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LONG-RANGE DREDGED MATERIAL MANAGEMENT PLAN FOR THE INTRACOASTAL WATERWAY IN ST. JOHNS COUNTY, FLORIDA

Final Report
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Prepared for:

FLORIDA INLAND NAVIGATION DISTRICT

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EXECUTIVE SUMMARY

The identification and permitting of suitable dredged material disposal sites for the Intracoastal Waterway in Florida has become increasingly difficult because of the nature of dredging and disposal operations and the environmentally sensitive areas in which they occur. In response to this situation the Florida Inland Navigation District has initiated a program of long term dredged material management. It is intended that this program, the FIND's Fifteen Year Atlantic Intracoastal Waterway Maintenance and Management Plan, will provide a permanent infrastructure for accommodating all maintenance material dredged from Waterway channels. The pilot study which addressed the needs of the Waterway within Nassau and Duval Counties is now nearing completion with the acquisition of seven upland sites upon which permanent dredged material management facilities will be constructed. The remainder of the Waterway south to Miami is being treated on a prioritized county-by-county basis, with St. Johns, Brevard, and Palm Beach Counties, constituting the second group of counties to be addressed. This report documents Phase I of a two-phased effort to develop the dredged material management plan for the Intracoastal Waterway channel in St. Johns County.

Work Performed

The methods used in the development of the long-range dredged material management plan for the Intracoastal Waterway in St. Johns County are based on the previous pilot study addressing similar needs within Nassau and Duval Counties. Elements of the plan development were as follows: (1) Establishment of the disposal requirement within the St. Johns County project area based on historical maintenance dredging volumes and subsequent examination surveys; (2) Evaluation of existing easements and/or disposal areas within the project area to determine the disposal capacity deficit; (3) Development of a disposal concept or strategy appropriate to specific engineering and operational requirements, and environmental and land-use constraints; (4) Identification of candidate alternative disposal sites consistent with the disposal concept; and (5) Evaluation of all candidate sites based on a standard set of evaluation criteria developed within the framework of the disposal concept, and reflecting engineering, operational, environmental and land-use considerations.

To begin this process, engineering records at the Jacksonville District Office of the Army Corps of Engineers were reviewed and analyzed to develop estimates for the fifty-year maintenance dredging and disposal requirements of the 43 miles of channel within the study area. The analysis showed a projected total disposal requirement of 8,989,816 cubic yards of bulked material distributed over five channel reaches. Corresponding estimates of existing disposal capacity were obtained from a preliminary assessment of 50 sites for which legal access is presently available. From this, only five sites involving nine separate disposal easements were found acceptable for further consideration. Under the assumption that these five sites could be used to their full potential, a projected fifty-year short-fall in disposal capacity of approximately 5.9 million cubic yards was obtained.

Having established the maintenance characteristics of the Waterway and the projected fifty-year disposal requirement, a disposal concept was then developed to focus the selection of disposal alternatives in a manner consistent with the unique characteristics of the study area and the projected channel maintenance requirements. In this manner, unrealistic and impractical disposal alternatives were eliminated and the identification of more reasonable alternatives could proceed in a logical manner. In addition, as will be seen shortly, the disposal concept embodies principles which have long term implications regarding the management of material dredged from the Waterway. The concept adopted for St. Johns County is stated as follows:

(1) Confined upland disposal capabilities will be provided for all channel reaches, regardless of previous channel maintenance history.

(2) Sites will be established to provide centralized disposal in a minimum number of locations per operating reach of waterway as determined by the analysis of historical data.

(3) Because of the large quantities of beach quality sand introduced to the Waterway channel in the vicinity of Matanzas Inlet, beach disposal of material dredged from the channel in this area will be used as a primary means of disposal in combination with a confined upland disposal capability.

(4) Disposal sites will be operated and maintained as permanent facilities.

Within this framework a total of 23 candidate sites were identified for further consideration. These included five sites involving the nine existing disposal easements mentioned earlier. Each site was then field inspected, and evaluated under a standard set of criteria addressing engineering, operational, environmental and land use considerations. By this process, 10 sites were selected to form a site bank of 5 primary or first choice disposal options including beach disposal, and 5 secondary or alternative sites.

Experience gained from the earlier Nassau-Duval project has demonstrated the importance of the systematic documentation of disposal 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 St Johns County. All work performed under this contract is documented in this report and a companion set of 58 photobase engineering plans which summarize pertinent channel and disposal 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 disposal facilities on each of the sites selected. Cost considerations associated with these actions, as well as the development of detailed site operation and management plans, will also be addressed. A detailed scope of work for Phase II of the project is presented in Section 5.0 of this report.

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ACKNOWLEDGEMENTS

The authors wish to express their appreciation to E. Lynn Mosura and Lora Smith of Water and Air Research, Inc. for their assistance in the performance of this project.

1.0 INTRODUCTION

This report documents work performed during the first phase of a two phased effort to develop a fifty year plan for the management of maintenance material dredged from Intracoastal Waterway channels in St. Johns County, Florida (Figure 1-1). The initial phase of the project focuses on the development of basic plan concepts, the definition of short and long-term dredging requirements, and the identification of suitable disposal alternatives which satisfy these requirements based on preliminary environmental, engineering, and operational criteria. During Phase II of the project, detailed site-specific information required for the preparation and submission of permit applications for the primary or first-choice disposal sites identified in Phase I will be obtained and documented. In addition, the design of site disposal facilities, and the construction and continuing operation and maintenance of these sites as permanent dredged material management facilities will be addressed.

The methods used in the performance of the work reported herein are based on a previous study which addressed similar needs of the Waterway within Nassau and Duval Counties, Florida (Taylor and McFetridge, 1986). This earlier effort was performed under the sponsorship of the Florida Inland Navigation District (FIND) and was intended to serve as a pilot study for the FIND's Fifteen Year Atlantic Intracoastal Waterway Maintenance and Management Plan. Phase II of the Nassau-Duval study is now nearing completion with the acquisition of seven upland sites upon which permanent dredged material management facilities will be constructed. It is intended that these facilities serve the needs of the Waterway within Nassau and Duval Counties for a minimum period of 50 years.

Experience gained from this earlier project has demonstrated the importance of the systematic documentation of disposal alternatives and the basis upon which these alternatives are evaluated. This report provides such information for the long range dredged material management plan for the Intracoastal Waterway in St. Johns County.

1.1 Background

Since its formation in 1927 the Florida Navigation District (FIND) has served as the state governmental body responsible for maintaining Intracoastal Waterway (ICWW) channels along the east coast of Florida between Fernandina Harbor and Miami.

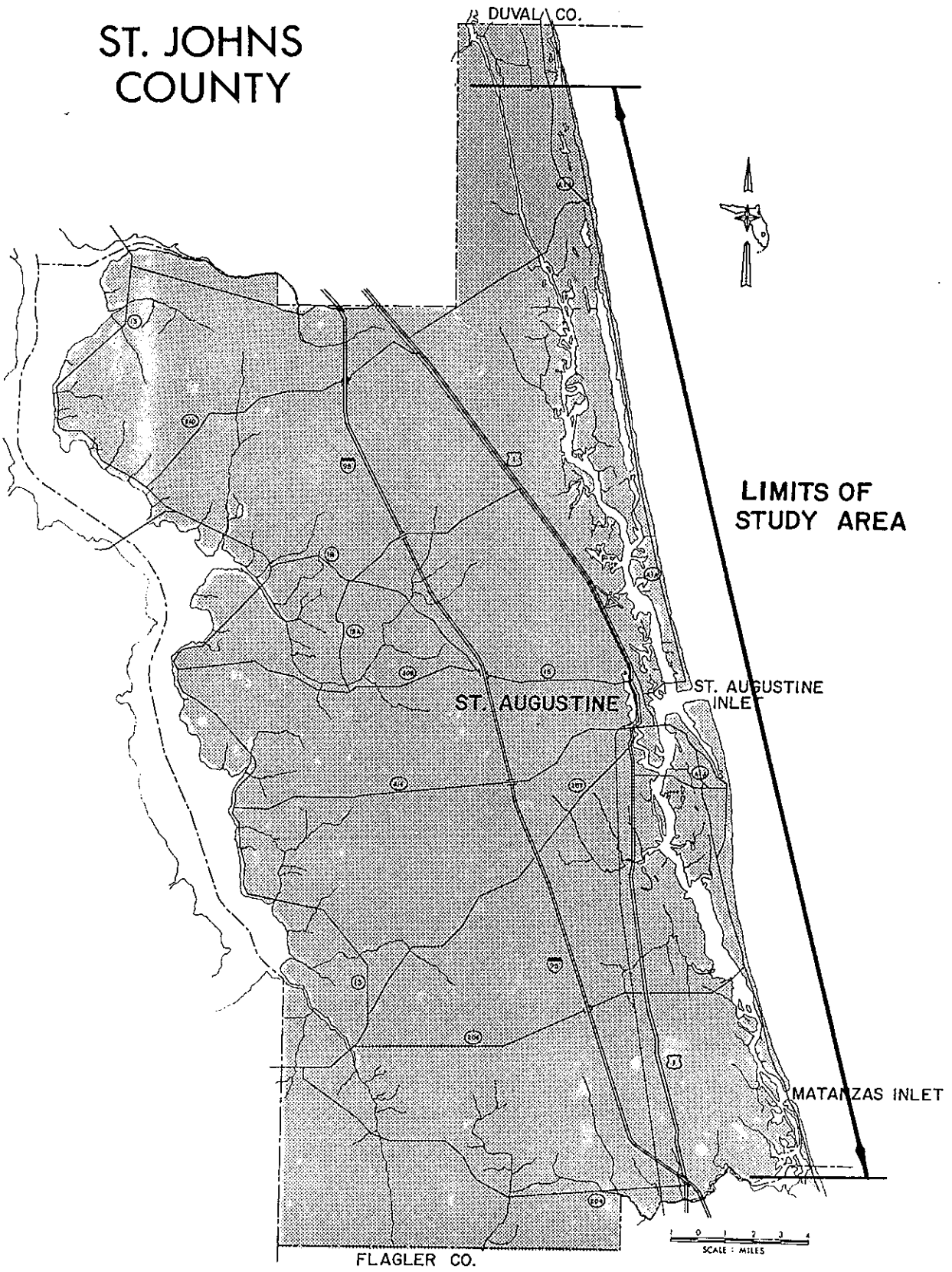

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Figure 1-1: Study Area, Dredged Material Management Plan, Intracoastal Waterway, St. Johns County, Florida

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As such, the FIND must provide to the U.S. Army Corps of Engineers disposal sites suitable for the placement of 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, the disposal of dredged material was guided by an approach which emphasized short-term economy. Engineering, cost, and operational considerations were of primary importance in the design and execution of channel maintenance projects. To this end, an abundant number of perpetual easements had been granted to the FIND by the Trustees of the Internal Improvement Trust Fund (hereafter referred to as Trustees). The majority of these 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 upon which it is based, the unconfined disposal of dredged material within wetland areas is no longer a responsible approach to the maintenance of the Waterway. Neither is it a realistic approach given present day agency reviews and permitting constraints. Current State and federal legislation mandates that all dredging and dredged material disposal activities satisfy a spectrum of environmental requirements dealing with water quality, habitat protection, threatened and endangered species, and the filling of wetlands. 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 disposal sites becomes increasingly difficult. Moreover, the intensive development pressure being experienced throughout coastal Florida has made the acquisition of additional disposal areas an ever more expensive proposition.

In order to secure its ability to maintain the Waterway within the existing framework of engineering, operational and environmental constraints, the FIND

initiated a fifteen year program of long-term planning and site acquisition to provide a means for accommodating all maintenance material dredged from the Intracoastal Waterway during the next fifty years and beyond. The first program element, addressing the needs of the Waterway within Nassau and Duval counties, was briefly described in Section 1.0. The continuation of the program, is now guided by a prioritization of waterway segments, county by county, based on the immediate need for channel maintenance and the relative difficulty of providing appropriate disposal areas. This prioritization, jointly decided upon by the FIND and the Jacksonville District, U.S. Army Corps of Engineers, identified three counties, St. Johns, Brevard, and Palm Beach, as the second group of counties for which long range dredged material management plans were needed.

1.2 Project Overview

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

A vital element in the plan development process was the participation of cognizant federal and state agency representatives. At key points during the project period of performance an advisory committee consisting of representatives from the FIND, the Florida Department of Environmental Regulation (DER), and the Jacksonville District, 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. Input and guidance received from this group of individuals proved invaluable to the successful completion of the project.

The entire process is documented in the remaining sections of this report beginning with Section 2.0 which describes the establishment of fifty year disposal

needs for various reaches of the Waterway. This was accomplished by the use of historical data, and the comparison of projected disposal quantities and dredging locations with the capacities of existing sites and easement areas. Section 3.0 discusses the disposal concept, the initial selection of alternative disposal sites, and the re-evaluation of all existing and alternative sites based upon field observations. The final site evaluation process is described in Section 4.0 including the evaluation criteria used and the formation of the site bank. Finally, Section 5.0 summarizes the results of this Phase I effort and presents a specific scope of work for its implementation in Phase II.

