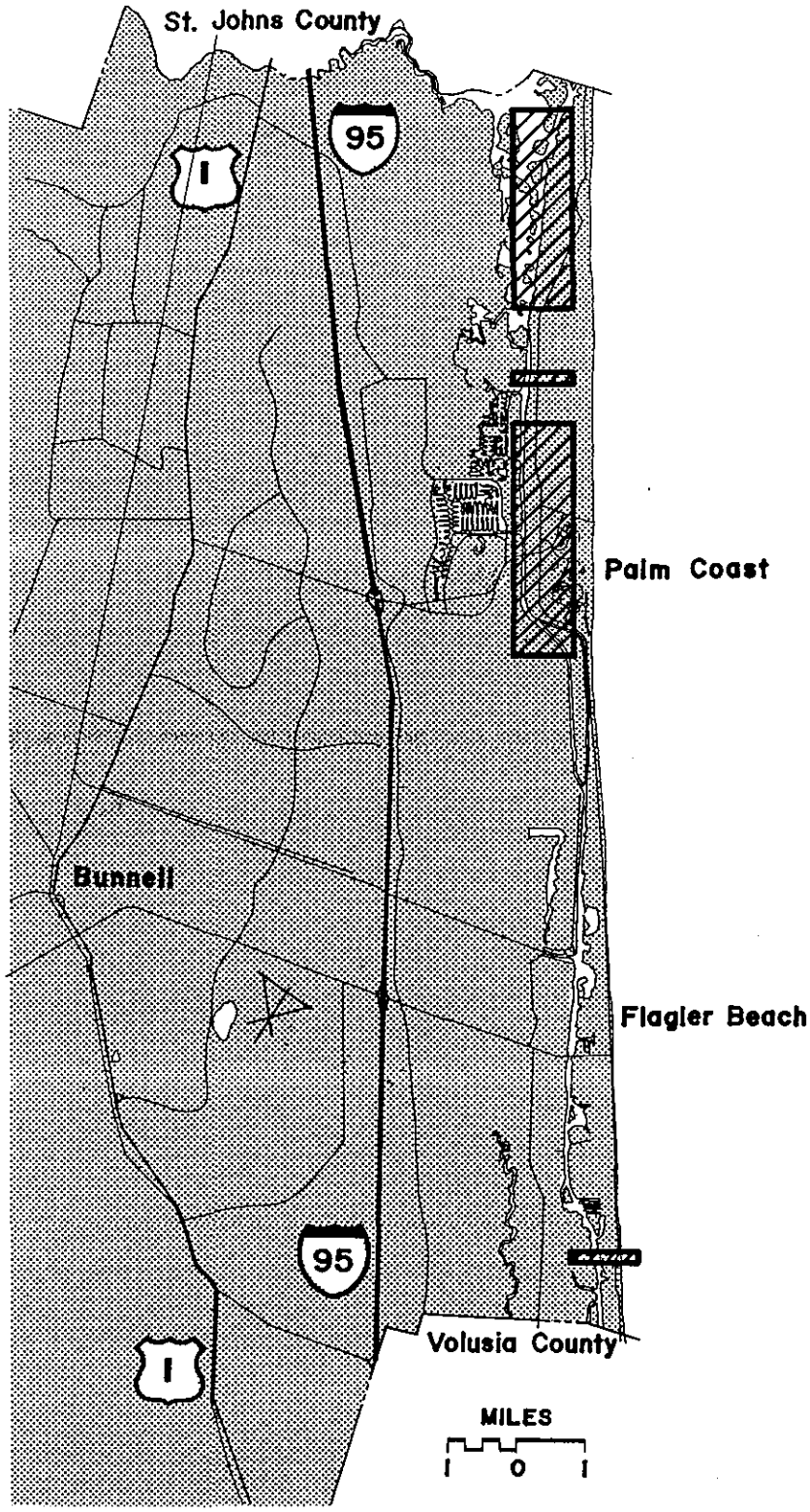
[1] Based on data contained in "Control Data, Intracoastal Waterway, Jacksonville to Miami, St. Johns River to Melbourne, 12 ft Project" D.O. File No. 8A-30, 014, Jacksonville District, U.S. Army Corps of Engineers (undated).

TABLE 2-2: SUMMARY OF HISTORICAL MAINTENANCE

DREDGING/RECENT SHOALING - FLAGLER COUNTY 1951-1987

ICWW Mileage From	To	Channel Cut/Sta From	To	Length	Year	Design Vol. (c.y.)	Pay Vol. (c.y.)	Disposal Area
55.91	56.34	F-2/10+50	F-2/33+50	0.44	1967	23,100	27,500	MSA 3001
55.99	56.33	F-2/15+00	F-2/32+50	0.34	1979	42,000	50,000	MSA 3001/3004
56.20	58.48	F-2/26+00	F-5/55+00	2.28	1986	97,000	115,475	D/A F-3/F-4
56.36	56.77	F-2/34+50	F-3/19+00	0.41	1967	7,000	8,334	MSA 3004
56.77	57.44	F-3/19+00	F-4/32+00	0.67	1967	22,800	27,143	MSA 3005
58.54	58.84	F-5/58+00	F-6/2+00	0.30	1987*	13,060	15,543	----
59.82	59.95	F-9/9+00	F-10/2+50	0.13	1987*	7,886	9,388	----
60.61	62.35	F-11/25+00	F-16/1+00	1.74	1986	135,000	160,730	MSA 3021/3033
62.33	63.94	F-16/0+00	F-20/0+00	1.61	1979	342,000	407,151	MSA 3048/3050A
62.71	62.92	F-16/20+00	F-17/3+00	0.21	1960	17,000	20,239	MSA 3037 (rev.)
72.80	72.86	F-31/28+00	F-31/31+00	0.06	1987*	3,333	3,968	----
			TOTAL			**710,179 cy**		
							(x 1.1905)	
			(Est.) Pay Volume			**845,476 cy**		
							(- 36)	
			Dredging Volume/yr			**23,485 cy**		
							(x 50)	
			50-yr Dredging Requirement			**1,174,272 cy**		
							(x 2.15)	
			50-yr Disposal Requirement			**2,524,685 cy**		

* Estimated shoal volumes based on centerline survey "Reconaissance Survey, 10 and 12-foot Project, St. Johns River to Key West" D.O. File No. 8-35, 044, Jacksonville District, U.S. Army Corps of Engineers, July, 1987.



TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	Figure 2-1 Areas of Previous Maintenance or Recent Shoaling, Intracoastal Waterway Flagler County, Florida	PROJECT REVISION SHEET DATE

2.1.2 Material Quantities and Locations

Examination of Table 2-2 leads to two primary conclusions concerning the characteristic pattern of shoaling within the Flagler County segment of the ICWW. First, a relatively small volume of shoaling has occurred since the present 12-foot MLW project depth was established. The total volume of material removed in previous channel maintenance is only 816,572 cubic yards (cy), with only an additional 28,904 cy in recently documented shoaling, for a total shoaling volume of 845,476 cy.

For purposes of comparison, this county-wide total represents only slightly more than one-third of the volume of shoaling which has occurred over the same period of time in the 4.5-mile segment of the Waterway immediately north of the Flagler County project area. This area of intense shoaling, centered on Matanzas Inlet, is characteristic of those areas of the Waterway near tidal inlets. A relatively high shoaling rate is expected in such areas, as inlets typically introduce littoral sediments to interior navigation channels. Indeed, within the counties addressed thus far in the present long-range dredged material management program, tidal inlets are the primary source of ICWW channel sediment. Without the influence of an inlet, the Flagler County segment of the ICWW experiences less shoaling than other segments in counties dominated by one or more tidal inlets. As a result, the Flagler County segment of the ICWW has required only four maintenance operations since 1951. In contrast, the Matanzas Inlet reach of the ICWW immediately north of the Flagler County project area has required 13 dredging events to maintain the authorized channel depth over the same time period.

Localized shoaling is the second characteristic of the shoaling pattern within the Flagler County segment of the ICWW. With the exception of a single minor shoal recently documented at the southern end of the county, all historic channel maintenance and recent shoaling has occurred in the county's northern half. Specifically, the 8.23 channel miles extending southward from the vicinity of Marineland (Cut F-2, ICWW mile 55.71) to the northern end of Fox Cut (Cut F-20, ICWW mile 63.94) account for over 99 percent (841,508 cy) of the total historic volume of shoaling. Within this segment, the distribution of shoaling has been heavily weighted toward the south: approximately 70 percent (588,120 cy) of the total volume has occurred in the southernmost 3.33 mile segment (ICWW mile 60.61 to mile 63.94). This roughly corresponds to the area extending southward from the Palm Coast Parkway Bridge to the north end of Fox Cut. Dug through uplands, the Waterway in this area is an artificial canal connecting the Matanzas River and Pellicer Marsh to Smith Creek. Most of the shoaling in this area (567,881 cy) reflects the material dredged from the channel in two maintenance operations — 160,730 cy in 1986 and 407,151 cy

in 1979. The remaining 30 percent of the shoaling in Flagler County is distributed throughout the northern 4.9 miles of the project area.

Thus, the greater portion of the shoaling within the Flagler County project area is located over 7.5 miles south of Matanzas Inlet. This suggests that a portion of the shoal material may be derived from adjacent uplands or slumped from the channel side slopes. The physical characteristics of Flagler County channel sediment are discussed further in Section 2.1.3.

Southward from the north end of Fox Cut (Cut F-20, ICWW mile 63.94) to the Flagler-Volusia County line, no maintenance dredging has been performed since the channel was originally deepened to 12 feet. Moreover, only recently has a single minimal shoal (estimated volume, 3400 cy) been documented at the southern end of the county (Cut F-31, ICWW mile 72.8), opposite the Gamble Rogers Memorial State Recreation Area. However, the formation of this shoal suggests that the previous absence of shoaling within the southern half of the county may be changing, possibly as a result of continuing development along the ICWW, accelerated upland runoff, increased boat traffic, or other less direct factors. The existence of this shoal represents an example of how changing coastal development influences historic shoaling patterns.

Combining the maintenance dredging quantities and existing shoal volumes for the various segments of the ICWW within the county yields a total county-wide volume of shoaling of 845,476 cy for the 36-year period of record (1951-1987). To project the corresponding 50-year maintenance requirement, this figure was then apportioned upward by linear extrapolation (i.e., multiplied by a factor or 50/36, or 1.389). The resulting 50-year projected dredging volume of 1,174,272 cy corresponds to the in *situ* or unbulked volume of anticipated shoaling throughout the county.

To translate the projected 50-year in *situ* volume of shoaling into an equivalent volume required to store the dredged material, the bulking characteristics of the material must be considered. Bulking refers to the expansion of consolidated sediment that occurs as a result of dredging. Hydraulic dredging leads to material bulking by increasing the water content of the dredged material compared to its in *situ*, consolidated state. After dredging, the dredged material will begin to consolidate under its own weight. Given appropriate conditions and sufficient time, the material may approach its original pre-dredging volume. The degree to which the material expands (bulks) depends on the physical characteristics of the sediment, as well as its relative consolidation prior to dredging. For this study a factor of 2.0 was used to account for the increase in volume of the in *situ* shoal material as it is dredged. An additional allowance of 15 percent of

the original in *situ* volume accounts for anticipated non-pay volume or unauthorized overdredging. The selection of these values is based upon Jacksonville District, U.S. Army Corps of Engineers experience and recommendation and is considered to be conservative. Multiplying the projected 50-year volume of shoaling by the effective bulking factor of 2.15 yields a projected 50-year material storage requirement of 2,524,685 cy for the Flagler County project area.

2.1.3 Material Quality

In addition to projected material quantities, a dredged material management plan must also consider the chemical and physical properties of the sediment to be dredged. Techniques employed to maintain water quality during dredging and dewatering are highly dependent on sediment chemistry and the physical characteristics of the dredged material (i.e., particle size, specific gravity, etc.). Also, both the chemical and physical properties of the dredged material determine its potential for reuse, and therefore, the effective site lifetime. In a manner similar to the procedure used to establish historic dredging volumes, a complete review was made of all available sediment chemistry and physical data. To augment the limited data on Flagler County sediments, a program of sediment sampling and analysis was performed specifically for the present planning effort. Both the historic and more recent sediment data are discussed in the following paragraphs.

2.1.3.1 Sediment Chemistry

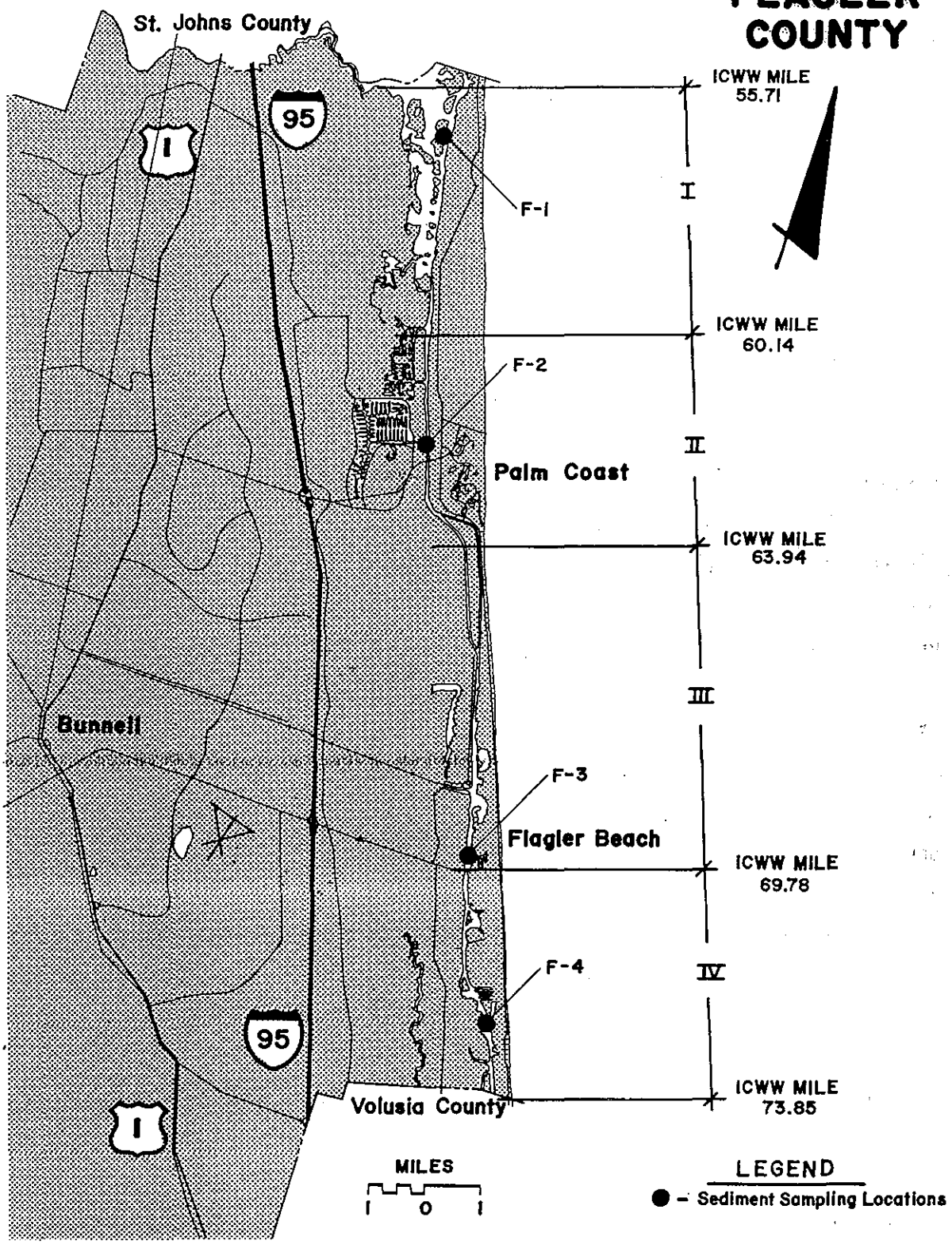
The Jacksonville District COE was not required to obtain sediment chemistry data for its earlier channel maintenance operations. As a result, historic sediment chemistry data for the ICWW channel within Flagler County are limited to the results of a Florida Department of Environmental Regulation (DER) sediment sampling program. In 1984, the DER sampled sediments within the ICWW or adjacent waters at seven locations within the vicinity of the project area: (1) Station MZR-5, mid-channel of the ICWW opposite the entrance to Marineland Marina (Cut F-2, sta 0+00); (2) Station MZR-6, west of ICWW channel at the mouth of Pellicer Creek; (3) Station MZR-7, west of the ICWW channel at the mouth of the north entrance to the Palm Coast canal system; (4) Station MZR-8, west of the ICWW channel at the mouth of the central entrance to the Palm Coast canal system; (5) Station MZR-9, west of the ICWW channel at the mouth of the south entrance to the Palm Coast canal system; (6) west of the ICWW channel at the mouth of the St. Joe Canal; and (7) Station HXR-1, west of the ICWW channel inside the Lehigh Portland Cement entrance canal/SeaRay boat basin. Thus, of the seven locations sampled, only one is in the ICWW channel,

albeit at the extreme north end of the Flagler County project area. Therefore, only the data from this location should be considered representative of the material to be dredged in channel maintenance operations. As expected, metals concentrations at this location did not exceed natural background levels.

The DER chose the remaining six sampling locations outside but near the ICWW channel to characterize worst-case conditions — that is, at locations where contaminants, if present in the system, would most likely be encountered. Many contaminants, most notably heavy metals, have a strong affinity for fine-grained sediment. As discussed in the next section, ICWW channel sediment in Flagler County is composed largely of sand. This is especially true near Matanzas Inlet where strong tidal currents flush fine sediment from the channel. Significant deposits of fine-grained sediment are more typically encountered nearer shore where tidal currents are weaker. The six stations outside of the ICWW channel were located inside the entrances of tidal creeks, major canals, and/or boat basins where fine-grained sediments may accumulate. Although the data from these stations cannot be considered representative of the sediment to be dredged from the ICWW channel, metals concentrations at four of these worst-case locations were found to be within natural ranges. In the remaining two locations — Station MZR-8 at the central entrance to the Palm Coast canal system and Station HXR-1 inside the SeaRay boat basin — only copper was found at concentrations slightly above levels expected under natural conditions.

To augment this limited historic chemistry data, the FIND contracted Taylor Engineering to conduct a preliminary sediment quality assessment, an effort completed in April, 1993. The methods used in the performance of this assessment and its findings, including sediment sampling, analytical results, and interpretation, are documented in a separate report (Schropp and Taylor, 1993) briefly summarized below.

In January, 1993, samples were taken from four locations throughout the project area, each location centered in the ICWW channel (Figure 2-2). In an effort to sample worst-case conditions, each station was located near a potential source of contamination as follows: (1) Station F-1, opposite the mouth of Pellicer Creek (Cut F-3, sta 0+00, ICWW mile 56.41); (2) Station F-2, 100 feet south of the entrance to the Palm Coast Marina (Cut F-15, sta 8+00, ICWW mile 61.89); (3) Station F-3, opposite the mouth of the first canal north of S.R. 100 on the east side of the ICWW (Cut F-26, sta 56+50, ICWW mile 69.48); and, (4) Station F-4, opposite a residential embayment on the east side of the ICWW approximately 1000 feet north of Gamble Rogers Memorial State Recreation Area (Cut F-31, sta 15+00, ICWW mile 72.55). Notably, only stations F-1 and F-2 are within areas of active shoaling.



TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	Figure 2-2 Sediment Sampling Locations Intracoastal Waterway Flagler County, Florida	PROJECT REVISION SHEET DATE

The samples were analyzed to determine grain size distribution and to measure a suite of potential pollutants including metals (i.e., arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc), nutrients, polynuclear aromatic hydrocarbons (PAH), chlorinated pesticides, and polychlorinated biphenyls (PCB). Samples were analyzed using U.S. Environmental Protection Agency or American Public Health Association standard methods. The suite of sediment constituents examined is more extensive than that usually required by the Florida Department of Environmental Regulation (FDER) in support of dredge and fill permit applications. The broader suite of constituents was examined, however, to provide a thorough characterization of sediment chemistry and to identify potential sediment contaminant problems.

The results of sediment chemistry analyses are often difficult to interpret. No sediment quality standards exist comparable to the water quality standards adopted by the Florida Department of Environmental Regulation. The FDER has supported, however, the development of guidance documents to simplify the interpretation of sediment chemistry data. Two procedures detailed in these documents were used to evaluate the ICWW sediment data. The first procedure compares measured chemical constituent concentrations to natural background concentrations. A chemical within its natural range is considered to pose no environmental threat. The second procedure compares measured chemical constituent concentrations to concentrations determined to represent hazards to aquatic life.

Application of both methods indicate that the ICWW sediments examined during this project are not contaminated and pose no environmental threat. With one exception, sediment metal concentrations are all within natural ranges. In the one exception, concentrations of mercury exceeded the expected values at Station F-1. However, the reported concentrations were below those deemed to represent a significant hazard to aquatic life. This isolated case of metal enrichment could, however, prompt the FDER to request elutriate testing or additional sediment sampling during its evaluation of dredge and fill permit applications for proposed operations at or near this location. The elutriate test is intended to ensure that water quality standards will not be violated during dredging or discharge of ponded water.

PAHs, PCBs, and pesticides were all below detectable limits. Comparison of the detectable limits to biological effects-based sediment quality guidelines indicate that the tested ICWW sediments pose no threat to aquatic life. In addition, levels of nutrients and oil and grease are typical of normal estuarine sediments and do not indicate any significant contamination.

2.1.3.2 Physical Characteristics

The primary source of physical data used to characterize ICWW channel sediment within the Flagler County project area is based on a series of core borings taken by the Jacksonville District COE prior to scheduled maintenance activity. Only since the early 1970's have core boring data been systematically included in maintenance dredging plans prepared by the Jacksonville District. Thus, data of this type are available only for segments of recently dredged channel. Conversely, no core boring data are available for the southern 9.9 miles of the Waterway in Flagler County in which no channel maintenance has been performed.

Within the Flagler County project area, two sets of core boring data are available. First, core borings were taken and analyzed in December, 1978, at four locations in Cuts F-1 and F-2 and eight locations in Cuts F-16 through F-19. This work was done in anticipation of the 1979 maintenance operation. To prepare for the 1986 operation, a second set of data was obtained in September, 1985, at 11 locations in Cuts F-2 through F-5 and in 16 locations in Cuts F-12 through F-16. In each case, the data consist of individual core boring logs, which present qualitative characterizations of the sediment at elevations referenced to MLW. In addition, gradation or sieve analysis results and suspended sediment-time curves are also contained in the data for a very limited number of core boring locations. The total depth of each boring is typically -17 to -20.5 feet MLW, or 3 to 6.5 feet below the maximum depth of dredging. Sediment which enters the channel to form shoals may be qualitatively different than the native material underlying the channel. Therefore, only data which correspond to the material above the depth to which the channel was originally constructed (i.e., -14 feet MLW, or 12 feet, plus 2 feet over-dredging) are considered.

The core boring logs uniformly characterize the sediments from all but two boring locations as fine sand, light gray to brown in color, with varying minor fractions of silt and shell. The two exceptions to this characterization include one location each from the 1978 and 1985 series. In 1978, the sediment from one location (Cut F-17, sta 8+00, ICWW mile 63.01) is classified as silt. This material, which was removed in the 1979 maintenance operation, was highly localized, perhaps resulting from a single storm event. In 1985, a single core boring (Cut F-5, sta 4+00, ICWW mile 57.52) produced sediment classified as brown clayey silt with a trace of organics. This deposit was highly localized as well, as shown by core borings taken at the same time within 700 feet on either side of the first location. The adjacent core borings produced fine brown shelley sand, consistent with most of the locations sampled. Similar to the area of silt

identified in 1978, the second anomalous deposit was removed during the 1986 channel maintenance operation. The characterization of the shoal material in the northern portion of Flagler County as predominantly fine shelley sand is qualitatively supported by inspection of the areas adjacent to this reach which were previously used as dredged material sites. The surface of these areas is generally composed of fine sand, light gray to white in color, with a noticeable component of shell, both ground and whole. Because of the shell content, the compaction and the bearing capacity of this material make it suitable for roadbeds. Palm Coast ITT Community Development Corporation (ICDC) mines this material for use in road construction and maintenance. This practice by ICDC is somewhat unique. Because the Waterway channel in this area was originally dredged through upland property, the current owner (ICDC) holds title to the channel bottom. Thus, ICDC retains the right to use the material dredged from the channel. More typically, the submerged lands beneath the channel are held by the state, and therefore material dredged from the channel cannot be mined by private interests without the state's approval.

In addition to the Jacksonville District COE core boring logs, Schropp and Taylor (1993) provide a second source of sediment data. In this previously cited study, surface samples from the same locations described in Section 2.1.3.1 were analyzed for grain size distribution, as well as chemical components. The resulting grain size distribution curves presented in their report are briefly summarized below.

The mean grain sizes of the four samples range from 0.139 mm to 0.071 mm. As expected, the sediment becomes increasingly finer with increasing distance from Matanzas Inlet as progressively lower tidal current velocities allow successively finer sediments to settle out of suspension. Based on mean grain size, the sediments from all four sampling locations are classified as fine to very fine sand under the Wentworth Classification system. Under the Unified Soils Classification (USC) system, used by the COE and thereby more common in dredging applications, sediments from the three northern locations are classified as fine sand, with sediments from the most southern location classified as coarse silt. In addition, under the USC system the percentage of each sample classified within the silt-sized fraction (i.e., less than 0.074 mm or passing on a #200 sieve) increases with distance south of Matanzas Inlet. In the sample from the northernmost station, F-1, only 8 percent of the sediment is classified as silt. The silt-sized fraction of the samples from Station F-2, F-3, and F-4 containing 11 percent, 18 percent, and 33 percent silt-sized particles, respectively. As noted in the previous section, only stations F-1 and F-2 are within areas of active shoaling and therefore represent the channel sediment to be dredged.

No sediment quality data are presently available to characterize the shoals identified in the most recent centerline survey which may be specifically scheduled for maintenance during the next dredging cycle. Core borings will be obtained in connection with a detailed examination survey of each shoal prior to the initiation of contracting procedures. Sediment chemistry typically is not analyzed unless required to obtain the necessary Water Quality Certificate from the Florida DER.

2.2 Existing Sites

A review of Jacksonville District COE Real Estate Maps (Drawing No. RE-C 12,214) and FIND real estate aerial basemaps (1986) of the project area yielded 40 tracts which the FIND controls for the purposes of dredged material management. These are identified in Table 2-3 and shown in Figure 2-3. The FIND holds six of these tracts, totalling 200.2 acres, under fee simple ownership, while it holds the remaining 34 privately or publically owned parcels, totalling 1408.08 acres, under perpetual disposal easement.

A preliminary evaluation of each existing easement and FIND-owned tract was then performed. In addition to the COE Real Estate Maps and FIND aerial basemaps already mentioned, the evaluation was based on four resources: (1) black and white aerial photography of nominal 1" = 800' scale, flown January-December, 1985 for the Jacksonville District COE; (2) 1:24,000 scale (1" = 2,000') color-infrared aerial photography, flown March 1983 and March 1984, from the National High Altitude Photography Program of the U.S. Geological Survey (USGS); (3) 1:24,000 scale (1" = 2,000') USGS Topographic Quadrangle Maps, 7.5-minute series; and (4) 1:24,000 scale (1" = 2,000') National Wetlands Inventory maps from the U.S. Fish and Wildlife Service.

Consideration of the most basic operational and site evaluation criteria eliminated all but 15 of these tracts from further consideration. The full range of site evaluation criteria are presented in detail in Section 4.0 and discussed throughout the remainder of this report. However, at this preliminary level of the site evaluation process, two criteria were of primary consideration — (1) that, to the greatest extent possible, the placement of dredged material must be confined to upland areas; and (2) that a site must contain sufficient upland area to allow for the efficient construction of earthen containment dikes to dewater and store the dredged material. Examination of Table 2-3 confirms that most of the tracts were eliminated because they contained insufficient contiguous upland area, either as a result of minimal overall acreage (e.g., less than 5 acres) or because the tract consisted primarily of wetlands, most notably saltmarsh. The

TABLE 2-3: INVENTORY OF EXISTING DISPOSAL EASEMENTS

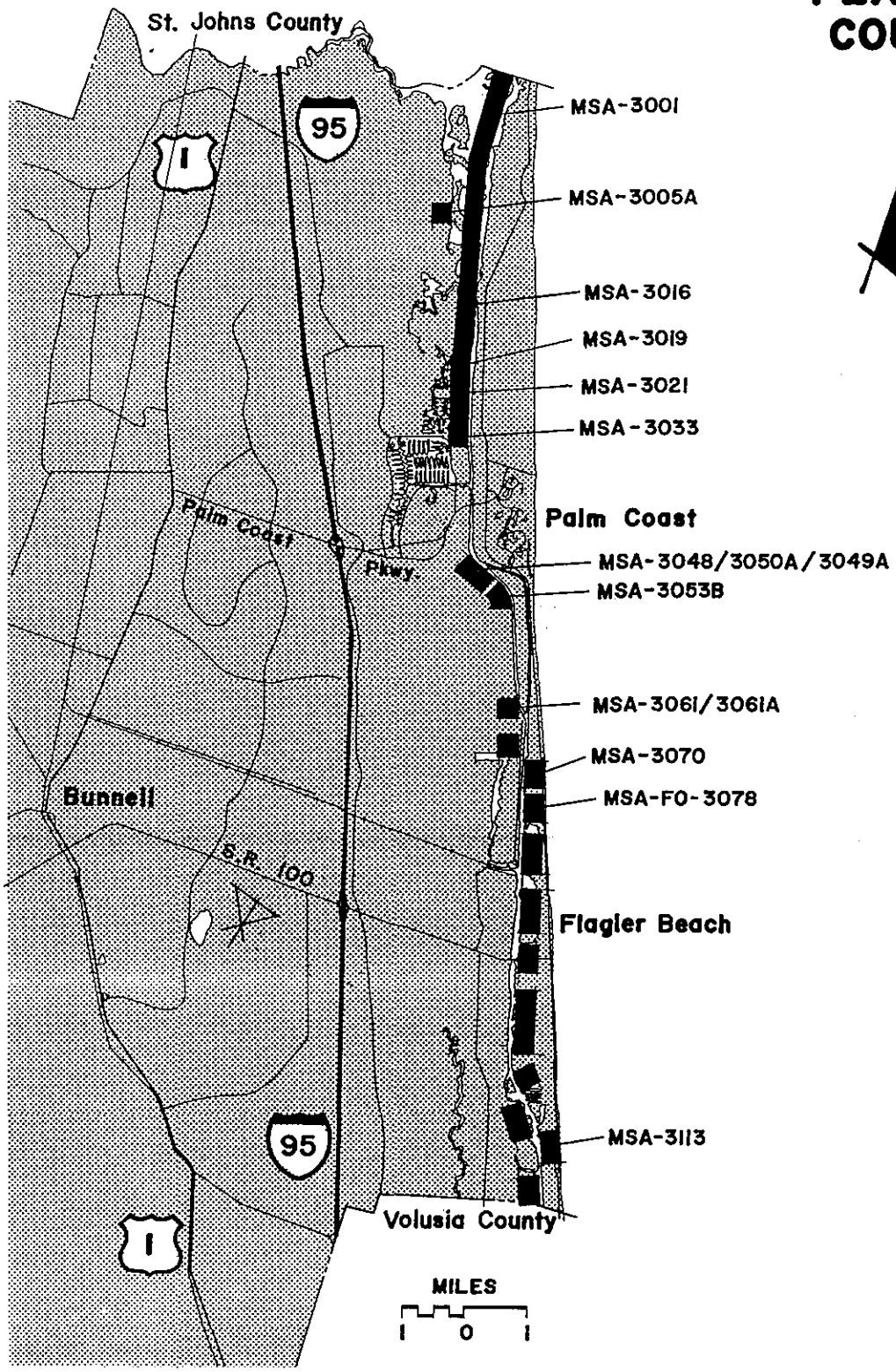
INTRACOASTAL WATERWAY, FLAGLER COUNTY, FLORIDA
(page 1 of 2)

F.I.N.D. Designation	C.O.E. Tract No.	ICWW Mile	Total Acreage	Useable Upland Acreage	Containment Capacity (c.y.)	Comments
MSA 3001	109	55.53-56.24	109.40	32.86	438,842	Usable upland area consists of three spoil islands located west of ICWW, no road access.
MSA 3002	110	55.53	2.30	---	---	Unusable, marsh with minimal upland.
MSA 3004	114	56.24-57.26	126.10	---	---	Unusable, marsh with numerous small spoil islands.
MSA 3005A	2000 E-1	57.26	33.90	33.4	457,094	Located within area of planted pine, one half of site presently filled to capacity, redistribution or removal of material required to obtain capacity shown. Adjacent land could support expansion of site. Potential road access exists.
MSA 3005	116	57.26-58.35	125.30	---	---	Unusable, marsh with numerous small spoil islands.
MSA 3006	118	58.35-58.99	89.50	---	---	Unusable, marsh with numerous small spoil islands.
MSA 3016	125	58.99-59.65	130.70	---	---	
MSA 3019	129	59.65-60.67	100.10			Contiguous easements located west of ICWW adjacent to residential area, road access available.
MSA 3021	139	60.67-61.39	67.80	110.98	1,784,520	
MSA 3033	148	61.44	7.60			
MSA 3048	166	63.05	13.60			Contiguous easements, material on site is presently being mined. Capacity shown assumes all usable on-site material has been removed.
MSA 3049A	169	63.74	1.14	37.01	637,674	
MSA 3050A	167	63.39	45.50			
MSA 3053B	---	63.57	123	50.5	877,124	Replaces MSA 3053 and 3053A, major portion of easement is upland, road access available.
MSA 3061	192	65.53	27.90	10.65	77,289	Upland site, road access available.
MSA 3061A	2302E	65.93	55.0	18.43	236,711	Upland site, adjacent to MSA 3061, road access available.
MSA 3065	195	66.20	35.70	13.79	---	Configuration of usable upland limits potential use as a containment site.
MSA 3067	196	66.47	1.20	---	---	Unusable due to insufficient area.
MSA 3069	197	66.69	2.10	---	---	Unusable due to insufficient area.
MSA 3071	204	66.77	4.20	---	---	Contiguous easements, potential limited by on-site wetlands.

TABLE 2-3: INVENTORY OF EXISTING DISPOSAL EASEMENTS

INTRACOASTAL WATERWAY, FLAGLER COUNTY, FLORIDA
(page 2 of 2, continued)

F.I.N.D. Designation	C.O.E. Tract No.	ICWW Mile	Total Acreage	Useable Upland Acreage	Containment Capacity (c.y.)	Comments
MSA 3070	205	66.77	14.80	4.23	11,280	Contiguous easements, potential limited by on-site wetlands.
MSA-FO-3078	213	67.29	25.90	---	14,300	Capacity limited by east-west ditch that bisects site.
MSA-FO-3084	221	67.96	44.10	---	---	Marsh, open water, insufficient upland available.
MSA 3087	225	68.50	48.40	---	---	Marsh, open water, insufficient upland available.
MSA 3088	234	68.47	0.30	---	---	Marsh, open water, insufficient upland available.
MSA 3091	231	69.02	0.10	---	---	Marsh, open water, insufficient upland available.
MSA 3094	234	69.79	8.35	---	---	Unusable due to insufficient area.
MSA 3094A	238	70.06	30.60	---	---	Insufficient upland available.
MSA 3102A	239	70.31	14.60	---	---	Open water, marsh, insufficient upland available.
MSA 3102B	240	70.69	102.50	---	---	Open water, marsh, insufficient upland available.
MSA 3098	241	70.31	1.60	---	---	Unusable due to insufficient area.
MSA 3100A	242	70.41	25.80	---	---	Open water.
MSA 3100	245	70.65	0.70	---	---	Unusable due to insufficient area.
MSA 3101	247	70.42	36.40	---	---	Open water, marsh, insufficient upland available.
MSA 3103	254	71.62	34.80	---	---	Open water, marsh, insufficient upland available.
MSA 3108	259	71.75	33.40	---	---	Open water, marsh, insufficient upland available. West of ICWW.
MSA-FO-3110	260	71.75	11.30	---	---	Open water, marsh, insufficient upland available. West of ICWW.
MSA 3113	A	72.70-73.28	48.12	13.87	45,507	Easement bisected by embayment, some potential as containment site.
MSA 3114A	267	73.27	26.40	---	---	Open water, marsh, insufficient upland available. West of ICWW.
			TOTAL		4,580,341	



TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	Figure 2-3 Existing FIND Easements and FIND Owned Tracts Flagler County, Florida	PROJECT REVISION SHEET DATE

15 remaining tracts, comprising 14 perpetual easements and one FIND-owned site, therefore exhibit at least some potential for development and use as dredged material management areas.

As identified in Figure 2-3, the 15 remaining tracts, combined to form 11 separate blocks, are distributed primarily within the northern two-thirds of the county. As discussed in Section 2.1.1, the northern segment of the ICWW channel has, historically, experienced the vast majority of shoaling. The one remaining tract (MSA 3113), located at the southern end of the county, is immediately opposite the recently documented shoal within Cut F-31 (ICWW mile 72.80). Thus, from the standpoint of location alone, the existing sites within Flagler County appear to be well matched to historic shoaling patterns. In the remainder of this section, the 15 tracts with at least minimal potential for receiving dredged material, as well as the 25 tracts eliminated from further consideration, are discussed in more detail.

Southward from the St. Johns-Flagler County line (ICWW mile 55.53), a series of six existing easements form a continuous band, 1000 to 1500 feet in width and over 4.0 miles in length, immediately west of and parallel to the ICWW channel. All of these tracts consist primarily of open water, mud flats, and saltmarsh. However, also contained within these easements are numerous spoil islands. These islands, varying in size from less than 1 acre to more than 15 acres, resulted from channel construction and maintenance activities since the 1920's. The smaller islands, relics from the earliest days of the ICWW, resulted from the unconfined placement of dredged material within areas of open water or salt marsh immediately beside the area of dredging. The larger islands most likely began in the same manner but have grown to their present size as regulation and dredging practice have required consolidating placement areas to minimize the destruction of wetland habitat. Regulation has also mandated that dredged material be placed within containment dikes so that the decanted water returned to the ICWW can meet established standards. The accumulation of material has allowed the more recent construction of rudimentary containment dikes on the larger islands. The most southerly of the three largest islands, located partially in MSA 3001 and partially in MSA 3004, was last used in 1979 to receive approximately 50,000 cy of dredged material. This area still shows evidence of containment dikes and outlet works (i.e., internal weir, outlet pipes) from that operation. The basin is now close to the capacity provided by its minimal dikes.

The three largest islands within MSA 3001/3004 possess upland sufficient to suggest their continued use (7.88, 10.02, and 14.96 acres) if their capacities were increased by redeveloping the sites and reconstructing the dikes. However, several additional considerations limit their potential for long-term use. The primary drawback of these areas is their isolation from adjacent upland areas. Thus, they afford no

road access for construction or long-term site operation. Moreover, no possibility for site expansion exists. Indeed, providing even a minimal buffer between the redesigned containment dikes and the adjacent marsh would result in a significant reduction of storage area. Finally, the projected capacity for each site, to be addressed in the following section, represents only a portion of the total projected material storage requirements for the adjacent segment of the ICWW channel. These and other site evaluation criteria will be discussed in more detain in Section 4.0.

An additional, isolated easement is located at ICWW mile 57.26, approximately one-half mile west of the continuous band of easements adjoining the ICWW. This 33.9-acre tract lies within a larger area of planted pine located in the uplands west of the Pellicer Flats section of the Matanzas River. The easement, designated MSA 3005A, was obtained in 1985 in anticipation of a channel maintenance operation scheduled for the following year. A diked containment basin encompassing approximately 27.5 acres was constructed in late 1986. The site then received 115,475 cy of maintenance material dredged from the adjacent section of the ICWW (Cut F-2 to Cut F-5; Table 2-2). Approximately half of the diked area is filled to or beyond the elevation of the dike crest (5 to 7 feet above the surrounding grade). The half of the containment basin which did not receive material from the maintenance operation has been allowed to revegetate in a variety of herbaceous weeds and shrubs. The 6.4 acres within the easement but outside the containment dike remain in planted pine or native vegetation. A pipeline easement (Tract No. 2000E-2) obtained to access MSA 3005A extends about 770 feet from the eastern side of the disposal easement northeasterly to the Mean High Water (MHW) shoreline of the Matanzas River (Pellicer Marsh). Also cleared in 1986, this easement was allowed to revegetate naturally following its use.