2.0 50-YEAR DISPOSAL REQUIREMENT

2.1 Historical Analysis

2.1.1 Methodology

The establishment of a baseline rate of shoaling from which to project fifty year dredging and disposal volumes for the St. Johns County segment of the ICWW required a detailed examination of Jacksonville District, U.S. Army Corps of Engineers (COE) archival records, engineering plans, and survey data related to channel maintenance. These records represent the best available information on patterns of sedimentation within the project area.

Dredging volumes, as estimated in pre-dredging plan documents or as determined by post-dredging examination, are obtained from comprehensive bathymetric surveys of the Waterway channel. Over an adequate period of record during which maintenance dredging is regularly performed, these volumes provide a reasonable and reliable indication of sedimentation patterns. However, dredging frequency is often dependent on factors unrelated to rates of shoaling. These factors include the availability of funding and equipment, contracting procedures, and most relevant to the present study, the non-availability of suitable dredged material disposal sites. For example, the lack of an appropriate disposal site in the Palm Valley segment of the Waterway resulted in this area receiving no channel maintenance since 1973, despite the presence of documented and extensive shoals. For these reasons, it was decided to include in the calculation of future dredging and disposal requirements estimates of current shoaling volumes based on the most recent COE channel centerline survey performed in October of 1987.

Experience gained in the previous Nassau-Duval study demonstrated that a necessary first step in the analysis of dredging records and survey data is the establishment of an accurate and consistent system for cross-referencing a particular location along the Waterway to both cut and station, and channel mile. Moreover, such a system must resolve inconsistencies between project descriptions found in older engineering records and those of more recent origin. This was achieved here by adopting currently used designations of channel cut and station and referencing

these to ICWW channel mile. The system is therefore derived from the original navigation project record document which accompanied the establishment of the 12 ft. ICWW project depth in 1951-52, and modifications to that document which appeared in succeeding maintenance plans. Consistency with the previous Nassau-Duval study 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. It is also noted that within the central 18.80 miles of the St. Johns County segment of the Waterway (ICWW mile 26.56 to mile 45.36), the channel follows pre-existing naturally deep water within the Matanzas and Tolomato Rivers . No construction or maintenance dredging has ever been required in this stretch; therefore no channel cuts were ever designated, nor horizontal or vertical control established. Within this segment of the Waterway specific locations are identified by ICWW mileage only.

Within this framework, a comprehensive analysis was then conducted of all maintenance dredging occurring in the ICWW in St. Johns County since 1952. All available sources of dredging information within the Jacksonville District, Corps of Engineers were consulted to insure 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 source of information, however, was direct reference to archival maintenance plan documents and examination surveys.

The compilation and reduction of historical 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. Of those maintenance dredging events referenced in the OCE reports or other preliminary sources, only the plans for the 1963 and 1966 channel maintenance were unavailable. For these events the only information available was total pay volumes for project channel reaches given in summaries compiled by the Navigation Branch, Planning Division, Jacksonville District COE. All other relevant dredging information was verified by reference to the original plan sheets or microfiche versions of the original engineering drawings. Through

TABLE 2-1 : INTRACOASTAL WATERWAY

ST. JOHNS COUNTY, FLORIDA

	END STATION	MILEAGE 0.0 @ Cut SJ-1 STA 0+00	0.0 @ ICWW Mile 0.0 DU-1 STA 0+00	0.0 @ FHP CUT 34
Cut SJ-1	21 + 65.8	0.41	10.60	32.98
2	27 + 48.6	0.93	11.12	33.50
3	37 + 26.7	1.64	11.83	34.21
4	66 + 62.4	2.90	13.09	35.47
5	141 + 93.0	5.59	15.78	38.16
6	90 + 89.1	7.31	17.50	39.88
7	32 + 44.7	7.92	18.11	40.49
8	59 + 64.7	9.05	19.24	41.62
9	84 + 46.7	10.65	20.84	43.22
10	58 + 20.9	11.75	21.94	44.32
11	16 + 10.7	12.06	22.25	44.63
12	51 + 93.1	13.04	23.23	45.61
13	33 + 19.8	13.67	23.86	46.24
14	84 + 83.4	15.28	25.47	47.85
15	26 + 38.3	15.78	25.97	48.35
16	16 + 00.6	16.08	26.27	48.65
17 P.O.T.	15 + 00.0	16.37	26.56	48.94

No Vertical or Horiz. Control over next 18.80 channel miles ± (Cut SJ-45 STA 0+00, ICWW Mile 45.36).

		Begin	End	Begin	End	Begin	End
Cut SJ-45	24 + 31.2	35.17	35.63	45.36	45.82	67.74	68.20
46	8 + 47.8		35.79		45.98		68.36
47	8 + 11.2		35.94		46.13		68.51
48	59 + 62.4		37.07		47.26		69.64
49A	33 + 44.55		37.70		47.89		70.27
(No Cut SJ-50)							
51	14 + 33.1		37.97		48.16		70.54
52	21 + 35.1		38.38		48.57		70.95
53	16 + 49.6		38.69		48.88		70.90
54	18 + 48.6		38.04		49.23		71.61
55	19 + 03.3		39.40		49.59		71.97
56	15 + 18.7		39.69		49.88		72.26
57	30 + 57.2		40.27		50.46		72.84
58	11 + 14.1		40.48		50.67		73.05
59	23 + 83.8		40.93		51.12		73.50
60	26 + 86.3		41.44		51.63		74.01
61	70 + 06.9		42.77		52.96		75.34
62	52 + 26.5		43.76		53.95		76.33
63	41 + 25.1		44.54		54.73		77.11
64	36 + 59.2		45.23		55.42		77.80
F-1	15 + 07.4		45.52		55.71		78.09
2	37 + 30.5		46.22		56.41		78.79
3	21 + 88.7		46.64		56.83		79.21
4	32 + 35.0		47.25		57.44		79.82
5	71 + 87.7		48.61		58.80		81.18
6	23 + 42.2		49.05		59.24		81.62

Source: U.S. Army Corps of Engineers, Jacksonville, District, D.O File #8A-30, 014, Dated May 1967.

this procedure, it was determined that maintenance within the study area since the establishment of the present -12.0 ft. MLW project depth consisted of thirteen separate events.

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 planned disposal. Pay volumes (i.e., volumes actually dredged as determined by post-project bathymetric surveys) were obtained from preliminary sources already listed or directly from after-dredging examination survey documents. From the dredging events in which both design (pre-project estimates) and pay dredging volumes were documented, a mean ratio of design to pay volume of 0.84 was calculated. This ratio was applied to those maintenance events for which only the design or pay volume was given to obtain the missing quantity. For those events for which only total or combined dredging volume was documented, the total quantity was apportioned to specified shoaling areas based on the relative length of each individual shoal. The results of this analysis are summarized in Table 2-2.

In addition to historical maintenance dredging activity within the St. Johns County segment of the ICWW, Table 2-2 also includes estimates of shoaling which has occurred since the last channel maintenance 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 historical dredging. This measure of recent shoaling was combined with historical dredging volumes to determine projected dredging and disposal requirements. As discussed previously, this was done for purposes of completeness, and to extend the period of record in those channel reaches where the lack of available disposal sites has precluded dredging in recent years. Reaches of the Waterway within St. Johns County which have historically required maintenance, or have recently experienced shoaling are identified in Figure 2-1.

2.1.2 Material Quantities and Locations

By far the greatest proportion of dredging has occurred in the vicinity of Matanzas Inlet (ICWW mile 51.0 to mile 55.6). Of the total recorded dredging volume (total - 2,355,712 cubic yards) for St. Johns County in the 37 years since the

TABLE 2-2: SUMMARY OF HISTORICAL

MAINTENANCE DREDGING/RECENT SHOALING - ST. JOHNS COUNTY

1952 - 1987

PREVIOUS MAINTENANCE/RECENT SHOALING								
TO ICWW	FROM MILEAGE	FROM CUT	FROM STA	TO CUT	TO STA	LENGTH	Year	DESIGN VOL. (C.Y.)	PAY VOL. (C.Y.)
12.40	- 12.64	SJ-4	30+00	4	43+00	0.24	1987+	12,765	(15,196)
12.72	- 17.69	4	47+00	7	10+00	4.97	1987+	359,874	(428,421)
16.36	- 16.60	6	30+50	6	43+50	0.25	1967	14,100	(16,920)
17.88	- 18.85	7	20+00	8	39+00	0.97	1987+	35,252	(41,967)
18.11	- 18.83	7	32+00	8	32+00	0.73	1973	47,000	90,905
19.39	- 19.68	9	8+00	9	23+00	0.29	1987+	3,514	(4,183)
22.88	- 23.32	12	33+00	13	5+00	0.45	1960	22,000	29,061
23.25	- 23.34	13	1+00	13	6+00	0.09	1987+	6,005	(7,149)
35.17	- 35.36	----		----		0.19	1987+	2,398	(2,855)
51.03	- 51.90	59	19+00	61	14+00	0.87	1983	288,000	287,560
51.11	- 51.84	59	23+00	61	11+00	0.73	1978	260,000	312,776*
51.12	- 51.61	60	0+00	60	60+00	0.49	1964	66,900	(80,280)
51.12	- 51.76	60	6+00	61	7+00	0.64	1958	(53,372)	63,538*
51.23	- 52.73	60	6+00	61	58+00	1.49	1987	188,000	(225,600)
51.23	- 51.72	60	6+00	61	5+00	0.49	1962	105,000	103,504*
51.25	- 51.72	60	7+00	61	5+00	0.47	1960	102,000	87,727*
51.30	- 51.40	60	9+50	60	15+00	0.10	1967	15,700	20,240
51.32	- 51.83	60	10+50	61	10+50	0.51	1973	86,000	112,447
51.32	- 52.32	60	10+50	61	36+50	1.00	1963	(99,010)	117,869
51.47	- 51.61	60	18+50	60	25+75	0.14	1968	21,400	59,542
51.65	- 51.86	61	1+00	61	12+00	0.21	1987+	2,403	(2,861)
52.32		61	36+50				1966	(5,974)	7,112
52.39	- 52.79	61	40+00	61	61+00	0.40	1970	52,500	56,668*
52.39	- 53.62	61	40+00	62	35+00	1.23	1978	174,000	185,632*
52.39	- 53.01	61	40+50	62	2+50	0.61	1973	46,000	76,266
52.46	- 52.71	61	44+00	61	57+00	0.25	1960	16,000	46,664*
52.48	- 52.73	61	45+00	61	58+00	0.25	1958	(20,849)	24,820*
52.52	- 52.67	61	47+00	61	55+00	0.15	1987+	19,826	(23,602)
52.52	- 52.69	61	47+00	61	56+00	0.17	1962	14,000	35,909*
52.85	- 53.09	61	64+50	62	7+00	0.24	1970	31,500	34,000*
53.43	- 53.57	62	25+00	62	32+00	0.13	1958	(10,841)	12,906*
53.82		62	45+50				1966	(21,717)	25,853
53.99	- 54.48	63	2+00	63	28+00	0.49	1958	(40,863)	48,647*
54.02	- 54.44	63	3+80	63	26+00	0.42	1970	39,700	59,501*
54.03	- 54.54	63	4+00	63	31+00	0.51	1960	19,000	18,967*
54.10	- 54.54	63	8+00	63	31+00	0.44	1978	52,000	(62,207)
54.65	- 55.46	63	37+00	F1	2+00	0.81	1987+	37,776	(44,971)
54.69	- 54.84	63	39+00	64	6+00	0.16	1960	4,000	5,950*
55.32	- 55.53	64	31+00	F1	6+00	0.22	1978	31,000	(37,200)
55.38	- 55.57	64	34+50	F1	8+00	0.19	1967	14,000	9,441*
							Total		2,926,917

Note: Parenthetical values based on derived relationship: Pre-dredging estimate or design volume = 0.84 (pay volume)

* : Only total or combined dredging volume given in record; apportionment based on relative length of individual shoal.

\+ : Estimated shoaling volumes based on centerline survey, dated 10/87

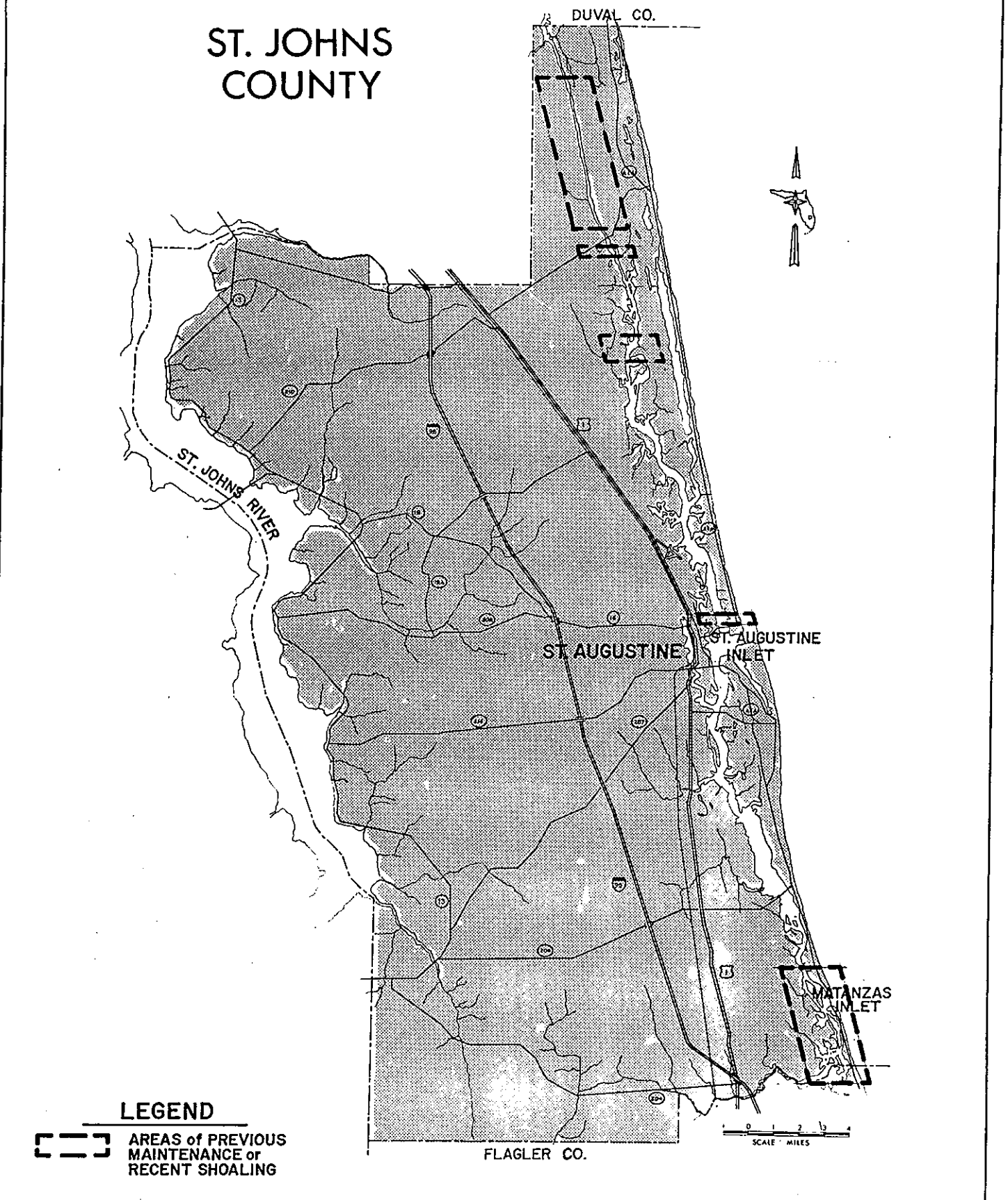

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Figure 2-1: Areas of Previous Maintenance Dredging or Recent Shoaling, Intracoastal Waterway, St. Johns County, Florida

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channel was deepened to its present 12 ft depth, 94 per cent has been required in the channel reach inside Matanzas Inlet. This is not unexpected, as inlets typically introduce littoral sediments to interior navigation channels. However, it is in dramatic contrast to the situation at the second inlet within St. Johns County, St. Augustine Inlet, which has not experienced significant shoaling in the interior ICWW channels over the history of the 12 ft project. For the ICWW in the vicinity of Matanzas Inlet, COE dredging summaries indicate a total dredging volume for the period 1952-1987 of 2,218,826 cubic yards (c.y.) in 13 separate dredging events. This results in a mean dredging frequency of 1 event per 2.69 years, with a mean dredging volume of 170,679 c.y. per event.

The results of the most recent centerline survey (October 1987) indicate that shoaling within this area continues at a rapid rate. In the seven months following the completion of the last maintenance of this reach, additional shoaling is estimated at over 70,000 c.y. It should be noted that this estimate is based on centerline soundings only, and assumes 2 feet of advanced maintenance or overdepth dredging below the authorized 12 ft. MLW authorized project depth in those reaches immediately adjacent to the inlet. This corresponds to the minimum overdepth required in this area since the 1973 maintenance event. This pattern of rapid shoaling within the channel is consistent with historically required dredging and shoaling rates since 1952 (65,000 c.y./year). However, the recent shoaling is present not at the confluence of the ICWW and the Matanzas River as would be expected if the sediment were primarily littoral material transported through the Inlet. Rather, shoaling is occurring 5,000 ft south (cut SJ-61, station 47+00 to 55+00; ICWW mile 51.65 to mile 51.86) immediately opposite the Inlet itself at the point at which the COE was forced to close a breech through Rattlesnake Island because of extreme current velocities and recurrent shoaling within the ICWW.

An additional shoal is evident approximately 10,000 ft further south, adjacent to the confluence of the Matanzas River South and the ICWW. This shoal extends across the St. Johns - Flagler County line, from cut SJ-63, station 37+00 to cut F-1, station 2+00. Examination of historical dredging information (Table 2-2), indicates that the shoals associated with Matanzas Inlet have typically extended in a continuous manner across the southern St. Johns County boundary. Therefore, the St. Johns County study area was extended 0.29 miles south of the County line to include the first channel cut within Flagler County (cut F-1, ICWW mile 55.71).

The second major channel reach within the study area which has consistently experienced shoaling is located in Palm Valley at the northern end of the County. From the point at which the previous Nassau-Duval study terminates and the St. Johns study begins (ICWW Mile 12.50) maintenance dredging has been performed southward to the Palm Valley Bridge (ICWW MIle 18.96) only twice since the establishment of the 12 ft project. The most recent dredging was performed in 1973, and the total historical maintenance of this reach totals only 107,825 c.y. However, the absence of recent dredging activity is not a result of minimal shoaling. Rather, maintenance of this reach has been prevented since 1973 by the lack of a suitable disposal site. Results of the most recent centerline survey indicate shoaling in this reach of over 485,000 c.y. of material.

Between the Palm Valley bridge to the north (ICWW mile 18.96) and the vicinity of Matanzas Inlet to the south (ICWW mile 51.03), a distance of over 32 miles, only one minor shoal has previously required dredging. This maintenance took place in 1960, and was located approximately 4 miles south of the Palm Valley Bridge, between cut SJ-12, sta 33+00 and cut SJ-13, sta 5+00 (ICWW mile 22.88 to mile 23.32). The volume of material removed in this event was 29,000 c.y. The October 1987 centerline survey documented a re-occurrence of shoaling in this same area (estimated volume, 7,149 c.y.) as well as an additional shoal of 4,183 c.y. immediately south of the Palm Valley Bridge (cut SJ-9 sta 8+00 to sta 23+00; ICWW mile 19.39 to 19.68). Within the central 18.80 miles of Waterway channel, which have required no dredging for channel construction or maintenance, a single minimal shoal of 2,855 c.y. is indicated approximately 0.40 miles north of the Vilano Beach Bridge (ICWW mile 35.17 to mile 35.36), immediately adjacent to the Comachee Cove basin entrance channel. The existence of this shoal represents a good example of how changing coastal development influences historical shoaling patterns.

The most obvious conclusion to be drawn from the preceding discussion is that historical dredging and/or recent shoaling within the St. Johns County study area has been primarily concentrated in two discrete reaches of the Waterway. The greater portion has occurred within the southern most 4.54 miles of the study area adjacent to Matanzas Inlet. Shoaling within this reach represents 2,290,260 c.y. yards of material, or approximately 78% of the total for the entire study area. The northernmost 6.43 miles of the study area in the vicinity of Palm Valley has

accounted for an additional 593,409 c.y., or 20% of the total quantity. The central 18.80 miles has never required dredging for channel construction or maintenance, and only recently has a single minimal shoal been documented within this reach. However, as previously noted, the existence of this shoal suggests that the total lack of historical shoaling within this reach may be changing due to increased Waterway development within the central portion of the County.

Combining the maintenance dredging quantities and existing shoal volumes for the various reaches of the Waterway within the County yields a total County-wide maintenance volume of 2,926,917 c.y. for the period 1952-1987. To obtain the corresponding 50-year maintenance requirement, this figure was then apportioned upward by linear extrapolation (50/35 or a factor of 1.43). The resulting 50-year projected dredging volume of 4,181,310 c.y. corresponds to the in-situ or unbulked volume of anticipated shoaling throughout the County. This quantity was then multiplied by an effective bulking factor of 2.15 to obtain a 50-year projected disposal volume of 8,989,816 c.y. The factor of 2.15 is based on Corps of Engineers' standard practice and recommendation, and represents a material bulking of 2.0, plus an additional 15 per cent of non-pay volume, or unauthorized overdredging.

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. Similar to the procedure used to establish historical dredging volumes, a complete review was made of all available sediment chemistry and physical data.

Sediment chemistry data for the ICWW channel within St. Johns County are limited to the results of a Florida Department of Environmental Regulation (DER) sediment sampling program. Sediments from within or immediately adjacent to the channel were sampled in 1984 at five locations within the vicinity of the project area: (1) at

the northern County line at the confluence of the Waterway with Pablo and Cabbage Creeks; (2) near Crescent Beach adjacent to the entrance to the Treasure Beach canal system; (3) and (4) two locations in the vicinity of Matanzas Inlet, north and south of the confluence of the Waterway and the Matanzas River North; and (5) adjacent to the entrance to the Marineland Marina boat basin. The first and last of these locations are outside the boundaries of the study area. However, they were considered for two reasons: first, their proximity to documented shoals within the study area governed by essentially the same sedimentary regimes as the sampling locations; and second, the likelihood that these locations represent the greatest potential for sediment contamination within the adjacent shoals. Additional samples were taken within tributaries of the Tolomato and Matanzas Rivers in a deliberate attempt to document worst-case conditions, but these results are not representative of ICWW channel sediments. Only the two sampling locations adjacent to Matanzas Inlet are within an area which historically has experienced shoaling.

Analysis of this data was based on DER guidelines for the interpretation of metal concentrations in estuarine sediments (Ryan et al, 1984; DER, 1986). It indicates the possibility of metals being present at levels marginally above natural conditions (i.e., 1-2 standard deviations above the mean for "uncontaminated" locations) at three locations: arsenic at Pablo Creek, cadmium at one Matanzas sampling point, and mercury at both Matanzas locations. Because of the determination of only minimally evaluated levels of metals within the few samples analyzed, it cannot be concluded that the samples have documented metal contamination. Rather, it indicates that a more comprehensive sampling effort should be conducted prior to dredging. If subsequent analysis then documents significant sediment contamination, close monitoring of ambient and effluent water quality, combined with increased efforts to control the release of the fine particles, may be required during dredging and disposal operations.

This same DER program analyzed the sediment samples for nutrient enrichment. At no locations were observed TKN:TOC ratios found to be above the DER criterion. However, elutriate testing would still be appropriate to guard against the possibility of excessive release of nutrients during dredging or dewatering.

Characterizations of the physical properties of the sediment deposited within the Waterway channel are based on core borings taken prior to scheduled maintenance

activity. These data are available for the Palm Valley area in 1970 and 1985, and in the vicinity of Matanzas Inlet in 1970, 1973, 1982 and 1985. The data consist of individual core boring logs, with qualitative characterizations of the sediment at elevations referenced to MLW, as well as gradation or sieve analysis results and suspended sediment-time curves for each boring. Only information contained in the boring logs was used in this study, and only to a depth of -14.0 ft. MLW (i.e., 12.0 ft. project depth, plus 2.0 ft. over-dredging). Total boring depth was typically -17.0 to -20.5 ft. MLW, and the entire composite sample was analyzed to produce grain size and fall velocity curves. This procedure is expected to yield representative results provided that the characteristics of the sediment below -14 ft. MLW are similar to those above this elevation.

The sediment data which best characterizes the material to be dredged within the Palm Valley area was obtained from samples taken immediately to the north of the present project area (cut SJ-2 sta 10+00 to cut SJ-3 sta 18+00; ICWW mile 10.79 to mile 11.46). However, because of the physical characteristics of this channel reach, these results should typify the majority of the Palm Valley sediments. Analysis of these borings indicates that the sediment is fine, brown to dark drown silty sand, with a significant clay and organic component. Sediments from one sampling location at ICWW mile 11.46 were obtained in 1973 apparently by grab sample. These were characterized as soft black organic silt. From this very limited data it is anticipated that a portion of the material dredged within this reach will require specialized handling and de-watering procedures because of its pronounced silty character and organic content.