Southward from the southern end of the string of spoil islands, a series of four predominantly upland easements extend along the western shore of the ICWW and form an almost continuous 800-foot wide band for a distance of approximately 1.8 miles (ICWW mile 59.67 to mile 61.47). Designated MSA 3016, MSA 3019, MSA 3021, and MSA 3033, these easements encompass the uplands between the ICWW and the main north-south canal in the northeastern section of Palm Coast (Figure 2-2), and extend across the northern two of the three main canals which connect the Palm Coast canal system to the ICWW. The total useable upland area of the four easements is almost 220 acres. The northern end of the four easements is approximately 1800 feet north of the northernmost of the three canal entrances. The southern end is approximately 2100 north of the southernmost of the three entrances.

The four easements are characterized by the large quantity of material they have received over the history of the ICWW. All four easements were obtained in 1932 in association with the initial excavation of the Waterway through the adjacent uplands. Since that time they have received an undetermined but significant volume of material. This includes material produced during the initial excavation of the ICWW through the uplands separating the Matanzas River from Smith Creek, as well as material dredged during successive phases of channel deepening. However, since the channel was dredged to its present 12-foot project depth, these easements have received material from only one maintenance operation. This operation, performed in 1986, placed 160,730 cy in MSA 3021 immediately south of the central entrance channel to Palm Coast. ICDC continues to mine dredged material from this and other areas for roadbed construction.

The next group of easements is located 1.6 miles to the south or approximately 1500 feet south of the St. Joe Canal at the intersection of the relic channel and the relocated Fox Cut of the ICWW. From this point southward to the former Lehigh Portland Cement plant, nine easements form four separate blocks along the ICWW's western shore. Each of these four blocks directly adjoins the westerly right-of-way line of the ICWW channel. The first of these, located at ICWW mile 63.05, includes MSA 3048, MSA 3049A, and MSA 3050A. These three contiguous easements, totalling 60.24 acres, were last used in 1979 to receive over 407,000 cy of dredged material in by far the largest channel maintenance operation ever performed in Flagler County. ICDC is also mining these easements for material to use in road construction and maintenance projects in Palm Coast.

To the south (ICWW mile 63.61) is a 123-acre easement designated MSA 3053B, recently obtained from the ICDC in exchange for the release of an easement containing similar acreage previously held in the same area. MSA 3053B is separated from the easements immediately to the north by an undeveloped county park, as well as county road and, as yet, unused FPL powerline easements. Further south, at the southern intersection of Fox Cut and the abandoned former Waterway channel (ICWW mile 65.46), two contiguous easements, MSA 3061 and MSA 3061A, total 82.9 acres. No record was found of these easements being used in connection with a channel maintenance operation. However, a single large spoil mound within MSA 3061, the more northerly of the two easements, attests to its use as a dredged material site at some point in the past. The last block of easements along this segment consists of MSA 3065, MSA 3067, and MSA 3069. MSA 3065 (ICWW mile 66.2) is by far the largest (35.7 acres) of the three. The latter two easements, at 1.2 acres and 2.1 acres, respectively, are clearly of inadequate size for long-term use. Moreover, even though connected to the larger MSA 3065, their location and configuration do prohibit

reasonable expansion. None of these easements gives evidence of having received dredged material previously.

In contrast, southward from the north end of Fox Cut (ICWW mile 63.61), almost all material removed from the ICWW has been placed along its east side. The series of spoil mounds and islands extending in an almost continuous chain along the eastern shore of the ICWW from the north end of Fox Cut southward to the Flagler-Volusia County line attest to their use. As previously discussed (Section 2.1.2), no maintenance dredging has been required in this segment of the ICWW since the establishment of the present 12-foot channel depth in 1951. Therefore, these deposits represent material both excavated and dredged during initial construction or during successive phases of channel deepening before 1951. Most of this material was placed in a series of disposal easements. In the 1950's and 1960's, a small number of these easements were released to private interests, and the areas of dredged material deposition have been or are now being incorporated into residential building lots. Development of this type includes the ICDC subdivision known as "Island Estates" on the island formed by the abandoned former ICWW channel and Fox Cut, and the residential development immediately north of S.R. 100. In the latter case, to form the building lots in an area of former saltmarsh, material dredged from residential finger canals was used to augment material dredged from the ICWW.

All of the 17 easements remaining along the east side of the ICWW are areas of former open water or saltmarsh, which now contain one or more spoil mounds. Most are small (less than 5 acres) and, typically, isolated from adjacent uplands by the remaining wetlands, as well as a network of mosquito ditches. Only three of these — MSA 3070/3071, MSA FO 3078, and MSA 3113 — show reasonable potential for future development as dredged material management areas on the basis of two factors: (1) sufficient upland exists to allow construction of a containment basin, and (2) the upland areas on site are either directly connected or minimally separated from adjacent uplands, thus affording potential upland site access. A brief discussion of these areas follows.

The most northern of the three, MSA 3070/3071, is located immediately south of the Beverly Beach mobile home community (ICWW mile 66.77). The two contiguous tracts, totalling 19 acres, contain two dredged material mounds separated by a narrow band of marsh and a mosquito ditch. The northern mound is directly connected to the uplands farther north. Wetlands isolate the southern mound. To the south, MSA FO 3078 is immediately north of the Silver Lake Marina/Condominium development (ICWW mile 67.25). This tract is not an easement but is held in fee simple ownership by the FIND. Similarly, this 25.9-acre

tract contains two dredged material mounds, one with a direct upland connection to the south. Saltmarsh, mosquito ditches, and open water isolate the other mound from adjacent uplands. The last of the three, MSA 3113, is located near the southern end of the county (ICWW mile 72.68). This 48.12-acre easement forms the western half of Gamble Rogers Memorial State Recreation Area. It consists of three large mounds, each directly connected to eastern uplands. A dredged boat basin and ramp divides the easement into two sections.

The three remaining easements — MSA 3108, MSA FO 3110, and MSA 3114A — are located on the western shore of the ICWW, a minimum of two miles south of S.R. 100. Each is predominantly saltmarsh, well isolated from adjacent uplands, and contains only one small dredged material mound. As a result, none show potential for future development as a dredged material management area.

2.3 Existing Storage Capacity

To further evaluate the existing disposal easements, an analysis was performed to determine the maximum potential capacity of the easements judged to have some potential for use as dredged material management areas as discussed in the previous section. The useable upland area within each contiguous easement tract was determined from tracings made of the 1" = 800' black and white aerials, guided by the color-infrared photography, and USFWS wetland inventory maps. Analysis was then carried out to establish whether the useable upland area could provide adequate material for dike construction and whether the resulting capacity within this area supported further consideration of the site. A set of relationships were developed (APPENDIX C) in which the required volume of dike material, the volume of dike material available on-site, and the resulting storage capacity are expressed in terms of a set of independent variables including dike crest elevation above grade, mean site elevation, depth of excavation, dike side slope, width of dike crest, and required minimum freeboard. During Phase II of the project, dike geometry will be specific to each site. However, for the purposes of this preliminary evaluation, a standard dike geometry was applied to all sites. Selected parameter values are within the range of standard practice for similar sites used for previous maintenance events. These included a 15-foot crest elevation above grade, a 1V:3H side slope, a 12-foot crest width, a 20-foot setback of the interior excavation from the inside toe of the dike, and a minimum freeboard plus ponding allowance of 4 feet. Calculations were based on a realistic dike configuration (i.e., a 3- to 5-sided polygon), specific to each site, which utilizes the maximum available upland area as delineated by photo-interpretation. The mean grade elevation for each site was estimated from survey transects, if available, or from USGS Quadrangle maps. In some cases, small upland acreage

or low mean grade elevation prevented the use of a 15-foot dike without requiring the excavation of the basin interior to an unreasonable depth. Typically, excavation was limited to an estimated site water table elevation of +2 to +4 feet NGVD. In such cases, the dike height was limited by the available material. The results of the preliminary capacity analysis are presented in Table 2-3.

Comparison of the total estimated capacity of the existing easements in Flagler County (4,580,341 cy) with the 50-year projected capacity requirement for the Flagler County segment of the ICWW (2,524,685 cy, Table 2-2) shows that the existing capacity exceeds the long-term requirement. In this respect Flagler County is unique among those counties yet addressed in the plan development program for the ICWW in Florida. In Brevard County, for example, existing easements provided no useable dredged material storage capacity. Moreover, the discussion in Section 2.2 established that the distribution of the existing easements also closely matches the distribution of the projected dredging and material storage requirement. However, the use of the existing easements, requiring the construction and maintenance of as many as 12 separate containment areas, does not constitute the most cost-effective and operationally efficient plan to meet the long-term needs of the ICWW. In the next section, the characteristics of the most appropriate plan — i.e., the "Management Concept" for the Waterway in Flagler County — are discussed.

3.0 DREDGED MATERIAL MANAGEMENT ALTERNATIVES

3.1 Management Concept

Inherent in every maintenance dredging operation is a set of guiding principles that reflect the attitudes and constraints of the project sponsor, the project engineer, and the contractor. Historically, these principles (i.e., the "Management Concept") have not been explicitly stated but rather have evolved primarily through the desire to maximize operational efficiency and short-term economy. Thus, prior to the initiation of this program in 1986, minimal consideration was given to environmental issues or, indeed, any long-term goals. Within Florida, including Flagler County, this approach resulted in the numerous small mounds and islands now lining the ICWW as the dredging contractor sought to place material as close as possible to the dredging area. For the extensive salt marsh-estuarine system of the Intracoastal Waterway in northeast Florida, this concept often led to the unconfined placement of dredged material within the marsh. The effluent from these areas would then return directly to the receiving waters, with, perhaps, unacceptably high levels of elutriates and turbidity.

With increased environmental awareness this approach is no longer desirable, nor even possible, given present-day agency reviews and permitting requirements. Concerns about water quality have led to the placement of dredged material within diked areas to increase retention time and ensure that return water quality meets established standards. Wetlands, particularly salt marsh areas, are now recognized as among the most biologically productive ecosystems and resources that must be conserved. However, preservation of marsh requires acquisition of upland sites and, in a high growth corridor such as that along the ICWW, developmental pressures and land-use conflicts make such acquisitions increasingly difficult and expensive. It has become apparent that these conflicts can only be resolved through long-range planning and the development of a dredged material management concept which addresses both environmental and operational concerns. As such, the management concept constitutes the foundation upon which the management plan is built.

3.1.1 Management Alternatives for Flagler County

The central issue guiding the development of a management concept for the ICWW in Flagler County is the selection of the most appropriate material management strategy. Four basic alternatives are available for consideration:

- o Beach Disposal
- o Ocean Disposal
- o Open Water Disposal (Spoil Island Creation)
- o Centralized Upland Containment

Each of these is discussed in the following paragraphs with respect to its applicability to the unique requirements of Flagler County.

Beach placement of dredged material compatible with the native beach sands is an approach to dredged material management that the State of Florida encourages. The FIND also includes this approach as an essential part of dredged material management for channel reaches which, based on historic data, are likely to contain beach quality sediments. These conditions are most typically encountered in the immediate area of tidal inlets where Waterway shoals are formed primarily by sand driven through the inlet by waves and tides. Such is the case at Matanzas Inlet immediately north of the Flagler County project area. Here, as well as at five additional inlet reaches addressed thus far in the FIND's 15-year program, beach disposal has been designated as the primary strategy for managing material dredged from the ICWW. However, in Flagler County, the ICWW remains unconnected to sea by tidal inlets—none exist. Moreover, as discussed in Section 2.1.3, channel sediments in the Flagler County project area, although generally categorized as clean fine sand, contain components of fine grained material which fail to meet state standards for beach placement. As a result, the placement of dredged material on the beach in Flagler County is not feasible.

Similarly, ocean disposal of material dredged from the ICWW is not a realistic option for the Flagler County project area. Ocean disposal requires the transport of the dredged material from the dredging site to an authorized offshore disposal area. In the case of Flagler County, this operational requirement poses a very costly and difficult task for the following reasons. First, the material must be loaded into barges capable of transiting the relatively shallow depths of the ICWW. These barges must then proceed to the nearest inlet for passage to sea. The closest inlet to the Flagler County project area is St. Augustine Inlet, 24 miles north of the Flagler-St. Johns County line. Once the barges reach the inlet the material must then be transferred to deep draft seagoing barges for transport to the authorized disposal area. Collectively, these requirements render this method of material disposition impractical and prohibitively expensive.

A third management strategy for dredged material is referred to as open water disposal. This particular method of material disposition was perhaps the most widely used approach prior to the evolution

of today's environmental regulatory programs addressing wetlands protection. Discussions with representatives of the relevant regulatory agencies have confirmed that this approach carries with it unacceptable environmental impacts in terms of loss and degradation of wetlands and associated impacts. In addition to these regulatory issues there exist other valid reasons for not pursuing this particular strategy. First, the intent of the FIND dredged material management program is to provide a permanent infrastructure of material management facilities. The creation or expansion of open water islands represents a one-time opportunity for material placement and does not lend itself to active material management practices which require upland access for equipment and personnel. Finally, the use of open water disposal in Flagler County is not practical because the ICWW channel in this area was cut through upland along nearly its entire length. Thus, adequate open water surface area simply does not exist for the construction of islands large enough to contain the dredged material.

Given the limitations of the beach disposal, ocean disposal, and open water disposal material management strategies for the stated conditions, the use of confined upland disposal remains the only possible method of dredged material management in Flagler County. Provided that suitable upland sites can be identified, this strategy of material management avoids most wetland impact issues, can be accomplished at reasonable cost, does not require the nearby presence of a tidal inlet, and does not depend upon the physical characteristics of the material for its deposition. Moreover, the use of upland sites provides easy access to the management facility, thereby facilitating active material management, material off-loading and reuse, and the establishment of a permanent facility.

The use of a limited number of centralized upland sites has both operational and environmental advantages. A smaller number of centralized sites can be located in a logical, efficient manner to serve individual reaches of the ICWW (operational advantage). Fewer, larger sites reduce the total acreage required, therefore reducing the total impact to upland habitat (environmental advantage). The limited number of sites also produces a corresponding decrease in the number of effluent and stormwater discharges entering the ICWW from the material management sites (environmental advantage).

The active management of upland sites as permanent operating facilities complements the use of centralized sites as discussed above. It also represents a significant departure from the historic practice of more or less abandoning sites after limited use. Operating sites as permanent facilities allows for the implementation of a suite of management procedures and techniques with long-term operational and environmental benefits. Example management measures include improved detention area design; material

handling and processing to increase dewatering efficiency (e.g., mechanical grading, trenching, storm water control); and the use of natural buffer areas and vegetation of dikes to improve their appearance. Most importantly, the permanency of the sites implies that ways be explored to remove and reuse the dewatered material. Alternatively, if no market for the material is found, it could be removed and stored in less ecologically sensitive upland areas further inland. Road access, existing or potential, is therefore essential. Sites managed as intermediate processing areas rather than one-time holding facilities will serve the needs of the ICWW in perpetuity. This approach, in combination with effective site management measures, will establish the long-term material management capability required.

3.1.2 Management Concept for Flagler County

The preceding discussion has led to the following fundamental principles which constitute the management concept developed for the unique requirements of the Intracoastal Waterway in Flagler County:

(1) All future dredged material placement will be confined to upland areas.

(2) Sites will be established to provide centralized management areas in a minimum number of locations per operating reach of the ICWW.

(3) These sites will be operated and maintained as permanent facilities in which dredged material will be actively managed.

These principles provide the basic framework for identifying and subsequently evaluating management alternatives and candidate sites. The framework, in turn, establishes minimum acceptance standards and provides a focus to the planning process. Moreover, the early establishment of the management concept facilitates the later specification of a meaningful set of individual site evaluation criteria.

3.2 Delineation of Channel Reaches

With the management concept thus defined, logical channel reaches were then established. The limits of each channel reach were determined by considerations of maximum pumping distance, projected material storage requirements, and the anticipated management strategy as discussed in the preceding section. In performing this task, it was assumed that one or (at most) two sites would be required to serve each channel

reach. The resulting delineation of channel reaches is summarized in Table 3-1 and presented in Figure 3-1. Table 3-2 organizes the previous summary of historic dredging events and recent shoaling as presented in Table 2-2 by channel reach. Also presented in Table 3-2 are estimates of the historic and projected maintenance dredging volumes. The corresponding 50-year material storage requirements are also included for each reach. As an indication of the relative shoaling rate within each reach, the mean volume of maintenance dredging required annually per channel mile is also included.

The northernmost reach, Reach I, extends from a point 0.29 miles south of the St. Johns-Flagler County line near Marineland (Cut F-2, sta 0+00, ICWW mile 55.71) southward 4.4 miles to a point near the northern entrance channel to the Palm Coast canal system (Cut F-11, sta 0+00, ICWW mile 60.14). This reach covers the northern half of the area of documented shoaling (Figure 3-2). The northernmost 0.29 channel miles within Flagler County (Cut F-1) were addressed in the St. Johns County program element because the area of intensive shoaling associated with Matanzas Inlet extended into the first Flagler County channel cut. The projected 50-year material storage requirement for this reach is 757,000 cy. Since the 12-foot project depth was established, three channel maintenance operations (1967, 1979, and 1986) within Reach I have removed an average of 76,150 cy (in *situ* volume) of material per event. This average volume corresponds to an average material storage requirement (i.e., the dredging volume multiplied by a bulking plus over-dredging factor of 2.15) of approximately 164,000 cy per event.

Reach II continues southward from the northern Palm Coast entrance canal to the north end of Fox Cut (Cut F-20, sta 0+00, ICWW mile 63.94), a distance of 3.8 miles. This reach, encompassing the segment of the Flagler County project area with the highest rate of shoaling (Figure 3-2), has required the most channel maintenance. A total in *situ* volume of 588,120 cy of shoal material has been removed in three maintenance dredging operations (1960, 1979, and 1986). This yields an average dredging volume of approximately 196,000 cy and an average material storage requirement of approximately 421,500 cy per event. The 1987 channel centerline survey identified no additional shoals within Reach II. Therefore, the projected 50-year material storage requirement, based only on historic dredging activity, is 1,756,000 cy. This represents approximately 70 percent of the total material storage requirement for the Flagler County project area.

From the north end of Fox Cut southward to the Flagler-Volusia County line, no channel maintenance has ever been performed. Two reaches have been designated within this 9.91-mile channel segment. The first, Reach III, extends southward 5.84 miles from the north end of Fox Cut (Cut F-20, sta

Table 3-1 Delineation of Operational Channel Reaches,

Intracoastal Waterway, Flagler County

Reach	From	To	Length (mi)
1	Marineland ICWW Mile 55.71 Cut F2/sta 0+00	N. Canal, Palm Coast ICWW Mile 60.14 Cut F11/sta 0+00	4.43
2	N. Canal, Palm Coast ICWW Mile 60.14 Cut F11/sta 0+00	N. End Fox Cut ICWW Mile 63.94 Cut F20/sta 0+00	3.80
3	N. End Fox Cut ICWW Mile 63.94 Cut F20/sta 0+00	Flagler Bch (SR 100) Br. ICWW Mile 69.78 Cut F27/sta 0+00	5.84
4	Flagler Bch (SR 100) Br. ICWW Mile 69.78 Cut F27/sta 0+00	Flagler/Volusia Co. Line ICWW Mile 73.85 Cut V1/sta 0+00	4.07
		TOTAL	**18.14**

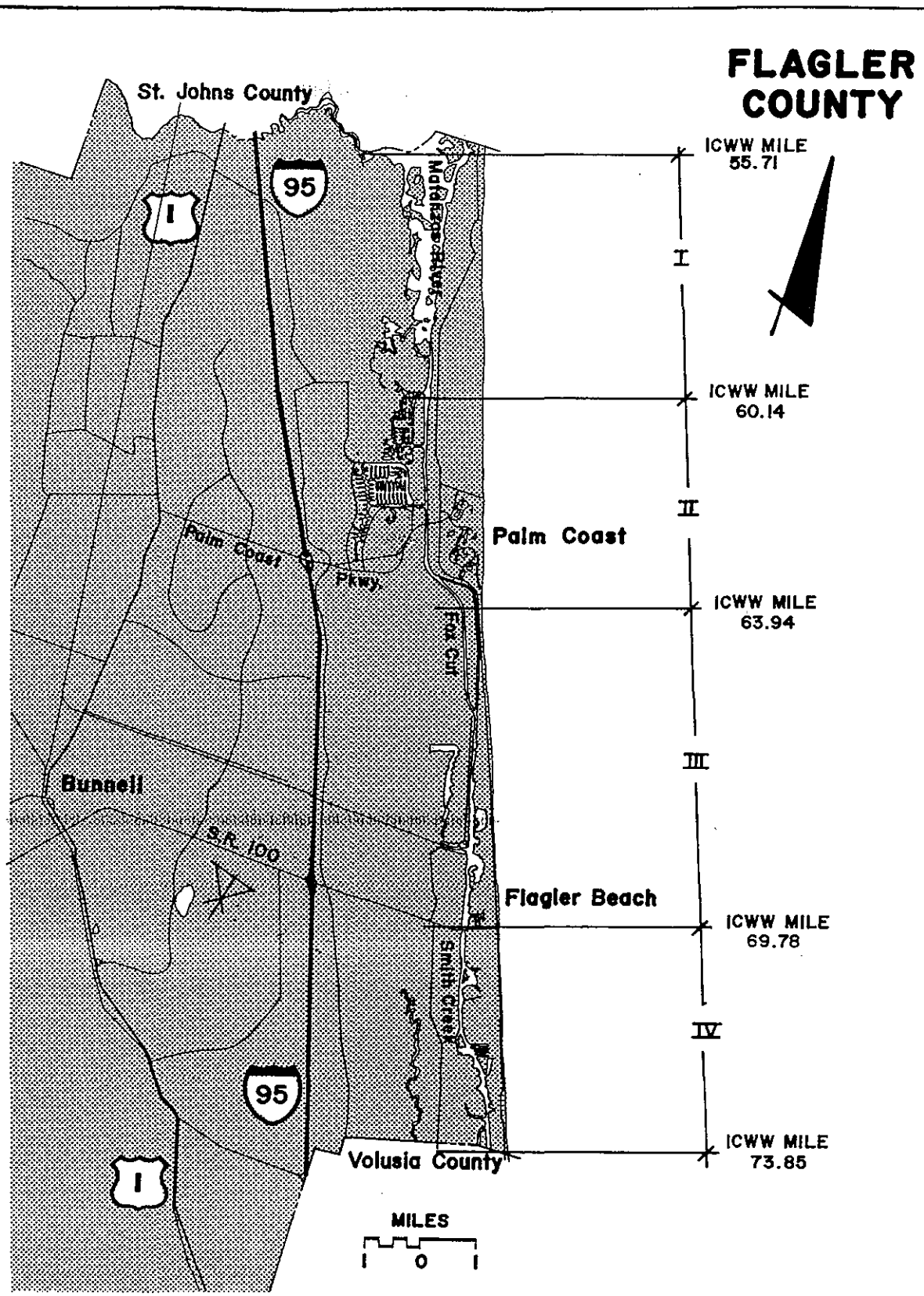


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Figure 3-1
Delineation of Channel Reaches,
Intracoastal Waterway,
Flagler County, Florida

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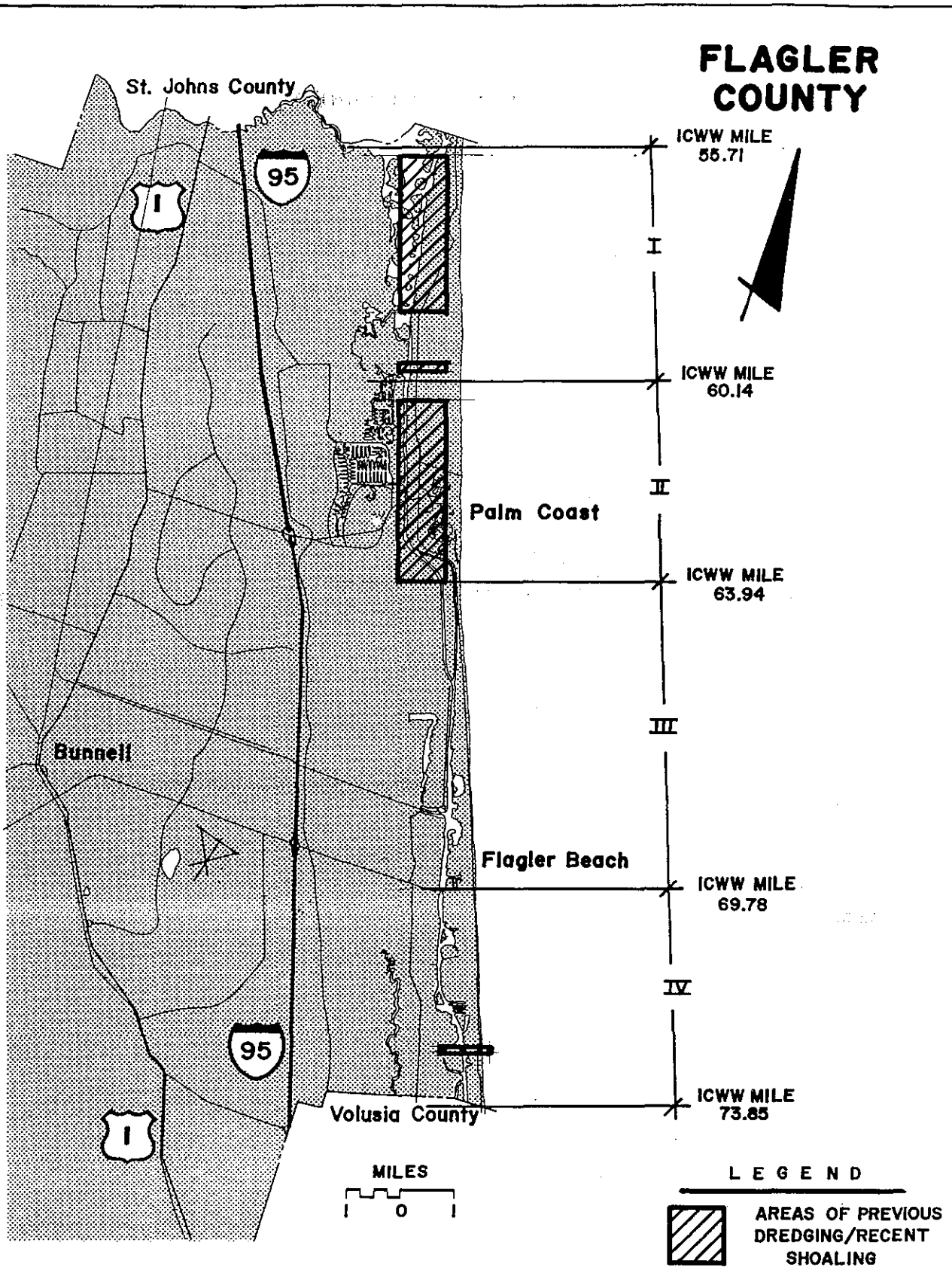
Table 3-2 Summary of Historical Maintenance Dredging/Recent Shoaling by Channel Reach

Intracoastal Waterway, Flagler County

1951-1987

Previous Maintenance/Recent Shoaling								Reach Summary				
Reach	To From ICWW Mileage	From Cut/Sta	To Cut/Sta	Length (mi)	Year	Design Vol (cy)	Pay Vol (cy)	Total Vol (cy)	Vol/Yr (cy)	Vol/Yr/Mi (cy)	50-yr Unbulked Vol (cy)	50-yr Storage Req't (cy)
I: Marineland to N. Canal, Palm Coast ICWW Mile 55.71 to 60.14	55.91 - 56.34	F-2/10+50	F-2/33+50	0.44	1967	23,100	27,500					
	55.99 - 56.33	F-2/15+00	F-2/32+50	0.34	1976	42,000	50,000					
	56.20 - 58.48	F-2/26+00	F-5/55+00	2.28	1986	97,000	115,475					
	56.36 - 56.77	F-2/34+50	F-3/19+00	0.41	1967	7,000	8,334					
	56.77 - 57.44	F-3/19+00	F-4/32+00	0.67	1967	22,800	27,143					
	58.54 - 58.84	F-5/58+00	F-6/ 2+00	0.30	1987*	13,060	15,543					
	59.82 - 59.95	F-9/ 9+00	F-10/2+50	0.13	1987*	7,886	9,388	253,383	7,038	1,589	351,921	756,630
II: N. Canal, Palm Coast to N. End Fox Cut ICWW Mile 60.14 to 63.94	60.61 - 62.35	F-11/25+00	F-16/ 1+00	1.74	1986	135,000	160,730					
	62.33 - 63.94	F-16/ 0+00	F-20/ 0+00	1.61	1979	342,000	407,151					
	62.71 - 62.92	F-16/20+00	F-17/ 3+00	0.21	1960	17,000	20,239					
								588,120	16,337	4,299	816,833	1,756,192
III: N. End Fox Cut to Flagler Bch (SR 100) Bridge, ICWW Mile 63.94 to 69.78	No Maintenance	Performed,	No Shoaling	Indicated				0	0	0	0	0
IV: Flagler Beach (SR 100) Bridge to Flagler/Volusia Co. Line, ICWW Mile 69.78 to 73.85	72.80 - 72.86	F-31/28+00	F-31/31+00	0.06	1987*	3,333	3,968	3,968	110	27	5,511	11,849

* Estimated shoal volumes based on centerline survey "Reconaissance Survey, 10 and 12-foot Project, St. Johns River to Key West" D.O. File No. 8-35, 044, Jacksonville District, U.S. Army Corps of Engineers, July, 1987.



TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	Figure 3-2 Areas of Previous Maintenance Dredging or Recent Shoaling, Intracoastal Waterway Flagler County, Florida	PROJECT REVISION SHEET DATE

0+00, ICWW mile 63.94) to the S.R. 100 Bridge at Flagler Beach (Cut F-27, sta 0+00, ICWW mile 69.78). The second, Reach IV, continues southward 4.07 miles to the County line (Cut V-1, sta 0+00, ICWW mile 73.85). For Reach III, no projection of a future storage requirement is possible because of the lack of historic shoaling since 1951. Within Reach IV a minimal shoal has been recently documented directly opposite Gamble Rogers Memorial State Recreation Area (Cut F-31, sta 28+00 to sta 31+00), approximately one mile north of the County line. This shoal (estimated in *situ* volume, 3,400 cy) results in a projected 50-year material storage requirement for this reach of 12,000 cy.

3.3 Identification of Candidate Sites

Defining the management concept and logical channel reaches provided the means to evaluate the use of existing easements and FIND-owned sites as the most appropriate locations for long-term ICWW needs in Flagler County. As discussed in Section 2.3, the storage capacity of the existing sites (4,580,000 cy) exceeds the projected 50-year requirement (2,525,000). However, review of existing sites with respect to now established channel reaches shows that within the northern two reaches where almost all of the historic shoaling has occurred, the use of existing sites to meet the long-term needs of the ICWW would require the construction, operation, and maintenance of up to five separate sites within each reach. Such a situation is neither desirable nor consistent with the management concept presented in Section 3.1. Therefore, to meet established program criteria, as well as to provide flexibility in the development of a plan most appropriate to the specific needs of Flagler County, it was necessary to identify and evaluate additional alternative sites.

The process began with the identification of all areas within reasonable distance of the ICWW having the potential to satisfy the upland storage requirements listed in Table 3-2 with existing or potential upland road access to meet the demands of ongoing site management. Also considered was the degree to which the area had been previously disturbed by land clearing, logging, agriculture, or mining. Additional environmental considerations, such as the quality of existing habitat or the diversity of vegetation, were not included in the initial site identification. However, these factors were considered in the final site evaluation and are discussed in Section 4.1. In some instances adjacent land-use conflicts (such as adjoining high-density residential development) or operational limitations (such as excessive overland pipeline access) eliminated sites from further consideration.

Preliminary identification and evaluation of the sites was accomplished through the use of the black and white aerial photographs (1" = 800' nominal scale), color infrared photography, and USFWS Wetlands

Inventory maps previously described in Section 2.2. A total of 15 candidate sites — or from one to seven sites within each reach — were selected. These are shown in Figure 3-3. Two of the sites, F-3 in Reach I and F-8 in Reach II, represent expansions of existing easements. In Reach I, Site F-3 represents an expansion of MSA 3005A. In Reach II, Site F-8 represents an expansion of MSA 3048/3050A. In both cases the expansion is needed to provide the full 50-year storage requirement of each reach within a single site.

Tracings were made from the 1" = 800' black and white aerials of the initial delineation of useable upland area of each site. An initial determination of the maximum storage capacity of each site (as described in Section 2.3) was then made based on the most efficient, realistic dike configuration attainable within the delineated upland. This was done to ensure that each site possessed potential capacity appropriate to each respective reach requirement. Within each reach, the total potential capacity of the candidate sites greatly exceeded the corresponding material storage requirement. The overages in capacity were retained to provide the greatest flexibility prior to final site selection. Also, it was expected that subsequent field inspection of the sites would result in the total elimination of some sites and a reduction in the usable acreage of others. The site inspection procedure is discussed in the following section.

3.4 Site Inspections

Field inspections of the 15 existing easements and FIND-owned tracts with potential for future use were performed during July, 1992. Inspections of all 15 newly identified candidate sites were performed during September - October, 1992. The basic objectives of each field inspection, conducted by a biologist and an engineer, were to document and evaluate the environmental characteristics and the existing and adjacent land-use of each site and to assess its general suitability for site development. Specific objectives included preliminary delineation of wetlands and the initial assessment of vegetation communities, habitat, and environmental constraints including the presence of protected wildlife. Also noted during the site inspections were site topography, general soil conditions, existing or potential road access, possible pipeline routes, and obvious archeological features, if present. In addition, a video camera was used to record significant features of each site and to document the on-site and adjacent land-use at the time of the site inspections.

Within each site, ecological conditions were assessed by combined photographic aerial interpretation and ground-truthing as necessary to identify and map vegetation communities. Aerial coverage included the

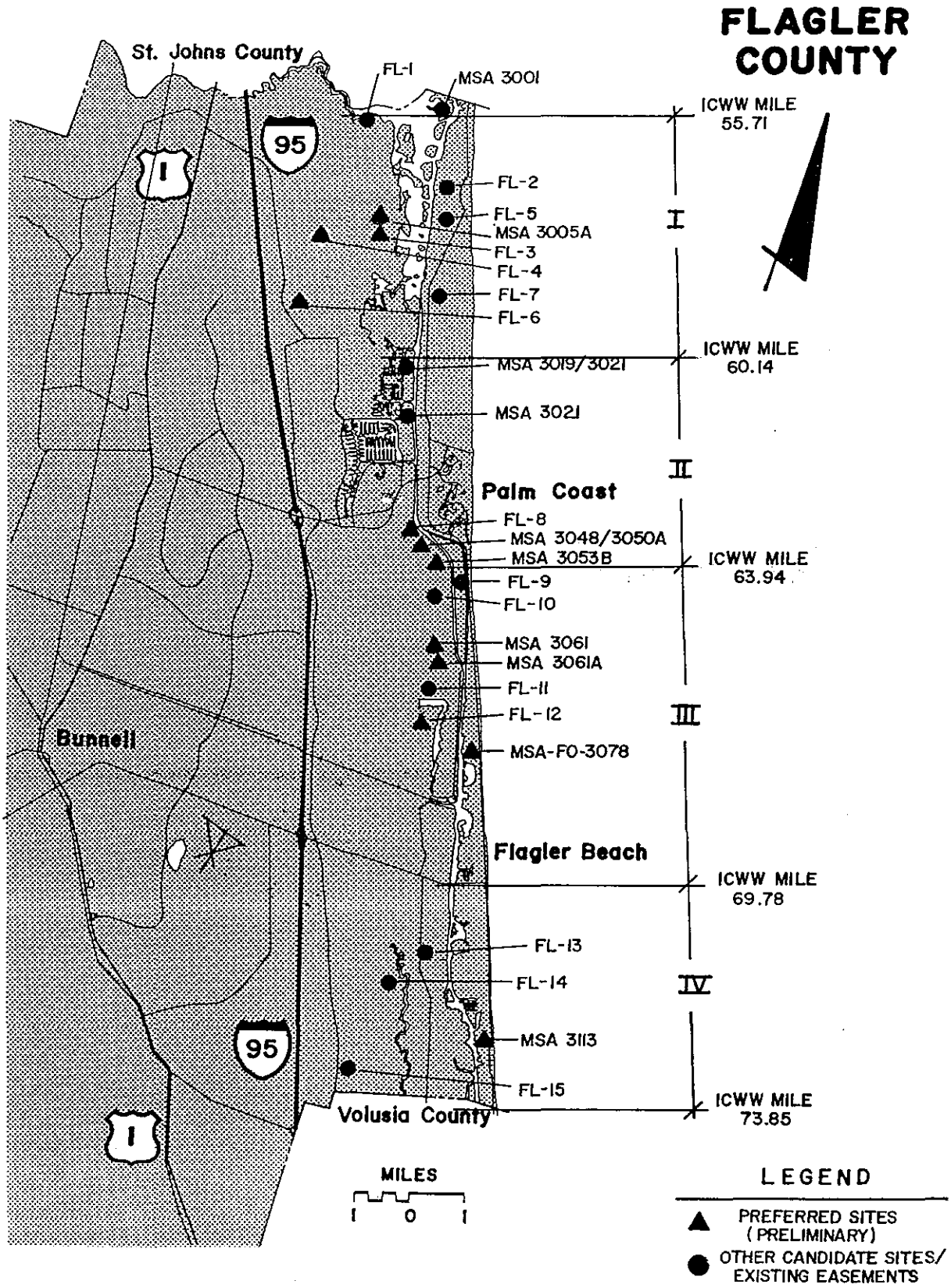


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Figure 3-3
Candidate Sites, Long-Range Dredged Material Management Plan Intracoastal Waterway Flagler County, Florida

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same resource material discussed in Section 2.2, specifically, 1985 1" = 800' black and white photography, 1984 1" = 2000' color infrared photography, and in some cases, 1986 blueline aerials at a scale of 1" = 400'. In addition to pedestrian surveys, ground-truthing was carried out using 4-wheel-drive vehicles accessing adjacent roads or on-site dirt roads and trails. Dominant or significant photographic signatures were identified on aerials and visited by truck or on foot. Maps were prepared in the field by drawing on acetate overlays on the 1" = 800' black and white aerial photographs. Other sources of information, such as USGS 7.5' quadrangles and U.S. Fish and Wildlife Service Wetland Inventory Maps and soils surveys, were checked to aid in the interpretation of site conditions. Observations of significant wildlife species were also noted when encountered on-site. This included the presence or sign of state or federally protected wildlife species.

Following each site inspection, the original site tracings were modified to exclude sensitive areas. The most common modification was to withdraw from areas possessing wetland or transitional vegetation. Specifically excluded were those areas exhibiting salt marsh characteristics or wetland-transitional areas contiguous with the ICWW or its tributaries. Because of this latter consideration which establishes the jurisdiction of DER permitting, all drainage features were examined for evidence of this contiguity. Isolated wetlands or drainage features still within the jurisdictional permitting authority of the COE and the St. Johns River Water Management District (SJRWMD) were excluded where feasible. However, if the exclusion of a minimal isolated wetland made an otherwise viable site unusable, some wetland impacts were considered unavoidable.

A second analysis of maximum potential storage capacity was then performed for each site based on its field-verified configuration. Results of this analysis are presented in Table 3-3. Again, the combined potential capacity of the remaining easements and the FIND-owned tracts and the newly identified candidate sites exceeds the material storage requirement for each reach. During the final site evaluation, described in the following section, the acreages of the sites are reduced such that their capacities match the reach requirements.

Table 3-3 Candidate Sites, Long-Range Dredged Material Management Plan, Intracoastal Waterway, Flagler County (page 1 of 3)

Reach	Site	Location (ICWW Mile)	Initial Site Area (ac)	Containment Area (ac)	Total Required Area (ac)	Containment Capacity (cy)	Maximum Pumping Distance (mi)	Comp. Plan Designation	Current Zoning	Comments
I Marineland to North Canal, Palm Coast ICWW Mile 55.71 to 60.14	MSA 3001/3004	55.22	235.50	32.86	32.86	438,812	4.92	Conservation	C2	Esmt. contains 3 spoil islands, limited upland, no road access
	FL-1	55.80	322.5	45.0	91.80	779,400	4.34	Agriculture/ Timberlands	AC	2.3 miles west of ICWW on Pellicer Creek, recently logged and replanted
	FL-2	56.94	110.0	44.5	110.00	770,200	3.86	Low Intensity Mixed Use	R1, RC, C & PUD	East of ICWW, recently developed as residential subdivision (ICDC)
	MSA 3005A	57.26	33.90	26.67	33.90	457,094	3.37	Agriculture/ Timberlands	AC	Existing easement, filled to approx. one half of present dike capacity in 1986, site could be expanded to surrounding pine plantation
	FL-3	57.26	181.5	45.0	84.20	777,740	3.37	Agriculture/ Timberlands	AC	Expansion of existing easement MSA 3005A, acreages and capacity include existing easement
	FL-4	58.06	441.6	45.0	91.83	777,740	3.88	Agriculture/ Timberlands	AC	Disturbed area (partially logged and planted pine), 2 or 3 scattered residences in vicinity, 1.8 miles west of ICWW
	FL-5	57.26	169.2	45.18	94.30	781,600	2.46	Recreation/ Open Space	State Park	Within Washington Oaks State Park/Gardens
	FL-6	58.72	294.3	45.0	101.47	775,036	4.52	Agriculture/ Timberlands	AC	1.6 miles west of ICWW, pine plantation (logged and replanted), no adjacent development
	MSA 3016/3019	59.67	38.8	11.74	38.80	150,366	4.01	Low Intensity/ Mixed Use	AC	Western shore of ICWW, north of northern canal, fronting Palm Coast
	FL-7	59.08	369.9	45.0	90.85	779,292	4.22	Low Intensity Mixed Use, Educational	PUD	East of ICWW and SR A1A, presently undeveloped except for adult ed. facility, area developing rapidly, bi-sected by N/S canal

Table 3-3 Candidate Sites, Long-Range Dredged Material Management Plan, Intracoastal Waterway, Flagler County (page 2 of 3, continued)

Reach	Site	Location (ICWW Mile)	Initial Site Area (ac)	Containment Area (ac)	Total Required Area (ac)	Containment Capacity (cy)	Maximum Pumping Distance (mi)	Comp. Plan Designation	Current Zoning	Comments
II North Canal, Palm Coast to North End, Fox Cut ICWW Mile 60.14 to 63.94	MSA 3019/3021	59.84	106.60	59.05	106.60	1,014,782	3.27	High Density Residential	C2, R3	Located on western shore of ICWW fronting to Palm Coast
	MSA 3021	60.78	46.20	24.43	46.20	416,975	2.81	High Density Residential	R3	Located on western shore of ICWW fronting Palm Coast
	MSA 3021/3033	61.22	28.10	15.77	28.10	202,397	2.51	High Density Residential	R3	Located on western shore of ICWW fronting Palm Coast
	FL-8	62.88	166.70	100.98	166.70	1,763,800	2.80	High-Low Density Res.	R3 & AC	Expansion of existing easements MSA 3048/3050A, acreages and capacity include easements
	MSA 3048/3050A	63.05	59.10	37.01	59.10	742,000	2.97	Low Density Residential	AC	Contiguous easements, material on site is presently being mined
	MSA 3053B	63.61	123.0	50.52	123.00	1,098,000	3.54	Low Intensity Mixed Use/ Low Density Residential	AC	Recently acquired by FIND, separated from MSA 3048/3050A by county park, powerline/road easements
III North End Fox Cut to SR 100 Bridge ICWW Mile 63.94 to 69.78	FL-9	63.90	293.8	101.50	195.00	1,758,900	4.55	Low Intensity Mixed Use	PUD	Northern portion of site developed as "Island Estates." Development of remainder of site imminent
	FL-10	64.08	197.7	35.98	71.08	463,223	5.54	Mixed Use, Rec./Open Space	PUD	Presently undeveloped
	MSA 3061/3061A	65.46	82.90	E: 10.65 W: 18.43	82.90	E: 75,628 W: 236,800	4.00	Mixed Use, Rec./Open Space	PUD	Two upland areas separated by longitudinal wetland, 3061 contains old spoil mound, road access available
	FL-11	66.18	321.91	53.03	103.31	920,400	3.52	Agriculture/ Timberlands	AC, PUD	Presently undeveloped

Table 3-3 Candidate Sites, Long-Range Dredged Material Management Plan, Intracoastal Waterway, Flagler County (page 3 of 3, continued)

Reach	Site	Location (ICWW Mile)	Initial Site Area (ac)	Containment Area (ac)	Total Required Area (ac)	Containment Capacity (cy)	Maximum Pumping Distance (mi)	Comp. Plan Designation	Current Zoning	Comments
III	FL-12	67.98	756.7	10.0	36.45	128,131	5.05 (Reach III)	Agriculture/ Timberlands & Industrial	AC & I	Site within highly disturbed former sand mine, acreage requirement based on efficient use of minimum area
Continued	MSA-FO-3078	67.25	26.3	3.75	26.3	14,277	3.35	Low Intensity, Mixed Use	N/A	eastern shore of ICWW, two spoil mounds divided by creek, adjacent to condo/marina complex
IV	FL-12	67.98	756.7	10.0	36.45	128,131	6.23 (Reach IV)	Agriculture/ Timberlands & Industrial	AC & I	Site within highly disturbed former sand mine, acreage requirement based on efficient use of minimum area
	FL-13	70.76	435.8	4.86	25.80	13,692	3.36	Agriculture/ Timberlands	AC	Pine plantation, presently undeveloped.
SR 100 Bridge to South Co. Line	FL-14	71.62	77.8	4.86	25.80	13,692	3.08	Agriculture/ Timberlands	AC	Pine plantation, adjacent to headwaters of Bulow Creek, entire site very low
ICWW Mile 69.78 to 73.85	MSA 3113	72.68	48.12	4.13	48.12	15,196	2.90	Recreation/ Open Space	N/A	Located in Flagler Beach State Park, two spoil mounds bisected by dredged boat basin, minimal park infrastructure
	FL-15	73.80	259.2	4.86	25.80	13,692	6.32	Medium Density Residental	R1, MH3 PUD	Adjacent to Bulow Ruins State Park, southern portion of site now expanding residential development

4.0 ESTABLISHMENT OF SITE BANK

The final evaluation of the 15 existing easements and FIND-owned tracts and the 15 newly identified candidate sites was accomplished by assessing the ability of each site to satisfy a standard set of evaluation criteria. Through this process a group of eight sites was selected to form a site bank serving the four reaches of the Intracoastal Waterway channel within the Flagler County project area. The site bank consists of three primary (first-choice) sites and five secondary (second-choice) alternatives for the long-term management of dredged material removed from ICWW channels. As will be discussed later in this section, part of one of the primary sites also serves as a secondary alternative under a different management approach.

4.1 Evaluation Criteria

A standard set of criteria was used to perform the final site evaluation. However, no matrix analysis was performed to quantify the relative merits of each evaluation criterion. Although such an approach is sometimes very useful, it was deemed inappropriate in this case. Rather, the sites received a holistic evaluation which allowed for some subjectivity. In evaluating a site, each criterion was then given more or less weight based on the effect the specific information pertinent to that criterion had on the overall suitability of the site. The remaining portions of Section 4.0 describe the evaluation procedure, including the specific evaluation criteria used and the final bank of primary and secondary sites compiled via this procedure.

Each site was evaluated by its ability to satisfy criteria in three broad areas:

- o Engineering/Operational Considerations
- o Environmental Considerations
- o Socioeconomic or Cultural Considerations

Individual criteria considered in each of these areas are described below.

4.1.1 Engineering/Operational Considerations

Capacity - The primary objective of the Phase I planning effort was to identify suitable dredged material management sites of adequate capacity to meet the projected 50-year material storage requirements of the Waterway in the Flagler County project area. Therefore, the potential capacity of a site was a primary site evaluation criterion. In keeping with the management concept which emphasized centralized sites, all alternative sites were selected and existing sites were retained based on their ability to provide the required capacity with a minimum number of sites. Typically, one site possessing sufficient capacity was selected to serve each reach. However, as will be discussed, a single site was selected as the primary site to serve both Reaches III and IV.

Adequate Dike Material - Closely related to site capacity is the availability of adequate dike material on-site to construct the containment basin as employed in the preliminary capacity analysis (APPENDIX C). As discussed in Section 2.3, in some cases, small upland acreage or low mean grade elevation preclude the construction of a 15-foot dike without excavating the basin interior to an unreasonable depth. In such cases, the dike height was limited to that which could be constructed from the material above a reasonable depth of excavation. It is possible to circumvent an insufficient on-site supply of dike material by one of two methods: (1) trucking in additional material from off-site sources, or (2) using dewatered dredged material to build the dike in increments to its ultimate design elevation. However, the expense of obtaining and transporting material from off-site sources and the possibility that the dewatered dredged material may be unsuitable for dike construction make an adequate on-site supply of material preferable.

Pumping Distance - Pumping distance from the area to be dredged to the area of placement is also a criterion affecting the suitability of a site. Although booster pumps can significantly extend pumping distance, the increase is achieved only through a significant reduction in dredging efficiency and a corresponding increase in operating costs. In discussions with representatives of the Jacksonville District COE, a pumping distance of three to six miles was determined to be the limit for efficient operation. However, should extraordinary circumstances require increased distances, 10 miles was established as the absolute maximum pumping distance acceptable to the COE. Therefore, selecting a site requiring the shortest possible pumping distance must be balanced with the need to keep the total number of sites to a minimum.

Pipeline Access - A site affording the greatest ease of pipeline access from the Waterway, as well as the return of effluent to the Waterway, is also preferred. Apart from the potential for environmental impacts to sensitive saltmarsh or other wetlands (discussed in Section 4.3.2) difficult pipeline access adds to mobilization-demobilization costs and reduces operating efficiency. Examples of pipeline access difficulties include extensive marsh crossings, significant elevation changes, or the crossing of road or railroad rights-of-way. Moreover, difficult pipeline access may require the costly acquisition of additional pipeline easements.

Upland Access - Upland access with existing or potential road service is desirable for initial site construction and is required if the site is to be managed as a permanent operating facility, as intended. Notably, existing or potential upland road access was a requirement for the identification of new candidate sites.

Soil Properties - The properties of the soil on-site (e.g., load bearing capacity, resistance to piping, etc.) and the depth of the water table below grade are additional factors which are also included as criteria for site evaluation. However, these determinations require field testing not included in the initial phase of the project. Therefore, data supporting site soil properties and geohydrology will be obtained during Phase II. Observations made during Phase I field inspections revealed no obvious areas of concern.

4.1.2 Environmental Considerations

The environmental criteria used for site evaluation are intended to minimize adverse impacts to sensitive estuarine and upland areas, within the constraint of providing suitable sites to serve the needs of the Waterway. The resulting criteria may be organized under two categories reflecting the desire to restrict the placement and storage of dredged material to upland sites only: (1) criteria for the avoidance of wetland areas to the greatest extent possible, and (2) criteria for minimizing unavoidable impacts to upland areas.

Wetland Impacts - Avoidance of wetlands, a primary consideration throughout the site selection process, has largely been achieved by use of USFWS Wetlands Inventory maps and color-infrared photography. However, where a question remained or where avoidance of isolated or transitional wetland areas would have precluded the use of a site, several specific criteria were used to weigh the relative success in minimizing wetland impacts.

Salt marsh and all wetland areas exhibiting salt water characteristics, particularly those judged to be contiguous with state waters, are recognized by all state and federal agencies to be an extremely valuable resource. Therefore, the degree to which a site succeeds in eliminating the impacts to the salt marsh is obviously a crucial criterion in site selection. Closely related to this is the sometimes unavoidable impact caused by pipeline access to the site. If no other avenue is available (e.g., floating the pipeline in a tidal creek), crossing the marsh itself may be required. This practice, a necessary consideration in site selection, was minimized wherever possible.

Isolated freshwater wetlands, also a valuable biological community, can afford a system of filtering runoff and recharging groundwater supplies. Nevertheless, such wetlands receive less protection under DER permitting criteria. However, such wetlands are under the jurisdiction of the COE and the St. Johns River Water Management District (SJRWMD). The presence of these isolated wetlands was considered in the evaluation of a particular site, and their disruption was avoided wherever possible. Experience gained in previous plan development efforts suggests that the sacrifice of small, isolated areas possessing wetland vegetation may be acceptable if required to provide an adequate containment area. However, mitigation may be required to offset such impacts, if incurred. Somewhat independent of the extent of an interior wetland is the quality of the habitat it may afford or the unusual vegetation it may support. Thus, the quality of impacted wetlands was also a criterion of site selection and will affect the mitigation which may be required.

Upland Impacts - The use of uplands for the development of dredged material management areas minimizes impacts to wetlands. However, upland site development requires the removal of existing upland vegetation and habitat within the footprint of the containment basin, as well as along the associated pipeline access route and the access and perimeter service roads. Again, the quality of the impacted uplands can vary widely, and therefore assessments of the relative ecological value of the existing upland communities are useful site evaluation criteria. Specific assessments include the quality of habitat; the presence or potential presence of threatened or endangered species; the uniqueness, maturity, and aesthetic quality of the existing vegetation (e.g., mature hardwood canopy vs. second-growth saplings); and the extent to which a site was disturbed by previous human activities (e.g., clearing, logging, drainage, etc.).

Buffer Area - Also considered was the ability of a site to provide a buffer of undisturbed vegetation outside the containment area while still maintaining adequate storage capacity. The primary function of the buffer is to act as a visual barrier. However, other potential benefits can include the preservation of areas of particular environmental value such as maritime hammock, coastal scrub, or transitional wetlands which

could otherwise fall to development. Moreover, the preservation of a buffer region within a dedicated conservation easement may facilitate the permitting required for site construction by mitigating the impacts of site development.

Archeological Value - While not strictly an environmental consideration, the relative archeological value of each site was an evaluation criterion. Phase I of the project does not include a formal archeological survey of each candidate site. However, during the preliminary inspection of each candidate site, obvious evidence of early habitation or other cultural resources (e.g., shell middens) was noted. The presence of a documented archeological site, common to upland regions within the study area, is being investigated only for the final site bank of primary and secondary alternatives. A request for a records search of the Florida Master File of historical and archeological sites and the National Register of Historical Places has been forwarded to the Division of Historical Resources, Florida Department of State, so that potential conflicts can be identified. This search has not yet been completed. The presence of a verified archeological or historical site may necessitate a formal site survey or documentation effort prior to containment area construction. However, the discovery of such a site may not preclude the use of an otherwise viable management area.

Groundwater Conditions - The final environmental evaluation criterion, groundwater conditions, addresses the possibility that local groundwater supplies may be impacted as a direct result of site development and operation. As discussed in Section 2.1.3, all existing data indicates that the Waterway channel sediments in Flagler County are non-contaminated and pose no environmental threat. In addition, before each future dredging operation the sediment to be dredged will undergo further analysis, including elutriate testing. Should elevated levels of contaminants be identified, permitting procedures will require that appropriate measures be taken to ensure these contaminants remain sequestered with the dredged material. Therefore, contamination of local groundwater by materials contained in channel sediments is not anticipated.

The primary source of potential impacts to local groundwater is salt — specifically, saltwater mixed with the sediment and pumped from the Waterway to the site. Saltwater will be held in the containment area only during the relatively short and infrequent periods of active dredging and dewatering. Nevertheless, specific safeguards against the occurrence of saltwater contamination of the local shallow aquifer are an essential part of the design and operation of each site. In addition, each site will include a comprehensive program of groundwater monitoring before, during, and after each dredging operation. These safeguards,

addressed in detail in the site-specific documentation developed during Phase II, minimize the possibility of saltwater contamination. However, the possibility that saltwater may enter the local shallow aquifer cannot be totally eliminated except by extremely costly methods. Therefore, the relative isolation of a site, both in terms of its hydrology and its geographic separation from adjacent development, was a criterion in site evaluation. As such, this criterion is closely related to adjacent land use, an issue addressed in the following section.

4.1.3 Socioeconomic or Cultural Considerations

Land Use - The third major category of site evaluation criteria considers the socioeconomic issues of on-site or adjacent land use, current comprehensive plan and zoning designations, local governmental jurisdictions, and site ownership. Every effort was made during the initial identification of new candidate sites to select areas of suitable existing on-site land use. For obvious reasons, areas of minimal development were preferred. Moreover, areas previously disturbed by clearing, excavation, timber harvesting, or draining were given priority because of their reduced environmental value. Managed timberlands or other agricultural areas were not excluded from consideration, however, and seven tracts containing areas of planted pine were identified as candidate sites. Similarly, existing adjacent land use was an important consideration. The objective was to select areas isolated from existing residential or, in some cases, commercial or retail development.

Because of the rapid pace of development in some areas, available aerial photography often did not accurately depict current on-site or adjacent land use. In several cases, field inspections revealed on-site residential or commercial development which required site reconfiguration. Adjacent land-use conflicts were not so easily resolved, and in areas with limited upland acreage, such conflicts remain. To the maximum extent possible, these conflicts were reduced by a buffer zone to separate the containment area from residential or commercial development.

Zoning and Comprehensive Plans - In addition to field inspection of each site, on-site and adjacent land use was also investigated through the determination of existing zoning (county or municipal) and comprehensive plan future land-use designations. The present long-range planning effort, because it is being performed in support of a federal navigation project, is not subject to local zoning regulations. Moreover, the provision for dredged material management areas has not been addressed in local comprehensive plans. Indeed, in many cases comprehensive plans have not even recognized pre-existing dredged material disposal

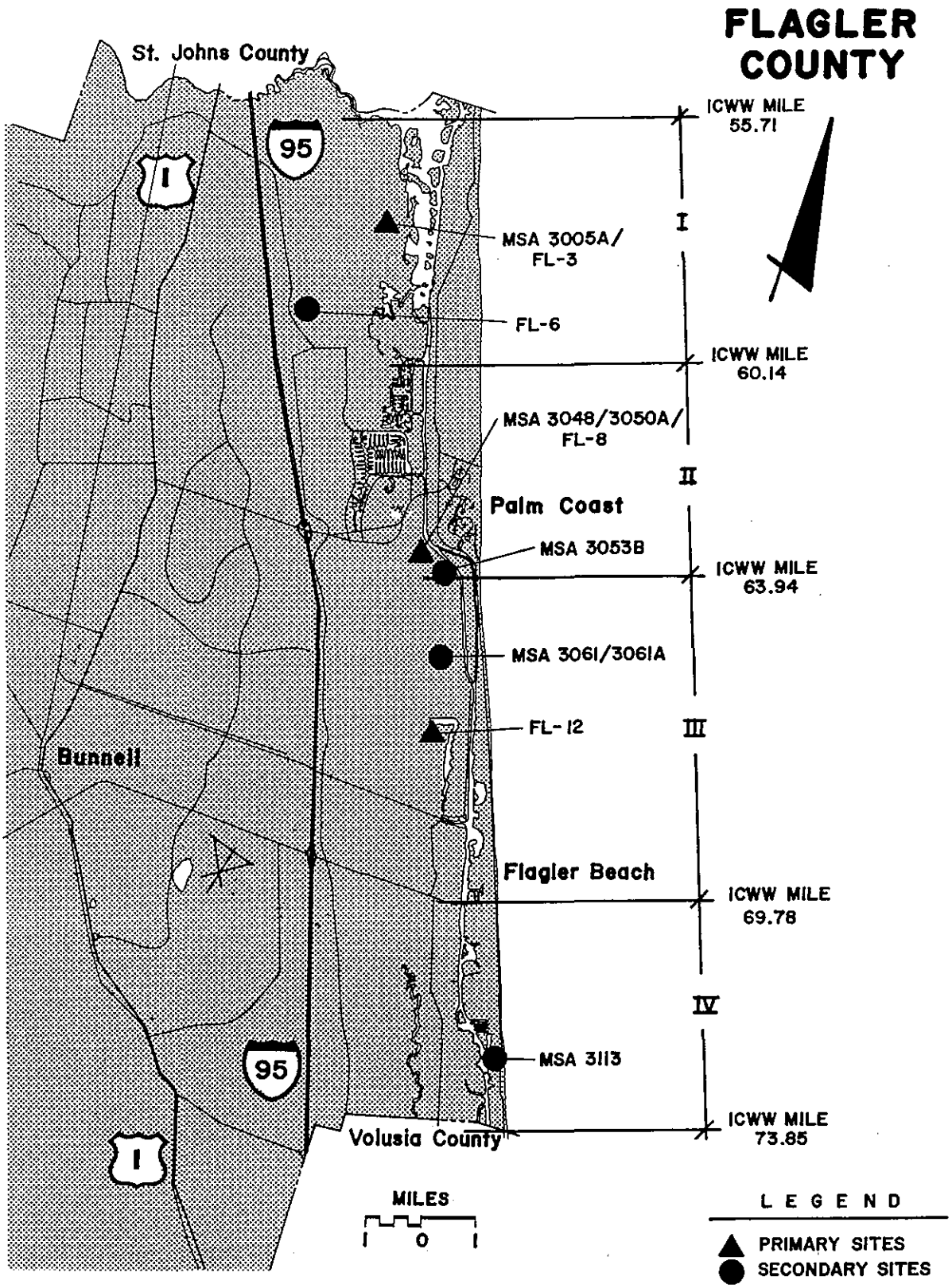
easements. This oversight is now being corrected by legislation. Notwithstanding the lack of clear guidelines in this matter, the FIND intends to recognize and address community concerns embodied in zoning and comprehensive planning laws. Thus, in the identification of new sites and the evaluation of existing easements, priority was given to those areas designated for industrial or agricultural uses.

Property ownership - Property ownership was investigated and established for primary and secondary sites to obtain authorized access to these sites required for the more detailed Phase II plan implementation effort. In addition, site ownership and recorded parcel boundaries were considered in the establishment of site boundaries, and when appropriate, to reduce the number of individual property owners involved. Property ownership information for all primary and secondary sites is presented in Appendix D.

4.2 Site Bank

Following the final evaluation of all candidate sites, a total of eight sites were selected to form the site bank to serve the four reaches of the Intracoastal Waterway channel within the Flagler County project area. These sites are identified in Figure 4-1. Of these, three sites represent primary or first-choice options. One site, Site FL-12, was selected to serve as the primary site for both Reaches III and IV. The remaining five sites provide secondary dredged material management alternatives should use of one or more of the primary sites prove not to be feasible. As discussed later in this section, a portion of one of the primary sites also serves as a secondary alternative under a different management approach. As their names imply, these eight sites represent the three best and five second-best alternatives after consideration of all engineering, operational, environmental, and socioeconomic factors influencing site selection.

Detailed information for each primary and secondary site in the site bank is presented in Appendix A. For each site, a data summary sheet outlines significant information on site location and reach parameters. Other site characteristics listed include acreage requirements, preliminary site capacity, and additional operational considerations such as access easement requirements and land use designations. In addition, Appendix A presents a map of each site showing the initial site boundaries (tied to geographic landmarks) and major vegetation communities and land-use categories under the FLUCFCS (Florida Land Use, Cover and Forms Classification System, Florida Department of Transportation, 1985) as verified by field inspection. Approximate acreages of each vegetation and land-use category are presented in tabular form. Finally, narratives accompanying each site summarize pertinent characteristics including general physiographic and environmental conditions, vegetative communities, and observed plant species typical of



TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	Figure 4-1 Site Bank, Long-Range Dredged Material Management Plan Intracoastal Waterway Flagler County, Florida	PROJECT REVISION SHEET DATE

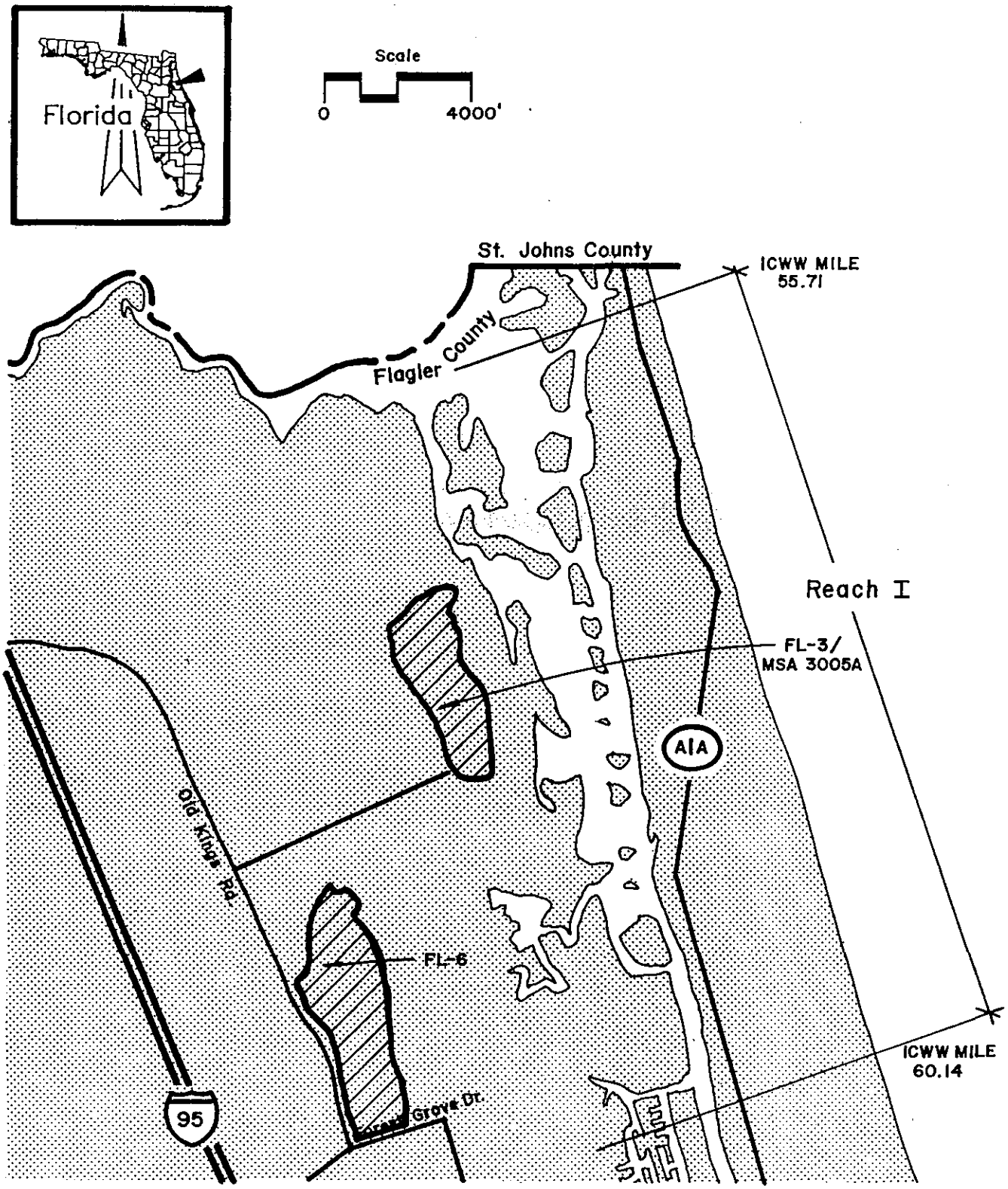
these communities. Appendix B presents similar information for the candidate sites not selected for the site bank.

Each of the four channel reaches within the Flagler County project area has been assigned at least one primary and one secondary site. In each case, both the primary site and the secondary site are well suited to serve the requirements of their designated channel reach. In the remainder of this section the key factors which led to the selection of the individual sites comprising the site bank are discussed, as well as the considerations which influenced the designation of the selected sites as either primary or secondary alternatives.

Within Reach I, Site MSA 3005A/FL-3 has been designated the primary site, while Site FL-6 has been designated the secondary site. Site locations are shown in Figure 4-2. The primary site represents the expansion of an existing easement, MSA 3005A. The expansion was necessary to obtain sufficient acreage for the projected Reach I 50-year material storage requirement and to maintain an adequate buffer around the containment basin.

Site MSA 3005A/FL-3 was selected as the Reach I primary site for several reasons. First, as an expansion of an existing easement, the use of this site reduces the amount of property needed to be acquired by the FIND. Second, the existing easement, MSA 3005A, was used previously to receive 115,000 cy of maintenance material dredged from the ICWW. Third, the required site expansion lies wholly within an area of planted pine, and therefore site development will result in minimal environmental impacts. Fourth, the site is isolated from existing residential development. Finally, Site MSA 3005A/FL-3 is located close to the Waterway and affords good pipeline access via an existing, previously cleared easement.

The secondary site for Reach I, Site FL-6, is a realistic management alternative should use of Site MSA 3005A/FL-3 prove not to be feasible. However, Site FL-6 is less desireable than the primary site for several reasons. First, Site FL-6 would involve the acquisition of more acreage to provide the required capacity than would the primary site. Second, Site FL-6, identified as a completely new site, contains no existing easements. Notably, the acreage requirement of the secondary site assumes that the existing easement MSA 3005A could not be used, either in its present or in an expanded form. If MSA 3005A were retained for continued use in its present form, but could not be expanded, a smaller Site FL-6 would still be required. Third, Site FL-6 is located farther from the Waterway than is the primary site, resulting in a



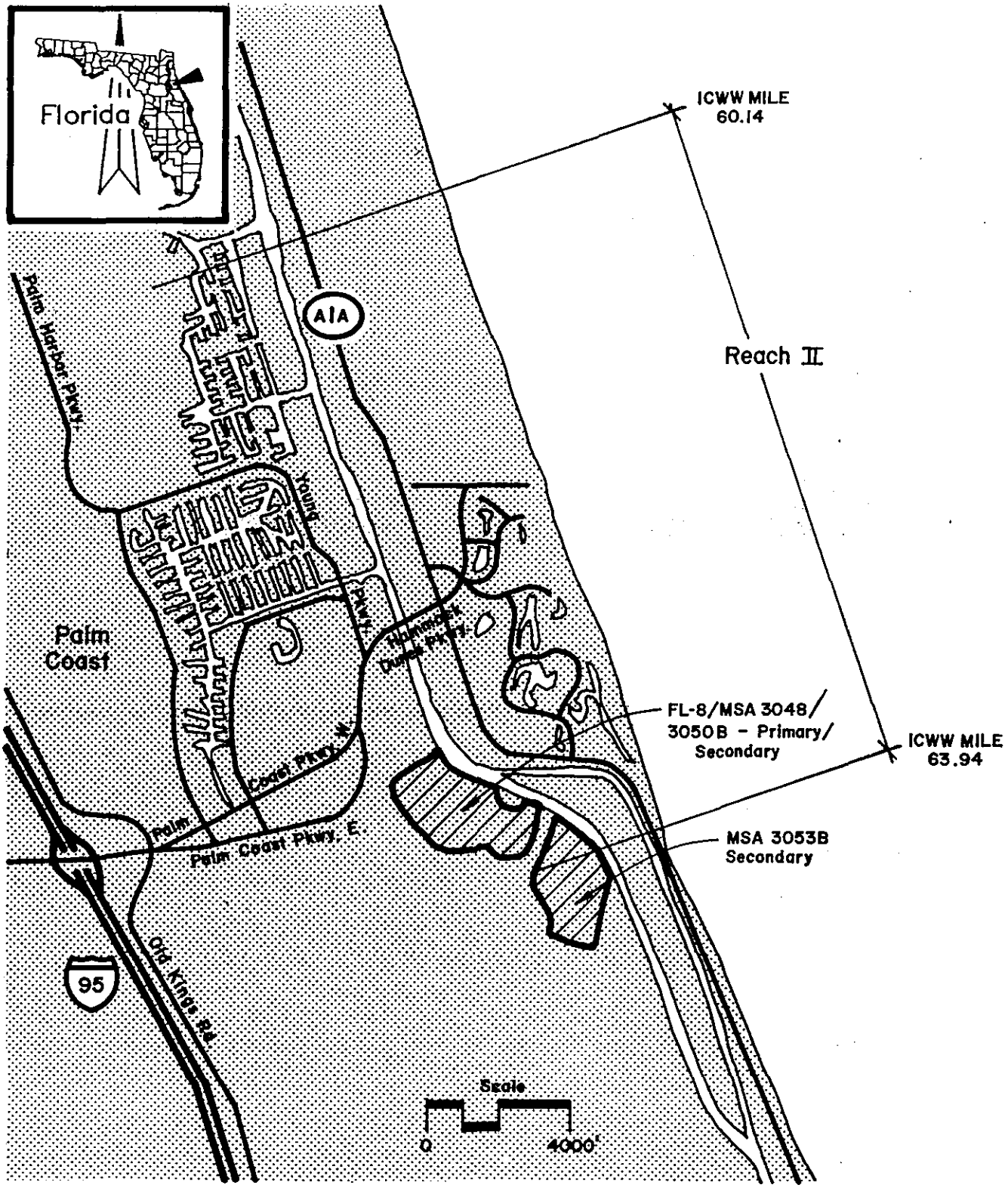
TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	**Figure 4-2** **Location Map,** **Primary and Secondary Sites, Reach I** **Flagler County, Florida**	PROJECT REVISION SHEET DATE

significantly more difficult pipeline access. Finally, the location of Site FL-6 places it nearer adjacent development.

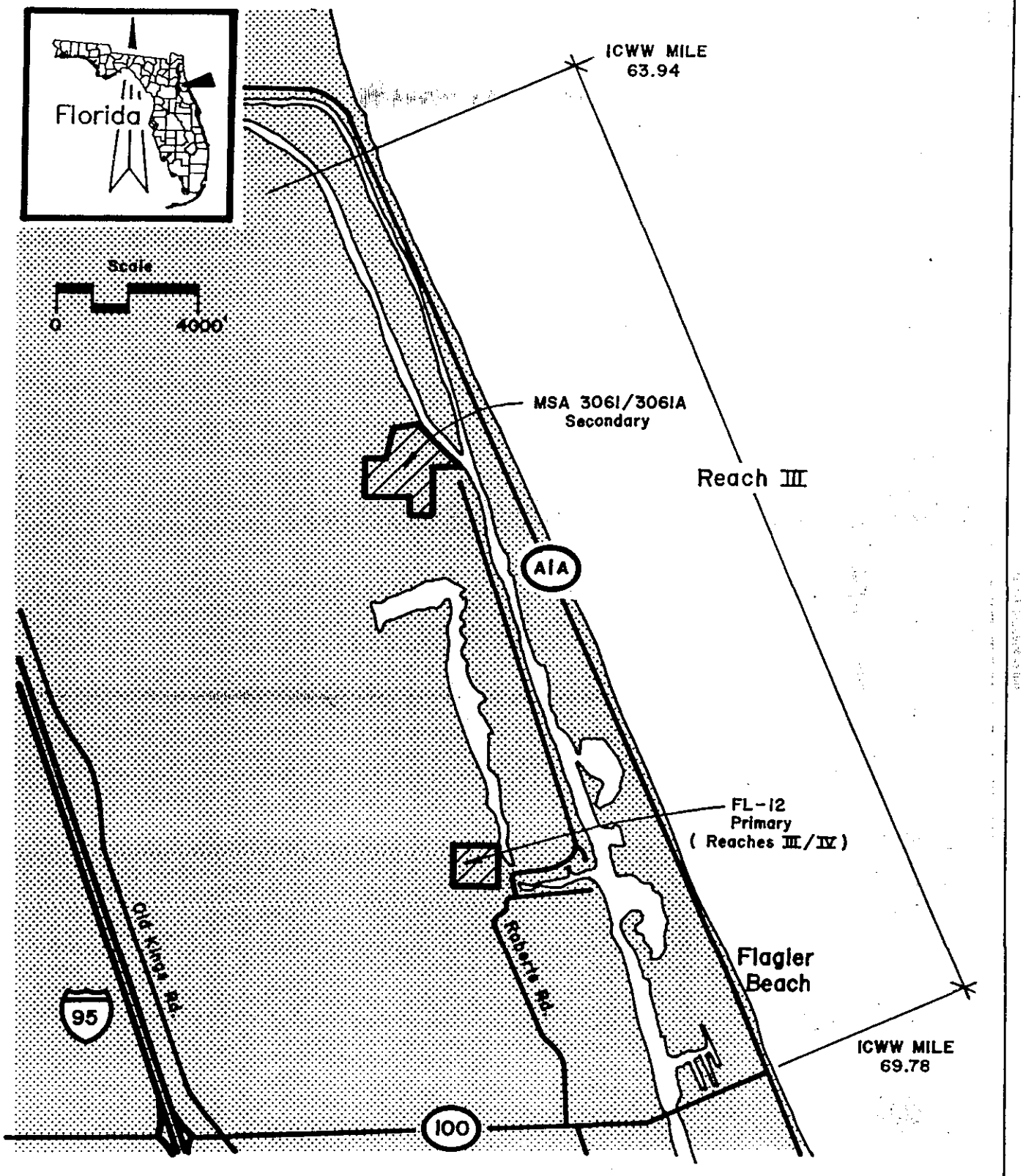
Similar to the situation in Reach I, the primary site for Reach II, designated Site MSA 3048/3049A/3050A/FL-8, also represents the expansion of an existing easement or, rather, three contiguous easements (Figure 4-3). Again, the expansion is necessary to obtain capacity sufficient for the projected Reach II 50-year material storage requirement and to provide adequate buffer area. Two of the three existing easements which form a portion of the primary site serve as one of two sites comprising the secondary alternative for Reach II. The second of these, Site MSA 3053B, is separated from the first group of easements by a county park, an easement for a county road to serve the park, and a Florida Power and Light Company (FPL) powerline easement (Figure 4-3). Thus, although the combined capacity of the two secondary sites meets the reach requirement, it is not possible to join them to form one site. In all other respects, the two secondary sites are well suited to provide for the long-term maintenance of Reach II. However, a basic principle of the management concept developed for the Flagler County project area requires the use of a minimum number of centralized sites. Therefore, Site MSA 3048/3049A/3050/FL-8 was designated the primary site for this reach.

A single primary site, Site FL-12, has been selected to serve both remaining Reaches III and IV. Two existing easements, MSA 3060/3061A and MSA 3113, have been designated as the respective secondary sites for these reaches (Figures 4-4 and 4-5). Even though these reaches have not required maintenance since 1951, future patterns of sedimentation are subject to change in response to upland development, alteration of upland drainage patterns, extreme storm events, or other unforeseen occurrences. This is demonstrated by the shoaling recently documented opposite the Gamble Rogers Memorial State Recreation Area where no shoaling had previously been reported. Thus, as discussed in Section 3.0, the long-range dredged material management plan for the Intracoastal Waterway in Flagler County provides a permanent infrastructure of facilities to serve all reaches of the Waterway.