Conversely, the sediment which typifies the Matanzas vicinity shoal has been well characterized by the results of 20 core borings (cut SJ-60 sta 8+00 to cut SJ-63 sta 19+00; ICWW mile 51.27 to mile 54.31) taken over four of the last five maintenance events in the area. Here the shoal material has been uniformly described as fine to medium quartz sand, gray to tan in color, with varying minor fractions of shell fragments. This characterization is consistent with the assumption that the Waterway shoals in the Matanzas area result from littoral material introduced through the Inlet. A single boring location (ICWW mile 51.61) documented a thin strata of silty organic material when examined in 1982; however, the same approximate location sampled in 1985 produced only clean, tan, fine quartz sand. This suggests that the silty strata may have been removed in the previous maintenance of the

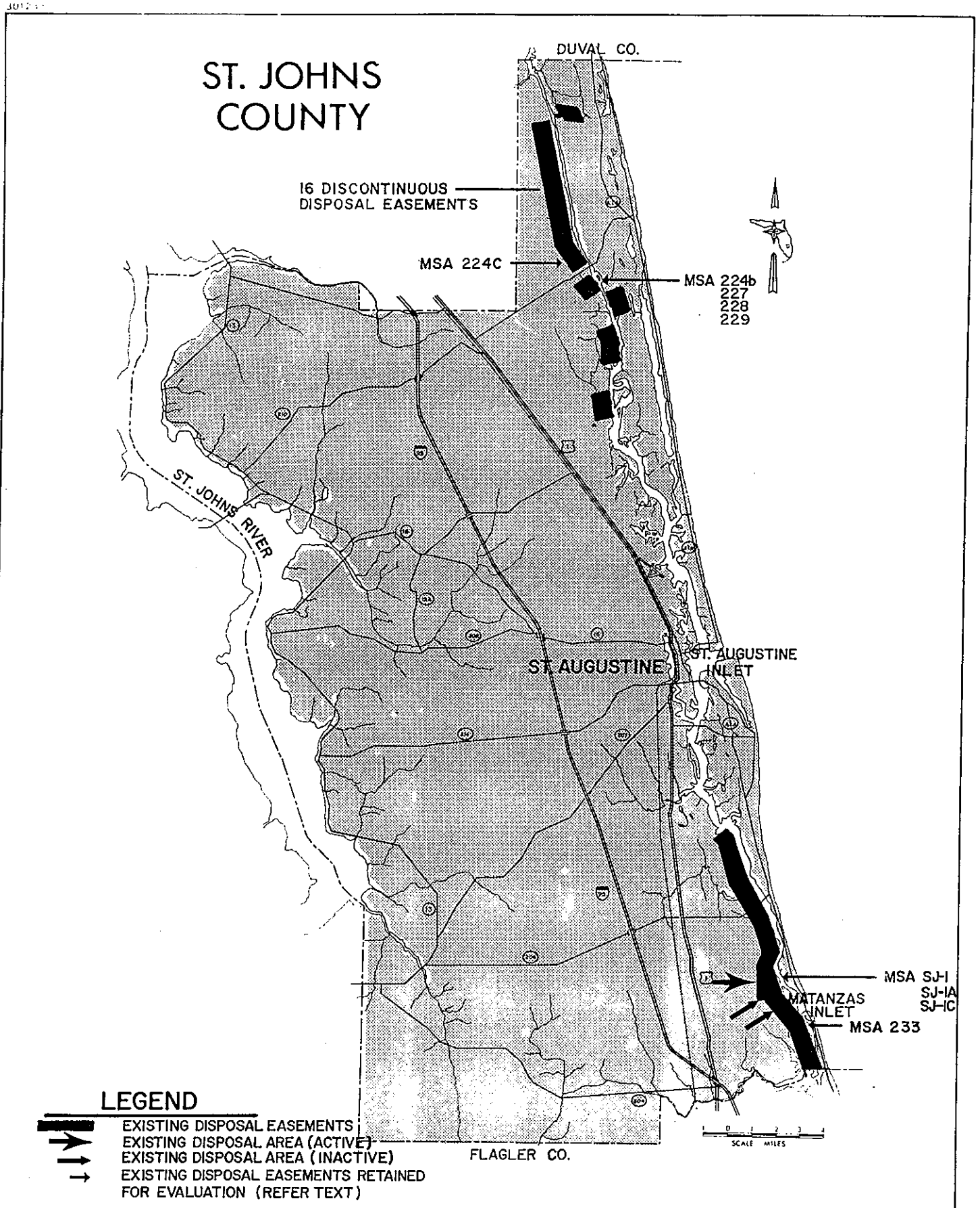
channel, and in any event was highly localized, perhaps resulting from a single storm event. The characterization of the Matanzas shoal material as predominantly fine to medium quartz sand was qualitatively supported by inspection of the disposal areas adjacent to this reach within disposal easements MSA SJ-1, 1A, 1C and MSA 233. The surface material visible at these disposal sites is generally fine sand, light tan to white in color and capable of supporting a variety of pioneering dune vegetation. Only a very minor deposition of finer material was evident within the depression which forms near the outlet weirs.

No sediment quality data is 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 Corps of Engineers' real estate maps yielded a total of 50 tracts within the project area to which the FIND holds either an existing easement or ownership, involving over 2470 acres (Figure 2-2). A preliminary evaluation of each site was then performed using three resources: (1) black and white aerial photography of nominal 1" = 800' scale, flown January-December, 1985 for the Corps of Engineers, Jacksonville District; (2) 1:24,000 scale (1" = 2,000') color-infrared aerial photography, flown March 1983 and February 1984, from the National High Altitude Photography Program of the U.S. Geological Survey; and (3) 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 criteria, combined with the desire to confine disposal to upland areas, eliminated all but 9 of these tracts from further consideration. The 9 tracts form three separate blocks, two in the vicinity of Palm Valley, and one adjacent to Matanzas Inlet. These are shown in Figure 2-2.

The 41 tracts eliminated were clearly not feasible from both an environmental and an operational standpoint. Within the northern part of the County, north of the S.R. 210 bridge and adjacent to the documented areas of shoaling in the vicinity of Palm Valley, the easements which are found east of the ICWW were judged in the



TAYLOR ENGINEERING INC
9086 CYPRESS GREEN DRIVE
JACKSONVILLE FLORIDA 32216

Figure 2-2: Existing Disposal Easements and Disposal Areas, Intracoastal Waterway, St. Johns County, Florida

PROJECT	C8905
REVISION	
SHEET	
DATE	9/30/89

Nassau-Duval study to possess inadequate upland area to merit further development as long-term disposal sites. These include one disposal area (MSA-204) used by the COE to receive dredged material during the most recent dredging cycle (1986). This site has a history of slumping and dike failure as a result of inadequate foundation conditions. South of this tract, also on the east side of the Waterway, two disposal easements, MSA 208 (tract No. 39) and MSA 211G (tract No. 1701E, COE No. 700 AE-1) were the subject of a preliminary feasibility analysis performed by Taylor Engineering, Inc. under contract to the FIND. It was determined that these sites did possess upland area sufficient to allow construction of containment facilities (15.87 acres and 32.78 acres respectively). However, other considerations limited the appropriateness of these sites for disposal site development. Foremost among these was that even when considered together, these sites do not possess sufficient capacity to satisfy the disposal requirements projected for this reach of the Waterway, nor do they adjoin upland to which expansion off-site would sufficiently increase their capacity. Moreover, site MSA 208 contains inadequate material on-site to construct the containment dikes and would require additional construction material to be obtained from an off-site source. Therefore, it was decided that the best use of these easements would be to arrange their release in exchange for acreage within an area more in keeping with the long-term goals of the present dredged material management program.

The remaining easements north of the S.R. 210 bridge, to the west of the Waterway and south of the easements already mentioned, all lie within the Dee Dot Ranch, owned by the Danov Corporation (J.E. Davis). These easements, obtained in the 40's and 50's, are typically 10-20 acres in size, and clearly were laid out without consideration of the presence of wetlands or other future permitting requirements. Indeed, since originally granted they have been modified to lie primarily within the wetland slough which backs the relic mounds of initial channel construction material which line this reach of the Waterway. All contain insufficient upland acreage (less than 7.5 acres) for dike construction or efficient utilization. Of the 19 disposal easements within this area only one, was retained for further evaluation. This is MSA 224C which lies 0.2 miles north of the S.R. 210 bridge. Although it possesses in itself minimal upland area (6.47 acres), it is contiguous with additional uplands (total - 50.08 acres) to which expansion appears feasible.

Southward from the S.R. 210 bridge (ICWW mile 18.96) to the vicinity of Deer Creek (ICWW mile 25.47, or approximately 10 miles north of the Vilano Beach bridge) a total of 9 disposal easements are found. From a point 0.17 miles south of the S.R. 210 bridge, a contiguous group of four easements (MSA 224b, 227, 228, 229) extends southward 0.64 miles along the Waterway. Although divided east to west by a tidal creek/open water area, each of two upland portions contains sufficient on-site and adjacent upland area to justify further evaluation. The more northerly of the two, consisting of MSA 224b, 227 and a portion of 228, contains approximately 9.91 acres of upland within the easements. An additional 8.56 acres of contiguous upland exists off-site for a total potential upland acreage of 18.47. The more southerly upland area, consisting of MSA 229 and the major portion of 228, contains 24.66 acres of upland within the easements, with the potential to expand off-site to a total of 30.10 acres. The 5 remaining easements within this reach south to Deep Creek are predominantly submerged lands, both open water and salt marsh. The limited upland area which these easements contain is restricted to isolated spoil islands, typically less than 3 acres in size. Such areas offer little potential for disposal site development and therefore will be eliminated from further consideration.

From Deep Creek, southward along the Tolomato and Matanzas Rivers through St. Augustine, to a point approximately 2 miles north of the S.R. 206 (Crescent Beach) bridge, a distance of over 20 miles, no disposal easements exist. This is a consequence of the channel in this reach being natural, and never having required dredging either for construction or maintenance. However, as previously discussed (Section 2.1.2) the most recent centerline survey has identified one area of shoaling within this reach, immediately north of the Vilano Beach Bridge.

Continuing southward, over 1220 acres of disposal easement extend along the western boundary of the channel right-of-way to the southern St. Johns County line. These easements are primarily under the ownership of the State of Florida (T.I.I.F.) and include significant portions of submerged lands, both open water and salt marsh or unvegetated tidal flats. The northern portion of the major disposal easement, MSA SJ-1 (total area - 631.92 acres) contains only minor spoil islands, each less than 1 acre in size, which resulted from original channel construction or early channel maintenance.

In the vicinity of Matanzas Inlet, however, significant upland islands formed of dredged material have resulted from the original construction of the artificial bypass channel as well as the extensive dredging which has been required to maintain this channel. Five of these islands exceed 20 acres, with two additional mounds of greater than 10 acres. These islands all appear to have originated from the unconfined placement of dredged material within areas of open water or salt marsh. The accumulation of material has allowed the more recent construction of rudimentary containment dikes on three of the four largest of these. The fourth of these areas constitutes the northern end of Rattlesnake Island (MSA 232) adjacent to Fort Matanzas, and now lies within the Fort Matanzas National Monument. No additional dredged material may be placed within this area.

No information was found in Jacksonville District (COE) archival records to conclusively establish the last use of the two more southerly of the three confined disposal areas, but it is believed to be prior to 1978. The southernmost area, within MSA 233, appears to be the more recently used and still contains outlet works (i.e., internal weir, outlet pipes) from the last operation. Both sites are now close to the capacity provided by their minimal dikes. The dikes on both areas border directly on marsh areas or open water and show evidence of erosion along the Waterway. Both of these former disposal sites possess upland sufficient to suggest the feasibility of their continued use (26.01 and 20.65 acres) if their capacities were increased by raising the dikes. However, several additional considerations limit their utility. The primary drawback of these areas is their insular nature. 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 re-designed containment dikes and the adjacent marsh would result in a significant reduction of disposal area. Lastly, the projected capacity for each site, to be addressed in the following section, represents only a minor portion of the total projected disposal requirements for the ICWW channel in the vicinity of Matanzas Inlet. Therefore, the reconstruction and continued use of these two former disposal areas does not appear to serve the program objectives of long-term dredged material management.

The major disposal site within the Matanzas Inlet reach of the Waterway is a 108.8 acre area of upland originally formed by the unconfined placement of dredged material. This area is commonly referred to as MSA SJ-1, although it lies within

three adjacent disposal easements, MSA SJ-1, SJ-1A, and SJ-1C. Prior to 1973 a 41.0 acre diked containment basin was constructed within the larger upland area. Since 1978 all material dredged from the Waterway in the Matanzas area has been placed within this confined disposal basin. This was accomplished by using the dewatered dredged material to progressively raise the crest height of the dikes. Analysis of topographic surveys performed prior to the last maintenance operation in 1987, combined with the volume of material known to have been placed in MSA SJ-1, indicates that the removal of over 1.4 million cubic yards of predominantly fine to medium quartz sand would be required to return the area to the mean grade elevation immediately outside the dikes (approximately +12 ft. NGVD). The existing dike crest elevation is roughly +33 ft. NGVD, or 21 ft. above the site grade. The basin is presently at or near capacity, with only a minor depression remaining adjacent to the weirs.

Two factors make the continued use of site MSA SJ-1 more feasible than the two previously discussed spoil islands to the south. First, the greater upland area of MSA SJ-1 would allow the expansion of the containment basin from the present 41.0 acres to approximately 78.5 acres while still providing a reasonable buffer between the containment dikes and the adjacent wetlands. Second, it appears possible to improve the existing road access to the site. A dirt road or trail now enters the southwestern corner of the site by crossing approximately 200 feet of high salt marsh. This access could be improved by the addition of a raised road bed with culverts. The section of the existing access road which crosses the marsh area is within an existing disposal easement (MSA SJ-1C), although the approach follows a private logging road. Therefore, disposal area MSA SJ-1 appears to be the most appropriate of the existing disposal areas in the vicinity of Matanzas Inlet for redevelopment and continued utilization.

2.3 Existing Disposal Capacity and Projected Disposal Shortfall

To further evaluate the existing disposal easements, an analysis was performed to determine the maximum potential capacity of the easements which contain useable upland area. 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 the USFWS wetland inventory maps. Analysis was then carried out to establish whether the useable upland area could provide adequate

material for dike construction, and if the resulting capacity within this area supported further consideration of the site. A set of relationships were developed (APPENDIX A) in which the required volume of dike material, the volume of dike material available on-site, and the resulting disposal 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 15.0 ft. crest elevation above grade, a 1V:3H side slope, a 12.0 ft. crest width, an excavated grade elevation of +4.0 ft. NGVD., and a minimum freeboard plus ponding allowance of 4.0 ft. 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 U.S. Geological Survey Quadrangle maps.

The results of this analysis are presented in Table 2-3. Only the projected capacities of the easements that proved feasible for further expansion or continued use as discussed in the previous section are included in the existing disposal capacity of the project area. All but three of the easements which were eliminated in this process possess minimal disposal capacity as well as insufficient dike material on-site. The remaining three, MSA 208 and 211G in the northern portion of the project area and MSA 233 in the vicinity of Matanzas Inlet, were eliminated for other reasons previously discussed.

Although all existing easements retained for further evaluation are centered in those channel reaches demonstrating a continuing pattern of shoaling, the magnitude of the projected 50-year disposal requirement indicates that significant shortfalls in disposal capacity remain. Within the northern portion of the St. Johns County study area, where the projected disposal requirement is on the order of 1.8 million cubic yards (m.c.y.), the maximum estimated disposal capacity within the five easements which have demonstrated potential for disposal site development is only 500,000 c.y. This leaves an existing disposal shortfall of 1.3 m.c.y. It should be noted that the easements immediately north and south of the S.R. 210 (Palm

TABLE 2-3: INVENTORY OF EXISTING DISPOSAL EASEMENTS

INTRACOASTAL WATERWAY, ST. JOHNS COUNTY, FLORIDA

F.I.N.D. Designation	C.O.E. Tract No.	ICWW Mile	Useable Upland Acreage	Disposal Capacity (c.y.)	Comments
MSA 208	39	11.32	15.87	129,192	Presently involved in negotiated release, refer to text
MSA 211G	700 AE-1	12.09	32.78	430,683	Presently involved in negotiated release, refer to text
MSA 211B	1700 E1	12.81	4.49	32,839	Insufficient upland acreage for efficient use of site
PSA 211C	1700 E4	13.22	0.40	-----	Minimal upland present within easement
PSA 211D	1700 E7	13.54	0.78	-----	Minimal upland present within easement
PSA 211E	1700 E10	14.02	0.41	-----	Minimal upland present within easement
PSA 213N	1800 E1	14.54	1.65	-----	Insufficient upland for efficient use of site
PSA 213S	1800 E3	14.59	2.42	------	Insufficient upland for efficient use of site
PSA 214N	1800 E6	14.79	4.31	31,582	Insufficient upland for efficient use of site
PSA 214S	1800 E8	14.91	3.10	23,072	Insufficient upland for efficient use of site
PSA 216A	1800 E10	15.25	4.01	29,483	Insufficient upland for efficient use of site
PSA 216B	1800 E13	15.67	7.51	53,046	Insufficient upland for efficient use of site
PSA 216C	1800 E16	16.16	6.77	48,628	Insufficient upland for efficient use of site
PSA 218E	1900 E1	16.64	6.38	45,942	Insufficient upland for efficient use of site
PSA 218W	1900 E3	16.64	6.86	49,247	Insufficient upland for efficient use of site

F.I.N.D. Designation	C.O.E. Tract No.	ICWW Mile	Useable Upland Acreage	Disposal Capacity (c.y.)	Comments
PSA 219	1900 E5	17.14	7.29	52,202	Insufficient upland for efficient use of site
MSA 220B	B 207E	17.59	7.29	52,202	Insufficient upland for efficient use of site
MSA 223A	B 210E	18.01	0.0	-----	Contains no useable upland
MSA 223B	B 211E	18.01	2.95	22,008	Insufficient upland acreage for efficient use of site
MSA 224B	B 212E	18.12	8.00	57,070	Insufficient upland acreage for efficient use of site
MSA 224C	B 213E	18.58	6.47	46,562	Insufficient upland acreage for efficient use of site
MSA 224b	81	19.24	9.91	70,107	Group of small connected easements, expansion to adjacent upland possible, potential road access exists, only acreage in northern tip of MSA 228 included in group total, group merits furhter consideration
MSA 227	82	19.21			
MSA 228	83	19.21			
MSA 229	84	19.39	24.66	169,341	Adjoins southern tip of MSA 228, combined acreage shown, potential road access exists, expansion to adjacent upland possible, merits further consideration
MSA 230	87	19.86	8.15	58,097	Insufficient upland acreage, not accessible by road
MSA 231	B 216E	20.97	6.24	44,977	Submerged, with spoil islands as only upland, not of sufficient size, no road access
MSA 231A	88	20.97	0.0	------	Contains no useable upland
MSA 231C	89	22.04	0.0	------	Contains no useable upland
MSA 231D	B219E	22.04	0.0	------	Contains no useable upland

F.I.N.D. Designation	C.O.E. Tract No.	ICWW Mile	Useable Upland Acreage	Disposal Capacity (c.y.)	Comments
MSA 231B2	2300E	24.84	0.0	------	Contains no useable uplnad
MSA 231B	B 218E	22.04	10.32	72,897	Submerged, with spoil islands as only upland not of sufficient size, no road access
MSA SJ-1	91	45.92	108.77	1,367,000	Acreage and capacity shown is for large existing disposal site "SJ-1" with potential road access, easement MSA SJ-1 also contains 19.65 acre spoil island which has no road access
MSA SJ-1A	93	51.50			
MSA SJ-1C	B 222E	51.06			
MSA SJ-1B	94	52.12	0.0	------	Contains no useable upland
MSA 233	107	52.74	26.01	178,352	Existing spoil disposal site west of Matanzas Inlet, no road access
MSA 233A	1701E	53.75	7.59	54,261	Insufficient upland acreage
MSA 236A	102	54.02	0.0	------	Contains no useable upland
MSA 237	104	54.63	41.84	283,554	Existing spoil disposal site presently filled to near capacity, inaccessible by road
MSA 237A	105	55.17	4.90	33,160	Insufficient upland acreage, inaccessible by road

Valley) Bridge (MSA 224C, and MSA 224b, 227, and 228, respectively) are retained because of the potential to expand to adjacent upland areas. By themselves, these easements suffer from the same insufficiency of disposal capacity and on-site dike material that eliminated other easements. Only MSA 229 combined with the adjacent uplands within the southern portion of MSA 228 possesses adequate material on-site sufficient to construct an efficient containment basin (capacity, 400,000 c.y.).

The rapid and extensive shoaling which continues within the southern portion of the study area, adjacent to Matanzas Inlet, results in a projected 50-year disposal requirement of over 7 million cubic yards of predominately fine to medium quartz sand. Continued use of the existing disposal area MSA SJ-1 would first require the removal of approximately 1.4 m.c.y. of material. Expansion of the site and re-construction of a containment basin as previously discussed would regain an equivalent capacity (1.36 m.c.y.). Re-development of the two more southerly disposal sites which demonstrate the greatest disposal potential would add only an additional 1 m.c.y. capacity, leaving a disposal shortfall of approximately 4.6 million cubic yards. Indeed, providing the full projected 50-year disposal requirement would require the commitment of over 440 acres of upland for the containment basin alone. It is apparent that the extreme shoaling within the Waterway channel in the vicinity of Matanzas Inlet requires a re-assessment of the concept of confined upland disposal and the evaluation of alternate strategies. This will be discussed in the following section.

3.0 DISPOSAL ALTERNATIVES

3.1 Disposal Concept

Inherent in every dredged material disposal operation is a set of guiding principles which reflect the attitudes and constraints of the project sponsor, the project engineer, and the contractor. Historically, these principles (i.e., the "Disposal Concept") have not been explicitly stated, and have evolved primarily through the desire to maximize operational efficiency and short-term economy. Thus, minimal consideration was given to environmental issues or indeed any long-term goals. Within Florida, including St. Johns County, this approach has resulted in the numerous small mounds and islands which line the Waterway as the dredging contractor sought to place the material as close as possible to the area being dredged. For the extensive salt marsh/estuarine system which characterizes the Intracoastal Waterway in northeast Florida, this concept often led to the unconfined disposal of the dredged material within the marsh. The effluent from these areas would then return uninhibited to the receiving waters, its elutriate and turbidity loads undiminished.

With increased environmental awareness this approach is no longer desirable; nor is it possible, given present day agency reviews and permitting requirements. Concerns about water quality have led to the disposal of dredged material within diked areas to increase retention time and insure that return water quality meets established standards. Wetlands, particularly salt marsh areas, have come to be recognized as among the most biologically productive of ecosystems, and a resource that must be conserved. However, preservation of marsh requires that upland disposal sites be acquired, and in a high growth corridor such as that which exists along the Waterway, 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 disposal concept which addresses both environmental and operational concerns. As such, it constitutes the foundation upon which the disposal plan is built.

3.1.1 Disposal Concept as Developed for Nassau-Duval Counties

The basis for the disposal concept adopted for St. Johns County was initially developed as part of the pilot study addressing similar needs of the Waterway within Nassau and Duval Counties. The three fundamental principles which constitute that concept are as follows:

(1) All future disposal will be confined to upland areas.

(2) Sites will be established to provide centralized disposal in a minimum number of locations per operating reach of Waterway as determined by the analysis of historical data.

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

These principles provided the basic framework within which various disposal alternatives and candidate disposal sites could be identified and subsequently evaluated. In so doing, minimum acceptance standards were established and a focus was given to the planning process. Moreover, the early establishment of the disposal concept facilitated the specification of a meaningful set of individual site evaluation criteria later in the project.

The utility of the above set of principles is demonstrated by the successful implementation of a workable dredged material management plan based on those principles. This process is now underway within Nassau and Duval Counties.

Conditions within the St. Johns study area are very much the same as to those addressed in the pilot Nassau-Duval study and suggest that a similar disposal concept be applied. These similarities include the physiography of the Waterway and the coastal areas through which it passes, the relative level of waterfront development, and the quantity and quality of sediment to be dredged and disposed of. A brief review of the Nassau-Duval disposal concept follows.

The first principle of the disposal concept as originally developed for the Nassau-Duval segment of the Waterway is the exclusive use of upland sites for dredged

material disposal. It is recognized that the use of upland areas for this purpose has its own set of environmental liabilities, most notably the loss of upland habitat. However, the filling of sensitive wetland and transitional areas has been judged to carry a greater long-term environmental cost, and thus these areas have been granted a greater degree of legislative and regulatory protection. It must be noted that in the vicinity of the Waterway in northeast Florida the total avoidance of all wetland impacts as part of the disposal site selection process is virtually impossible. Examples of minor wetland impacts which are typically very difficult to avoid include marsh pipeline crossings, and minimal encroachment on isolated wetland areas to provide realistic site geometries for dike construction. However, by limiting future disposal to predominantly upland areas the majority of the adverse wetland impacts associated with past dredged material disposal operations can be prevented.

The second principle of the disposal concept as originally developed has both operational and environmental advantages. The centralization of disposal within fewer sites has the operational advantage of locating these sites in a logical manner so as to efficiently serve individual reaches of the Waterway as defined by the analysis of historical data. Moreover, the use of fewer, larger sites reduces the total acreage required through economies in dike area requirements. It also eliminates the proliferation of smaller sites each with their own outlet works and attendant water quality considerations. Thus, the use of centralized disposal sites is considered to be an important element of the disposal concept.

Active management of disposal sites as permanent operating facilities complements the two preceding principles. It also represents a significant departure from historical practice in which sites were more or less abandoned following limited usage. By operating the sites as continuing facilities a suite of management procedures and techniques can be implemented, all of which have 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 the vegetation of dikes to reduce the visual impact of the site. Most importantly, the permanency of the sites implies that ways be explored of removing the dewatered material from the site to be used as construction material, or simply to be stored in less ecologically sensitive upland areas further inland.

Road access, existing or potential, is therefore essential. By not regarding the sites as one-time holding facilities, as in the past, but as intermediate processing areas, it is hoped that they will serve the needs of the waterway in perpetuity. This type of activity in combination with effective site management measures will establish the long term material handling facilities required.

3.1.2 Modification of the Disposal Concept – St. Johns County

The disposal concept which evolved from the previous Nassau-Duval study, provided the framework for the development of a strategy appropriate to the unique requirements of the St. Johns County study area. However, these unique requirements, in turn, mandate that modifications be made to the original disposal concept as discussed in the previous Section. The uniqueness of these requirements derives from the extremely uneven spatial distribution of shoaling within the St. Johns County segment of the Waterway. To accommodate this the disposal concept was modified as described in the following paragraphs.

The Matanzas Inlet reach of the Waterway presents a set of circumstances which precludes the sole reliance upon confined upland disposal as a disposal strategy. As discussed in Sections 2.1.2 and 2.2, the rapid and extensive shoaling of the Waterway channel in this area has resulted in a projected 50-year disposal requirement which far exceeds any similar reach addressed thus far. To accommodate this would require the dedication of over 440 acres of upland adjacent to the Waterway. However, existing residential development and the Fort Matanzas National Monument along the eastern side of the ICWW and the broad expanse of marsh to the west limit the availability of upland acreage in such quantity. Moreover, of the existing disposal islands which lie within the marsh to the west of the Waterway, only the most recently active disposal site, MSA SJ-1, demonstrates the potential for expansion and the possibility for establishing adequate road access. However, the redevelopment and continued use of this area would first require the removal of approximately 1.4 million cubic yards of predominantly sandy material to gain a similar increase in disposal capacity. However this volume represents less than 20 per cent of the disposal requirement for the Waterway in this area. Thus, a realistic alternative to confined upland disposal is required to satisfy the 50-year disposal requirement near Matanzas Inlet.