Several reasons led to the selection of Site FL-12 to serve both Reaches III and IV. First, Site FL-12 is within a large, highly disturbed area, the site of the former sand and shell mine of the abandoned Lehigh Portland Cement Company operation. Thus, sufficient acreage is available for use with minimum environmental impacts or adjacent land-use conflicts. Second, the site is located both near the southern end of Reach II and close to the Waterway, thus affording acceptable pumping distances from the extreme ends of the two combined reaches (5.05 miles and 6.23 miles, respectively). With only a minimum combined



TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	Figure 4-3 Location Map, Primary and Secondary Sites, Reach II Flagler County, Florida	PROJECT REVISION SHEET DATE



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9086 CYPRESS GREEN DRIVE
JACKSONVILLE, FLORIDA 32256

Figure 4-4
Location Map,
Primary and Secondary Sites, Reach III
Flagler County, Florida

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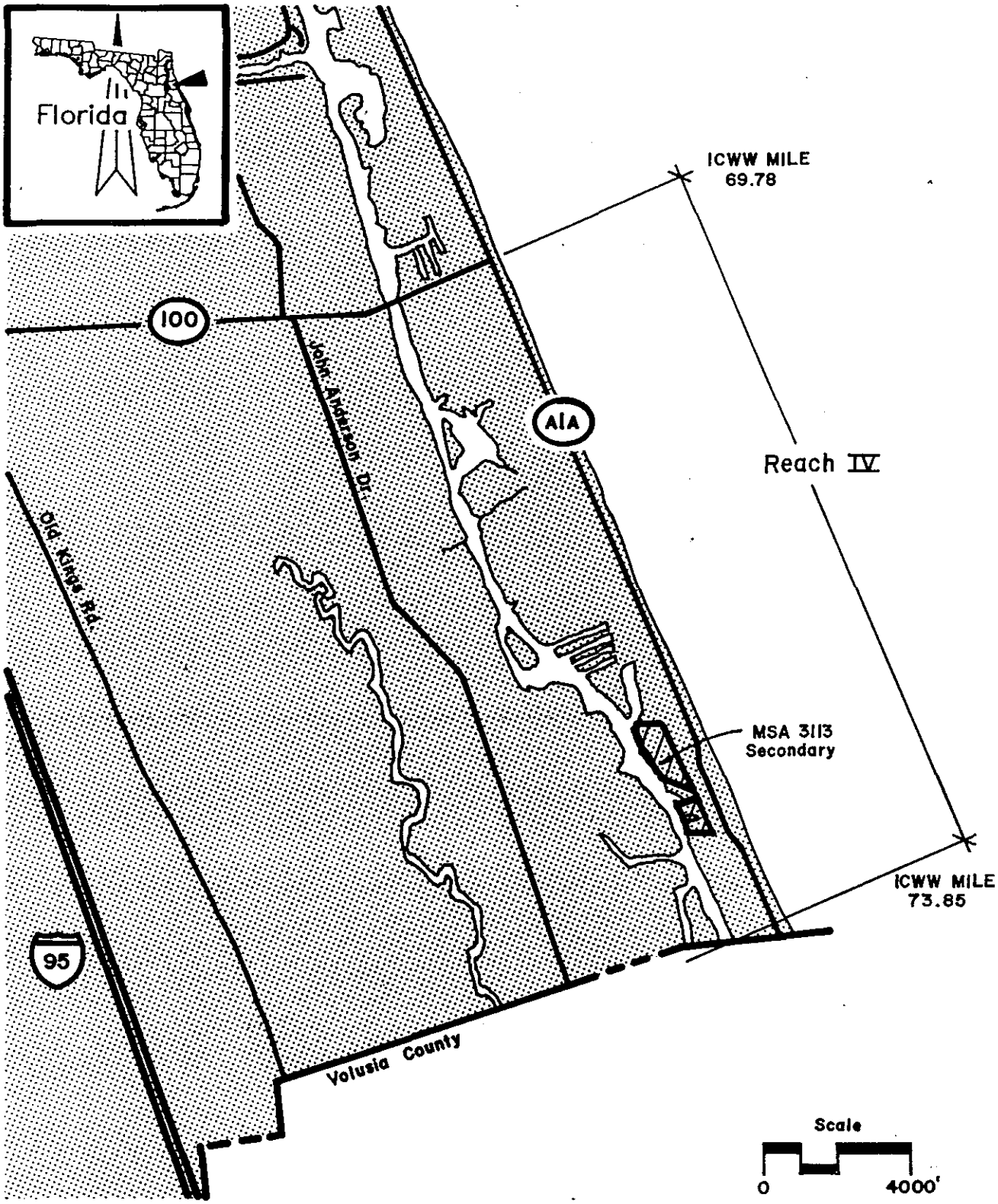

TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	**Figure 4-5** **Location Map,** **Primary and Secondary Sites, Reach IV** **Flagler County, Florida**	PROJECT REVISION SHEET DATE

material storage requirement for Reaches III and IV (12,000 cy), the site area for FL-12 is based on the efficient use of minimum acreage. The specified containment area of 10 acres represents the smallest area required for the construction and efficient operation of a containment basin in a manner consistent with program criteria. The total site requirement of 36.45 acres provides a 300-foot buffer surrounding the 10-acre containment basin. The resulting storage capacity of Site FL-12 is 128,000 cy.

As stated above, the secondary sites for both Reaches III and IV use existing easements to provide the minimal storage requirements projected for these reaches. As such, both sites serve as acceptable management alternatives should the use of FL-12 prove not to be feasible. However, both sites carry disadvantages compared to Site FL-12. Development of Site MSA 3060/3061A, the secondary site for Reach III, will require the clearing of previously undisturbed uplands. In addition, on-site wetlands somewhat limit the potential capacity of this site. However, since Reach III has no history of shoaling, the upland portions of the site can provide adequate capacity. Similarly, the secondary site for Reach IV, Site MSA 3113, can provide the required minimum storage capacity of 12,000 cy. However, because this easement is located within the waterfront area of the Gamble Rogers Memorial State Recreation Area, its use may introduce land-use conflicts.

Preliminary acreage requirements, storage capacities, and operational factors for each site in the site bank are summarized in Table 4-1. The final determination of these parameter values will be made during Phase II of the project. However, the preliminary estimates presented here are felt to be both realistic and conservative. In all cases, site material storage capacities are sufficient to meet the projected 50-year requirements of the reach to be served.

In Table 4-1, the containment area for each site represents the acreage within a realistic dike configuration necessary to contain the stated material storage capacity for that site. For all sites the required dike configuration lies wholly within the initial site acreage. The total required area corresponds to the required containment area, plus an appropriate buffer surrounding the diked containment basin. A 300-foot minimum buffer width is provided with two exceptions. The first, Site MSA 3048/3049A/3050A/FL-8, the designated primary site for Reach II, represents an expansion of a block of existing easements. The expanded site is limited by physiographic features on three sides and by a county park on the fourth. To obtain the required containment acreage, it may be necessary to reduce the amount of buffer provided along the Waterway to 200 feet. The second exception is Site MSA 3113, the secondary site for Reach IV. In

Table 4-1 Site Bank, Long-Range Dredged Material Management Plan, Intracoastal Waterway, Flagler County (page 1 of 2)

Reach	Site	Location (ICWW Mile)	Initial Site Area (ac)	Containment Area (ac)	Total Required Area (ac)	Containment Capacity (cy)	Maximum Pumping Distance (mi)	Comp. Plan Designation	Current Zoning	Comments
I Marineland to North Canal, Palm Coast ICWW Mile 55.71 to 60.14	MSA 3005A/ FL-3 Primary	57.26	181.5	45.0	125.10	777,740	3.37	Agriculture/ Timberlands	AC	Expansion of existing easement MSA 3005A, acreages and capacity include existing easement
	FL-6 Secondary	58.72	294.3	45.0	101.47	775,036	4.52	Agriculture/ Timberlands	AC	1.6 miles west of ICWW, pine plantation (logged and replanted), no adjacent development
II North Canal, Palm Coast to North End, Fox Cut ICWW Mile 60.14 to 63.94	MSA 3048/3049A/ 3050A/FL-8 Primary	62.88	166.70	100.98	215.20	1,763,800	2.80	High-Low Density Res.	R3 & AC	Expansion of existing easements MSA 3048/3049A/ 3050A, acreages and capacity include easements
	MSA 3048/3050A Secondary	63.05	59.10	37.01	59.10	742,000	2.97	Low Density Residential	AC	Contiguous easements, material on site is presently being mined
	MSA 3053B Secondary	63.61	123.0	50.52	123.00	1,098,000	3.54	Low Intensity Mixed Use/ Low Density Residential	AC	Recently acquired by FIND, separated from MSA 3048/ 3049A/3050A by county park, powerline/road easements
III North End Fox Cut to SR 100 Bridge ICWW Mile 63.94 to 69.78	MSA 3061/3061A Secondary	65.46	82.90	E: 10.65 W: 18.43	82.90	E: 75,628 W: 236,800	4.00	Mixed Use, Rec./Open Space	PUD	Two upland areas separated by longitudinal wetland, 3061 contains old spoil mound, road access available
	FL-12 Primary	67.98	756.7	10.0	37.40	128,100	5.05	Agriculture/ Timberlands & Industrial	AC, I	Site within highly disturbed former sand mine, acreage requirement based on efficient use of minimum area

Table 4-1 Site Bank, Long-Range Dredged Material Management Plan, Intracoastal Waterway, Flagler County (page 2 of 2, continued)

Reach	Site	Location (ICWW Mile)	Initial Site Area (ac)	Containment Area (ac)	Total Required Area (ac)	Containment Capacity (cy)	Maximum Pumping Distance (mi)	Comp. Plan Designation	Current Zoning	Comments
IV SR 100 Bridge to South Co. Line	FL-12 Primary	67.98	756.7	10.0	37.40	128,100	6.23 (Reach IV)	Agriculture/ Timberlands & Industrial	AC & I	Site within highly disturbed former sand mine, acreage requirement based on efficient use of minimum area
ICWW Mile 69.78 to 73.85	MSA 3113 Secondary	72.68	48.12	4.13	48.12	15,196	2.90	Recreation/ Open Space	N/A	Located in Flagler Beach State Park, two spoil mounds bisected by dredged boat basin, minimal park infrastructure

this case, efficient use of limited available upland requires the reduction of the buffer in some areas to 100 feet.

The total required primary site acreage for the 18.14 miles of Waterway channel within the Flagler County project area is approximately 378 acres. This includes 156 acres of active containment area and 222 acres of buffer. Of the total required area of 378 acres, approximately 94 acres are contained in four existing easements. In the corresponding total secondary site requirement of 415 acres, 147 acres are containment area and 268 acres are buffer. Included in the secondary set of management alternatives, 299 of the 415 acres are contained in six existing easements.

5.0 RECOMMENDED SCOPE OF WORK: PHASE II - DETAILED SITE DOCUMENTATION

Task I: Preparatory Documentation

The purpose of this task is to obtain all of the information and authorizations necessary to facilitate the detailed documentation of site conditions and facilities design in Task II and to document public record information concerning land use and zoning restrictions, taxes and assessed values, easements, and property ownership. This will be done for all primary and secondary sites subject to property acquisition proceedings. Specific sub-tasks are outlined below.

A. Public Information - From county tax rolls and related public records, verify and update, as necessary, site ownership and tax information including parcel size, boundaries, and assessed value. This information will be provided to the FIND at the earliest possible date to facilitate the FIND obtaining from all relevant property owners appropriate written permission as required for site access, survey work, field testing, and data collection.

B. Zoning - Verify and update, as necessary, existing zoning classification and permitted uses under that classification.

C. Other Site Encumbrances - Identify other restrictions which may limit the use of the site such as local or regional planning constraints, rights-of-way, easements, adjacent property constraints, or potential damages to adjacent properties.

D. Site Reconfiguration - Modify site boundaries, as necessary. Eliminate unusable or unnecessary acreage and finalize site configuration for performance of boundary survey.

Task II: Site Conditions

Obtain necessary engineering and environmental site information required for preliminary engineering design and permitting of primary sites only as modified by results of Task I.

A. Boundary Survey - Provide boundary survey of each primary site. Provide boundary surveys of additional pipeline and road access easements as required. Document results of each survey in sufficient detail to support legal and engineering actions required for the acquisition of the sites and additional easements under consideration by the FIND and for the

development of the sites for the purposes of dredged material management. Provide final boundary survey drawings, written legal descriptions, and other supporting documents to the FIND for each site. Reference boundary information for each site and easement to the Florida State Plane Coordinate System.

B. Engineering Topographic Survey - Provide site topographic information necessary for site planning, permitting, and design purposes. Reference horizontal and vertical control of data to established bench marks and reference all elevations to NGVD.

C. Subsurface and Soils Survey - This task will be performed by the Jacksonville District, U.S. Army Corps of Engineers.

1. Soils Survey - By means of core borings and analysis, document site soil characteristics including boring logs, grain size distributions, specific gravity, organic content, Atterberg limits (where appropriate), shear strength, compaction, and consolidation.
2. Groundwater - Obtain groundwater table elevations at a sufficient number of locations to provide estimates of on-site water table potential surface elevations referenced to NGVD.

D. Environmental Survey - Perform field survey and data collection efforts to provide the following:

1. Detailed documentation of site vegetation communities, including species frequencies of occurrence, and the delineation of wetlands and transitional areas using state approved methods.
2. Detailed documentation of on-site animal species, including endangered or threatened species, and pertinent habitat information.
3. Documentation of existing vegetation communities and species habitats along proposed pipeline access and return drainage routes.
4. Documentation for a Phase I Environmental Site Assessment for concerns related to hazardous waste.

Task III: Preliminary Design and Analysis

Using data obtained from Task II, develop site documentation and complete preliminary design necessary to prepare permit drawings.

A. Environmental - Using information obtained from Task II-D, prepare the following:

1. Detailed site maps showing vegetation communities, species locations and habitats, revised usable boundaries, and wetland areas
2. Detailed written text supporting (1) above
3. Specific mitigation measures as required
4. Archeological site locations as recorded in published records available from the Division of Historical Resources, Florida Department of State
5. Recommended pipeline access and return water routes
6. Phase I Site Environmental Assessment Report

B. Engineering - Using information obtained in Task II, prepare the following:

1. Site Capacity Analysis - Recalculate estimated site capacity and dike material requirements
2. Site Topographic Map
3. Engineering Report on Subsurface and Soils Conditions - Prepared by Jacksonville District, U. S. Army Corps of Engineers
4. Preliminary design calculations and permit drawings of:
   - o Location/Reach Map
   - o Site Plan
   - o Pipeline Access and Return Routes
   - o Inlet Works
   - o Outlet Works
   - o Dike Section
   - o Internal Structures
   - o Equipment Ingress and Egress Features
   - o Service Roads and Interdiction Ditches
   - o Vegetation and Buffer Area Plan

o Site Drainage Plans

5. Detailed written text supporting (1) - (4) above

C. Agency Coordination - Obtain from pertinent state and federal agencies a preliminary statement on the acceptability of the proposed site plans based on the site engineering narrative, permit drawings, environmental report, and preliminary delineation of agency jurisdiction.

Task IV: Site Management Plans

Prepare a site management plan for each primary site in the Site Bank as modified by Task I. Each plan will address the following:

A. Design Features - Brief description of all site design features as they relate to the long-term operation of the site and the management of dredged material.

B. During-Dredging Procedures

1. Outlet Operations
2. Inlet Operations
3. Ponding Depth
4. Material Distribution
5. Monitoring

C. Post-Dredging Procedures

1. Dewatering
2. Surface Water Management
3. Material Handling/Reuse
4. Monitoring

Task V: Cost Considerations

For all primary sites, evaluate the following cost considerations:

A. Site Improvement Costs

B. Site Operation Costs

C. Site Maintenance Costs

Task VI: Documents and Deliverables

Prepare and submit the following project documents for each primary site:

A. Site boundary survey with legal description, with additional boundary surveys of pipeline and road access easements as required.

B. Site topographic survey, with additional topographic surveys of pipeline and road access easements as required.

C. Permit drawings and accompanying engineering narrative.

D. Subsurface and soils report prepared by Jacksonville District, U. S. Army Corps of Engineers.

E. Environmental Report.

F. Phase I Site Environmental Assessment Report.

G. Site Management Plan.

H. Cost Report.

REFERENCES

Schropp, S.J., and Taylor, R.B. (1993). *Sediment Quality in the Intracoastal Waterway in Flagler, Volusia, and Martin Counties, Florida*. Taylor Engineering, Inc., Jacksonville, FL.

Taylor, R.B., and McFetridge, W.F. (1986). *Long-Range Dredged Material Management for the Intracoastal Waterway in Northeast Florida*. Taylor and Divoky, Inc., Jacksonville, FL.

APPENDIX A

Site Bank

(Primary and Secondary Sites)

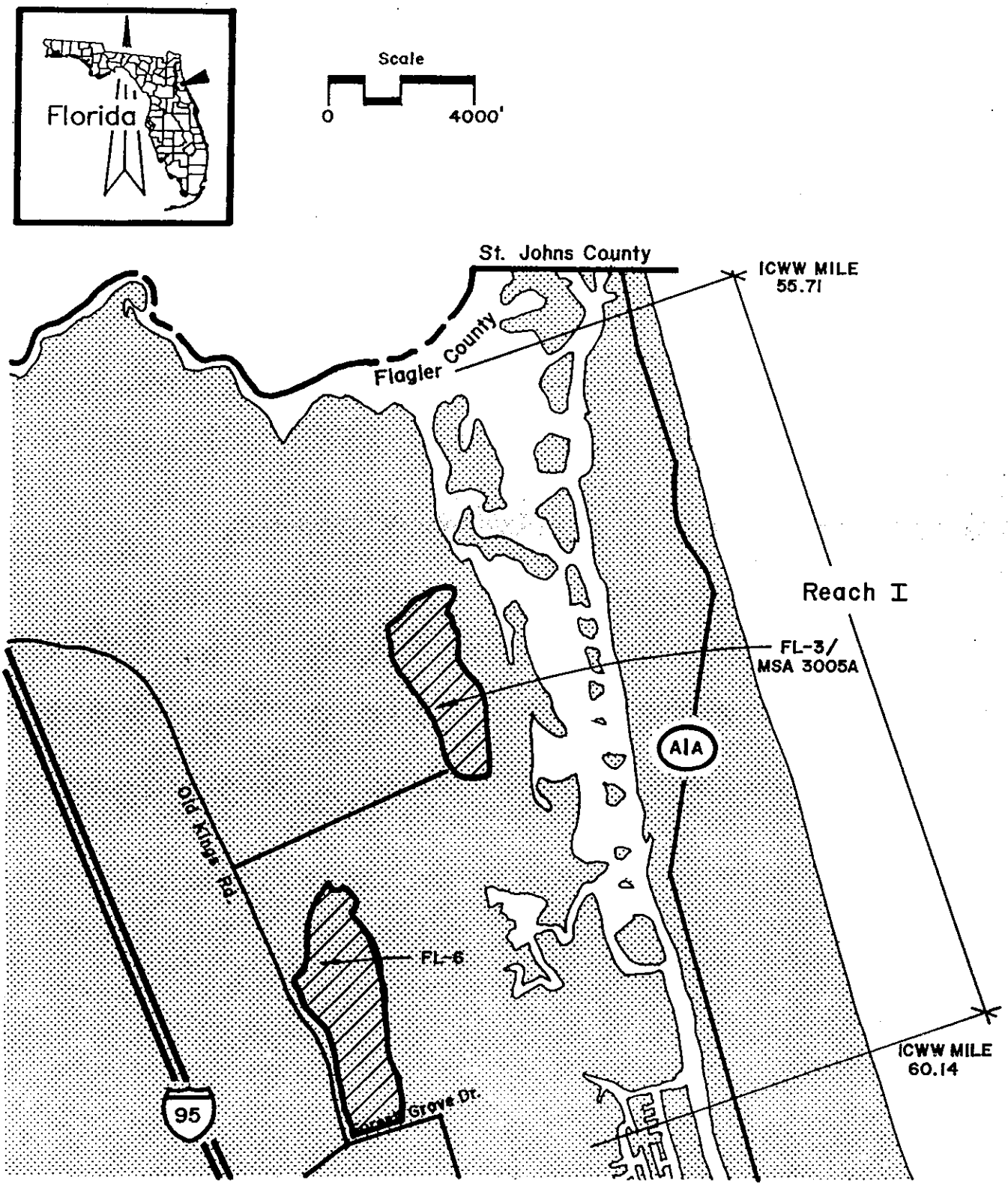

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Figure A-1
Location Map,
Primary and Secondary Sites, Reach I
Flagler County, Florida

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SITE FL-3/MSA 3005A DATA SUMMARY SHEET

I General Location

Flagler	I	Matanzas River
County	**Reach #**	**Waterbody Name**
13/10S/30E	757,000 cy	0.66 mi
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
County	4.43 mi	II
Municipality	**Reach Length**	**DER Receiving Water Classification**
Marineland (mi 55.71) to N. Canal, Palm Coast (mi 60.14)		57.26
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

181.5 ac	45.0 ac	125.1 ac	>300 ft N,W,S Min. Upland on E
Initial Site Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
> +5.0 ft NGVD	777,740 cy	2000 E-2 (Existing Easement, 800 ft±)	Agriculture & Timberlands
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
3.37 mi	15 ft	2.33 mi	Pine Plantation
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Old Kings Rd. to a Private Road	3.9 ft below grade	None	Mixed Wetland Forest, Freshwater Marsh
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site FL-3/MSA 3005A is the primary site for Reach I of Flagler County. This 125.10 acre site is composed of an existing 33.90 acre dredged material storage easement plus an additional 91.20 acres of surrounding land. It lies in a secluded area roughly one mile north of Palm Coast on the western shore of the Matanzas River. MSA 3005A, the existing easement, forms the nucleus of this site. Alone, MSA 3005A cannot provide capacity adequate to meet the 50-year reach disposal requirement. Therefore, the additional acreage is required to provide the needed capacity.

Site vegetation consists mainly of a coniferous plantation (441). It contains slash pine (*Pinus elliottii*), saw palmetto (*Serenoa repens*), laurel and live oaks (*Quercus laurifolia*, and *Q. virginiana*), and an occasional cabbage palm (*Sabal palmetto*). Numerous small, isolated freshwater marshes (641) are scattered throughout the site. These marshes contain Florida cinnamon fern (*Osmunda cinnamomea*) and royal fern (*Osmunda regalis*), two varieties listed by the state as commercially exploited. A large, freshwater marsh is located in the northeastern corner of the site. In addition to the species listed above, this wetland also contains wax myrtle (*Myrica cerifera*) and swamp bay (*Persea palustris*). Preliminary site inspection indicates that this area may be connected to other wetlands off-site. A small wetland forest mix (630) community surrounds an improved pasture (211) which occupies the northwestern site corner. A large wetland community lies immediately west of and adjacent to the site.

A few gopher tortoise (*Gopherus polyphemus*) burrows were observed in the coniferous plantation community. The gopher tortoise is a Florida species of special concern.

Four key considerations led to the selection of FL-3/MSA 3005A as the primary site for Reach I. First, MSA 3005A is an existing easement presently held by the FIND. It served as a dredged material site, most recently in 1986. Second, site vegetation consists mainly of planted pine, so site clearing will require minimal disturbance of native vegetation and habitat. Third, the site lies well away from developed areas. Finally, the site's central location within the reach will minimize pumping distance.

Table A-1 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site FL-3, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
211	Improved Pasture	14.4
434	Hardwood-Conifer Mixed	12.0
441	Coniferous Plantations	114.8
630	Wetland Forested Mix	2.6
641	Freshwater Marsh	6.0
643	Wet Prairie	0.4
643/742	Wet Prairie/Borrow Area	3.8
743	Spoil Area	27.5
	Total	**181.5**

Source: WAR, 1993

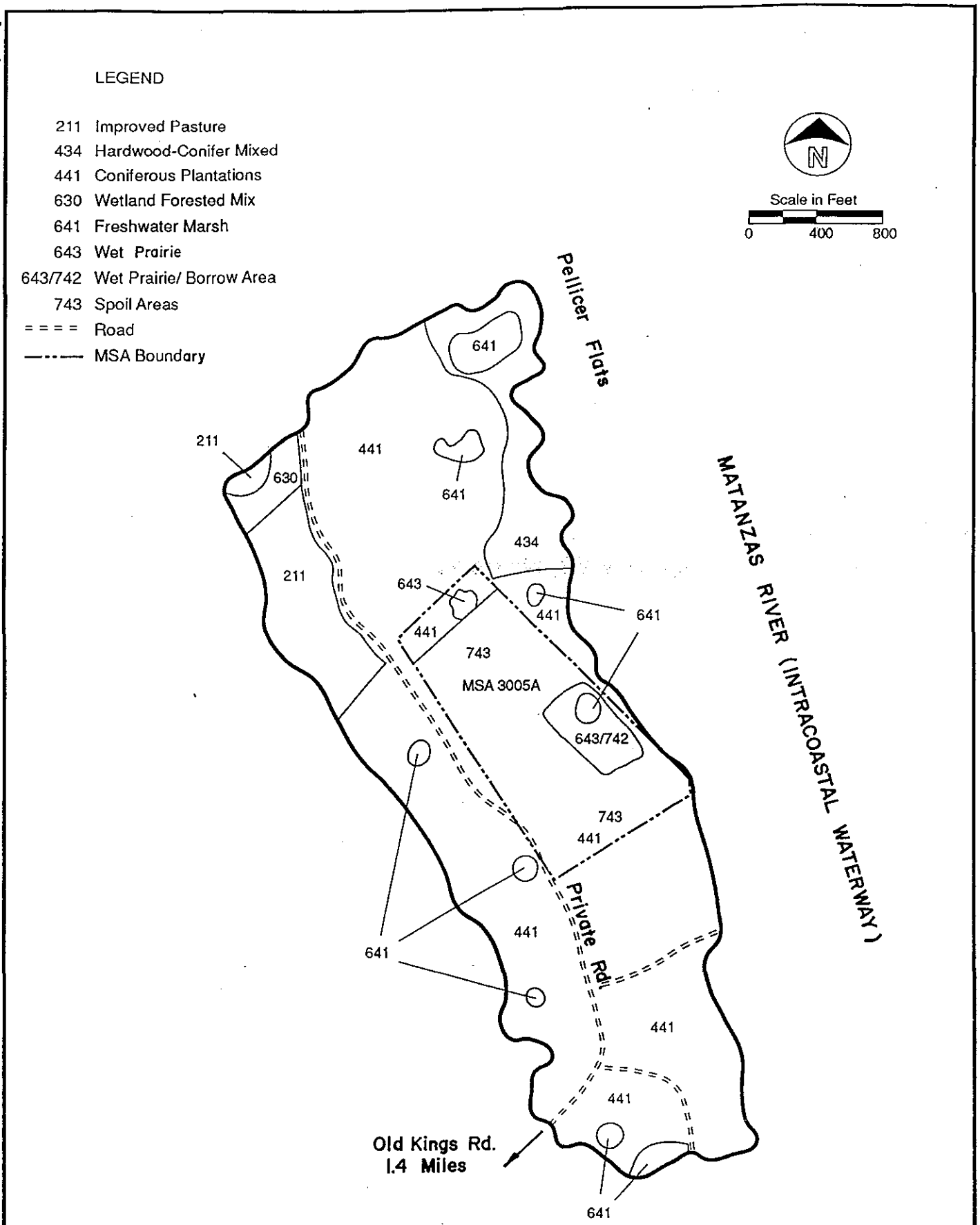


Figure A–2
Vegetation and Land Use of Site FL–3
Flagler County, Florida

SITE FL-6 DATA SUMMARY SHEET

I General Location

Flagler	I	Matanzas River
County	**Reach #**	**Waterbody Name**
24,25/10S/30E	757,000 cy	1.52 mi
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
County	4.43 mi	II
Municipality	**Reach Length**	**DER Receiving Water Classification**
Marineland (mi 55.71) to N. Canal, Palm Coast (mi 60.14)		58.72
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

294.3 ac	45.0 ac	101.47 ac	300 ft Minimum all sides
Initial Site Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+20 ft NGVD±	775,036 cy	0.95 mi	Agriculture & Timerlands
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
4.52 mi	15 ft	None Required	Pine Plantation
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Old Kings Road	5.03 ft below grade	None	Freshwater Marsh
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site FL-6 is the secondary choice for Reach I of Flagler County. It lies about 1.5 miles west of the ICWW and one-half mile north of Palm Coast. A large power line right-of-way and Old Kings Road parallel the western site boundary.

Site vegetation is predominately coniferous plantation (441) interspersed with many isolated freshwater marsh wetlands (641). The coniferous plantation occupies the northern two-thirds of the site. It contains slash pine (*Pinus elliottii*), saw palmetto (*Serenoa repens*), and fetterbush (*Lyonia lucida*). A small, water-filled ditch partially separates the coniferous plantation from the pine flatwoods community to the south. The pine flatwoods community (411) contains slash pine, saw palmetto, blazing star (*Liatris sp.*), live oak (*Quercus virginiana*), and prickly-pear cactus (*Opuntia sp.*), the latter a species the state lists as threatened. Two reservoirs (530) located in this community contained standing water at the time of the site inspection.

Site FL-6 is considered secondary to Site FL-3/MSA 3005A because of its distance from the ICWW. Its use would require the acquisition of an additional pipeline easement of approximately 1.5 miles. The presence of a broad expanse of tidal marsh along this route would make placement of supply and return pipelines difficult. Moreover, the location of Site FL-6 increases the possibility of future conflicts with encroaching residential development.

Table A-2 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site FL-6, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
411	Pine Flatwoods	73.3
441	Coniferous Plantations	211.2
530	Reservoirs	3.9
641	Freshwater Marsh	5.9
	Total	**294.3**

Source: WAR, 1993

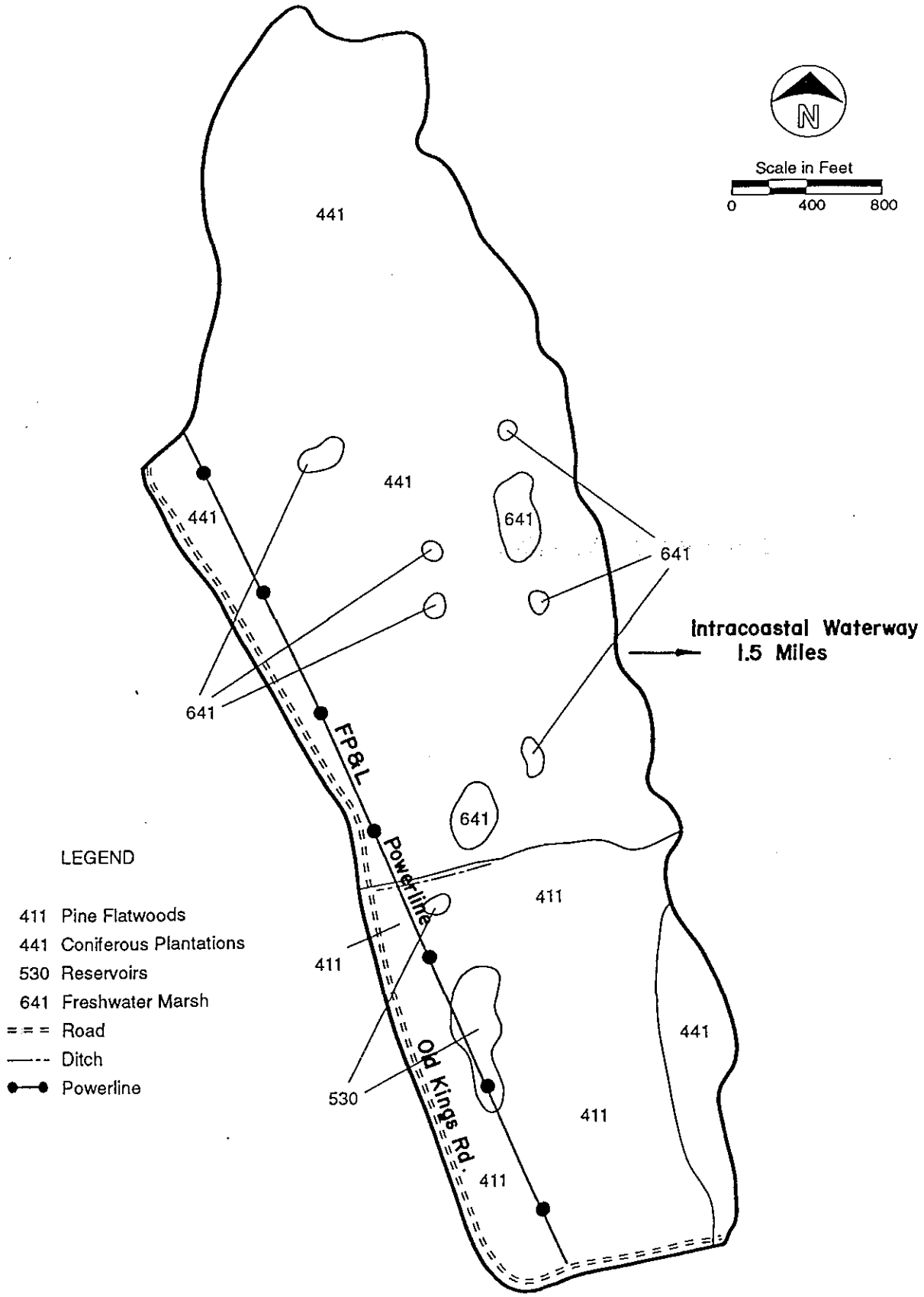
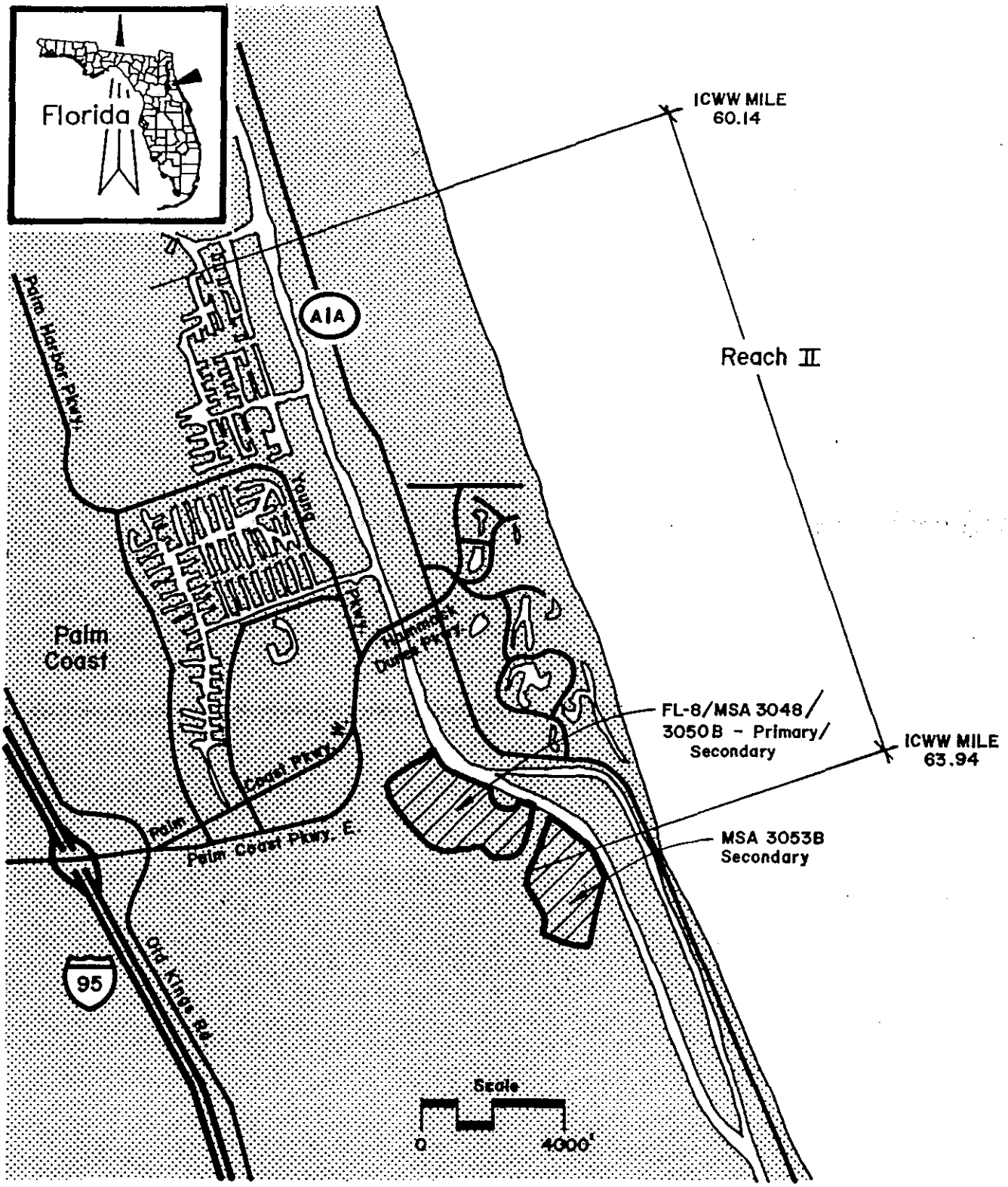


Figure A–3
Vegetation and Land Use of Site FL–6
Flagler County, Florida



TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	Figure A-4 Location Map, Primary and Secondary Sites, Reach II Flagler County, Florida	PROJECT REVISION SHEET DATE

SITE FL-8/MSA 3048/3049A/3050A DATA SUMMARY SHEET

I General Location

Flagler	II	ICWW
County	**Reach #**	**Waterbody Name**
9,38,48,49/11S/31E	1,756,000 cy	On West Shore
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
Palm Coast (Unincorp.)	3.80 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
N. Canal, Palm Coast (mi 60.14) to N. End, Fox Cut (mi 63.94)		62.88
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

166.7 ac	100.98 ac	215.2 ac	200 ft Minimum all sides
Initial Site Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+10 to +30 ft NGVD±	1,763,800 cy	None Required	High-Low Density Residential
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
2.80 mi	15 ft	1.6 mi	Undeveloped
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Palm Coast Pkwy to Private Road	5.6 ft below grade	Mixed Wetland Hardwoods	Mixed Wetland Hardwoods
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site FL-8/MSA 3048/3049A/3050A is the primary site for Reach II. It lies on the western shore of the ICWW at the north end of Fox Cut. The site is configured to utilize three existing dredged material containment easements. Dredged material placed on these easements during previous maintenance events is presently being mined as construction material. An additional tract of land adjacent to the easements is also required to meet the 50-year reach disposal requirement. The site will be accessible via Colbert Lane, a public road scheduled for construction.

The dredged material containment area (743) occupies the eastern portion of the site. The remainder of the site hosts a mixed agricultural/forested community. Much of the site consists of temperate hardwoods (425) and shrub and brushland (329). Areas of mixed wetland hardwoods (617) are prevalent within and bordering the site. The brush and shrub vegetation types on-site are typical of once-cleared areas naturally regrown. This vegetation consists of a variety of grasses and a significant population of young trees and shrubs. Species include bahia grass (*Paspalum notatum*), broomsedge (*Andropogon virginicus*), wax myrtle (*Myrica cerifera*), and cabbage palm (*Sabal palmetto*). The temperate hardwood community contains live oak (*Quercus virginiana*), cabbage palm (*Sabal palmetto*), hackberry (*Celtis laevigata*), and numerous small, grassy clearings. The mixed wetland hardwood areas have a variety of trees including cypress (*Taxodium sp.*), Florida elm (*Ulmus floridana*), hackberry, maple (*Acer rubrum*), and cabbage palm. The diked containment area (743) hosts a thick cover of saltbrush (*Baccharis halimifolia*) within its basin.

Table A-3 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site FL-8, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
211	Improved Pasture	0.4
329	Other Shrubs and Brush	40.9
425	Temperate Hardwoods	76.5
510	Streams and Waterways	0.3
617	Mixed Wetland Hardwoods	10.1
630	Wetland Forest Mixed	4.2
743	Spoil Area	32.7
814	Roads and Highways	0.6
	Total	**166.7**

Source: WAR, 1993

3/17/93
92-5149-2/Taylor-Flagler

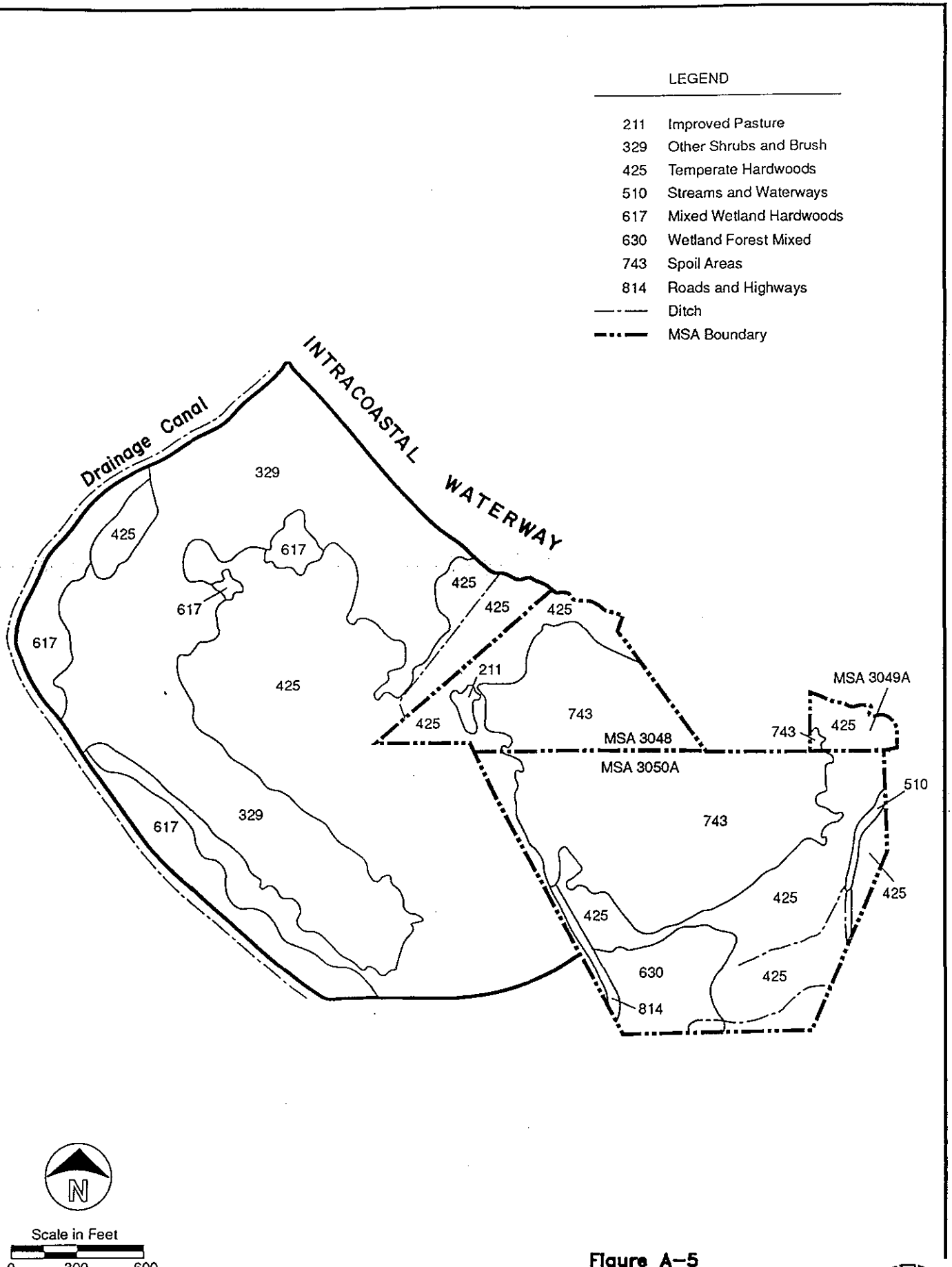


Figure A–5
Vegetation and Land Use of
Site FL–8/MSA 3048, 3049A, and 3050A
Flagler County, Florida

SITE MSA 3053B DATA SUMMARY SHEET

I General Location

Flagler	II	Intracoastal Waterway
County	**Reach #**	**Waterbody Name**
9,10,15,16/11S/31E	1,756,000 cy	On Western Shore
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
Palm Coast (Univcorp.)	3.80 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
N. Canal, Palm Coast (mi 60.14) to N. End Fox Cut (mi 63.94)		63.61
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

123.0 ac	50.52 ac	123.0 ac	300 ft/>400 ft/300/300 ft
Initial Esmt. Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+10 to +25 ft NGVD	1,098,038 cy	None Required	Low Density Residential, Low Density Mixed-Use
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
3.54 mi	19 ft	None Required	Undeveloped, County Park
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Roberts Road (from South)	2.8 ft below grade	None	Freshwater Marsh, Wet Prairie
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

MSA 3053B is an existing dredged material management easement located on the west shore of the ICWW at the north end of Fox Cut. It lies close to FL-8, separated from it by a small creek and a 400-foot powerline easement. Though an unpaved road and several jeep trails are present, the site remains largely undisturbed.

This easement contains a variety of upland communities including coastal scrub (322), pine flatwoods (411), and temperate hardwoods (425). There are several large herbaceous wetlands located in the central part of the site (643 and 641). An old dredged material storage area lies along the northwestern site boundary. A hard-packed dirt road bisects the property, connecting the northwest and southeast property corners. Due to the orientation of on-site wetlands, this easement does not contain sufficient contiguous upland acreage to meet the 50-year reach requirement. Therefore, it has been designated as a secondary choice for Reach II. In this scenario, it would serve in combination with easements MSA 3048 and MSA 3050A.

A coastal scrub community covers much of the site. Vegetation there includes sand live oak (*Quercus geminata*), sand pine (*Pinus clausa*), myrtle oak (*Quercus myrtifolia*), Chapman's oak (*Quercus chapmanii*), and rusty lyonia (*Lyonia ferruginea*). Some portions of the scrub community canopy are very thick and 15 to 20 feet high. The condition of this growth indicates that no burning has occurred on-site in recent times. The pine flatwoods are vegetated with slash pine (*Pinus elliottii*), cabbage palm (*Sabal palmetto*), saw palmetto (*Serenoa repens*), fetterbush (*Lyonia lucida*), and wax myrtle (*Myrica cerifera*). This area also exhibits a lack of burning. The temperate hardwood community along the western site boundary was not visited at the time of the site inspection.

The wet prairie is vegetated with sand cordgrass (*Spartina bakerii*), Virginia chain fern (*Woodwardia virginica*), and sawgrass (*Cladium jamiacense*). The spoil area (743) has partially regrown with a cover of saw palmetto, cabbage palm, wax myrtle, prickly-pear cactus (*Opuntia sp.*, state threatened), and unidentified grasses.

Table A-4 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site MSA 3053B, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
322	Coastal Scrub	59.5
411	Pine Flatwoods	43.0
425	Temperate Hardwoods	9.4
641	Freshwater Marsh	3.1
643	Wet Prairie	3.7
743	Spoil Areas	2.4
814	Roads and Highways	1.9
	Total	**123.0**

Source: WAR, 1993

1/19/93
92-5149-2/Taylor-Flagler

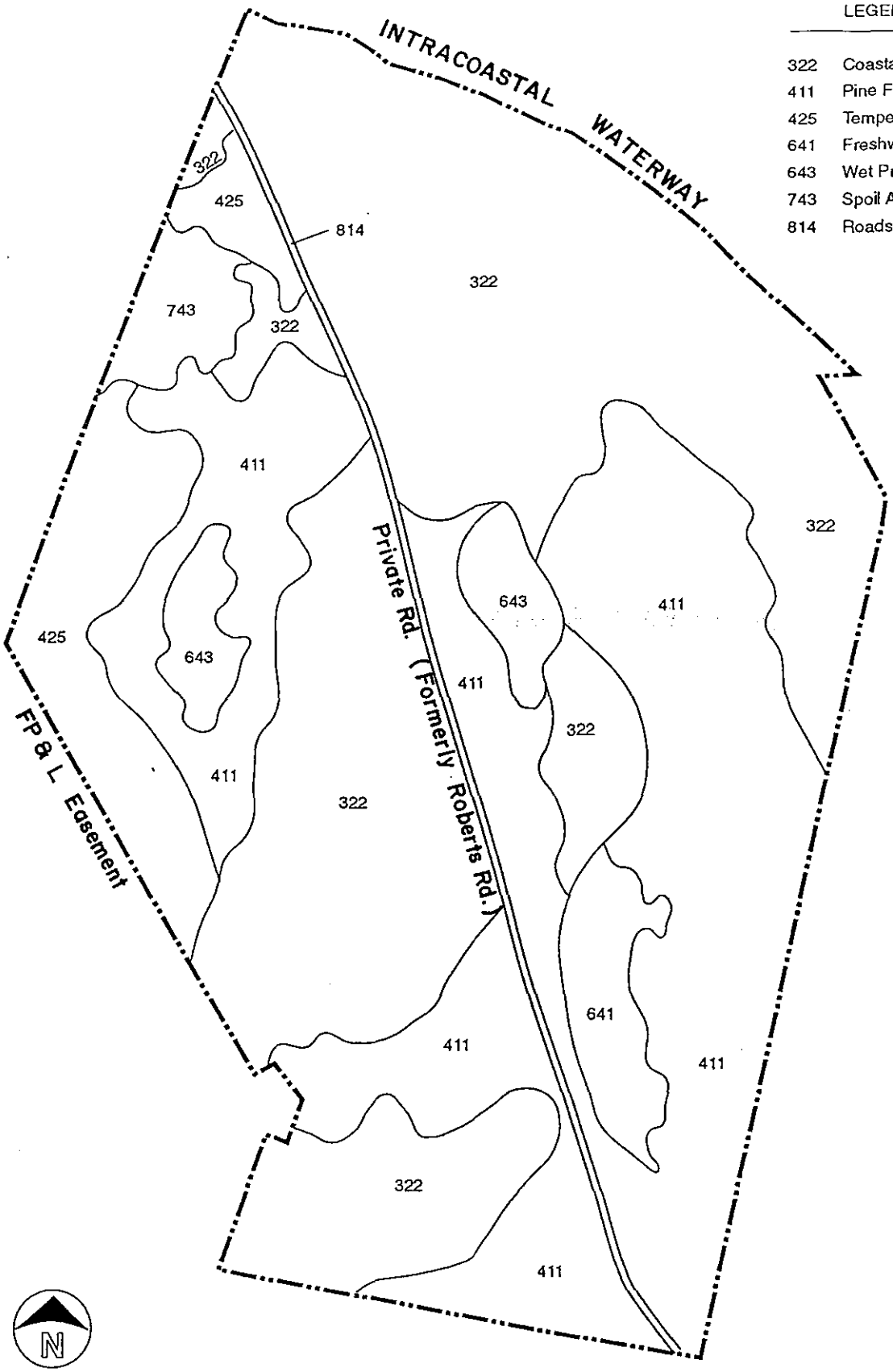
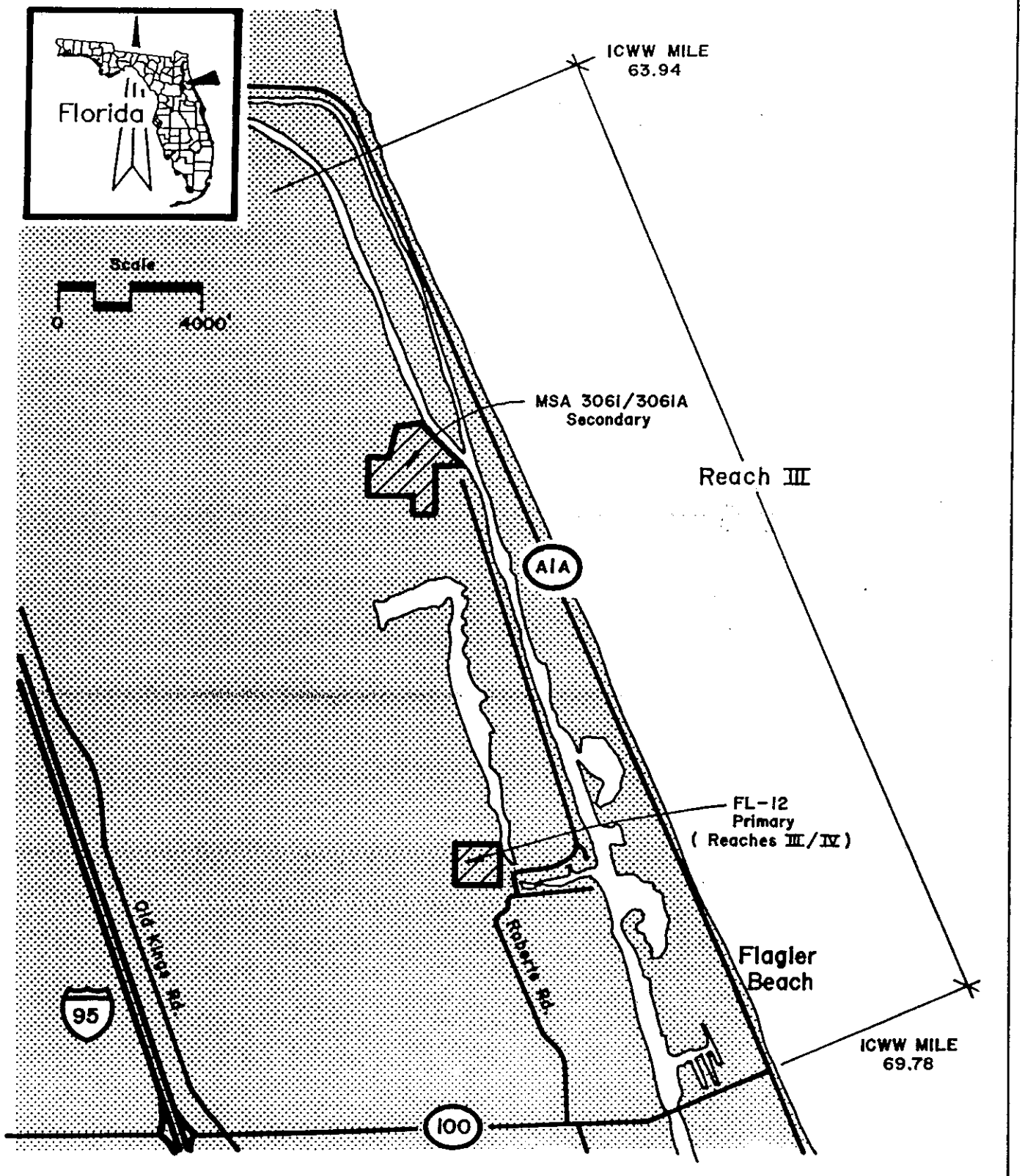


Figure A–6
Vegetation and Land Use of Site MSA 3053B
Flagler County, Florida



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9086 CYPRESS GREEN DRIVE
JACKSONVILLE, FLORIDA 32256

Figure A-7
Location Map,
Primary and Secondary Sites, Reach III
Flagler County, Florida

PROJECT
REVISION
SHEET
DATE

SITE MSA 3061/3061A DATA SUMMARY SHEET

I General Location

Flagler	II	Smith Creek (ICWW)
County	**Reach #**	**Waterbody Name**
22/11S/31E	0	Easement adjoins ICWW R/W
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
County	5.84 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
N. End Fox Cut (mi 63.94) to S.R. 100 Bridge (mi 69.78)		65.46
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

82.9 ac	3061: 10.65 3061A: 18.43	82.9 ac	300/0/200 - 1000/ 150 - 400
Initial Esmt. Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+10 ft NGVD±	3061: 75,628 cy 3061A: 236,800 cy	None Required	Recreation/Open Space, Low Intensity Mixed-Use
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
4.0 mi	3061: 8 ft 3061A: 12 ft	None Required	Same
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Roberts Road	5.5 ft below grade	Forested Wetland	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

MSA 3061 and MSA 3061A are two contiguous, existing dredged material storage easements centrally located within Reach III. They lie on the western shore of the ICWW at the southern end of Fox Cut. A private road (formerly Roberts Road) bisects MSA 3061A, running east to west through the easement's center. A band of wetlands lies along the boundary between the two easements. However, the upland portion of each easement is of sufficient size to support a containment basin.

MSA 3061/3061A is considered the secondary choice for Reach III because the primary site, FL-12, can serve both Reaches III and IV. Therefore, only three sites would be needed to serve the four reaches in Flagler County.

MSA 3061, which lies northeast of MSA 3061A, contains an old dredged material mound (743). This area has partially revegetated with red cedar (*Juniperus silicicola*), broomsedge (*Andropogon sp.*), cabbage palm (*Sabal palmetto*), prickly-pear cactus (*Opuntia sp.*), and lantana (*Lantana camera*). It is bordered by temperate hardwoods on the west and coastal scrub on the east. Bands of forested wetland (610) border the hardwood areas. The eastern portion of MSA 3061A is vegetated much like MSA 3061. It contains forested wetlands (610), temperate hardwoods (425), and coastal scrub (322). However, it shows no evidence of dredged material deposition. The western portion of MSA 3061A is dominated by pine flatwoods (411). It also contains areas of coastal scrub (322) and temperate hardwoods (425).

The temperate hardwood areas of both easements contain live oak (*Quercus virginiana*), hackberry (*Celtis laevigata*), southern red cedar (*Juniperus silicicola*), devilwood (*Osmanthus americana*), and slash pine (*Pinus elliottii*). The coastal scrub communities include sand live oak (*Quercus geminata*), myrtle oak (*Quercus myrtifolia*), Chapman's oak (*Quercus chapmanii*), and saw palmetto (*Serenoa repens*). In addition, individual sand and slash pines (*Pinus clausa and Pinus elliottii*) are scattered throughout these communities. The pine flatwoods are dominated by varying sizes of slash pine, while saw palmetto, bracken fern (*Pteridium aquilinum*), and muscadine grape (*Vitus rotundifolia*) form ground cover. Hardwood invasion of the pine flatwoods is evident where laurel oaks (*Quercus laurifolia*) have taken hold. The forested wetlands are vegetated with red maple (*Acer rubrum*), loblolly bay (*Gordonia lasianthus*), swamp bay (*Persea palustris*), and cabbage palm. The site shoreline is quite steep and contains little emergent vegetation. Coquina rock outcroppings form portions of the shoreline along the southern end of the site.

Table A-5 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site MSA 3061/3061A, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
322	Coastal Scrub	19.9
411	Pine Flatwoods	22.3
425	Temperate Hardwoods	8.9
610	Forested Wetlands	25.5
743	Spoil Areas	5.4
814	Roads and Highways	0.9
	Total	**82.9**

Source: WAR, 1993

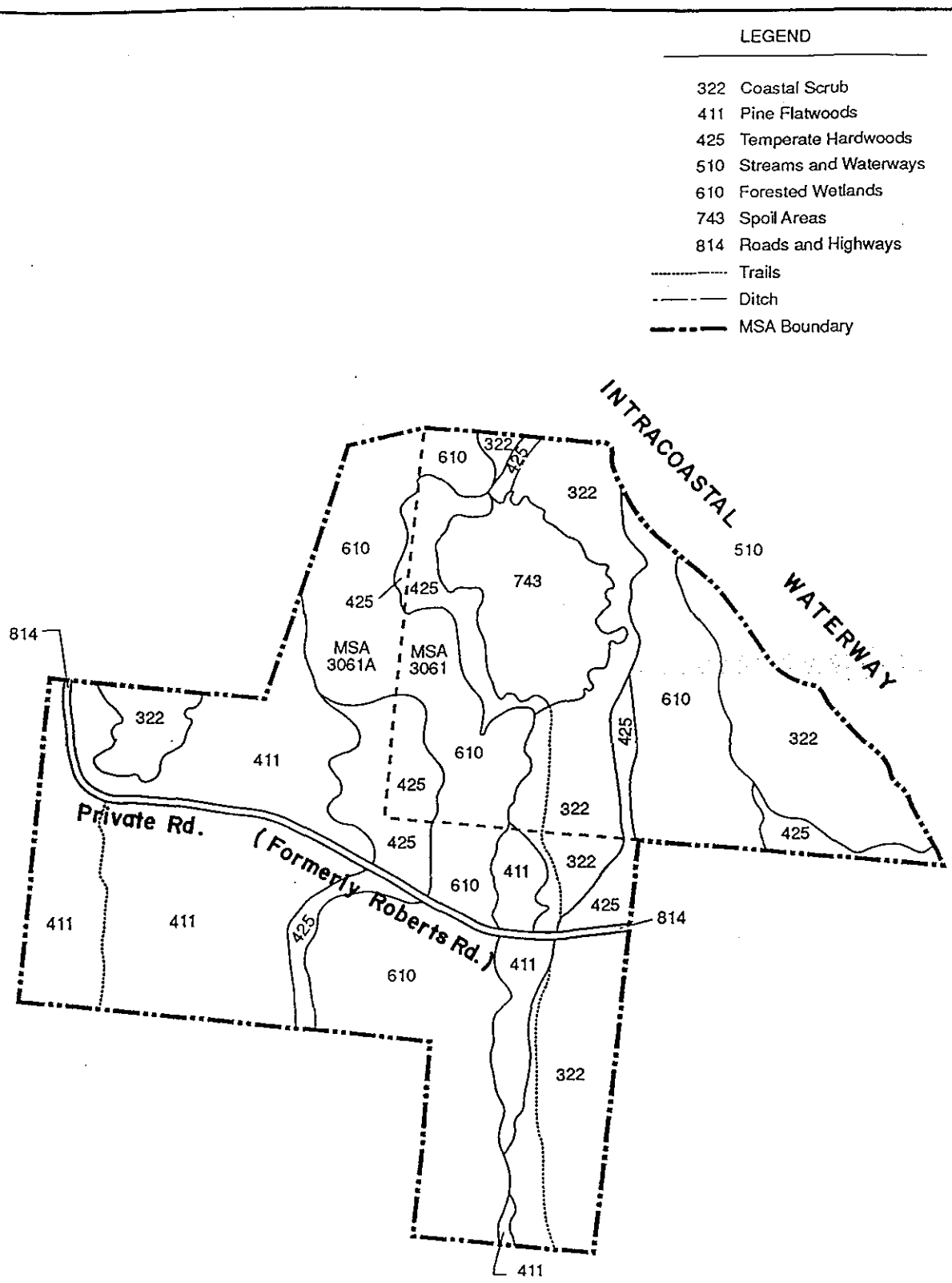


Figure A–8
Vegetation and Land Use of Site MSA 3061/3061A Flagler County, Florida

SITE FL-12 DATA SUMMARY SHEET

I General Location

Flagler	III (& IV)	Smith Creek (ICWW)
County	**Reach #**	**Waterbody Name**
34,35/11S/31E	0 (12,000 cy)	0.49 mi
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
County	5.84 mi (+4.07 mi)	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
N. End, Fox Cut (mi 63.94) to S.R. 100 (mi 69.78)		67.98
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

756.7 ac	10.0 ac	37.4 ac	300 ft Minimum all sides
Initial Site Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+18 ft NGVD±	128,131 cy	>1100 ft (to Sea Ray Basin)	Agriculture & Industrial
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
5.05 mi (Reach III) 6.23 mi (Reach IV)	12 ft	Undetermined	Industrial, Undeveloped
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Private Road	7.5 ft below grade	Mixed Forested Wetland, Freshwater Marsh	Shrub Marsh
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site FL-12, the primary site for Reaches III and IV, lies 1.5 miles west of the ICWW immediately north of the defunct Lehigh Portland Cement plant. This site was a portion of the plant's mining operation. Only 37.4 acres of the 756.7 acres originally identified would be required for a containment area. The southern end of the site provides the most favorable location for a containment basin. A large canal located there would provide pipeline access. By using Site FL-12, only three sites would be required to serve the four reaches of Flagler County.

The site contains a large, water-filled reservoir (532) excavated during a former mining operation. The mostly cleared lands (700) west and south of the reservoir are highly disturbed. Vegetation regrowth has occurred in some areas (740), while other large areas remain mostly barren. The areas adjacent to the reservoir have a very irregular topography created by the deposition of tailings from the mining operation. Some wetlands (618) formed in low areas between mounds are vegetated with a low canopy of red maple (*Acer rubrum*), Florida elm (*Ulmus floridana*), wax myrtle (*Myrica cerifera*), and willow (*Salix caroliniana*). A more mature band of wetland hardwoods is located along the western shoreline of the reservoir.

Plans for use of this site do not include the area east of the reservoir; therefore, it was not field inspected. However, evaluation of aerial photography indicates that the mining operation caused minimal disturbance there. The disturbance that did occur seems to be confined to areas along the margin of the reservoir where some vegetation remains or has regrown. Further conclusions drawn from aerial photography evaluation indicate that the large wooded area east of the reservoir is a hardwood conifer mixed forest (434). There is also a large wetland system (617 and 642) in this area that flows out toward the ICWW.

Table A.6 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site FL-12, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
434	Hardwood Conifer Mixed	316.1
532	Reservoirs	99.2
617	Mixed Forested Wetland	46.0
618	Shrub Marsh	26.5
642	Freshwater Marsh	14.7
700	Barren Land	186.1
740	Disturbed Land	67.9
Total		**756.7**

Source: WAR, 1993

1/7/93
92-5149-2/Taylor-Flagler

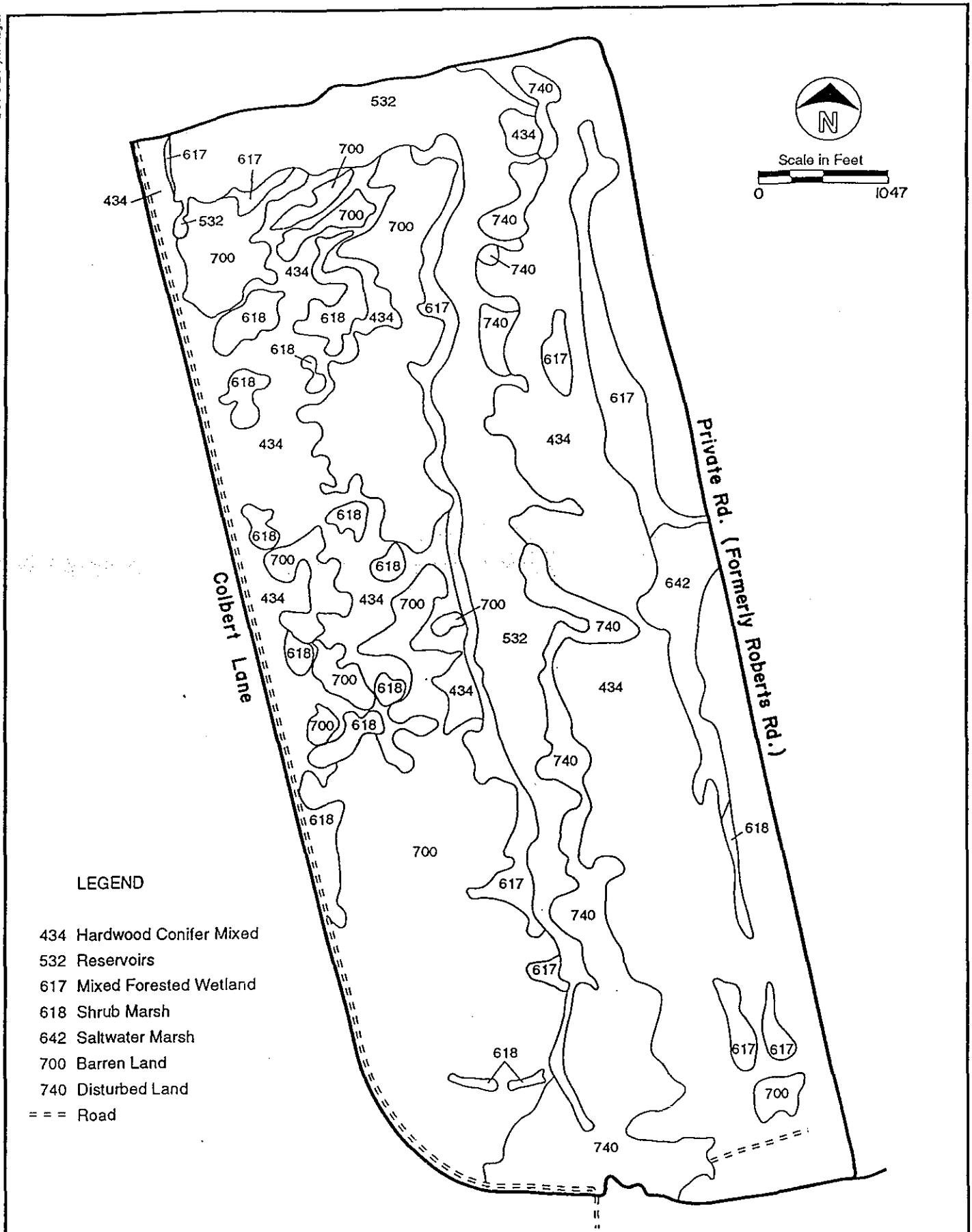
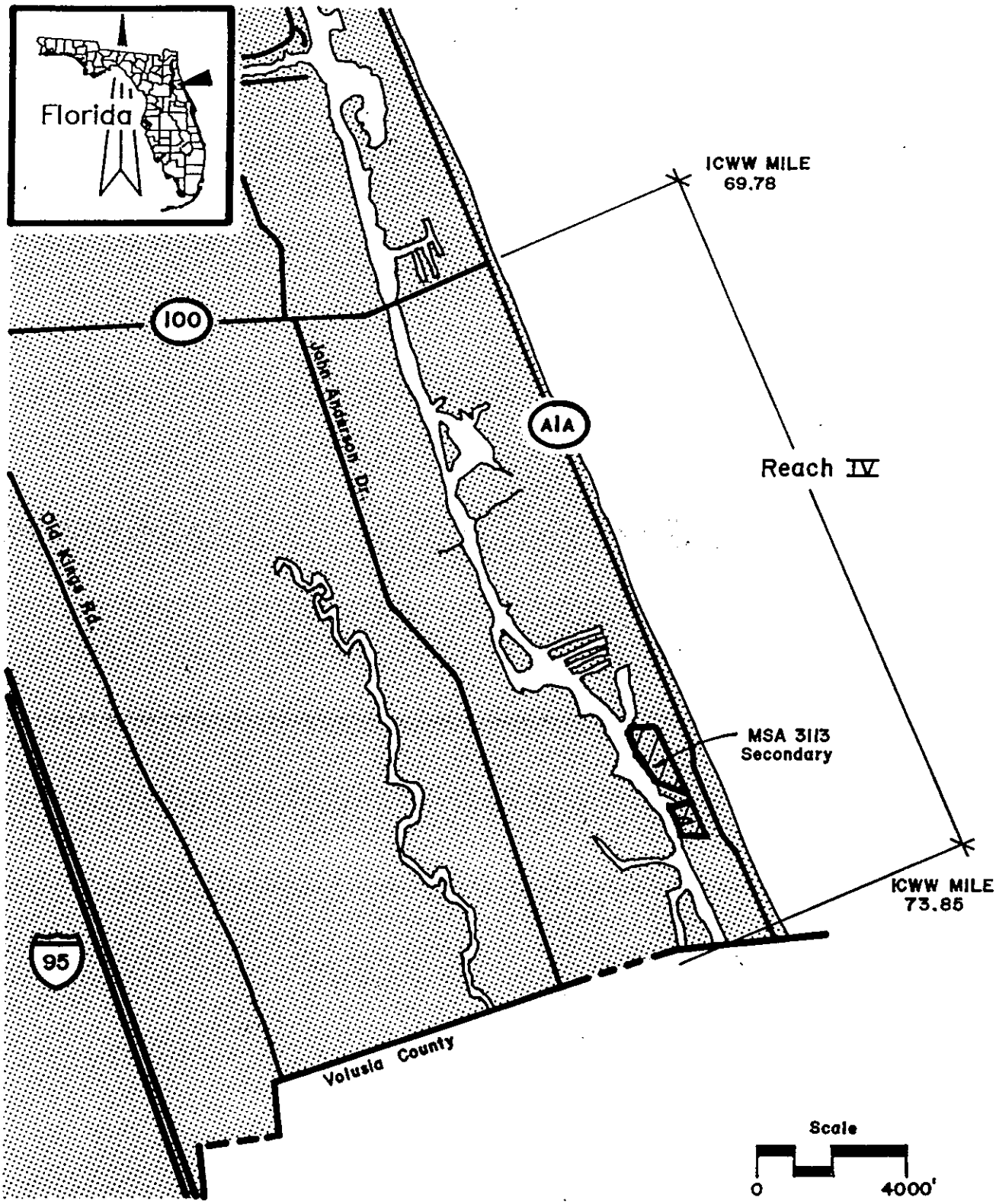


Figure A–9
Vegetation and Land Use of Site FL–12
Flagler County, Florida



TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	Figure A-10 Location Map, Primary and Secondary Sites, Reach IV Flagler County, Florida	PROJECT REVISION SHEET DATE

SITE MSA 3113 DATA SUMMARY SHEET

I General Location

Flagler	IV	Smith Creek (ICWW)
County	**Reach #**	**Waterbody Name**
30/12S/32E	12,000 cy	On Eastern Shore
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
County	4.07 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
S.R. 100 Bridge (mi 69.78) to Volusia/Flagler Co. Line (mi 73.85)		72.68
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

48.1 ac	4.13 ac	48.1 ac	Varies 100 - 500 ft
Initial Esmt. Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
< +5.0 ft NGVD	15,196 cy	None Required	Recreation/Open Space
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
2.90 mi	5.5 ft below grade	None Required	Mixed Use Med. Intensity
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
A1A to Park Access Road	2.99 ft	Saltwater Marsh	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

MSA 3113 is an existing dredged material storage easement located within Gamble Rogers Memorial State Recreation Area. Only a portion of the easement would be required for a containment basin, but park facilities would be impacted. For this reason and the lack of adequate buffer area, this site is viewed as the secondary choice for Reach IV.

Past use of this easement is evidenced by the presence of spoil mounds (743). The mounds are sparsely vegetated with grasses, shrubs, and a few trees. Species include red cedar (*Juniperus silicicola*), wax myrtle (*Myrica cerifera*), and cabbage palm (*Sabal palmetto*). Some of the spoil areas are bordered by wax myrtle/willow communities (429).

Upland communities within the easement include coastal scrub (322) and temperate hardwoods (425). The temperate hardwoods include live oak (*Quercus virginiana*), southern red cedar, and cabbage palm. The coastal scrub contains sand live oak (*Quercus geminata*) and myrtle oak (*Quercus myrtifolia*).

Table A-7 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site MSA 3113, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
180	Recreational	3.9
322	Coastal Scrub	4.0
425	Temperate Hardwoods	5.8
429	Wax Myrtle-Willow	3.2
510	Streams and Waterways	0.3
642	Saltwater Marsh	7.3
743	Spoil Areas	23.6
Total		**48.1**

Source: WAR, 1993

1/19/93
92-5149-2/Taylor-Flagler

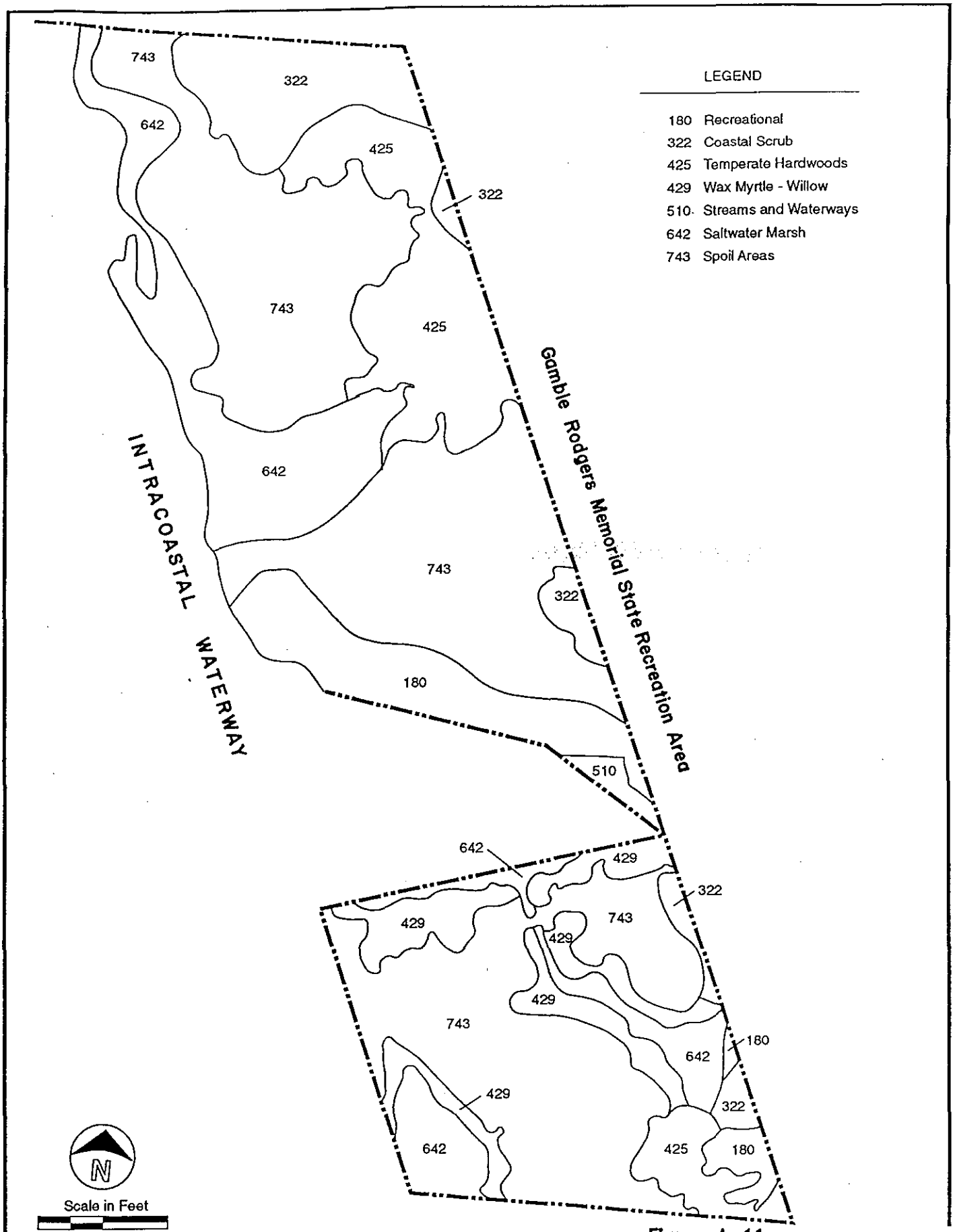
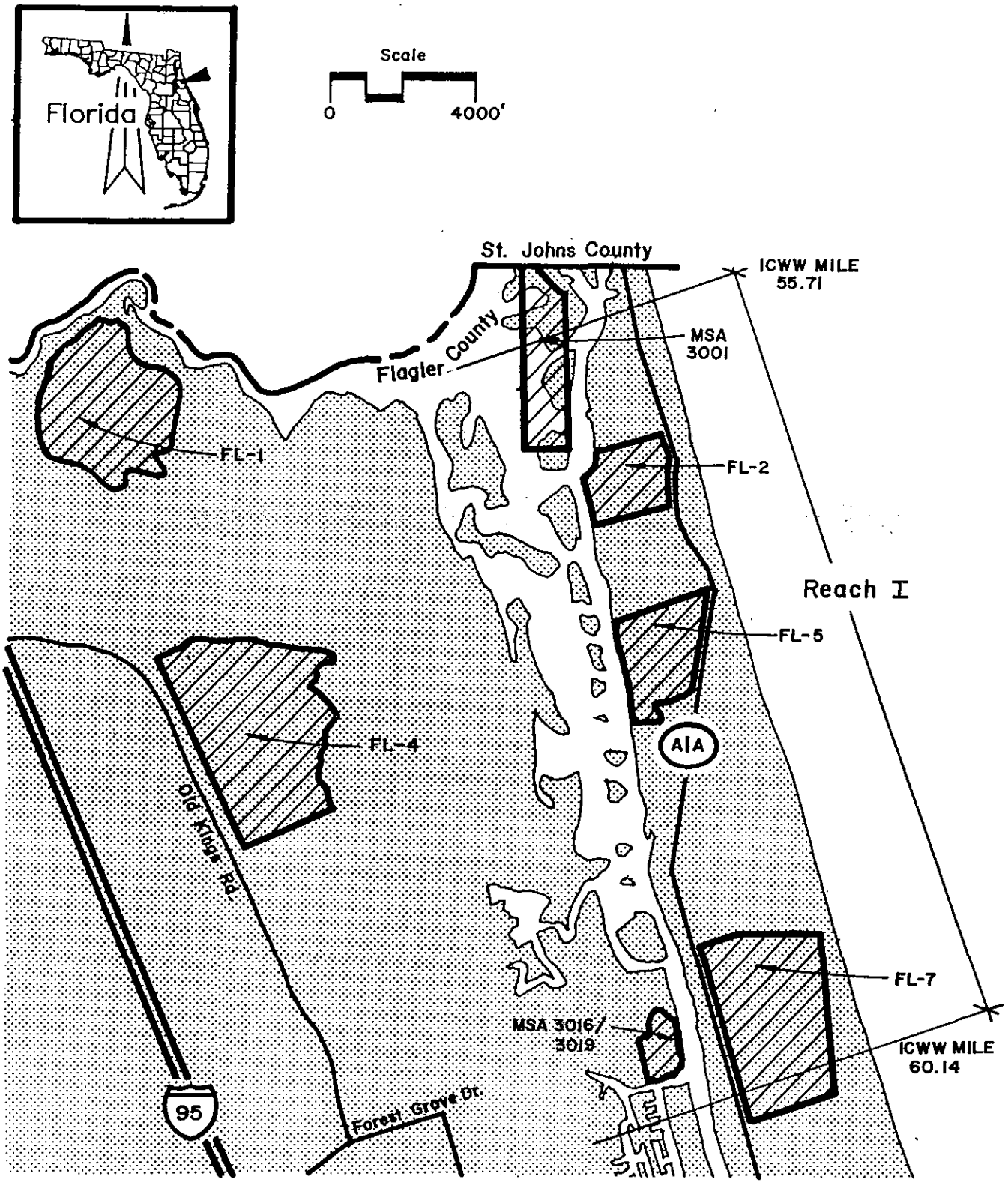


Figure A-11
Vegetation and Land Use of Site MSA 3113
Flagler County, Florida

APPENDIX B

Other Candidate Sites



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JACKSONVILLE, FLORIDA 32256

Figure B-1
Location Map,
Candidate Sites, Reach I
Flagler County, Florida

PROJECT
REVISION
SHEET
DATE

SITE MSA 3001/3004 DATA SUMMARY SHEET

I General Location

Flagler	I	Matanzas River
County	**Reach #**	**Waterbody Name**
6,7/10S/31E	757,000 cy	0
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
County	4.43 mi	II
Municipality	**Reach Length**	**DER Receiving Water Classification**
Marineland (mi 55.71) to N. Canal, Palm Coast (mi 60.14)		N: 55.22 M: 55.67 S: 56.09
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

Easement 235.50	N: 14.96 ac M: 7.88 ac S: 10.02 ac	32.86 ac	Minimal Upland Buffer
Initial Esmt. Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+8.0 ft NGVD±	N: 253,909 cy M: 56,737 cy S: 128,166 cy	None Required	Conservation
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
N: 4.92 mi M: 4.47 mi S: 4.05 mi	N: 15 ft M: 8 ft S: 12 ft	No Upland Access	Agriculture/Timberlands Conservation, Open Water
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
None	N: 8.4 ft below grade M:4.23 ft below grade S: 8.7 ft below grade	Saltwater Marsh	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

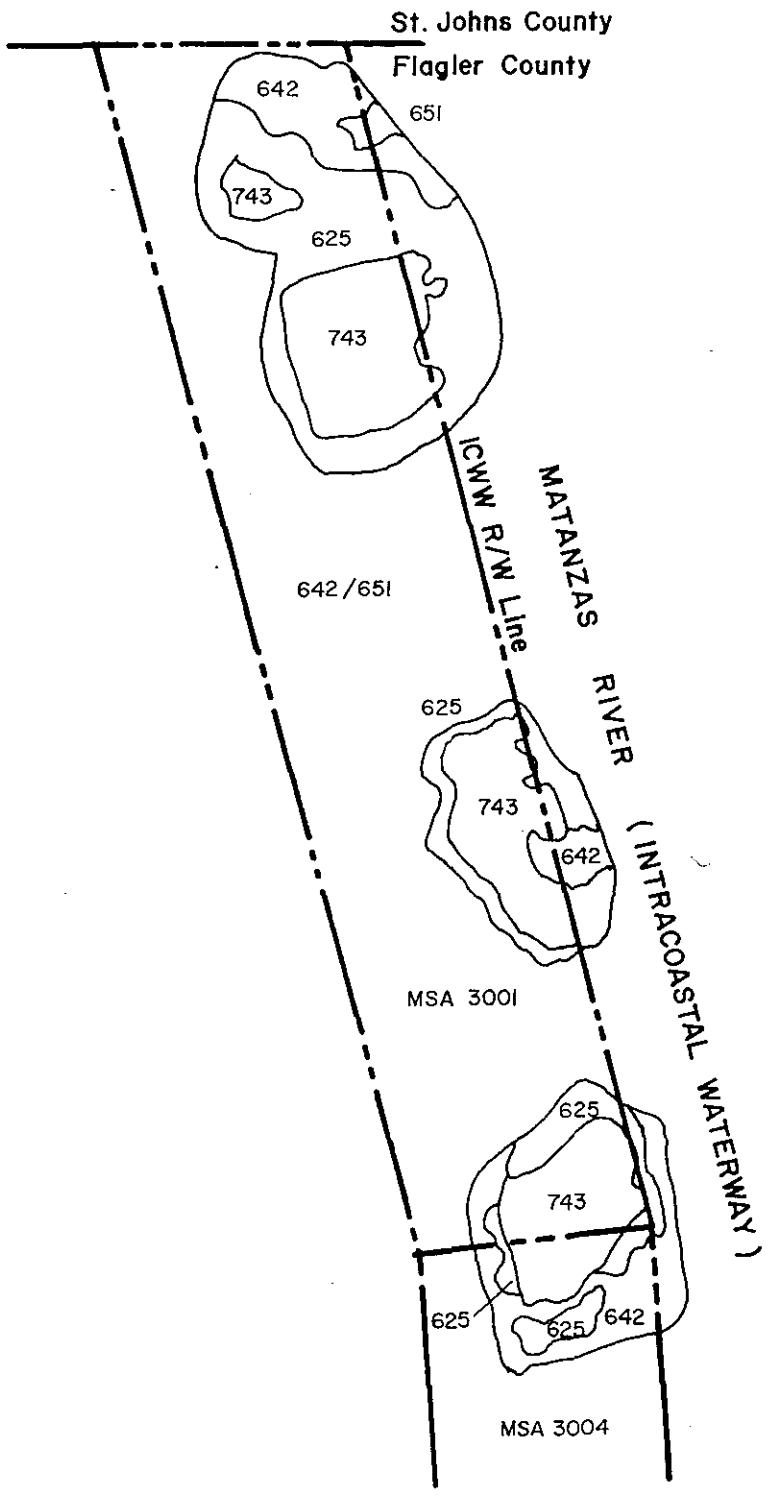
III Narrative Description

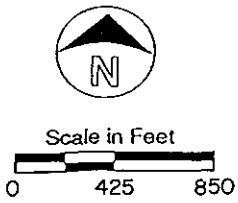
MSA 3001/3004 are two contiguous easements which extend southward from the St. Johns-Flagler County line, immediately west of and parallel to the ICWW channel. The easements contain primarily open water, mud flats, and saltmarsh. However, a number of relic spoil islands, ranging in size from less than one acre to almost 15 acres, are also located in these easements. The three largest islands, containing 7.88 acres, 10.02 acres, and 14.96 acres of useable upland, have all received dredged material at least as recently as 1967. The largest of the three, located partially within MSA 3001 and partially within MSA 3004, was also used in 1979. The minimal dikes constructed at that time are at or beyond their capacity.