Several considerations suggest that the concept of beach disposal is such an alternative. Foremost among these is the quality of material to be dredged from the Waterway channel in this area. Analysis of core borings obtained from documented shoals within this reach over the last 19 years indicate that the shoal material is predominantly fine to medium quartz sand, clean, gray to tan in color, with traces of shell. Silt or clay forms only a minor component within isolated strata. This composition is characteristic of littoral material introduced to the Waterway through the Inlet. The degree to which these channel sediments are compatible with the physical characteristics of the native beach material has not been determined. However, a high degree of compatibility is anticipated as a result of their apparent derivation from the same source.

The second consideration which suggests beach disposal to be a viable alternative is the presence immediately south of the Inlet of a critically eroded shoreline. Erosion in the vicinity of Summerhaven led the Corps of Engineers to construct an extensive granite revetment to protect S.R. A1A prior to its relocation westward. In addition, approximately 1.5 miles south of the revetment, erosion of the shoreline fronting the Marineland Marine Park resulted in the construction of a series of groins in an attempt to stabilize the beachfront. Most recently, a northeaster in March, 1989 succeeded in overwashing the frontal dune immediately south of the reveted beachfront section and established a short-lived secondary inlet connecting to the Matanzas River. Beach disposal of sediment captured by the Matanzas Inlet would constitute a needed restoration and continued re-nourishment of an historically eroded shoreline in this area.

Other factors which support the viability of beach disposal include the proximity of the inlet which makes the project operationally feasible, and the desire by the State of Florida to encourage mitigation of inlet-related erosion by returning all compatible material to the littoral system. It should be noted that current plans for the next scheduled cycle of channel maintenance by the COE, which is now entering the design phase, anticipate placing the dredged material on the beach south of the inlet. More specific design parameters related to the beach disposal of Waterway maintenance material will be addressed in Section 4.0 and in Appendix B.

Realistically, material quality and operational considerations of pumping distance and economy dictate the use of a combination of beach disposal and confined

upland disposal for the Waterway near Matanzas Inlet. It is therefore recommended that an appropriate upland site be retained and developed as a confined disposal area to complement a primary strategy of beach disposal.

Circumstances within other areas of St. Johns County are in marked contrast to those encountered at Matanzas Inlet. Shoaling which has occurred northward from Matanzas Inlet to the vicinity of Palm Valley, a distance of over 32 channel miles, represents less than 2 per cent of the total documented volume for the project area. Within the central 18.80 channel miles no dredging for channel construction or maintenance has ever been performed. Were the identification and acquisition of disposal sites to be based solely on historical dredging activity, no sites would be required within this reach. However, a primary objective of the FIND Fifteen Year Atlantic Intracoastal Waterway Maintenance and Management Plan is to provide a permanent infrastructure to serve the future maintenance needs of the Waterway. A plan which leaves a significant reach of the Waterway with no disposal capability could in the future be proven deficient should future development, extreme storm event, or other unforeseen occurrence alter patterns of sedimentation. As mentioned earlier, the variability in patterns of sedimentation has been demonstrated in the recent documentation of a shoal, albeit minor, immediately north of the Vilano Beach Bridge in an area which had never before required dredging. For these reasons it was considered appropriate and necessary to recommend the acquisition of one or more suitable upland sites of minimum size to serve this central area of the Waterway in St. Johns County. The location of these sites would be determined both by availability and by the operational requirement of a realistic pumping distance to the site. The specific identification, evaluation and continuing operation of these sites should be consistent with the original disposal concept.

The Palm Valley channel reach within St. Johns County is the area most similar to conditions documented in the previous Nassau-Duval study. Indeed, this reach is almost identical to the southernmost reach within Duval County in physiography, channel geometry, sediment quality, availability of suitable upland area adjacent to the Waterway, and projected disposal requirement. Therefore, within this area no modifications are required to the basic disposal concept of centralized confined upland disposal areas. Each site is sized to provide the projected 50-year disposal volume as determined from the completed historical analysis, and managed as a permanent facility.

3.2 Delineation of Channel Reaches

With the disposal concept thus defined, logical channel reaches were then established. The positioning and length of each channel reach was determined by considerations of maximum pumping distance, projected disposal requirements, and the anticipated disposal 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 historical dredging/recent shoaling as presented in Table 2-1 by channel reach. Also presented in Table 3-2 for each reach are the total dredging or shoaling volumes and 50-year disposal requirements. 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 the northern St. Johns County project boundary, 2.31 miles south of the St. Johns County line (ICWW mile 12.50) to the S.R. 210 bridge (ICWW mile 18.96). This reaches covers almost all of the area of documented shoaling within the northern part of the County. The S.R. 210 bridge demarcates a operationally desireable pumping distance of 6.46 miles, appropriate to a reach in which shoaling is well distributed, and corresponds to a point of discontinuity in reported shoaling. The projected 50-year disposal requirement for this reach, 1.82 m.c.y., is equivalent to that of the reach to the immediate north which was addressed in the previous Nassau-Duval study.

Reach II continues southward from the S.R. 210 bridge to the vicinity of Deep Creek (ICWW mile 25.47), a distance of 6.51 miles. Shoaling within this reach has been significantly less than in Reach I, with a projected 50-year disposal requirement of approximately 124,000 c.y. and only one maintenance event (1960, ICWW mile 22.88 to mile 23.32) over the 12 ft. project history. The shoaling which has occurred more recently has been very localized, with reoccurrence of a minimal shoal is the same area previously maintained. A second shoal, also very minor, has been recently documented 0.43 miles south of the S.R. 210 bridge.

TABLE 3-1: DEFINITION OF CHANNEL

REACHES, INTRACOASTAL WATERWAY, ST. JOHNS COUNTY

	Reach	ICWW Mileage	From Cut	From STA	To Cut	To STA	Length
(I)	Palm Valley to S.R. 210	12.50 - 18.96	SJ-4	35+00	SJ-8	44+80	6.46
(II)	S.R. 210 to Deep Creek	18.96 - 25.47	SJ-8	44+80	SJ-15	0+00	6.51
(III)	Deep Creek to Bridge of Lions	25.47 - 37.71	SJ-15	0+00	---	---	12.24
(IV)	Bridge of Lions to S.R. 206	37.71 - 47.61	---	---	SJ49A	18+56	9.90
(V)	S.R. 206 to Marineland	47.61 - 55.71	SJ-49A	18+56	F-2	0+00	8.10
	Total Project Length ---------->						43.21 mi

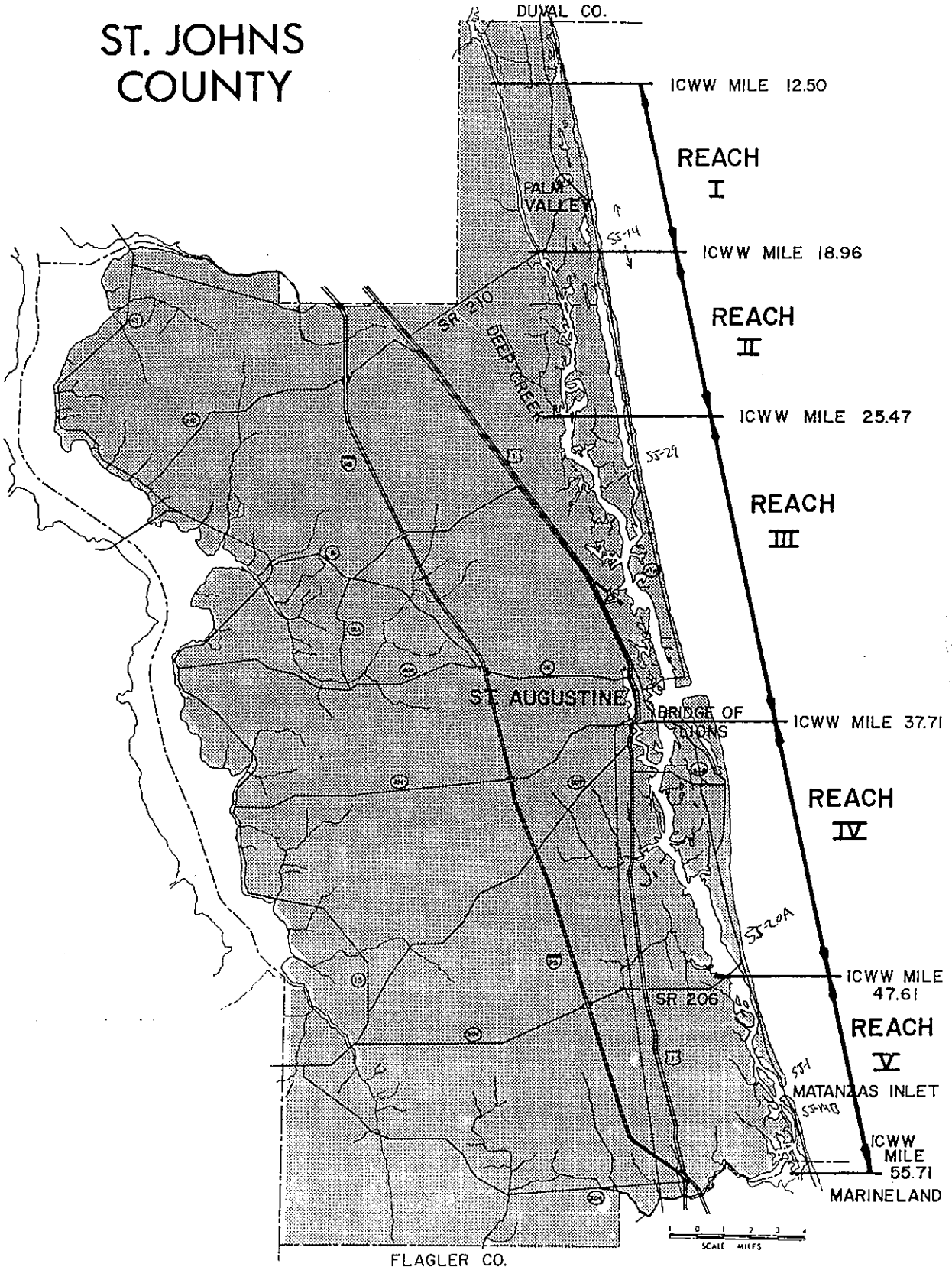


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Figure 3-1: Delineation of Operational Channel Reaches, Intracoastal Waterway, St. Johns County, Florida

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TABLE 3-2: SUMMARY BY CHANNEL REACH OF HISTORICAL MAINTENANCE DREDGING/RECENT SHOALING - ST. JOHNS COUNTY

1952 - 1987

Reach	PREVIOUS MAINTENANCE/RECENT SHOALING									REACH SUMMARY				
	To ICWW Mileage	From ICWW Mileage	From Cut Sta		To Cut Sta		Length (mi.)	Year	Design Vol (c.y.)	Pay Vol. (c.y.)	Total Vol (c.y.)	Vol/Yr. (c.y.)	Vol/Yr/Mi (c.y.)	50yr. Unbulked Vol (c.y.)	50yr. Disposal Vol (c.y.)
I: Palm Valley to S.R. 210; ICWW Mile 12.50 to 18.96	12.40	12.64	SJ-4	30+00	4	43+00	0.24	1987+	12,765	(15,196)					
	12.72	17.69	4	47+00	7	10+00	4.97	1987+	359,874	(428,421)					
	16.36	16.60	6	30+50	6	43+50	0.25	1967	14,100	(16,920)					
	17.88	18.85	7	20+00	8	39+00	0.97	1987+	35,252	(41,967)					
	18.11	18.83	7	32+00	8	32+00	0.73	1973	47,000	90,905	593,409	16,955	2,625	847,727	1,822,613
II: S.R. 210 to Deep Creek; ICWW Mile 18.96 to 25.47	19.39	19.68	9	8+00	9	23+00	0.29	1987+	3,514	(4,183)					
	22.88	23.32	12	33+00	13	5+00	0.45	1960	22,000	29,061					
	23.25	23.34	13	1+00	13	6+00	0.09	1987+	6,005	(7,149)	40,393	1,154	177	57,704	124,064
III: Deep Creek to Bridge of Lions; ICWW Mile 25.47 to 37.71	35.17	35.36	---		----		0.19	1987+	2,398	(2,855)	2,855	82	7	4,079	8,769
IV: Bridge of Lions to S.R. 206; ICWW Mile 37.71 to 47.61	No Maintenance Performed, No Shoaling Indicated.														