The islands are separated from one another by saltmarshes, mud flats, and tidal creeks. The northern two of the three largest islands were not visited. However, inspection of aerial photography indicates that the basic character of all the islands is very similar. Each contains areas of exposed sand occurring more or less in the center of the old spoil mounds, a vegetated fringe separating each mound from the adjacent saltmarshes. The dominant vegetation that makes up the wooded fringe includes southern red cedar (Juniperus silicicola), cabbage palm (Sabal palmetto), Brazilian pepper (Schinus terebinthifolius), and occasional thick stands of yaupon holly (Ilex vomitoria). The areas of exposed soil contain scattered prickly-pear cactus (Opuntia sp.), a state-threatened plant, and grass species.

Table B-1 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site MSA 3001/3004, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
625	Cabbage Palm	29.13
642	Saltwater Marshes	14.23
743	Spoil Areas	27.66
	Total	**71.02**





LEGEND

625	Cabbage Palm
642	Saltwater Marshes
651	Tidal Flats
743	Spoil Areas
- - - -	MSA Boundary

Figure B–2
Vegetation and Land Use of MSA 3001/3004
Flagler County, Florida

SITE FL-1 DATA SUMMARY SHEET

I General Location

Flagler	I	Matanzas River
County	**Reach #**	**Waterbody Name**
3/10S/30E	757,000 cy	2.27 mi
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
County	4.43 mi	II
Municipality	**Reach Length**	**DER Receiving Water Classification**
Marineland (mi 55.71) to N. Canal, Palm Coast (mi 60.14)		55.80
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

322.5 ac	45.0 ac	91.8 ac	300 ft All Sides
Initial Site Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+20 ft NGVD±	779,400 cy	None Required	Agriculture & Timberlands
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
4.34 mi	15 ft	2.25 mi	Agriculture/Pasturelands Pine Plantation
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Old Kings Rd. to a Private Road	3.4 ft below grade	None	Freshwater Marsh
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site FL-1 is located on the southern shore of Pellicer Creek, 2.27 miles west of the Matanzas River. Although the site meets most criteria for inclusion in the site bank, it was not included because of its distance from the ICWW. In addition, its location at the extreme northern end of Reach I would require a much greater pumping distance than primary and secondary site choices.

The largest community on site is a recently logged coniferous plantation (441). It is vegetated mainly by remnant sandhill species including blazing star (*Liatris sp.*), wire grass (*Aristida sp.*), broomsedge (*Andropogon virginicus*), and scattered live oak (*Quercus virginiana*). It also contains a scattering of Florida coontie (*Zamia umbrosa*), a state listed threatened species, prickly-pear cactus (*Opuntia sp.*), and turkey oaks (*Quercus laevis*) which inhabit drier areas. The northwestern section of this community is planted with sand pine (*Pinus clausa*). Many active gopher tortoise (*Gopherus polyphemus*) burrows are located throughout the community. Gopher tortoise is a Florida species of special concern.

Two freshwater marshes (641), a small live oak (*Quercus virginiana*) hammock (427), and a large hardwood-conifer mix community (434) occupy the eastern portion of the site. The larger of the freshwater marshes is located along the southeastern site boundary. It contained standing water at the time of the site visit. The smaller marsh, located in the east central part of the site, contained no standing water at the time of the site visit. The marshes are vegetated by emergent wetland species including panic grass (*Panicum sp.*), duck potato (*Sagittaria lancifolia*), and smartweed (*Polygonum sp.*). The live oak hammock partially surrounds the smaller wetland. The hardwood-conifer mix community lies along the eastern site boundary. It contains live oak, slash pine (*Pinus elliottii*), and an abundance of saw palmetto (*Serenoa repens*).

Woodstorks were observed flying overhead during the site inspection. An inactive osprey nest is located in the south central portion of the coniferous plantation.

Table B-2 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site FL-1, Flagler County, Florida

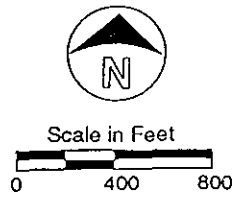
Map ID No.	Name	Approximate Acreage
427	Live Oak	4.3
434	Hardwood-Conifer Mixed	45.7
441	Coniferous Plantations	263.2
641	Freshwater Marsh	9.3
	Total	**322.5**

Source: WAR, 1993

1/11/93
92-5149-2/Taylor-Flagler

LEGEND

427 Live Oak
434 Hardwood-Conifer Mixed
441 Coniferous Plantations
641 Freshwater Marsh
= = = Dirt Road



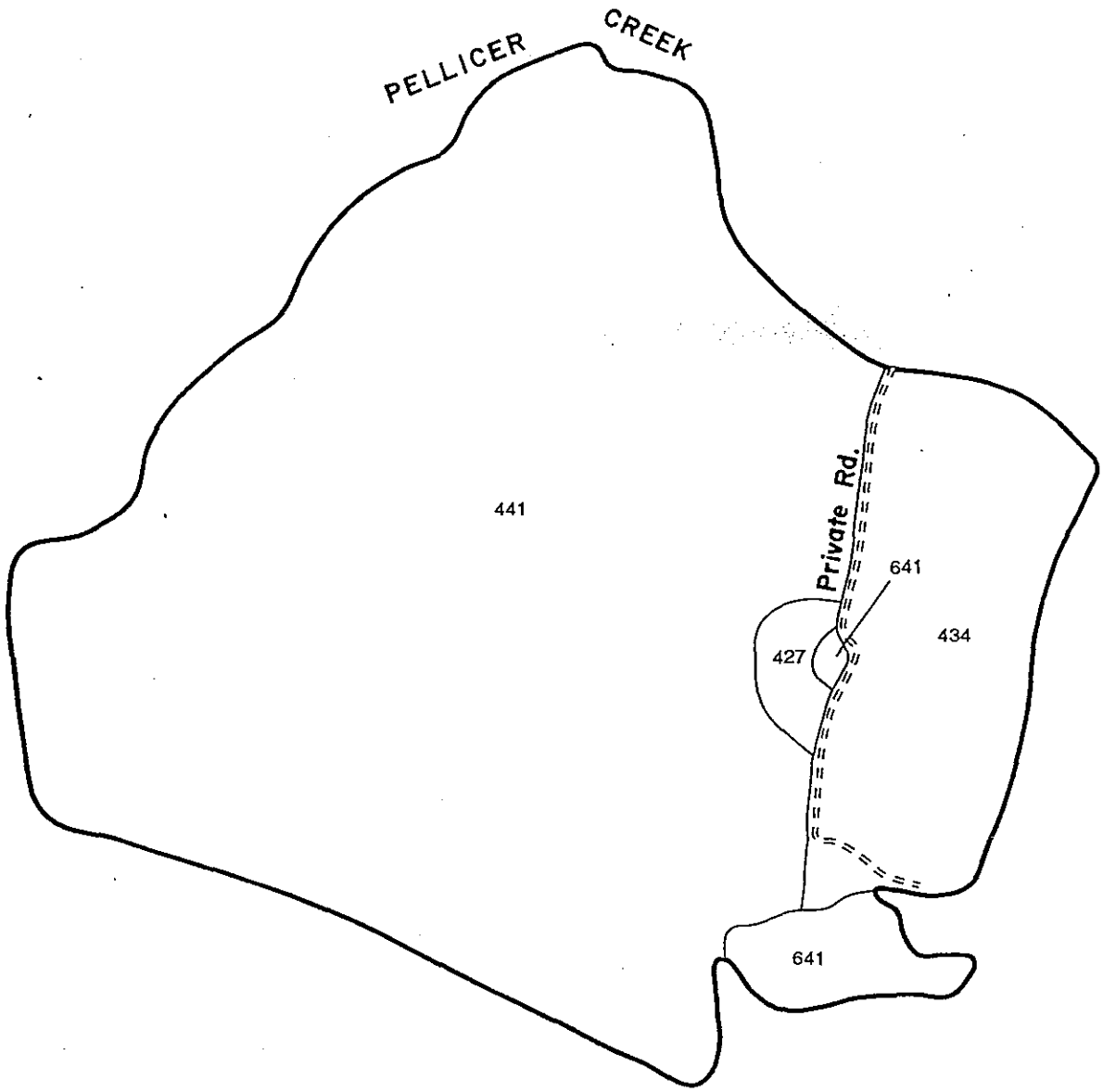


Figure B–3
Vegetation and Land Use of Candidate Site FL–1
Flagler County, Florida

SITE FL-2 DATA SUMMARY SHEET

I General Location

Flagler	I	Matanzas River
County	**Reach #**	**Waterbody Name**
38/10S/31E	757,000 cy	Located on East Shore
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
County	4.43 mi	II
Municipality	**Reach Length**	**DER Receiving Water Classification**
Marineland (mi 55.71) to N. Canal, Palm Coast (mi 60.14)		56.94
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

110 ac	44.5 ac	110 ac	300 ft Minimum all sides
Initial Esmt. Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
5.0 ft	770,200 cy	None Required	Low Intensity Mixed Use
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
3.86 mi	15 ft	½ mi may be required	Sparse Residential Dev.
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
A1A	3.4 ft below grade	N/A	N/A
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site FL-2 is now developed as gated residential community, "Lakeside by the Sea". Therefore, it is no longer being considered as a site.

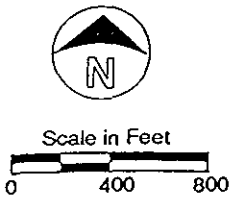
Table B-3 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site FL-2, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
110	Residential, Low Density	110.0
	Total	**110.0**

Source: WAR, 1993

LEGEND

100 Urban and Built-Up
642 Saltwater Marsh



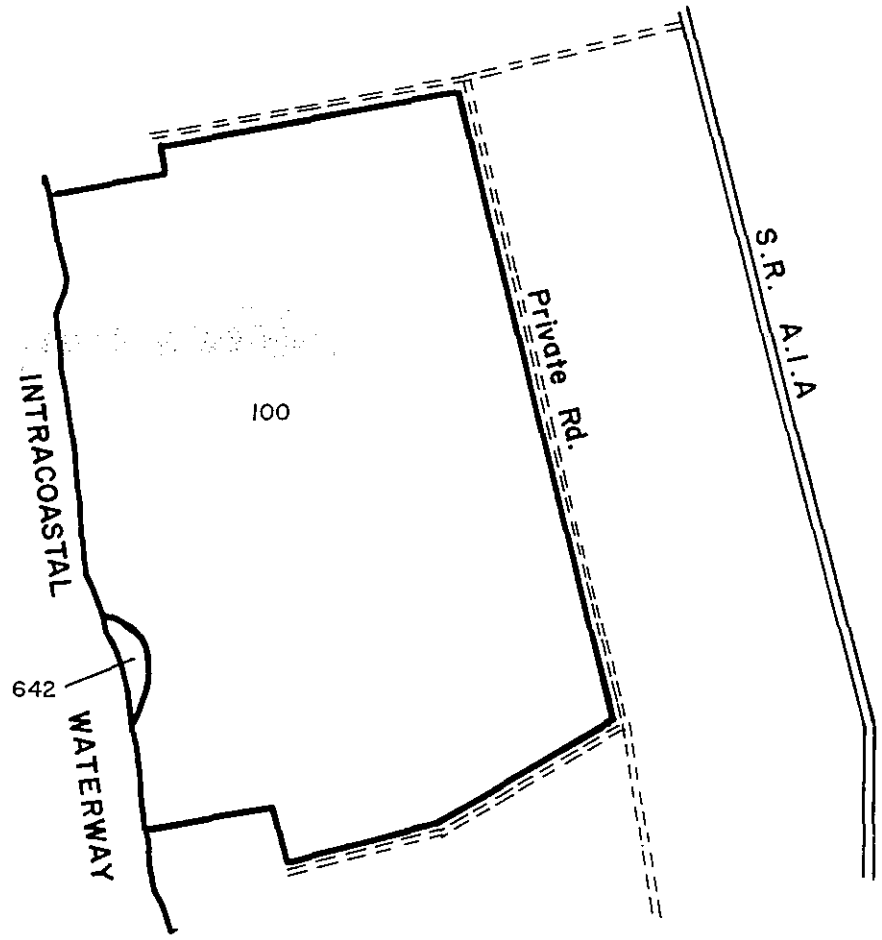


Figure B–4
Vegetation and Land Use of Candidate Site FL–2 Flagler County, Florida

SITE FL-4 DATA SUMMARY SHEET

I General Location

Flagler	I	Matanzas River
County	**Reach #**	**Waterbody Name**
23/10S/30E	757,000 cy	1.8 mi
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
County	4.43 mi	II
Municipality	**Reach Length**	**DER Receiving Water Classification**
Marineland (mi 55.71) to N. Canal, Palm Coast (mi 60.14)		58.06
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

441.6 ac	45.0 ac	91.83 ac	300 ft Minimum all sides
Initial Site Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+22.0 ft NGVD±	777,740 cy	1.23 mi	Agriculture & Timberlands
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
3.88 mi	15 ft	300 ft	Undeveloped, Timberland, Residential
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Old Kings Rd.	3.4 ft below grade	None	Mixed Forested Wetlands, Freshwater Marsh
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site FL-4 is located approximately 1.8 miles west of the Matanzas River and 1.9 miles north of Palm Coast. The site is bordered on the west by a Florida Power and Light easement as well as Old Kings Road. Although Site FL-4 otherwise meets all criteria, nearby residences make this site less desirable than the primary and secondary alternatives.

This site consists primarily of coniferous plantations (441) and hardwood conifer mix communities (434). The coniferous plantation on the northern one-third of the site is interspersed with freshwater marshes (641). A band of mixed wetland hardwoods (617) lies near the western site boundary within this area. Recent logging of planted slash pine (*Pinus elliottii*) has taken place in this area.

Vegetation in the central one-third of the site is dominated by a hardwood conifer mix (434). Recent activities in this area (classified as rural land in transition 741) include land clearing by the current property owner, the construction of borrow ponds (530, under construction), and industrial activities (150). Two residences are located within this area, both close to the eastern site boundary.

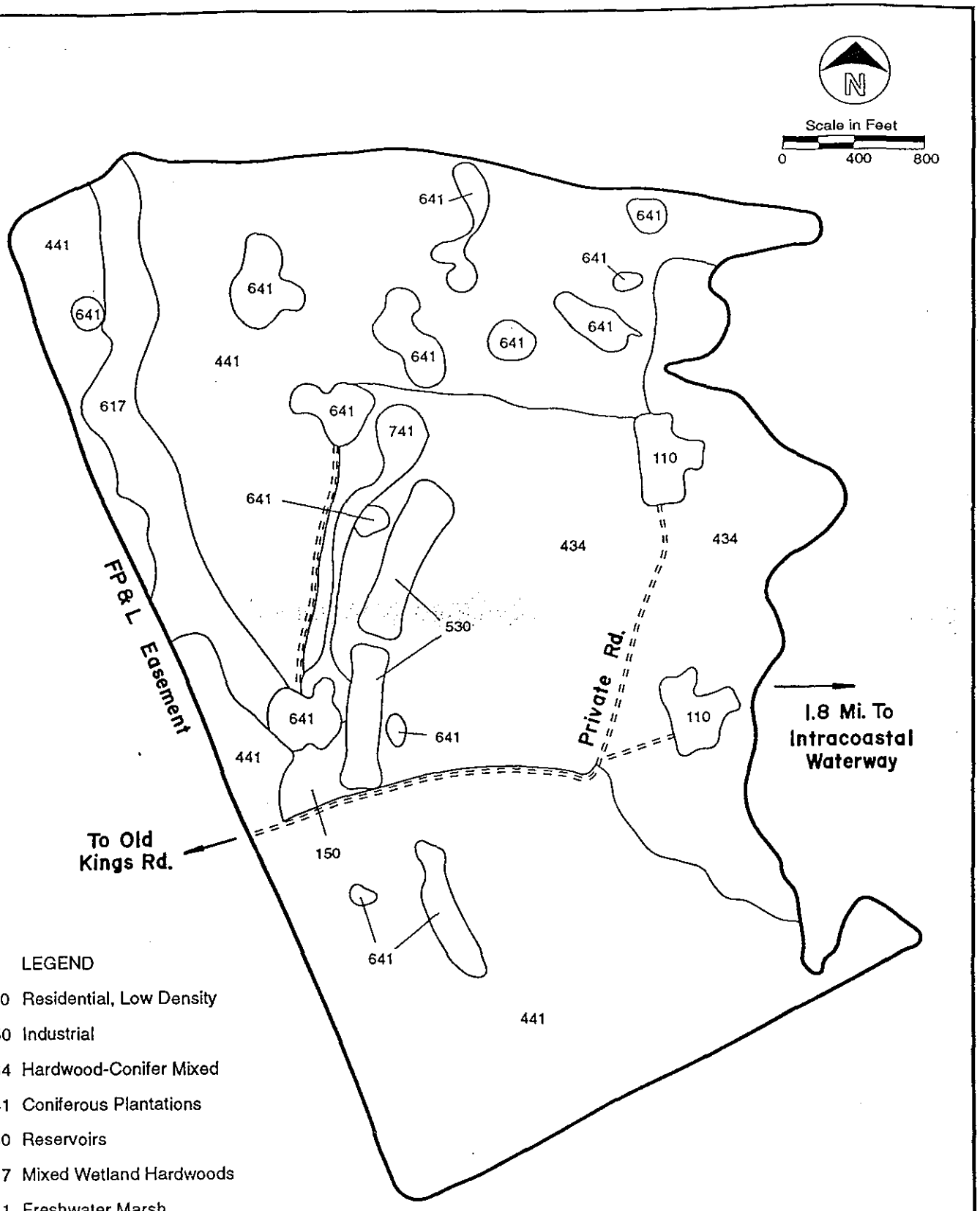
The southern one-third of the site is delineated on the north by an east-west dirt road. It consists of a coniferous plantation and contains a few freshwater marshes. Upland vegetation here includes slash pine, blazing star (*Liatris sp.*), broomsedge (*Andropogon virginicus*), and the Florida threatened prickly-pear cactus (*Opuntia sp.*). The marshes, located in the northwestern portion of the area, contain panic grass (*Panicum sp.*), smartweed (*Polygonum sp.*), and other common wetland herbs.

Table B-4 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site FL-4, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
110	Residential, Low Density	5.3
150	Industiral	3.2
434	Hardwood-Conifer Mixed	128.9
441	Coniferous Plantations	249.6
530	Reservoirs	7.8
617	Mixed Wetland Hardwoods	22.1
641	Freshwater Marsh	20.1
741	Rural Land in Transition Without Positive indicators of Intended Activity	4.6
	Total	**441.6**

Source: WAR, 1993

1/19/93
92-5149-2/Taylor-Flagler



LEGEND

110	Residential, Low Density
150	Industrial
434	Hardwood-Conifer Mixed
441	Coniferous Plantations
530	Reservoirs
617	Mixed Wetland Hardwoods
641	Freshwater Marsh
741	Rural Land in Transition Without Positive Indicators of Intended Activity
= = =	Road

Figure B–5
Vegetation and Land Use of Candidate Site FL–4
Flagler County, Florida

SITE FL-5 DATA SUMMARY SHEET

I General Location

Flagler	I	Matanzas River
County	**Reach #**	**Waterbody Name**
39/10S/31E	757,000 cy	Site lies on east shore
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
County	4.43 mi	II
Municipality	**Reach Length**	**DER Receiving Water Classification**
Marineland (mi 55.71) to N. Canal, Palm Coast (mi 60.14)		57.26
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

169.2 ac	45.18 ac	94.3 ac	300 ft Minimum all sides
Initial Site Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+7 ft NGVD±	781,600 cy	None Required	Recreation & Open Space
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
2.46 mi	15 ft	None Required	Sparse Residential Development, State Park
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
A1A	2.88 ft below grade	Saltwater Marsh	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site FL-5 lies along the eastern shore of the Matanzas River within Washington Oaks State Park (185). Temperate hardwood (425) and sand live oak (*Quercus geminata*) (432) communities are the predominate forms of site vegetation; however, a band of saltwater marsh (642) lines the river shore. The temperate hardwood community contains red bay (*Persea borbonia*), wild coffee (*Psychotria nervosa*), yaupon holly (*Ilex vomitoria*), and live oak (*Quercus virginiana*). Coontie (*Zamia umbrosa*, listed as commercially exploited by Florida) and green fly orchid (*Epidendrum conopseum*) are abundant here. An abandoned section of Highway A1A bisects this community. The sand live oak community containing saw palmetto (*Serenoa repens*), rusty lyonia (*Lyonia ferruginea*), and red bay occupies the eastern half of the site.

Upon confirmation that this site lies within the state park, it was dropped from consideration for the site bank.

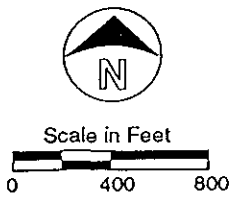
Table B-5 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site FL-5, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
185	Parks and Zoos	10.3
425	Temperate Hardwoods	62.9
432	Sand Live Oak	87.1
642	Saltwater Marsh	8.9
	Total	**169.2**

Source: WAR, 1993

LEGEND

185 Parks and Zoos
425 Temperate Hardwoods
432 Sand Live Oak
642 Saltwater Marsh
= = = Road



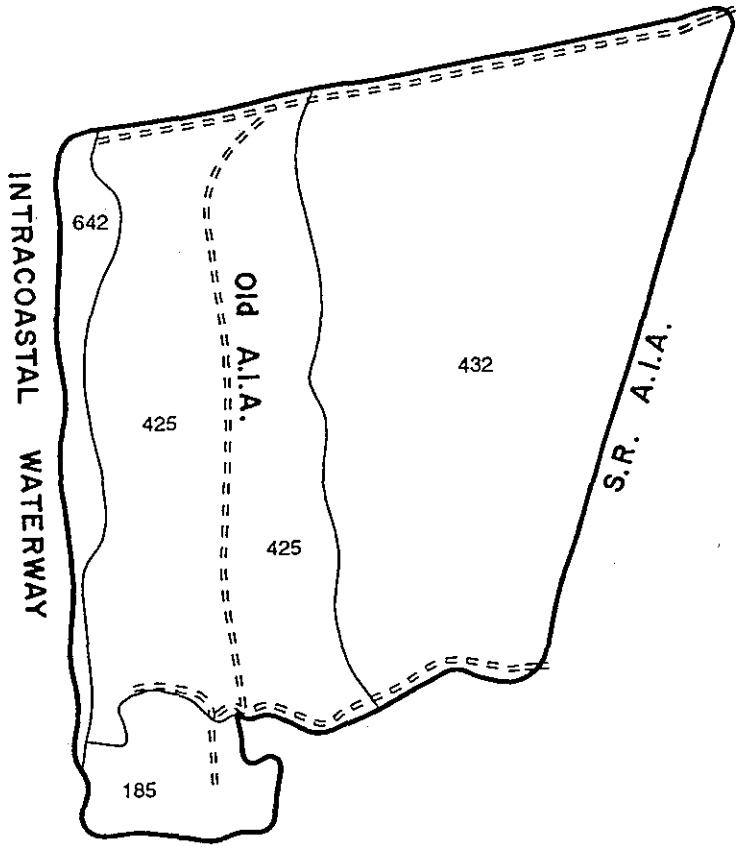


Figure B-6
Vegetation and Land Use of Candidate Site FL-5 Flagler County, Florida

SITE MSA 3016/3019 DATA SUMMARY SHEET

I General Location

Flagler	I	Intracoastal Waterway
County	**Reach #**	**Waterbody Name**
29/10S/31E	757,000 cy	0
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
Palm Coast (Unincorp.)	4.43 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
Marineland (mi 55.71) to N. Canal, Palm Coast (mi 60.14)		59.67
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

38.8 ac	11.74 ac	38.8 ac	100ft on NWS/200 ft on E
Initial Esmt. Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+7.0 ft NGVD±	150,366 cy	None Required	Mixed Use-Low Intensity
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
4.01 mi	12 ft	4600 ft±	High Density Residential/ Conservation
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Palm Coast Pkwy to Cimmaron Dr. to Coshier Ct. to Private Rd.	5.89 ft below grade	Saltwater Marsh	Forested Wetland/ Freshwater Marsh
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site MSA 3016/3019 is a portion of two adjoining easements located on the western shore of the ICWW adjacent to the northern-most canal of Palm Coast. This area was previously used for dredged material disposal, possibly during the construction of the waterway. An old spoil area (743) in the central part of the site remains largely barren (743) but hosts a sparse cover of cabbage palm (*Sabal palmetto*), sneezeweed (*Heterotheca subaxillaris*), broomsedge (*Andopogon virginicus*), and red cedar (*Juniperus silicicola*). An area of temperate hardwoods (425) surrounding the old spoil area is vegetated by a variety of species including red cedar, laurel oak (*Quercus laurifolia*), cabbage palm, hercules club (*Zanthoxylum clava-herculis*), and slash pine (*Pinus elliottii*). A forested wetland/freshwater marsh wetland (610/641) lies in the southwestern portion of the site. It is vegetated with sand cordgrass (*Spartina bakerii*), Carolina willow (*Salix caroliniana*), red maple (*Salix caroliniana*), and wood sage (*Teucrium canadense*). A wide band of pine flatwoods lies along the southern half of the western site boundary. This community is dominated by slash pine and saw palmetto (*Serenoa repens*).

This site does not contain sufficient upland acreage to provide the 50-year containment capacity. In addition, no road access is available since it is surrounded by marsh. Therefore, it was not included in the site bank.

Table B-6 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site MSA 3016/3019, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
411	Pine Flatwoods	6.5
425	Temperate Hardwoods	17.0
610/641	Forested Wetland/Freshwater Marsh	1.2
642	Saltwater Marsh	1.7
743	Spoil Areas	10.5
814	Roads and Highways	1.9
	Total	**38.8**

Source: WAR, 1993

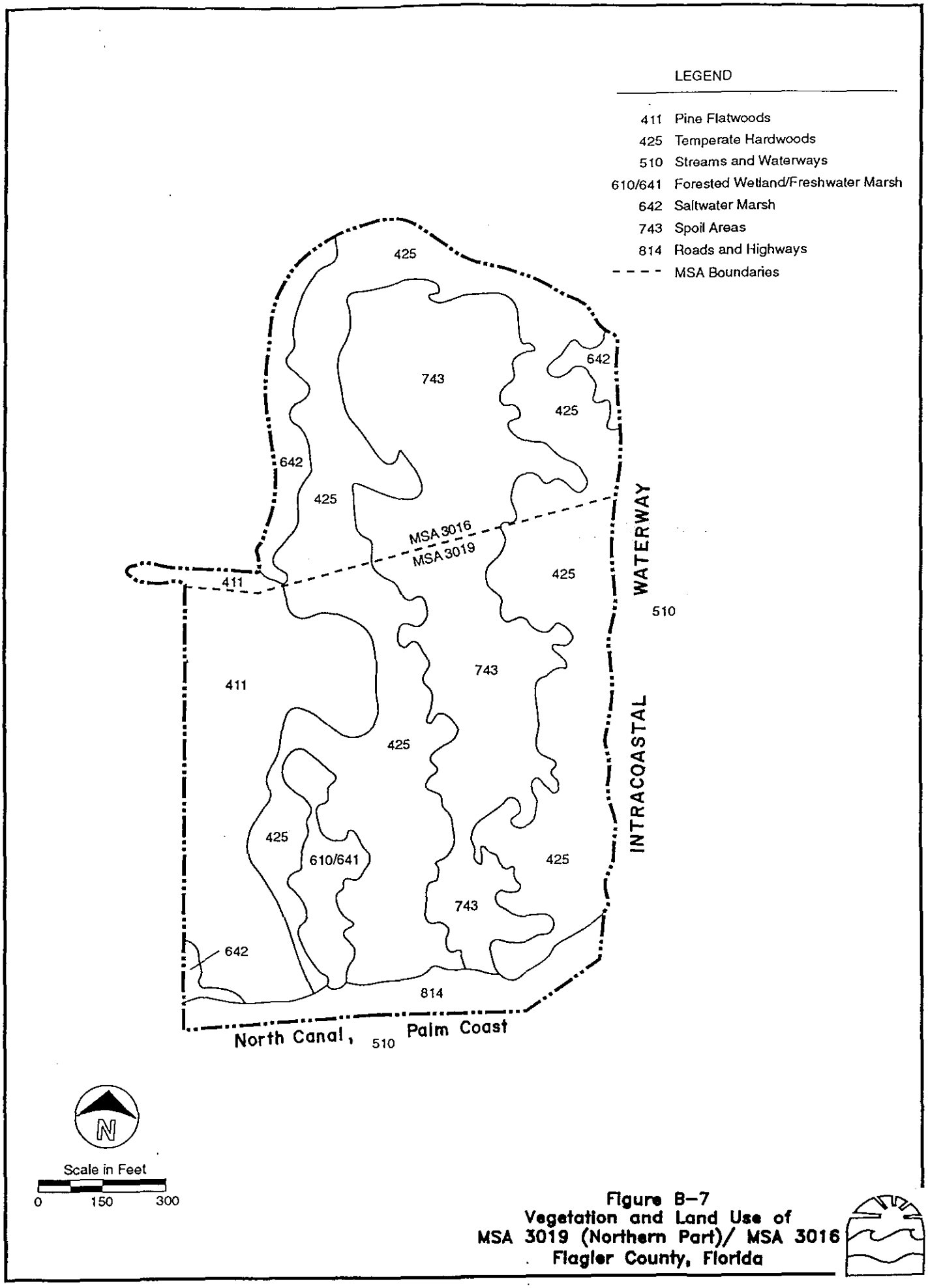


Figure B–7
Vegetation and Land Use of
MSA 3019 (Northern Part)/ MSA 3016
Flagler County, Florida

SITE FL-7 DATA SUMMARY SHEET

I General Location

Flagler	I	Matanzas River
County	**Reach #**	**Waterbody Name**
21,29,40/10S/31E	757,000 cy	800 ft
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
County	4.43 mi	II
Municipality	**Reach Length**	**DER Receiving Water Classification**
Marineland (mi 55.71) to N. Canal, Palm Coast (mi 60.14)		59.08
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

369.9 ac	45.0 ac	90.85 ac	300 ft Minimum all sides
Initial Site Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+7 ft NGVD±	779,292 cy	800 ft	Low Intensity Mixed Use
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
4.22 mi	15 ft	None Required	Residential Development, School
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
A1A	3.44 ft below grade	Saltwater Marsh, Freshwater Marsh	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site FL-7 lies 800 feet east of the Matanzas River. It is bordered on the east by Highway A1A, on the north by Mala Copra Road, and on the south by Salt Road (16th Street).

Vegetation in the western half of the site consists mainly of temperate hardwood (425). Coastal scrub (322), freshwater marsh (641), and saltwater marsh (642) dominate the eastern half of the site. The temperate hardwoods contain live oak (*Quercus virginiana*), southern magnolia (*Magnolia grandiflora*), cabbage palm (*Sabal palmetto*), red bay (*Persea borbonia*), and southern red cedar (*Juniperus silicicola*). State threatened or commercially exploited plant species found in this community include needle palm (*Rhapidophyllum hystrix*), golden polypody (*Phlebodium aureum*), and coontie (*Zamia umbrosa*). The coastal scrub community contains live oak, Chapman's oak (*Quercus chapmanii*), myrtle oak (*Quercus myrtifolia*), and saw palmetto (*Serenoa repens*). The freshwater marsh (641) is vegetated with sand cordgrass (*Spartina bakerii*), panic grass (*Panicum sp.*), foxtail (*Setaria sp.*), red maple (*Acer rubrum*), persimmon (*Diospyros virginiana*), and wax myrtle (*Myrica cerifera*). Some of the herbaceous wetlands are ditched and connect to roadside ditches.

An old abandoned canal system (510) lies in the southwestern part of the property near the western site boundary. Mounds of excavated material (dirt and coquina rock) form high banks along the canal which are vegetated with temperate hammock species. This canal system is probably part of a tourist attraction once located on the property. The A1A Adult Center, a Flagler County School Board adult education facility (171), is centrally located on the western site boundary. The building housing this facility and another building (now dilapidated) were also once part of the old tourist attraction. Because of nearby and ongoing development, Site FL-7 was not included in the site bank.

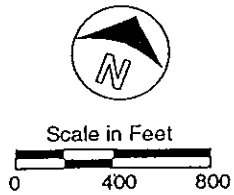
Table B-7 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site FL-7, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
171	Educational Facilities	2.8
322	Coastal Scrub	114.1
425	Temperate Hardwoods	207.4
510	Streams and Waterways	4.1
641	Freshwater Marsh	6.6
642	Saltwater Marsh	34.9
	Total	**369.9**

Source: WAR, 1993

LEGEND

171 Educational Facilities
322 Coastal Scrub
425 Temperate Hardwoods
510 Streams and Waterways
641 Freshwater Marsh
642 Saltwater Marsh
---- Ditch



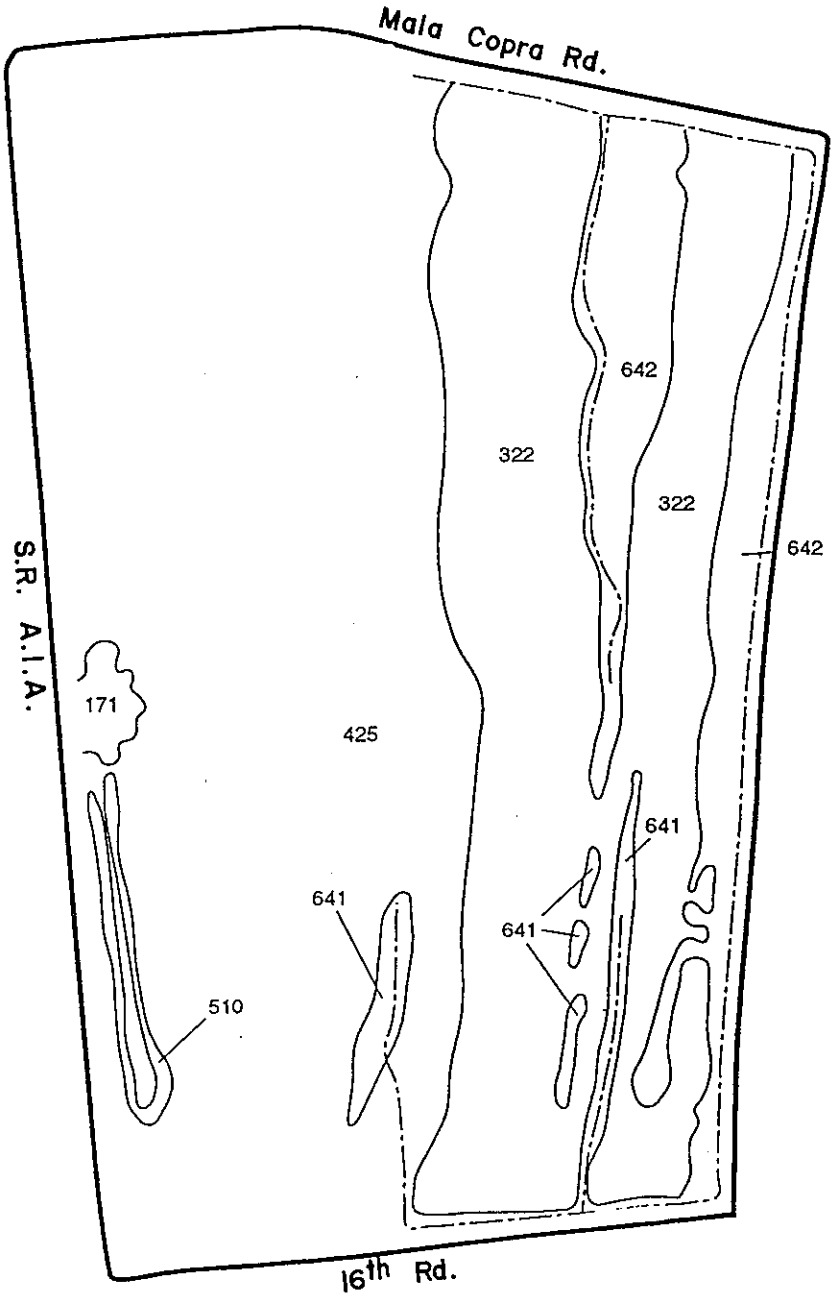
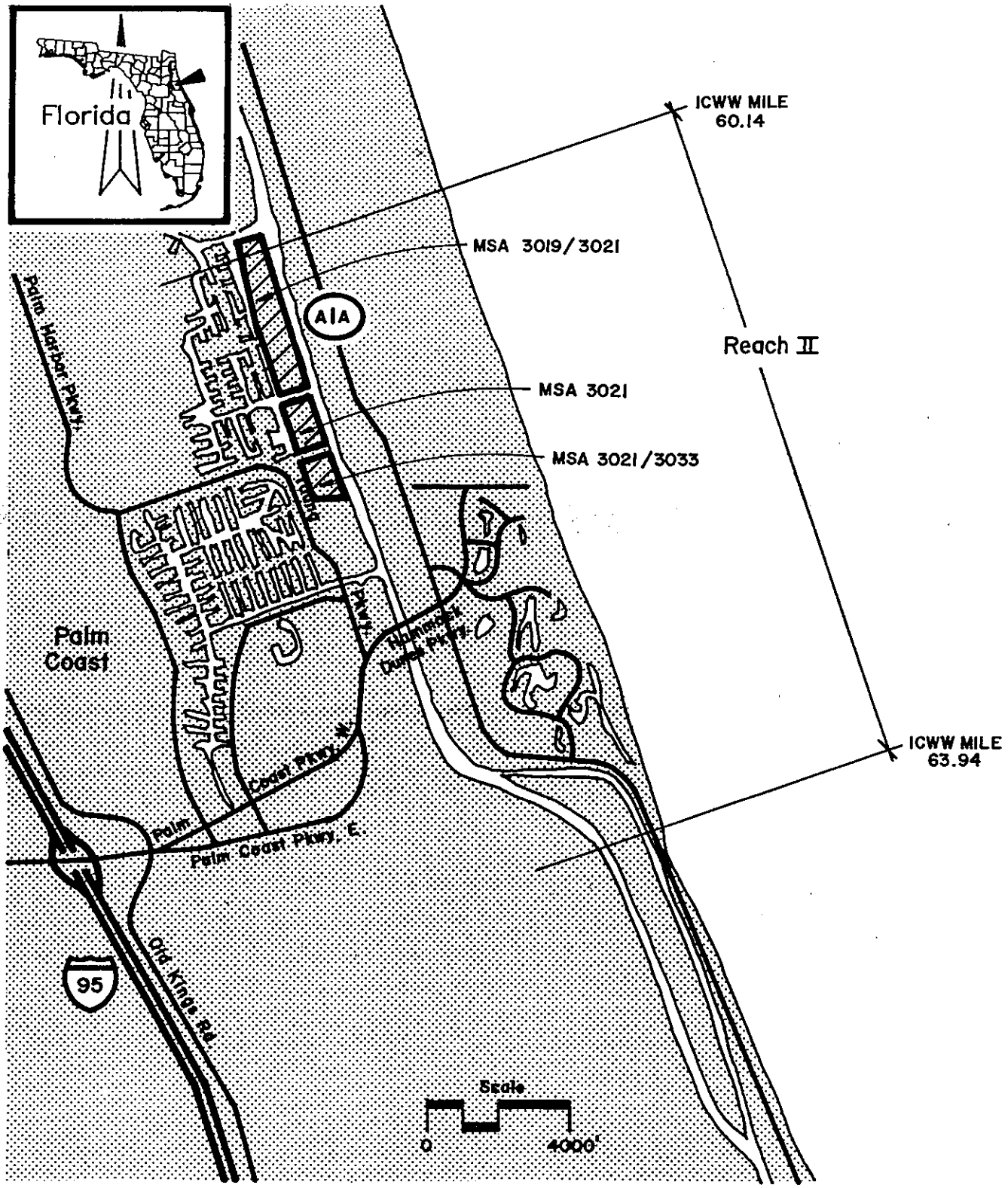


Figure B–8
Vegetation and Land Use of Candidate Site FL–7
Flagler County, Florida



TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	Figure B-9 Location Map, Candidate Sites, Reach II Flagler County, Florida	PROJECT REVISION SHEET DATE

SITE MSA 3019/3021 DATA SUMMARY SHEET

I General Location

Flagler	II	Intracoastal Waterway
County	**Reach #**	**Waterbody Name**
29,32/10S/31E	1,756,000 cy	0
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
Palm Coast (Unincorp.)	3.80 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
N. Canal, Palm Coast (mi 60.14) to N. End Fox Cut (mi 63.94)		59.84
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

106.6 ac	59.05 ac	106.6 ac	200 ft on all sides
Initial Esmt. Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+10.0 ft NGVD	1,014,782 cy	None Required	High Density Residential
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
3.27 mi	15 ft	< 150 ft Connection to mainland	High Density/Low Density, Residential/Agriculture-Timberlands
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Palm Coast Pkwy to Cimmaron Dr.	6.28 ft below grade	Saltwater Marsh	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site MSA 3019/3021 lies in two adjoining easements located on the western shore of the ICWW adjacent to a residential area of Palm Coast. The site is actually on an island formed by the canals of Palm Coast and the ICWW.

The site contains material dredged from the adjacent waterway. A central area of sparsely vegetated dredged material (743) dominates the site. Vegetation in this area includes cabbage palm (*Sabal palmetto*), red cedar (*Juniperus silicicola*), sneezeweed (*Heterotheca subaxillaris*), broomsedge (*Andropogon virginicus*), and matchhead (*Lippia nodiflora*). The areas adjacent to the old dredged material are covered by upland forest species including live oak (*Quercus virginiana*), slash pine (*Pinus elliottii*), hackberry (*Celtis laevigata*), cabbage palm (*Sabal palmetto*), red cedar, and chinaberry (*Melia azedarach*). A few areas of saltwater marsh lie along the ICWW.

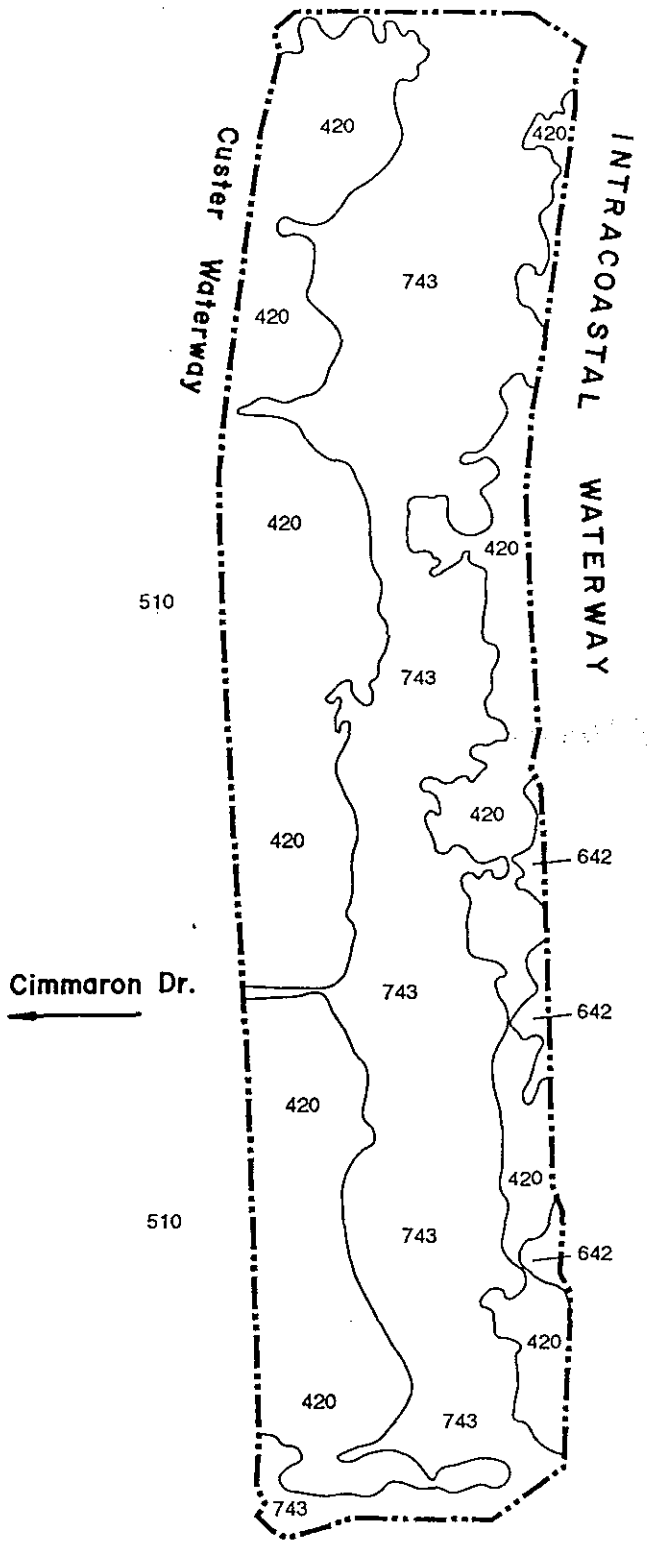
Due to the site's close proximity to residential development, it was not included in the site bank.

Table B-8 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site MSA 3019/3021, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
420	Upland Hardwood Forests	52.7
642	Saltwater Marsh	1.7
743	Spoil Areas	52.2
	Total	**106.6**

Source: WAR, 1993

1/19/93
92-5140-2/Taylor-Flagler



LEGEND

420 Upland Hardwood Forests
510 Streams and Waterways
642 Saltwater Marsh
743 Spoil Areas

N

Scale in Feet
0 300 600

Figure B–10
Vegetation and Land Use of
MSA 3019 (Southern Part)
MSA 3021 (Northern Part)
Flagler County, Florida

SITE MSA 3021 DATA SUMMARY SHEET

I General Location

Flagler	II	Intracoastal Waterway
County	**Reach #**	**Waterbody Name**
32/10S/31E	1,756,000 cy	0
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
Palm Coast (Unincorp.)	3.80 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
N. Canal, Palm Coast (mi 60.14) to N. End Fox Cut (mi 63.94)		60.78
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

46.2 ac	24.43 ac	46.2 ac	200 ft NWE/50 ft S
Initial Esmt. Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+10.0 ft NGVD	416,975 cy	None Required	High Density Residential
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
2.81 mi	15 ft	>500 ft	High-Low Density, Residential/Agriculture-Timberlands
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Palm Coast Pkwy to Young Pkwy	7.63 ft below grade	Saltwater Marsh	Wet Prairie
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site MSA 3021 lies on the western shore of the ICWW adjacent to a residential area of Palm Coast. It lies immediately south of MSA 3019/3021 and is similar to it in many respects. The central portion of the site contains sparsely vegetated mounds of dredged material (743). These are bordered on the east and west by upland forests (420) containing hackberry (*Celtis laevigata*), cabbage palm (*Sabal palmetto*), red cedar (*Juniperus silicicola*), chinaberry (*Melia azedarach*), and hercules club (*Zanthoxylum clava herculis*). A number of deer were seen during the site inspection. A small, depressional wet prairie (643) exists within the old dredged material containment area. Runoff from surrounding areas occasionally pools there for extended periods. Vegetation within this depression includes sedge (*Cyperus sp.*) and matchhead (*Lippia nodiflora*).

Due to its close proximity to residential development, this site was not included in the site bank.

Table B-9 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site MSA 3021, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
420	Upland Hardwood Forests	22.1
642	Saltwater Marsh	0.1
643	Wet Prairie	0.2
743	Spoil Areas	23.8
Total		**46.2**

Source: WAR, 1993

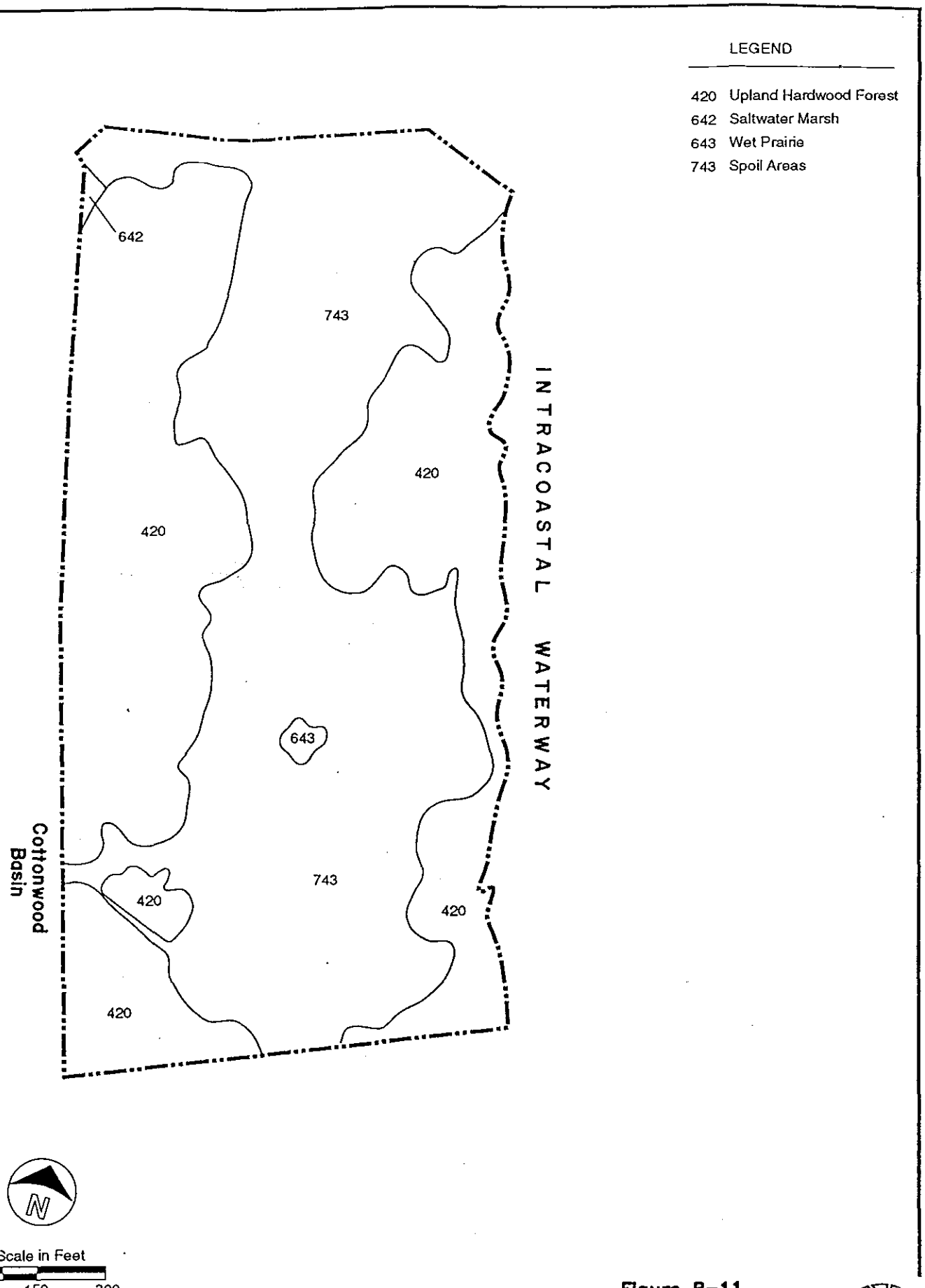


Figure B–11
Vegetation and Land Use of MSA 3021 (Central Portion) Flagler County, Florida

SITE MSA 3021/3033 DATA SUMMARY SHEET

I General Location

Flagler	II	Intracoastal Waterway
County	**Reach #**	**Waterbody Name**
32/10S/31E 37/11S/31E	1,756,000 cy	0
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
Palm Coast (Unincorp.)	3.80 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
N. Canal, Palm Coast (mi 60.14) to N. End Fox Cut (mi 63.94)		61.22
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

28.1 ac	15.77 ac	28.1 ac	50 ft/100 ft/200 ft/100 - 200 ft
Initial Esmt. Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+130.0 ft NGVD	202,397 cy	None Required	High Density Residential
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
2.51 mi	12 ft	< 500 ft	High-Low Density, Residential/High-Low Intensity Commercial
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Palm Coast Pkwy to Young Pkwy	5.34 ft below grade	None	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site MSA 3021/3033 lies on the western shore of the ICWW near the north end of Fox Cut. It is adjacent to a residential area of Palm Coast. As with the easements previously described, this site contains sparsely vegetated old dredged material (743). Adjacent areas contain upland forests consisting of a mixture of hardwoods (420) with some pine. These forests appear to have grown up on the margins of the dredge material mounds and reflect past disturbance.

This site lacks sufficient acreage to provide the 50-year containment capacity. In addition, it lies in close proximity to residential development. Therefore, it was not included in the site bank.

Table B-10 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site MSA 3021/3033, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
420	Upland Hardwood Forests	11.7
743	Spoil Areas	16.4
	Total	**28.1**

Source: WAR, 1993

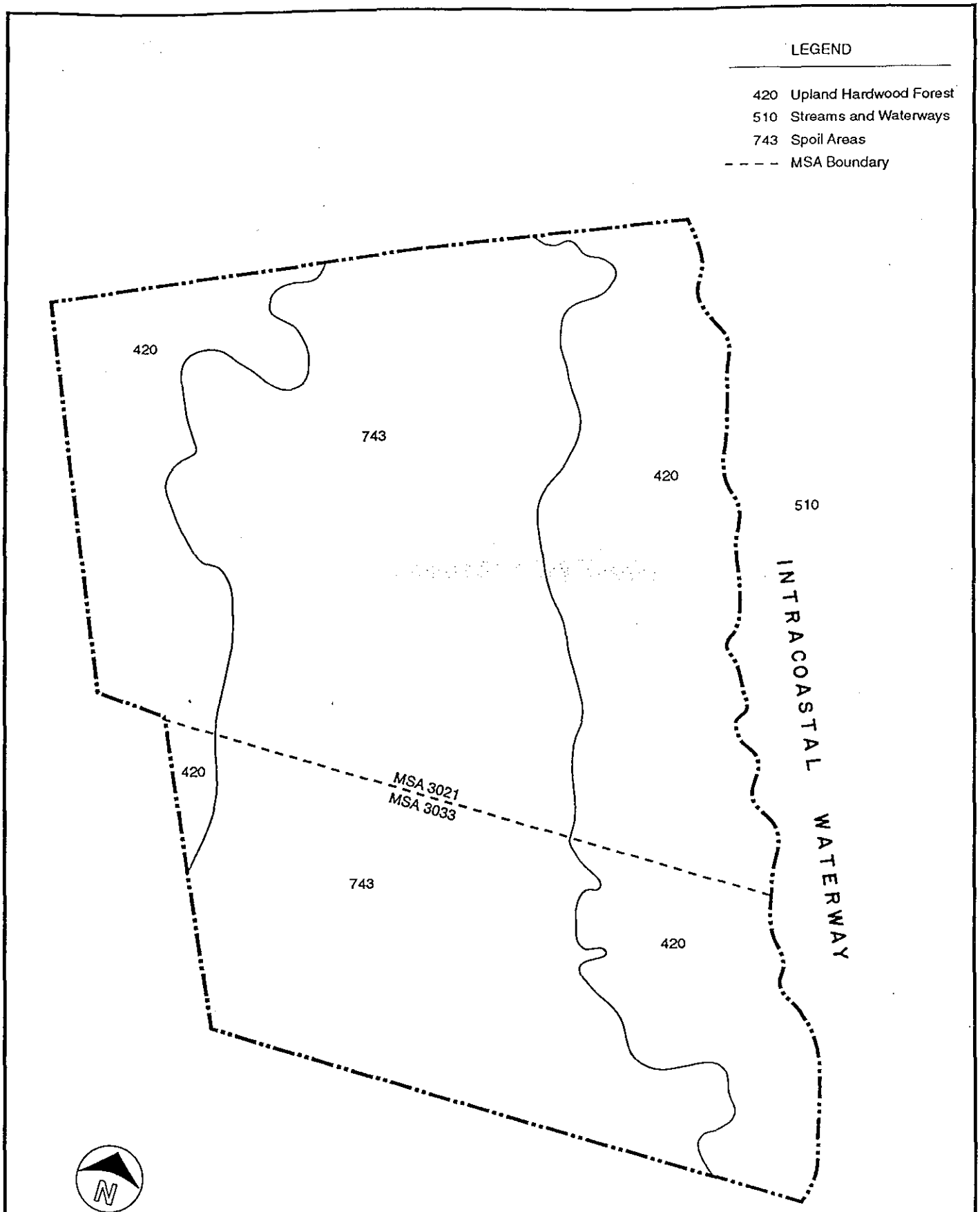
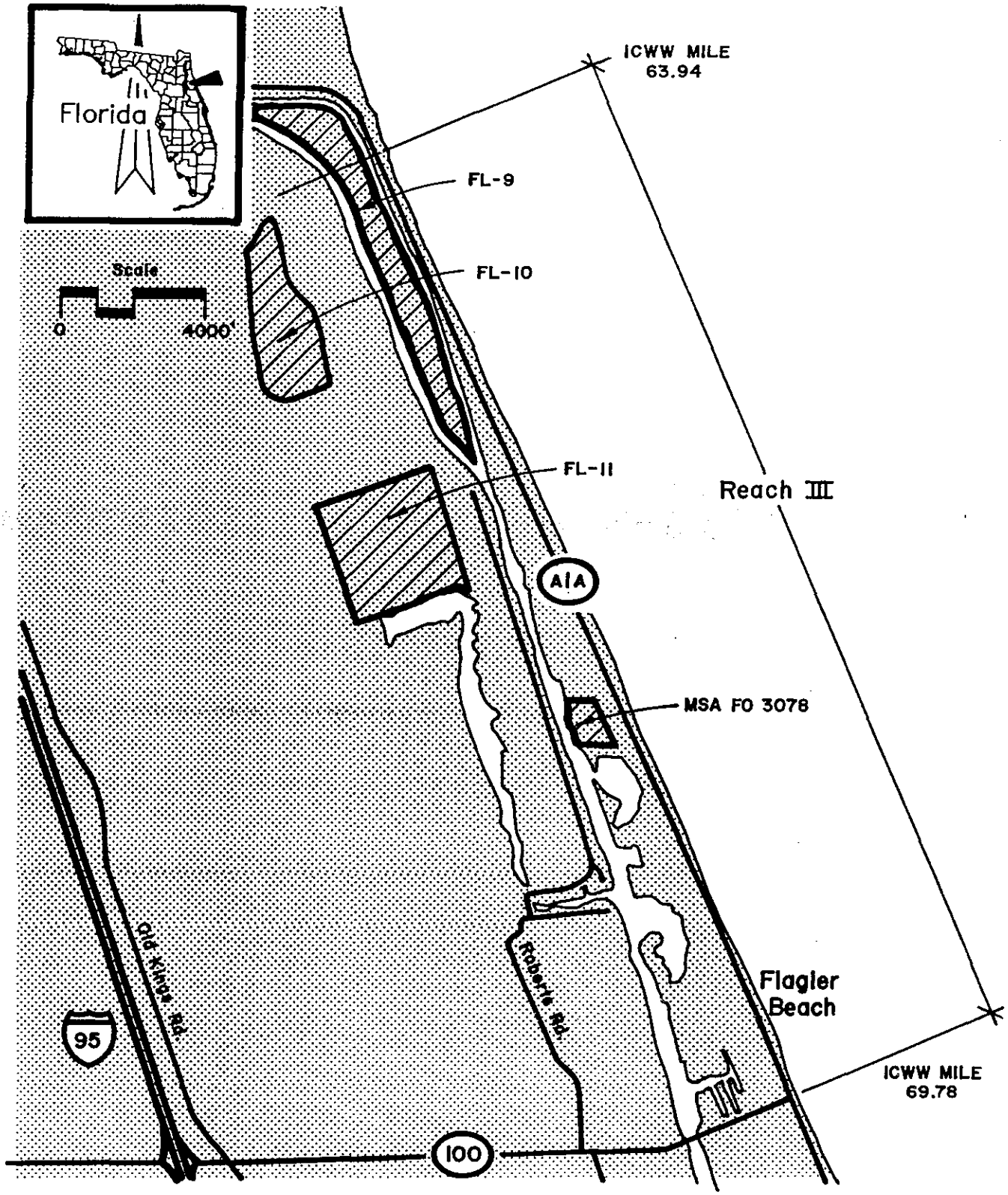


Figure B–12
Vegetation and Land Use of
MSA 3033/ MSA 3021 (Southern Part)
Flagler County, Florida



TAYLOR ENGINEERING INC 9086 CYPRESS GREEN DRIVE JACKSONVILLE, FLORIDA 32256	Figure B-13 Location Map, Candidate Sites, Reach III Flagler County, Florida	PROJECT REVISION SHEET DATE

SITE FL-9 DATA SUMMARY SHEET

I General Location

Flagler	III	Fox Cut, ICWW
County	**Reach #**	**Waterbody Name**
10,15,22/11S/31E	0	On East Shore
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
County	5.84 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
N. End, Fox Cut (mi 63.94) to S.R. 100 (mi 69.78)		63.90
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

293.8 ac	101.5 ac	195 ac	100 ft Minimum all sides
Initial Site Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
> +12 ft NGVD	1,758,900 cy	None Required	Low Density, Mixed Use
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
4.55 mi	15 ft	None Required	Residential Development, Low-Density
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
S.R. A1A	3.9 ft below grade	Saltwater Marsh	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site FL-9 is located on an island lying between the ICWW to the west and the old Florida Canal to the east. The site is connected to Highway A1A by a private drive and concrete bridge which spans the abandoned waterway channel. The northern portion of the site contains an upscale residential development (100). The southern portion consists of coastal scrub to the west, spoil areas in the center, and temperate hardwoods to the east. The southern end of the island contains several herbaceous wetlands that are evident on aerial photographs. At the time of the site visit, development of the southern portion of the island had begun. Because of existing and ongoing development, Site FL-9 was dropped from consideration for the site bank.

The coastal scrub areas consist of a low canopy or shrub thicket of live oak (*Quercus virginiana*) and myrtle oak (*Quercus myrtifolia*). Saw palmetto (*Serenoa repens*), wax myrtle (*Myrica cerifera*), and rusty lyonia (*Lyonia ferruginea*) are common in this densely vegetated area. The barren, white sand spoil areas were presumably created during the construction of the ICWW. Vegetation in these areas is quite sparse and consists of broomsedge (*Andropogon virginicus*), prickly-pear cactus (*Opuntia sp.*), and sneezeweed (*Heterotheca subaxillaris*). The temperate hardwood eastern edge is vegetated by live oak, hackberry (*Celtis laevigata*), cabbage palm (*Sabal palmetto*), and wax myrtle.

Table B-11 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site FL-9, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
100	Urban and Built-Up	101.9
322	Coastal Scrub	37.5
425	Temperate Hardwoods	69.3
640	Vegetated Non-Forested Wetland	0.3
642	Saltwater Marsh	8.7
743	Spoil Area	76.1
	Total	**293.8**

Source: WAR, 1993

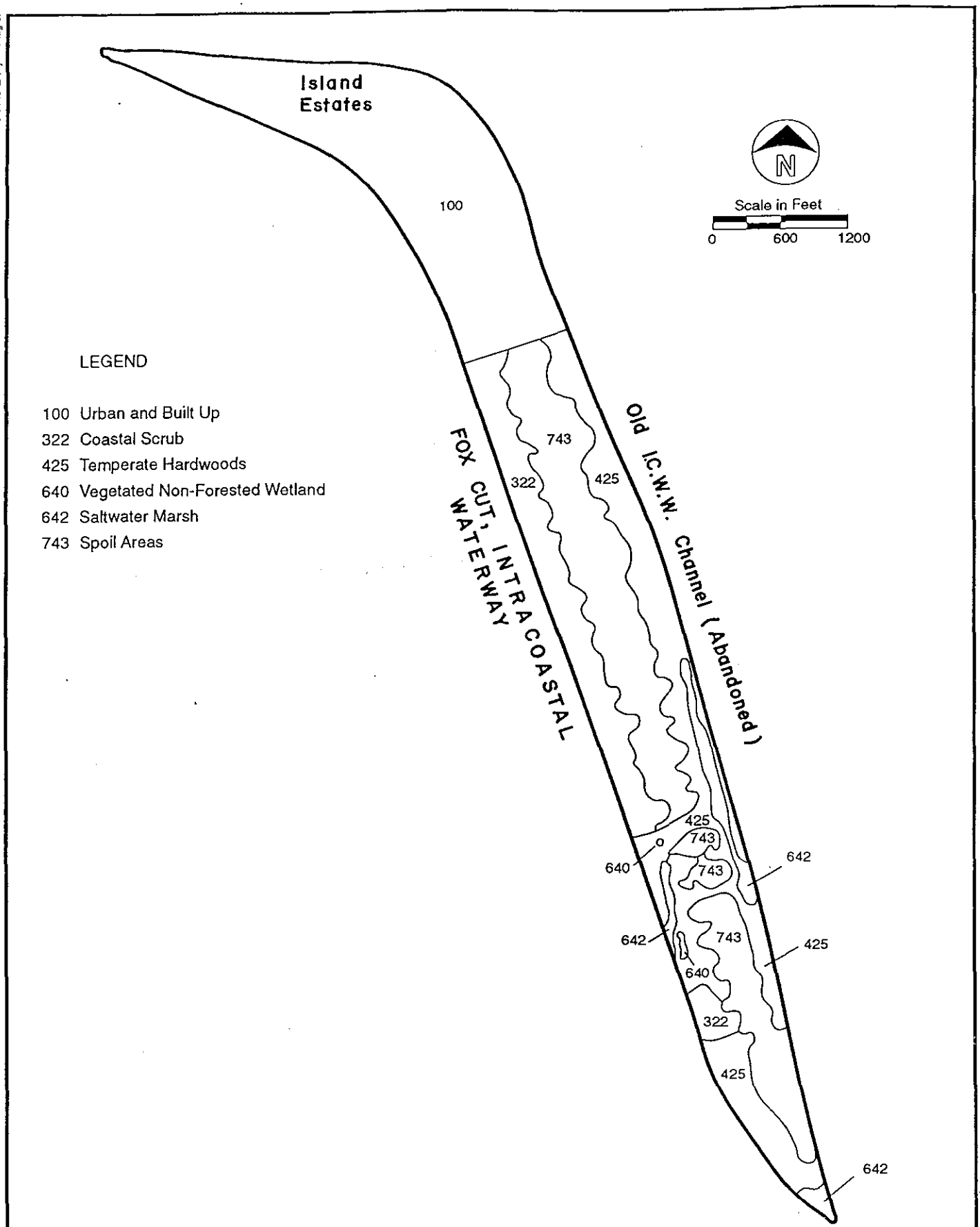


Figure B–14
Vegetation and Land Use of Candidate Site FL–9
Flagler County, Florida

SITE FL-10 DATA SUMMARY SHEET

I General Location

Flagler	III	Fox Cut, ICWW
County	**Reach #**	**Waterbody Name**
15/11S/31E	0	0.32 mi
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
----	5.84 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
N. End, Fox Cut (mi 63.94) to S.R. 100 (mi 69.78)		64.08
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

197.7 ac	35.98 ac	71.08 ac	200 ft Minimum all sides
Initial Site Area	**Containment Acreage**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+12.0 ft NGVD±	463,223 cy	0.44 mi	Low Intensity Mixed Use/ Recreation & Open Space
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
5.54 mi	12 ft	None Required	Undeveloped, Same as Above
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Roberts Road	4.4 ft below grade	None	Mixed Wetland Forest, Freshwater Marsh
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site FL-10 is located 0.32 miles west of the Fox Cut portion of the ICWW. It is bordered on the east by a private road (formerly Roberts Road). The site contains a variety of upland communities including coastal scrub (322), pine flatwoods (411), sand pine (413), and temperate hardwoods (425). Freshwater marshs (641) are scattered throughout the southern part of the site. One area of mixed wetland hardwoods (617) is also located there. The site is bordered on the west by a meandering stream. Recently placed survey flags were seen at many locations during the site inspection.

The south central portion of the site contains a large, open remnant sand pine area that may have been timbered. Vegetation in this area includes sand pine (*Pinus clausa*), rusty lyonia (*Lyonia ferruginea*), sand live oak (*Quercus geminata*), myrtle oak (*Quercus mytifolia*), and saw palmetto (*Serenoa repens*). Scrubby flatwoods are vegetated by slash pine (*Pinus elliottii*), sand pine, saw palmetto (*Serenoa repens*), fetterbush (*Lyonia lucida*), and sand live oak. The coastal scrub community along the northwestern part of the site is covered with myrtle oak, Chapman's oak (*Quercus chapmanii*), rusty lyonia, and saw palmetto.

Though FL-10 meets all candidate site criteria, it was ranked below the primary and secondary sites. Therefore, it was not included in the site bank.

Table B-12 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site FL-10, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
322	Coastal Scrub	34.7
411	Pine Flatwoods	111.9
413	Sand Pine	34.3
425	Temperate Hardwoods	1.5
617	Mixed Wetland Hardwoods	11.8
641	Freshwater Marsh	3.5
Total		**197.7**

Source: WAR, 1993

LEGEND

322 Coastal Scrub
411 Pine Flatwoods
413 Sand Pine
425 Temperate Hardwoods
617 Mixed Wetland Hardwoods
641 Freshwater Marsh
= = = Road
* * * * Small Borrow Pits

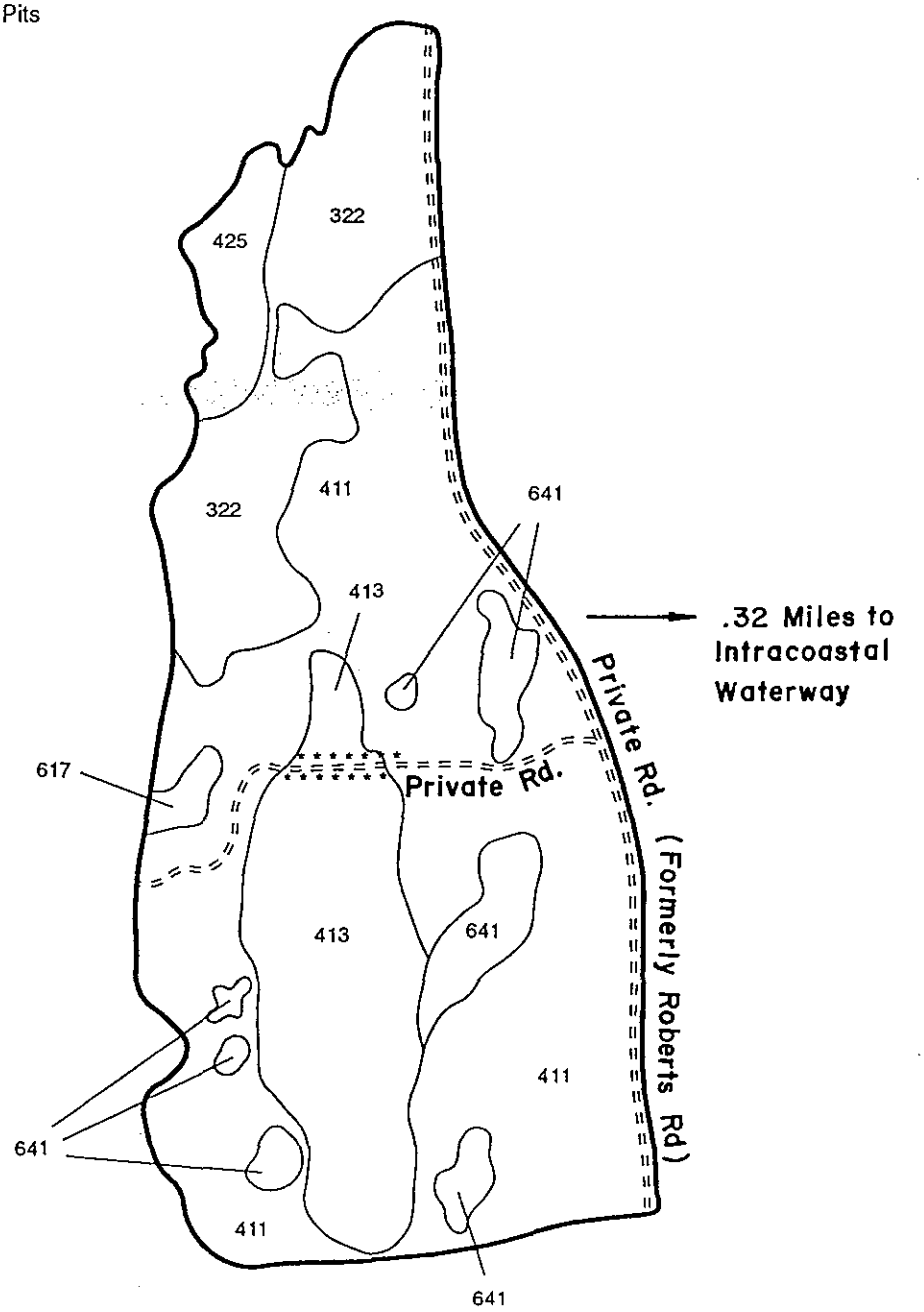


Figure B-15
Vegetation and Land Use of
Candidate Site FL-10
Flagler County, Florida

SITE FL-11 DATA SUMMARY SHEET

I General Location

Flagler	III	Smith Creek (ICWW)
County	**Reach #**	**Waterbody Name**
27/11S/31E	0	0.32 mi (1700 ft)
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
County	5.84 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
N. End, Fox Cut (mi 63.94) to S.R. 100 (mi 69.78)		66.18
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

321.9 ac	53.03 ac	103.3 ac	300 ft Minimum all sides
Initial Site Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+15.0 ft NGVD±	920,400 cy	0.32 mi	Agriculture & Timberlands
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
3.52 mi	15 ft	None Required	Mining, Hunt/Fish Club
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Private Road	3.04 ft below grade	Mixed Forested Wetlands	Wetland Coniferous Forest, Freshwater Marsh, Wet Prairie
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site FL-11 is located 0.32 miles west of the ICWW close to the southern end of Fox Cut. It is bounded on the south by a large freshwater impoundment once part of the Lehigh Portland Cement mining operation. The site is accessible by several private roads extending northward from the cement plant.

This site contains a variety of upland communities including coastal scrub (322), pine flatwoods (411), sand pine (413), and several disturbed community types along the southern boundary of the site. The site contains numerous wetlands including mixed wetland hardwoods (617), wetland coniferous forest (620), freshwater marsh (641), and wet prairies (643). Dirt roads and trails crisscross the property.