Reach	To ICWW Mileage	From Cut Sta	To Cut Sta	Length (mi.)	Year	Design Vol (c.y.)	Pay Vol. (c.y.)	Total Vol (c.y.)	Vol/Yr. (c.y.)	Vol/Yr/Mi (c.y.)	50yr. Unbulked Vol (c.y.)	50yr. Disposal Vol (c.y.)
	PREVIOUS MAINTENANCE/RECENT SHOALING							REACH SUMMARY				
V: S.R. 206 Marineland; ICWW Mile 47.61 to 55.71	51.03 - 51.90	SJ-59 19+00	61 14+00	0.87	1983	288,000	287,560					
	51.11 - 51.84	59 23+00	61 11+00	0.73	1978	260,000	312,776*					
	51.12 - 51.61	60 0+00	60 60+00	0.49	1964	66,900	(80,280)					
	51.12 - 51.76	60 6+00	61 7+00	0.64	1958	(53,372)	63,538*					
	51.23 - 52.73	60 6+00	61 58+00	1.49	1987	188,000	(225,600)					
	51.23 - 51.72	60 6+00	61 5+00	0.49	1962	105,000	103,504*					
	51.25 - 51.72	60 7+00	61 5+00	0.47	1960	102,000	87,727*					
	51.30 - 51.40	60 9+50	60 15+00	0.10	1967	15,700	20,240					
	51.32 - 51.83	60 10+50	61 10+50	0.51	1973	86,000	112,447					
	51.32 - 52.32	60 10+50	61 36+50	1.00	1963	(99,010)	117,869					
	51.47 - 51.61	60 18+50	60 25+75	0.14	1968	21,400	59,542					
	51.65 - 51.86	61 1+00	61 12+00	0.21	1987+	2,403	(2,861)					
	52.32	61 36+50			1966	(5,974)	7,112					
	52.39 - 52.79	61 40+00	61 61+00	0.40	1970	52,500	56,668*					
	52.39 - 53.62	61 40+00	62 35+00	1.23	1978	174,000	185,632*					
	52.39 - 53.01	61 40+50	62 2+50	0.61	1973	46,000	76,266					
	52.46 - 52.71	61 44+00	61 57+00	0.25	1960	16,000	46,664*					
	52.48 - 52.73	61 45+00	61 58+00	0.25	1958	(20,849)	24,820*					
	52.52 - 52.67	61 47+00	61 55+00	0.15	1987+	19,826	(23,602)					
	52.52 - 52.69	61 47+00	61 56+00	0.17	1962	14,000	35,909*					
	52.85 - 53.09	61 64+50	62 7+00	0.24	1970	31,500	34,000*					
	53.43 - 53.57	62 25+00	62 32+00	0.13	1958	(10,841)	12,906*					
	53.82	62 45+50			1966	(21,717)	25,853					
	53.99 - 54.48	63 2+00	63 28+00	0.49	1958	(40,863)	48,647*					
	54.02 - 54.44	63 3+80	63 26+00	0.42	1970	39,700	59,501*					
	54.03 - 54.54	63 4+00	63 31+00	0.51	1960	19,000	18,967*					
	54.10 - 54.54	63 8+00	63 31+00	0.44	1978	52,000	(62,207)					
	54.65 - 55.46	63 37+00	F1 2+00	0.81	1987+	37,776	(44,971)					
	54.69 - 54.84	63 39+00	64 6+00	0.16	1960	4,000	5,950*					
	55.32 - 55.53	64 31+00	F1 6+00	0.22	1978	31,000	(37,200)					
	55.38 - 55.57	64 34+50	F1 8+00	0.19	1967	14,000	9,441*	2,290,260	65,436	8,079	3,271,800	7,034,370

Note: Parenthetical values based on derived relationship: Pre-dredging estimate = 0.84 (Pay Volume)

* : Only total or combined dredging volume given in record; apportionment based on relative length of individual shoal.

\+ : Estimated shoaling volumes based on centerline survey, dated 10/87

From the vicinity of Deep Creek southward to the S.R. 206 (Crescent Beach) bridge, a distance of 22.34 miles, no channel maintenance has ever been performed. Two reaches have been designated within this channel segment. The first, Reach III, extends southward 12.24 miles from Deep Creek through St. Augustine Harbor to the Bridge of Lions (ICWW mile 37.71). The second, Reach IV, continues southward 9.90 miles to the S.R. 206 bridge (ICWW mile 47.61). Within Reach III a minimal shoal has been recently documented 0.38 miles north of the Vilano Bridge. This shoal (2,855 c.y.) constitutes the entire projected disposal requirement for the Reach (8,769 c.y.). For Reach IV no projection of a future disposal requirement is possible because of the lack of historical shoaling since 1952.

It is recognized that the greater lengths of Reaches III and IV (12.24 and 9.90 miles, respectively) result in greater pumping distances and associated costs of channel maintenance. However, this approach was considered to be acceptable based on several considerations. These included the difficulty of identifying suitable upland disposal areas within the heavily developed St. Augustine metropolitan area; the increased total project cost associated with acquiring, developing, and maintaining additional sites; and the relatively infrequent, minimal maintenance anticipated within these reaches.

The southernmost reach of the St. Johns County study area, Reach V, extends southward from the S.R. 206 bridge to a point 0.28 miles south of the St. Johns - Flagler County line in the vicinity of Marineland (ICWW mile 55.71), a distance of 8.10 miles. This reach encompasses all of the shoaling associated with Matanzas Inlet, resulting in by far the largest projected disposal requirement of the five project reaches (7.03 m.c.y.). This volume represents 78% of the total projected disposal requirement of the St. Johns County project area. All documented channel maintenance or shoaling within this reach has occurred in the southernmost 4.68 miles (ICWW mile 51.03 to mile 55.71). The extremely rapid rate of shoaling has resulted in 13 separate maintenance operations over project history, yielding a mean maintenance frequency of 1 event every 2.7 years. It is anticipated that beach disposal will be the primary disposal strategy for this reach, complemented by the redevelopment of the existing site MSA SJ-1 as a confined upland disposal area as required. However, because of the magnitude of the disposal requirement within this reach, the identification and evaluation of additional alternative upland sites was also considered necessary, in the event that either beach disposal or the

redevelopment of MSA SJ-1 prove not to be feasible. The process of identifying and evaluating candidate alternative sites is addressed in the following sections.

3.3 Identification of Candidate Sites

The definition of the disposal concept and logical channel reaches provided a necessary focus to the selection of appropriate candidate disposal sites. 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.

The process began with the identification of all sites within reasonable distance of the Waterway which had the potential to satisfy the basic requirement of centralized disposal in an upland area, with existing or potential road access to meet the demands of on-going disposal site management. Additional environmental considerations, such as the quality of existing habitat, the diversity of vegetation, or the degree to which the area had been previously disturbed were not included in this initial evaluation. 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, did eliminate sites from further consideration. A total of 20 candidate sites, or two to five sites within each reach, were selected. These are shown in Figure 3-2. Three of the sites, SJ-10, SJ-26, and SJ-27, incorporated the useable upland portions of existing easements MSA 224C, 224B, 227, 228, and 229, as discussed in Section 2.2.

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 disposal capacity of each site was then made by the same method described in Section 2.3 based on the most efficient realistic dike configuration attainable within the delineated upland. This was done to insure that each site possessed potential capacity appropriate to the requirements of the reach it was intended to serve. With the exception of Reach V, the total potential capacity of the candidate sites within each reach greatly exceeded the corresponding disposal requirement. Within Reach V, where beach disposal is a viable alternative, it was considered

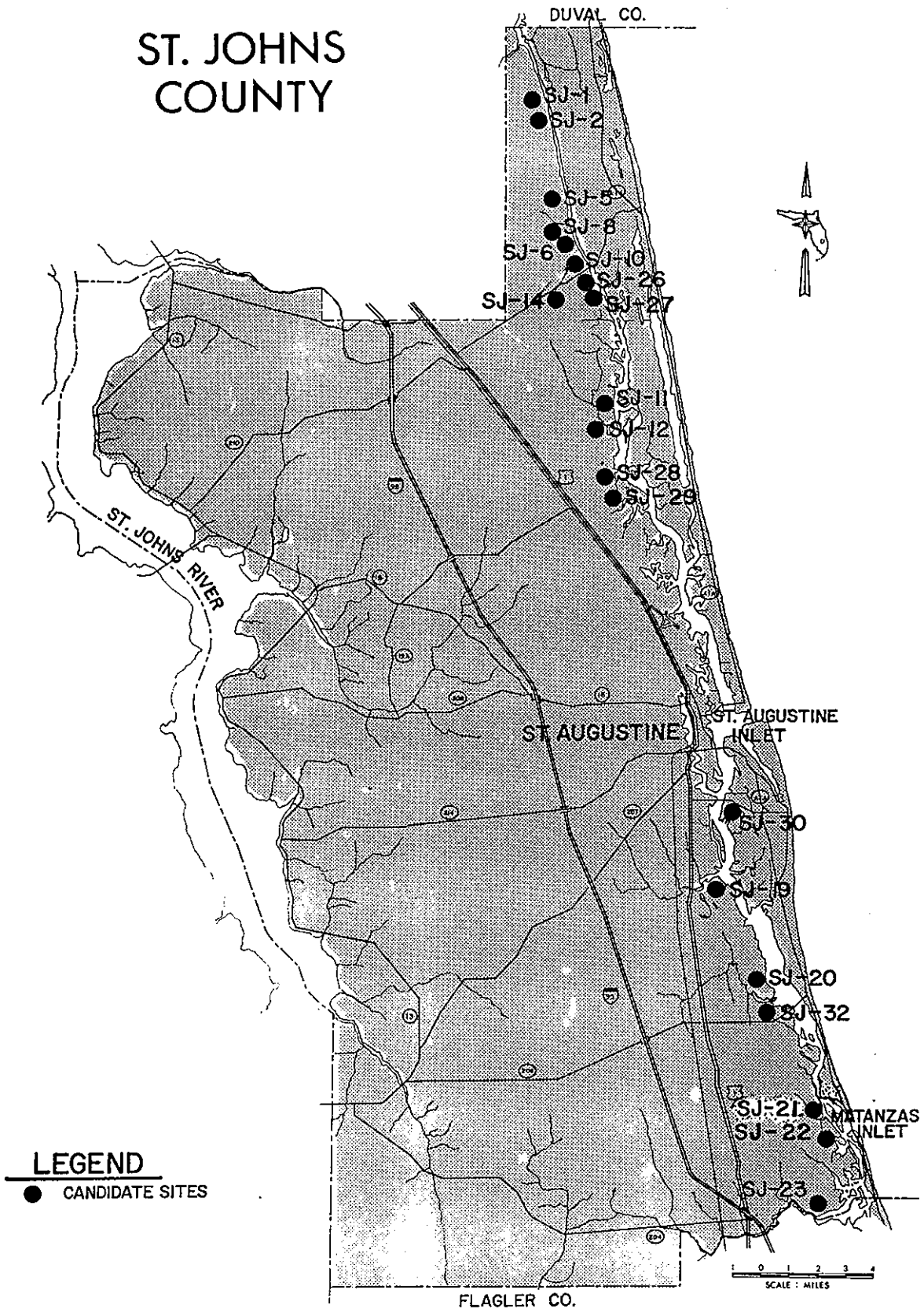

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Figure 3-2: Candidate Sites Intracoastal Waterway, St. Johns County, Florida

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neither feasible nor appropriate to provide contained upland disposal capacity for the full projected 50-year disposal requirement (Section 3.1.2). In all remaining reaches, 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 both existing and candidate sites were performed to document site environmental characteristics, as well to assess their general suitability for disposal 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 surrounding land uses, topography, general soil conditions, existing or potential road access, and possible pipeline routes. Nineteen of the 20 candidate sites as well as three existing disposal areas were visited by a team consisting of a biologist and an engineer during the period July to September, 1989. Access to the one site not visited was specifically denied by the site owner. This did not remove the site from further consideration.

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 1985 1" = 800' black and white photography, 1983-84 1" = 2000' color infrared photography, and in some cases, 1986 blueline aerials at a scale of 1" = 400'. Ground-truthing was carried out using 4-wheel-drive vehicles accessing adjacent roads or on-site dirt roads and trails, combined with pedestrian surveys. Dominant or significant photographic signatures were identified on aerials and visited by truck or on foot. The existing disposal areas in the vicinity of Matanzas Inlet were approached by boat, then covered 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 Waterway or its tributaries. Because of this latter consideration which establishes the jurisdiction of DER permitting authority, all drainage features were examined for evidence of this contiguity. Isolated wetlands or drainage features, which still fell within the permitting jurisdictional authority of the St. Johns River Water Management District (SJRWMD), were excluded where feasible, but not if their exclusion made an otherwise viable site unusable.

A second analysis of maximum potential disposal capacity was then performed for each site based on its field-verified configuration. Results of this analysis are presented in Table 3-3. Again, with the exception of Reach V, the total potential capacity of the candidate sites exceeds the disposal requirement for each reach. During the final site evaluation, described in the following section, these parameters were brought into agreement.