The flatwoods on-site are scrubby in nature and vegetated with slash pine (*Pinus elliottii*), sand pine (*Pinus clausa*), myrtle oak (*Quercus mytifolia*), saw palmetto (*Serenoa repens*), and rusty lyonia (*Lyonia ferruginea*). Coastal scrub areas are vegetated by these same species with the exception of slash pine. However, vegetation cover in coastal scrub areas is much denser than that in the flatwoods. A small area that formerly contained sand pine had been recently logged at the time of the site inspection. The shoreline of water-filled borrow pit located on the southern part of the site is vegetated with cattail (*Typha sp.*). Disturbed areas adjacent to the borrow pit contain mostly barren sand. However, sparse vegetation including cabbage palm (*Sabal palmetto*), wax myrtle (*Myrica cerifera*), and broomsedge (*Andropogon virginicus*) is present there.

The mixed wetland hardwood strands are vegetated with red maple (*Acer rubrum*), swamp bay (*Persea palustris*), sweet bay (*Magnolia virginiana*), and swamp dogwood (*Cornus foemina*). The freshwater marshes are dominated by sand cordgrass (*Spartina bakerii*), Virginia chain fern (*Woodwardia virginica*), and maidencane (*Panicum hemitomom*).

Though Site FL-11 meets all candidate site criteria, the primary and secondary sites appear better suited to serve Reach III.

Table B-13 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site FL-11, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
322	Coastal Scrub	79.3
411	Pine Flatwoods	165.3
413	Sand Pine	9.1
617	Mixed Wetland Hardwoods	18.8
620	Wetland coniferous Forest	1.7
641	Freshwater Marsh	10.6
643	Wet Prairie	1.2
740	Disturbed Land	16.9
742	Borrow Areas	4.5
743	Spoil Areas	14.5
Total		**321.9**

Source: WAR, 1993

LEGEND

322 Coastal Scrub
411 Pine Flatwoods
413 Sand Pine
617 Mixed Forested Wetlands
620 Wetland Coniferous Forest
641 Freshwater Marsh
643 Wet Prairie
740 Disturbed Land
742 Borrow Areas
743 Spoil Areas
= = = Road

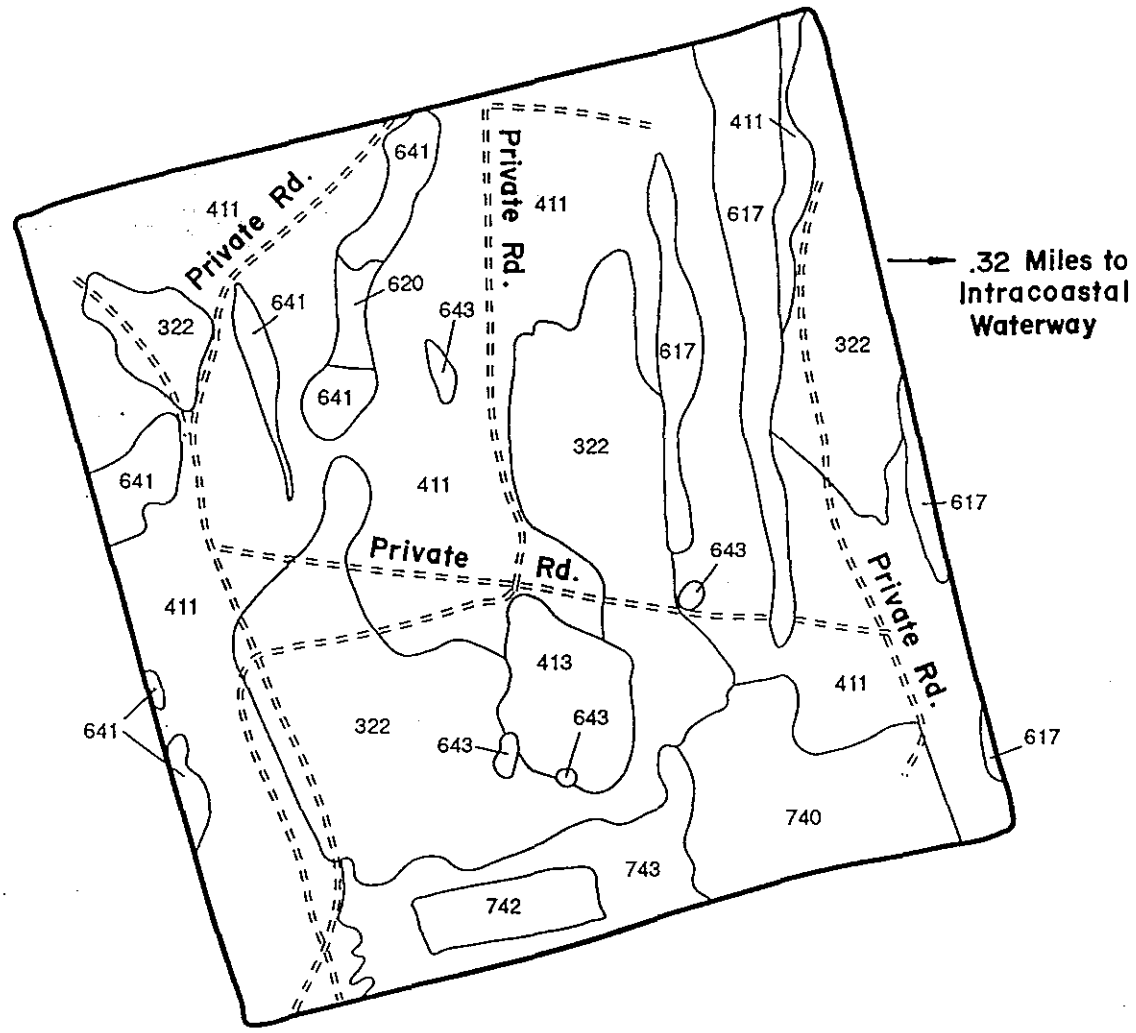


Figure B-16
Vegetation and Land Use of Candidate Site FL-11
Flagler County, Florida

SITE MSA FO 3078 DATA SUMMARY SHEET

I General Location

Flagler	III	Smith Creek (ICWW)
County	**Reach #**	**Waterbody Name**
35/11S/31E	0	On Eastern Shore
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
Beverly Beach	5.84 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
N. End Fox Cut (mi 63.94) to S.R. 100 Bridge (mi 69.78)		67.25
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

26.3 ac	3.75 ac	26.3 ac	Minimal Upland Buffer
Initial Esmt. Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
> +5.0 ft NGVD	14,277 cy	None Required	Low Intensity Mixed-Use
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
3.35 mi	5.5 ft	No Upland Access	High-Density Res./Marina
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
No Upland Access	5.78 ft below grade	Saltwater Marsh	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

MSA FO 3078 is located on the eastern shore of the ICWW in the vicinity of Beverly Beach. It contains two old spoil mounds (743) separated by a tidal creek and fringing saltwater marsh (642). The two mounds are sparsely vegetated with cabbage palm (*Sabal palmetto*), prickly-pear cactus (*Opuntia sp.*), sneezeweed (*Heterotheca subaxillaris*), red cedar (*Juniperus silicicola*), and broomsedge (*Andropogon virginicus*). Surrounding each mound is a band of vegetation (429) dominated by wax myrtle (*Myrica cerifera*), cabbage palm, and red cedar. The saltwater marsh (642) in the southeastern part of the site is a rich tidal area vegetated by smooth cordgrass (*Spartina alterniflora*), black rush (*Juncus roemarianus*), and a few black mangrove (*Avicennia germinans*). There are tidal flats containing oysters within this marsh. Adjacent properties south of the easement contain an apartment complex (100). Landscaping associated with this complex has apparently expanded into the easement.

The disjointed nature of available uplands makes the use of MSA FO 3078 impractical. Since better sites were available, this site was not included in the site bank.

Table B-14 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site MSA FO 3078, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
100	Urban and Built-Up	0.5
429	Wax Myrtle-Willow	4.5
642	Saltwater Marsh	10.9
743	Spoil Areas	10.4
Total		**26.3**

Source: WAR, 1993

1/19/93
92-5148-2/Taylor-Flagler

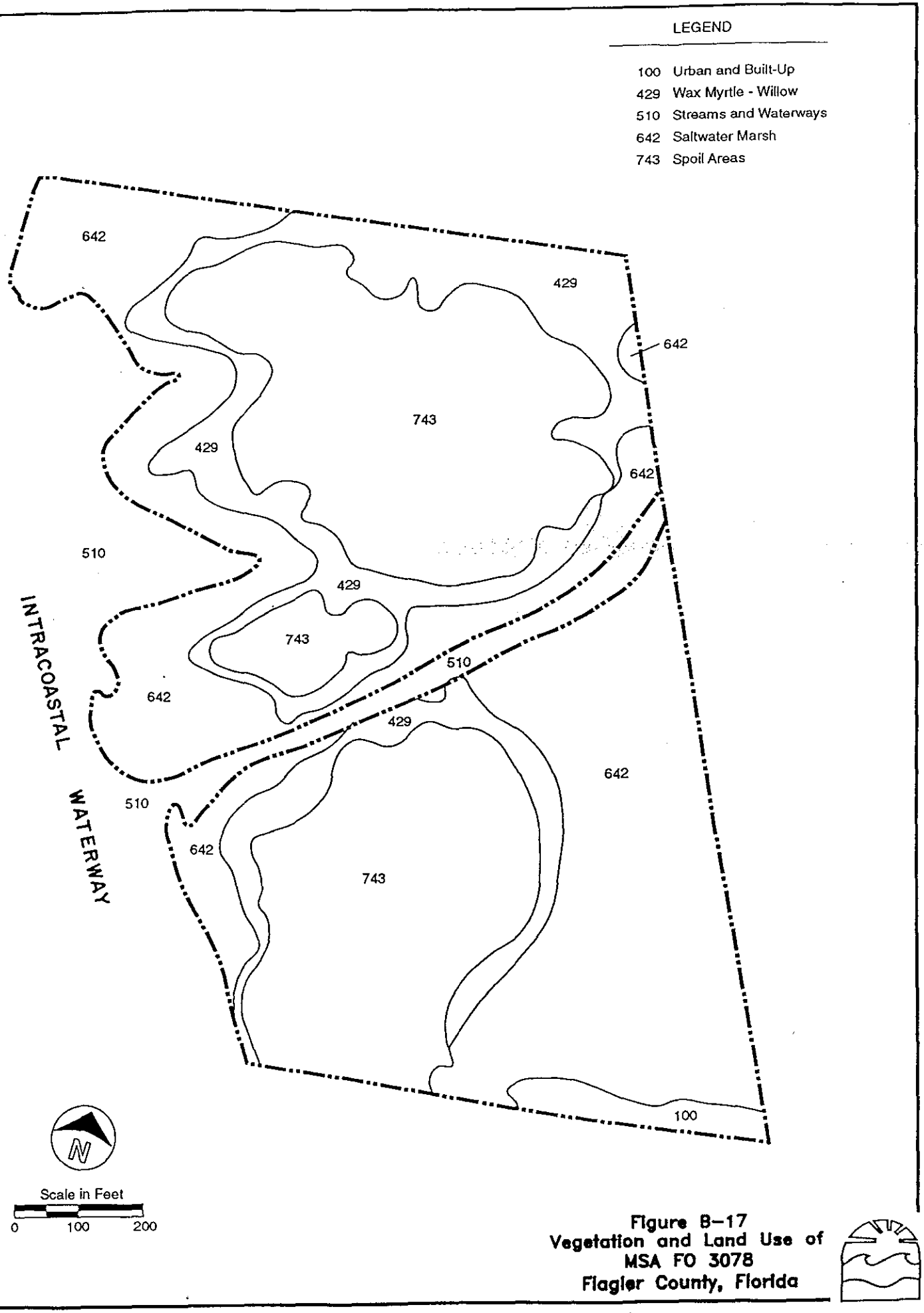
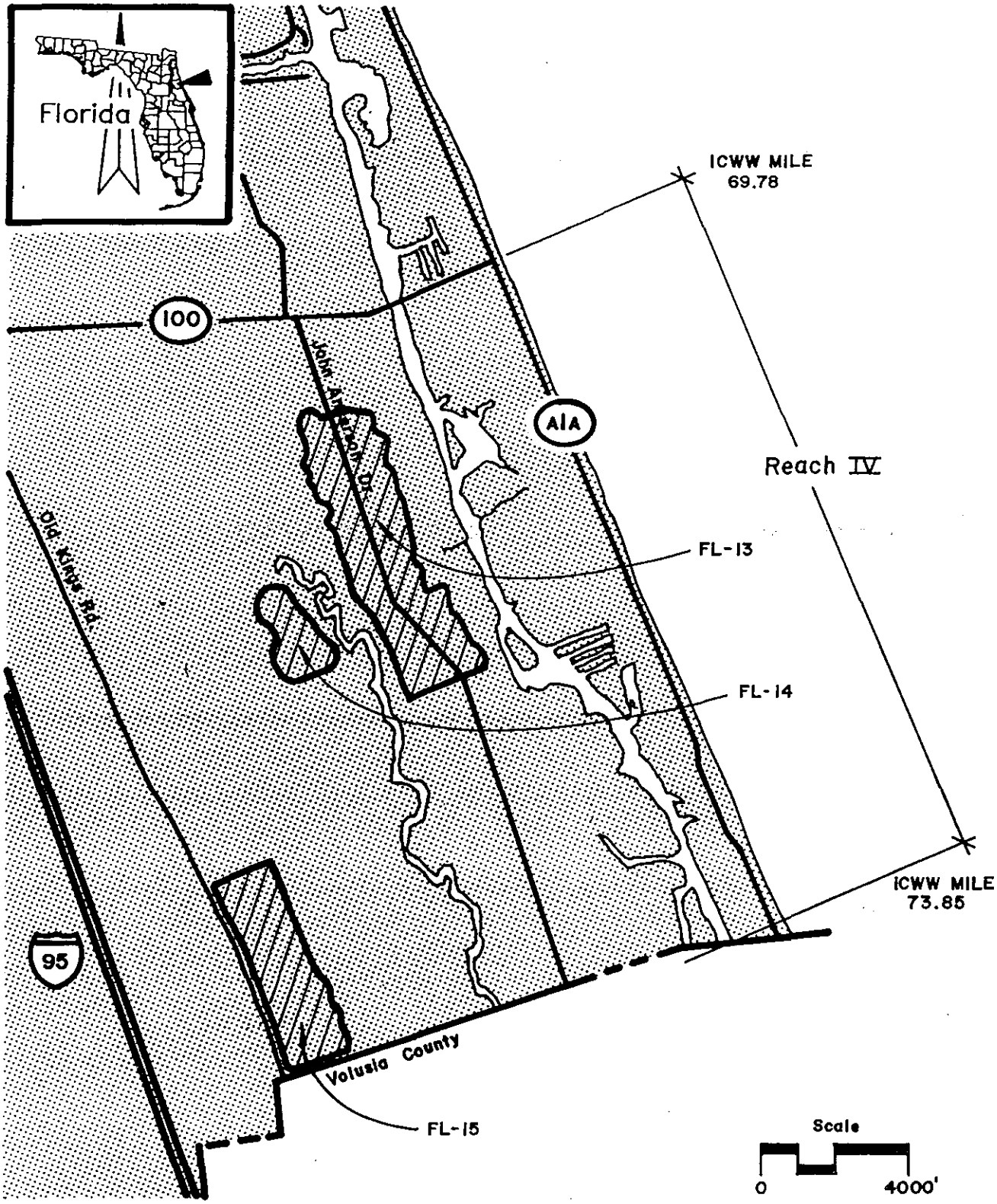


Figure B–17
Vegetation and Land Use of
MSA FO 3078
Flagler County, Florida



TAYLOR ENGINEERING INC
9086 CYPRESS GREEN DRIVE
JACKSONVILLE, FLORIDA 32256

Figure B-18
Location Map,
Candidate Sites, Reach IV
Flagler County, Florida

PROJECT	
REVISION	
SHEET	
DATE	

SITE FL-13 DATA SUMMARY SHEET

I General Location

Flagler	IV	Smith Creek (ICWW)
County	**Reach #**	**Waterbody Name**
38/12S/31E	12,000 cy	0.27 mi
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
County	4.07 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
S.R. 100 (mi 69.78) to S. County Line (mi 73.85)		70.76
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

435.8 ac	4.68 ac	25.80 ac	300 ft Minimum all sides
Initial Site Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+15.0 ft NGVD	13,692 cy	0.27 mi	Agriculture & Timberlands
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
3.36 mi	5 ft	None Required	Pine Plantation, Sparse Residential Development
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
John Anderson Hwy	2.08 ft below grade	None	Mixed Wetland Hard-woods, Freshwater Marsh
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site FL-13 consists of lands on both the east and west sides of John Anderson Highway. It lies approximately 1.4 miles south of S.R. 100 and 0.27 miles west of the ICWW. These lands are vegetated almost entirely by planted pine (441) and temperate hardwoods (425). There is a wetland system (617/641) located near the southeast site corner.

The planted pine areas in the northern part of the site contain mostly young trees. Slash pine (*Pinus elliottii*), sand live oak (*Quercus geminata*), saw palmetto (*Serenoa repens*), and rusty lyonia (*Lyonia ferruginea*) are common in these areas. The temperate hardwood area contains a cover of pignut hickory (*Carya glabra*), sand live oak (*Quercus geminata*), southern magnolia (*Magnolia grandiflora*), red bay (*Persea borbonia*), yaupon (*Ilex vomitoria*), and saw palmetto. Coontie (*Zamia umbrosa*), a state commercially exploited species, is lightly scattered in the hammock ground cover. The wetland on the south end of the site is vegetated with Carolina willow (*Salix caroliniana*, a sterile grass), buttonbush (*Cephalanthus occidentalis*), and wax myrtle (*Myrica cerifera*). Since it ranked below the primary and secondary site choices, Site FL-13 was not included in the site bank.

Table B-15 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site FL-13, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
425	Temperate Hardwoods	278.0
441	Coniferous Plantations	137.1
617/641	Mixed Wetland Hardwoods/Freshwater Marsh	2.0
814	Roads and Highways	18.7
	Total	**435.8**

Source: WAR, 1993

1/19/93
92-5149-2/Taylor-Flagler

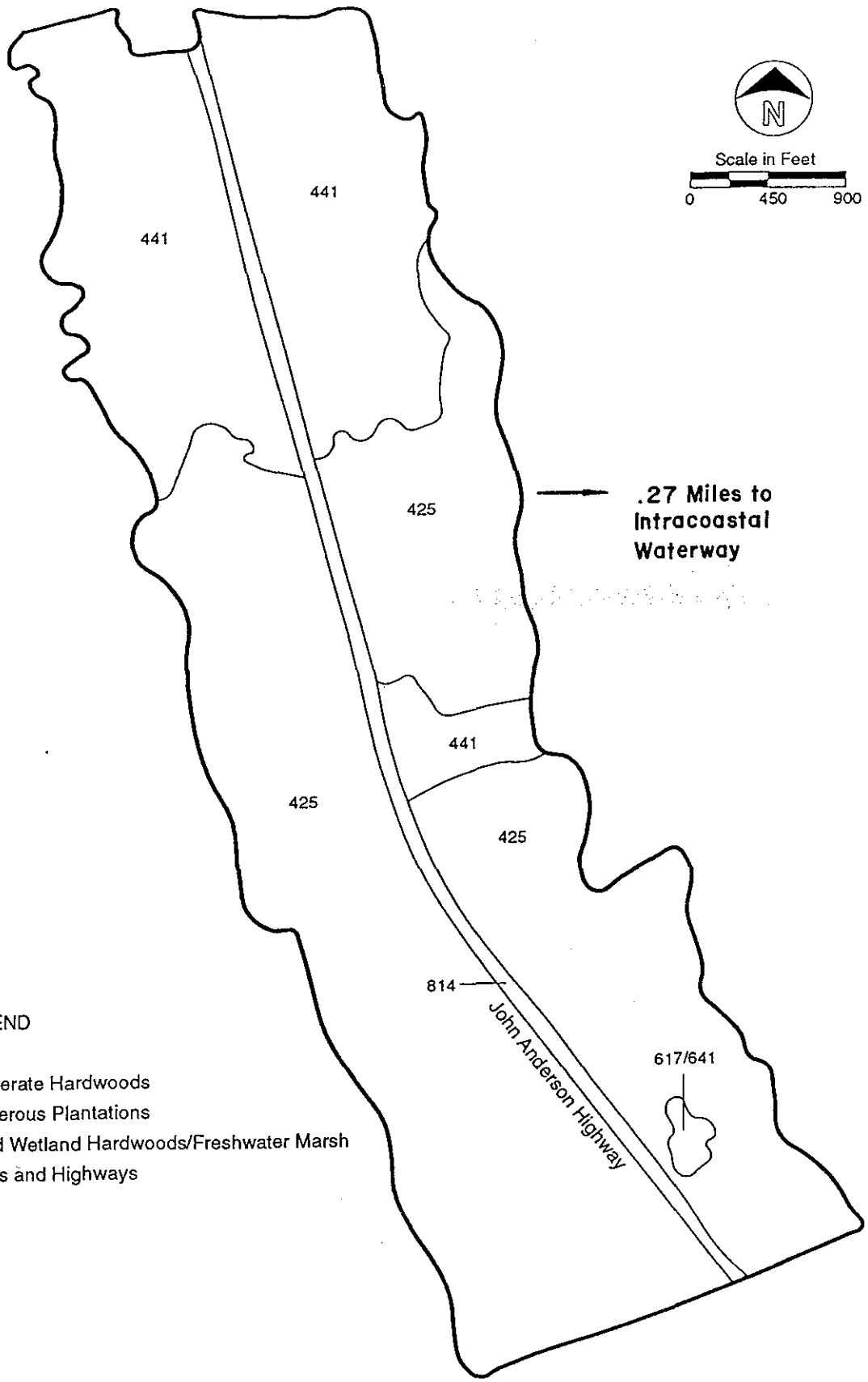


Figure B–19
Vegetation and Land Use of Candidate Site FL–13
Flagler County, Florida

SITE FL-14 DATA SUMMARY SHEET

I General Location

Flagler	IV	Smith Creek (ICWW)
County	**Reach #**	**Waterbody Name**
38/12S/31E	12,000 cy	0.85 mi
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
County	4.07 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
S.R. 100 (mi 69.78) to S. County Line (mi 73.85)		71.62
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

77.8 ac	4.86 ac	25.80 ac	300 ft Minimum all sides
Initial Site Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+5.0 ft NGVD±	13,692 cy	0.85 mi (Bulow Ck/Marsh)	Med. Density Residential, Agriculture & Timberlands
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
3.08 mi	5 ft	1.54 mi	Agricultural/Timberlands
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Old Kings Rd., Private Road	2.1 ft below grade	None	None
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site FL-14 lies 0.85 miles west of the ICWW. It is bordered on the east by Bulow Creek and is accessible to Old Kings Road only by a private road. The entire site is a coniferous plantation (441) consisting of slash pine (*Pinus elliottii*) and saw palmetto (*Serenoa repens*). The Virginia chain fern (*Woodwardia virginica*), a wetland variety, exists in areas at the site. Prior to planting pines, the site was a very wet pine flatwoods; however, according to the soil survey, it is now considered upland. The water table lies very close to the ground surface here and would be an important factor in site design. Since it ranked below the primary and secondary site choices, Site FL-14 was not included in the site bank.

Table B-16 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site FL-14, Flagler County, Florida

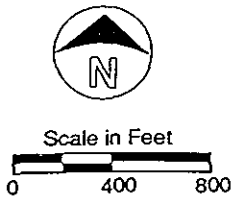
Map ID No.	Name	Approximate Acreage
441	Coniferous Plantations	77.8
	Total	**77.8**

Source: WAR, 1993

12/14/92
92-5149-2/Taylor-Flagler

LEGEND

441 Coniferous Plantations



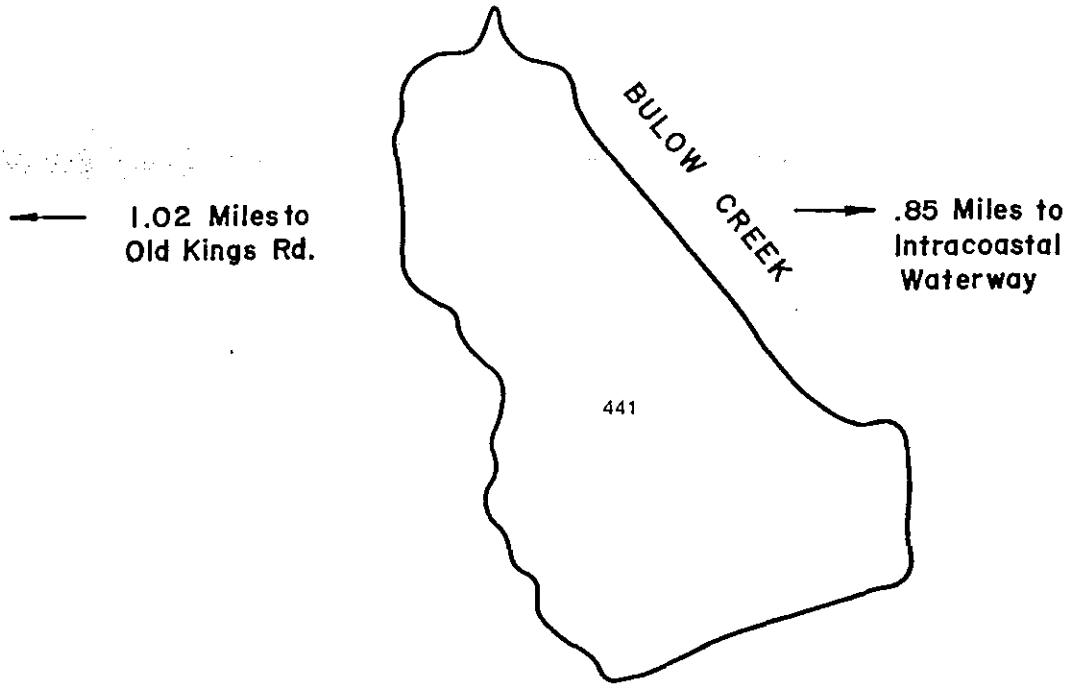


Figure B-20
Vegetation and Land Use of Candidate Site FL-14
Flagler County, Florida

SITE FL-15 DATA SUMMARY SHEET

I General Location

Flagler	IV	Smith Creek (ICWW)
County	**Reach #**	**Waterbody Name**
38/12S/31E	12,000 cy	2.30 mi
Sec/Twp/Rge	**50 yr Reach Req'mt**	**Distance from Waterbody to Site**
County	4.07 mi	III
Municipality	**Reach Length**	**DER Receiving Water Classification**
S.R. 100 (mi 69.78) to S. County Line (mi 73.85)		73.80
Reach Start/End		**ICWW Mile of Site**

II Site Characteristics

259.2 ac	4.86 ac	25.80 ac	300 ft Minimum all sides
Initial Site Area	**Containment Area**	**Total Area Req'd**	**Buffer Width N,S,E,& W**
+25.0 ft NGVD±	13,692 cy		Medium Density Residential
Avg. Site Elev.	**Containment Capacity**	**Pipeline Easement**	**Comp. Plan Designation**
6.32 mi	5 ft	None Required	Agricultural/Timberlands, Med. Density Residential, State Park
Max. Pumping Distance	**Dike Height**	**Road Easement**	**Surrounding Land Use**
Old Kings Rd.	2.1 ft below grade	Mixed Wetland Hardwoods	Inland Ponds and Sloughs
Road to Site	**Excavation Depth**	**DER Juris. Wetlands**	**Isolated Wetlands**

III Narrative Description

Site FL-15 is located approximately 0.34 miles north of the Flagler-Volusia County line. It is bordered on the east by Old Kings Road and on the north by the Bulow Ruins State Monument entrance road. Most of the site is vegetated by temperate hardwoods (425). The southern part of the site now contains a residential development (120). Expansion of this neighborhood is presently slated for cleared areas (190) to the north. A band of mixed wetland hardwoods (617) lies along the eastern site boundary. Lands immediately east of the site contain coastal marsh which lines the shore of the ICWW.

The temperate hardwood area is a rich hammock vegetated by live oak (*Quercus virginiana*), laurel oak (*Quercus laurifolia*), cabbage palm (*Sabal palmetto*), redbay (*Persea borbonia*), and southern magnolia (*Magnolia grandiflora*). Common shrubs and ground cover species include saw palmetto (*Serenoa repens*) and coontie (*Zamia umbrosa*), a species listed by the state as commercially exploited. A small area of drier forest (432) lies adjacent to the road in the southwest part of the site. It contains sand pine (*Pinus clausa*), sand live oak (*Quercus geminata*), myrtle oak (*Quercus myrtifolia*), and saw palmetto (*Serenoa repens*).

Two types of forested wetlands are present on-site, inland pond and sloughs (616) and mixed wetland hardwoods (617). The inland pond and slough area is a depressional strand vegetated with cabbage palm (*Sabal palmetto*), live oak (*Quercus virginiana*), swamp bay (*Persea palustris*), and laurel oak (*Quercus laurifolia*). The mixed wetland hardwood vegetation is similar to that of the inland pond and slough but contains species more characteristic of regular inundation such as green ash (*Fraxinus caroliniana*). Ground cover is sparse but mosses and cinnamon fern (*Osmunda cinnamomea*) are present.

Due to the recent residential development along the site's southern boundary, FL-15 was not included in the site bank.

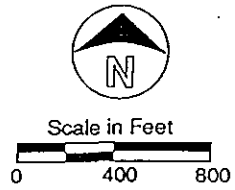
Table B-17 Approximate Acreage of the Florida Land Use, Cover, and Forms Classification System Found at Site FL-15, Flagler County, Florida

Map ID No.	Name	Approximate Acreage
120	Medium Density Residential	44.0
190	Open Land	19.9
425	Temperate Hardwood	153.6
432	Sand Live Oak	1.4
616	Inland Ponds and Sloughs	1.8
617	Mixed Wetland Hardwoods	38.5
	Total	**259.2**

Source: WAR, 1993

LEGEND

120 Medium Density Residential
190 Open Land
425 Temperate Hardwood
432 Sand Live Oak
616 Inland Ponds and Sloughs
617 Mixed Wetland Hardwoods
= = = Road



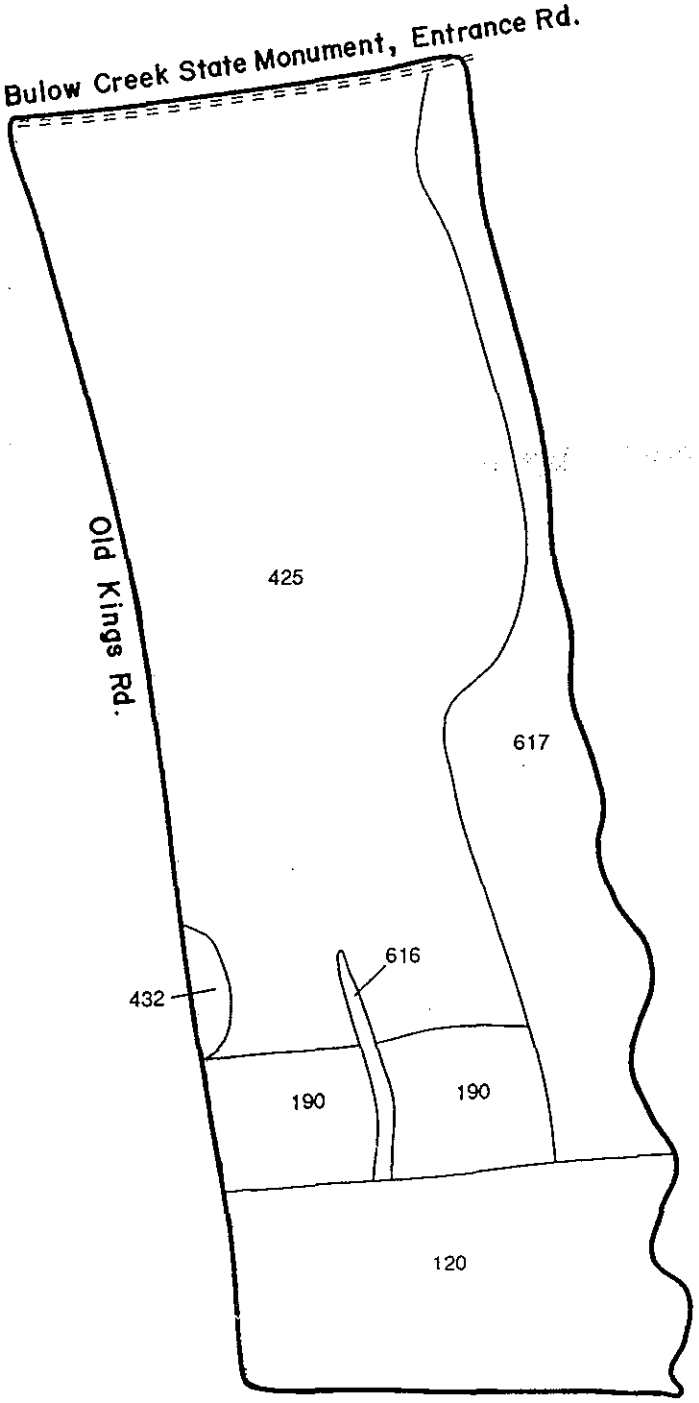


Figure B–21
Vegetation and Land Use of Candidate Site FL–15 Flagler County, Florida

APPENDIX C

Width of Dike at Grade, B_G

$$B_G = 2HS + T \quad (1)$$

Width of Dike at Excavated Grade, B_g

$$B_g = 2HS + T + (G - g)\,S \quad (2)$$

Width of Dike at Depth of Freeboard and Ponding, B_F

$$B_F = 2FS + T \quad (3)$$

Volume of Dike Material Required, V_{MR}

$$V_{MR} = \tfrac{1}{2}H\,(T + B_G)\,P \quad (4)$$

Volume of Dike Material Available on Site, V_{MA}

$$V_{MA} = (G - g)[A - \tfrac{1}{2}P_I\,(B_g - B_G)] \quad (5)$$

Volume of Disposal Capacity, V_D

$$V_D = V_{MA} + (H - F)\left\{A + \tfrac{1}{2}P_I[B_G - (H - F)\,S - B_F]\right\} \quad (6)$$

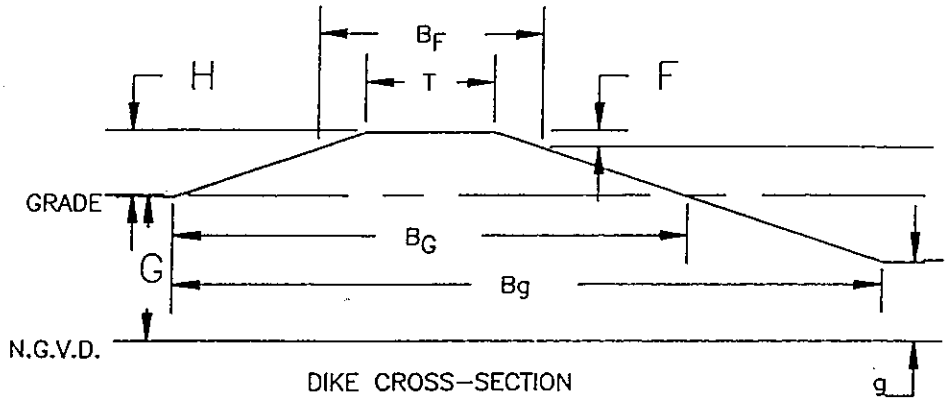
Depth of Excavation, $(G - g)$

$$(G - g) = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad (7)$$

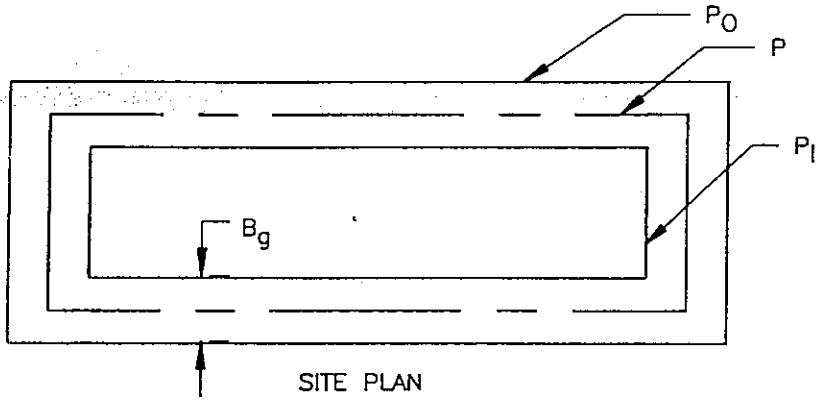
where: $a = \tfrac{1}{2}P_I S$

$b = P_I HS + \tfrac{1}{2}P_I T - A - \tfrac{1}{2}P_I B_G$

$c = \tfrac{1}{2}H\,(T + B_G)\,P$



DIKE CROSS–SECTION



SITE PLAN

P_o	OUTER PERIMETER OF DIKE FOOTPRINT	SITE SPECIFIC
P	DIKE PERIMETER @ CENTERLINE OF DIKE CREST	SITE SPECIFIC
P_I	PERIMETER OF DIKE AT INTERIOR DIKE TOE	SITE SPECIFIC
A	REQUIRED DISPOSAL AREA, BOUNDED BY P_o	SITE SPECIFIC
A_I	AREA WITHIN P_I	SITE SPECIFIC
G	SITE GRADE (+ NGVD)	SITE SPECIFIC
g	EXCAVATED GRADE (+ NGVD)	SITE SPECIFIC
H	DIKE HEIGHT ABOVE GRADE	15 ft.
S	DIKE SIDE SLOPE	3 (1V:3H)
T	DIKE CREST WIDTH	12 ft.
F	FREEBOARD AND PONDING	4 ft.

TAYLOR ENGINEERING INC
9086 CYPRESS GREEN DRIVE
JACKSONVILLE, FLORIDA 32256

Figure C-1
Dike Requirements and Site Capacity

PROJECT
REVISION
SHEET
DATE

APPENDIX D

Table D-1 Site Ownership[1], Primary and Secondary Sites, Flagler County (page 1 of 2)

Site Name	Parcel Number	Owner	Parcel Acreage	Assessed Value
FL-3/MSA 3005A	131030-0000-01010-0000	Corprop A&F, Inc. ATTN: Robert Cuff 1 Corporate Drive Palm Coast, FL 32151-0001	322.75	$294,690
	181031-0000-01010-0000	TIITF/State of Florida School Lands %DNR Douglas Bldg. Tallahassee, FL 32399	187.0	84,898
FL-6	241030-0000-01010-0000	Corprop A&F, Inc. ATTN: Robert Cuff 1 Corporate Drive Palm Coast, FL 32151-0001	276.83	263,349
	251030-0000-01010-0000	Same as Above	93.67	139,237
	251030-0000-01020-0000	Same as Above	188.44	261,735
	421030-0000-01010-0000	Same as Above	76.0	81,551
	421030-0000-01020-0000	Same as Above	138.39	112,420
	421030-0000-01030-0000	Same as Above	130.27	192,954
FL-8/MSA 3048/ 3049A/3050A	091131-0000-00010-0010	ITT Community Development Corp. Executive Offices 1 Corporate Drive Palm Coast, FL 32151	125.13	337,448
	091131-0000-00010-0011	Board of County Commissioners Flagler. County Flagler County Courthouse Bunnell, FL 32110	11.26	45,679
	381131-0000-01010-0000	ITT Community Development Corp. Executive Offices 1 Corporate Drive Palm Coast, FL 32151	51.36	2,568,000
	481131-0000-01010-0000	Same as Above	860.11	564,241
	491131-0000-01010-0000	Same as Above	0.76	1,140
MSA 3053B	101131-0000-01030-0000	Same as Above	18.96	22,752
	151131-0000-01100-0000	Same as Above	273.24	929,104
MSA 3061-3061A	221131-0000-02020-0000	Same as Above	450.36	1,528,051

[1] Based on 1992 tax roll information, Flagler County, Florida

Table D-1 Site Ownership[1], Primary and Secondary Sites, Flagler County (page 2 of 2)

Site Name	Parcel Number	Owner	Parcel Acreage	Assessed Value
FL-12	341131-0000-01010-0000	ITT Community Development Corp. Executive Offices 1 Corporate Drive Palm Coast, FL 32151	581.81	$441,445
	351131-0000-01010-0000	Same as Above	428.58	1,261,609
	021231-0000-01010-0000	Same as Above	390.99	1,439,861
MSA 3113	301232-0000-01030-0020	TIITF/DNR Division of Recreation and Parks Flagler County State Park NDR Douglas Building Tallahassee, FL 32399	134.0	1,537,051

[1] Based on 1992 tax roll information, Flagler County, Florida