TABLE 3-3: CANDIDATE SITES

ST. JOHNS COUNTY

Reach	Site	Location ICWW Mileage	Total Acreage	Disposal Acreage	Disposal Capacity (c.y.)	Depth of Excavation (ft)	Dike Material Shortfall (c.y.)
I	SJ-1	13.20	155.5	68.9	1,198,800	2.4	-----
	2	14.00	151.5	104.9	1,831,200	2.0	-----
	5	15.45	98.4	59.7	1,036,200	3.0	-----
	6	16.19	76.5	35.1	487,700	4.0	100,400
	8	15.90	60.4	37.6	649,700	3.6	-----
	10	18.30	61.4	30.6	526,400	4.7	-----
II	11	23.56	116.1	85.7	1,492,700	2.4	-----
	12	24.07	251.8	158.9	2,782,800	1.6	-----
	14	19.64	200.1	137.9	2,412,600	1.7	-----
	26	18.98	19.6	13.2	142,200	3.0	80,000
	27	19.40	29.2	22.6	387,900	3.9	-----

Reach	Site	Location ICWW Mileage	Total Acreage	Disposal Acreage	Disposal Capacity (c.y.)	Depth of Excavation (ft)	Dike Material Shortfall (c.y.)
III	28	26.22	52.5	30.6	526,000	4.6	-----
	29	26.52	74.3	52.8	915,200	3.0	-----
IV	19	42.00	89.5	58.2	1,012,600	2.4	-----
	20	45.56	662.2	92.6	1,615,500	2.2	-----
	30	39.63	29.9	15.5	161,000	4.0	98,000
	32	47.61	33.7	26.2	414,000	4.0	19,200
V	21	50.90	150.0	75.1	1,304,500	3.0	-----
	22	52.58	325.8	159.3	2,783,100	2.0	-----
	23	55.33	125.0	120.3	2,100,000	2.0	-----

4.0 ESTABLISHMENT OF SITE BANK

The final evaluation of the 20 candidate sites and 3 existing disposal areas was accomplished by assessing the ability of each site to satisfy a standard set of evaluation criteria, and by consideration of comments and suggestions provided by the project sponsor and advisory committee members throughout the course of the study. Through this process a group of 10 sites was selected to form a site bank serving the five channel reaches comprising the Intracoastal Waterway within the study area. The site bank consists of 5 primary and 5 secondary sites which, as their names imply, represent first and second choice options for the long term disposal and management of dredged material removed from ICWW channels.

A standard set of criteria were used to perform the final site evaluation. However, no attempt was made to quantify the relative merits of each evaluation criterion, using what is sometimes referred to as matrix analysis. Although such an approach is sometimes very useful it was not felt to be necessary in this particular case. Therefore, the decision was made to evaluate the sites using the criteria as a wholistic standard and to take into consideration specific information pertinent to a particular criterion when it was available.

The remaining portions of Section 4.0 describe the evaluation procedure and the results obtained from it, including the criteria used, the agency input considered, and the primary and secondary sites comprising the site bank.

4.1 Evaluation Criteria

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

A primary objective of this study was to identify suitable sites of adequate capacity to meet the projected fifty-year disposal requirements of the Waterway in the study area. Therefore, the potential disposal capacity of a site was included as an evaluation criterion. In keeping with the concept of centralized disposal, all alternative sites were selected and existing sites were retained based on their ability to provide adequate capacity with a minimum number of sites. Typically, a single site within each reach is required. However, within Reaches I and II a single site is designated as the primary site for both reaches. Within Reach V, upland disposal is intended only to complement the primary strategy of beach disposal. Therefore, the upland candidate sites within Reach V were evaluated in terms of providing maximum capacity within a single site.

Closely related to site capacity is the availability of adequate dike material on-site to construct the containment basin employed in the disposal capacity analysis (APPENDIX A). It is possible to circumvent an insufficient on-site supply by trucking in additional material, or by using dewatered material from a previous disposal operation to incrementally build the dikes to design elevation. However, the expense of transporting material from off-site sources, the uncertainties of dredging and disposal frequency, and the possible unsuitability of the dewatered dredged material for dike construction, make an adequate on-site supply of material preferable.

Pumping distance from the area to be dredged to the disposal site is also a criterion affecting site selection. The availability of add-on boosters can extend pumping distances as needed. However, this increased distance is achieved through a reduction in dredging efficiency and a significant increase in the cost of operation. Therefore, it is desirable to choose a site which is either centrally located within the reach it is to serve, or is located adjacent to the area requiring the highest maintenance.

A site which affords the greatest ease of pipeline access from the Waterway to the disposal area, as well as the return of effluent to the Waterway, is also preferred. Apart from the environmental concerns which will be discussed later, problems related to difficult pipeline access, such as extensive marsh crossings,

significant elevation changes, or the crossing of road or railroad right-of-way add to mobilization-demobilization costs, and decreased operating efficiency. Moreover, the need to acquire additional pipeline easements increases the cost of site development.

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 disposal facility. It should be noted that this criterion was a condition for the selection of candidate alternative sites.

Soil properties (e.g. foundation loading, resistance to piping, etc.), as well as the depth of the water table below grade, are additional factors which should be included as criteria for site evaluation. However, these determinations require field testing not included in the initial phase of the project. Data supporting site soil properties and geohydrology will be obtained during Phase II. Visual observations made during the 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 adequate disposal capacity to serve the needs of the Waterway. The resulting criteria may be organized under two categories reflecting the desire to restrict disposal to upland sites only: (1) criteria for the avoidance of wetland areas to the greatest extent possible; and (2) criteria for minimizing the unavoidable impacts to upland areas.

Avoidance of wetlands was a primary consideration throughout the site selection process, and by use of the USFWS Wetlands Inventory maps and the color-infrared photography this has largely been achieved. 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) this may involve crossing the marsh itself, a practice which should be minimized, and a necessary consideration in site selection.

Isolated freshwater wetlands are also a valuable biological community, and in addition can afford a system of filtering run-off and recharging groundwater supplies. However, such wetlands are not given the same degree of protection under joint Corps of Engineers and DER permitting criteria although they may fall under the jurisdiction of the SJRWMD. The presence of these isolated wetlands was considered in the evaluation of a particular site, and their disruption was avoided wherever possible. However, agency comments received during the previous Nassau-Duval study tend to support the position that the sacrifice of small isolated areas possessing wetland vegetation may be acceptable if required to provide an adequate disposal area. Somewhat independent of the areal extent of an interior wetland is the quality of the habitat which it may afford, or the unusual vegetation assemblages it may support. Thus, the quality of impacted wetlands was also a criterion of site selection.

The use of upland disposal areas minimizes the impact to wetlands; however, restricting disposal site development to upland areas requires the removal of the existing upland biota within the diked disposal area be removed. Again, the quality of the impacted upland communities can vary widely, and therefore considerations which reflect the existing ecological value of a potential disposal area are useful site evaluation criteria. Specifically, these include the quality of habitat afforded by a particular site as determined by field inspection and ecological categorization; the value, uniqueness, maturity, and aesthetic quality of the existing vegetation (e.g., mature hardwood canopy vs. second-growth scrub); and the extent to which a site was disturbed by previous activities.

Also considered as a criterion was the ability of a site to provide a buffer zone of undisturbed vegetation outside of the containment area while still maintaining adequate disposal capacity. The potential benefits of such a buffer,

beyond its primary function as a visual barrier, can include the preservation of areas of particular environmental value such as maritime hammock or transitional wetlands. Moreover, the preservation of a buffer region within a dedicated conservation easement may mitigate the impact of containment basin construction, as well as the assessment of the impact during the permitting process.

The final environmental evaluation criterion addresses potential groundwater impacts; specifically the possibility of residential well contamination. The confined upland disposal of dredged material should have no impact on the geologically isolated Floridan Aquifer from which private residential wells may obtain potable water. However, the possibility exists that within residential areas adjacent to a disposal site, private irrigation wells tapping the shallow aquifer may experience elevated chloride levels or saltwater intrusion as a result of disposal and dewatering operations. Nutrient enrichment or other contamination is less likely to occur. To minimize the possibility of such occurrences, the sediment to be dredged will undergo analysis including elutriate testing prior to the commencement of dredging and disposal operations. Moreover, the quality of local groundwater will be monitored before, during, and after disposal. Nevertheless, the potential for potential residential well contamination as measured by the proximity of residential development was a criterion in site evaluation. As such, this criterion is closely related to the issue of adjacent land use, to be addressed in the following section.

4.1.3 Socioeconomic or Cultural Considerations

The third major category of site evaluation criteria considers the socioeconomic or cultural issues of on-site or adjacent land use, site ownership, and the presence of archeological or historical resources. Every effort was made during the initial identification of candidate sites to select areas of minimal existing development. Areas of managed timberlands, however, were not excluded from consideration and four sites containing areas of planted pine were chosen. Moreover, areas having evidence of previous disturbance (e.g., earth-moving operations, timber-harvesting) were given priority because of their reduced environmental value. Subsequent discovery of existing on-site residential or commercial development resulted in modifying the configuration of the site if possible, or eliminating the site from further consideration if insufficient acreage remained. Adjacent land use conflicts were

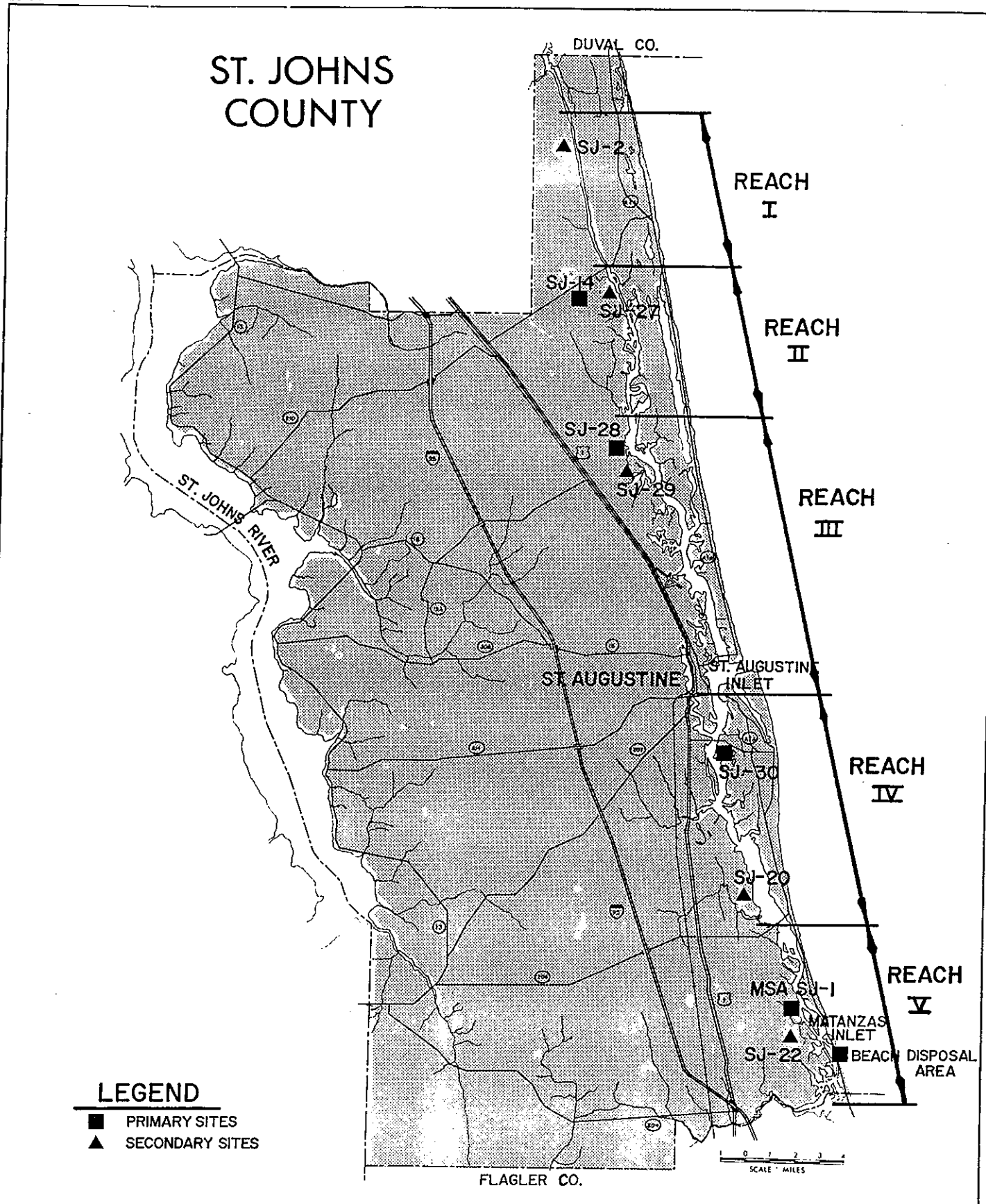
not so easily resolved, and in areas in which upland acreage was limited, such conflicts remain. To the maximum extent possible, these conflicts were mitigated by the recommendation of a buffer zone to separate the disposal area from residential or commercial development.

Site ownership was investigated and established for all candidate sites so that authorized access for the purpose of site inspection could be obtained where necessary. As an evaluation criterion, site ownership was only considered peripherally in those cases in which slight modification of the site boundaries significantly reduced the number of individual property owners involved. No consideration was given to the identities of the property owners.

The presence of a documented archeological site, common to upland regions within the study area, was an additional evaluation criteria. To apply this to the disposal sites under consideration, a request for a records search was forwarded to the Division of Historical Resources, Florida Department of State, so that potential conflicts with documented archeological or historical sites listed in the National Register of Historical Places or the Florida Master site file can be identified. This search has not yet been completed. The presence of a verified archeological or historical site may necessitate a site survey or documentation effort prior to containment area construction, or require the limitation of excavation during construction activities. However, it should not preclude the use of an otherwise viable site for dredged material disposal.

4.2 Site Bank

Following the final evaluation of all candidate sites and existing disposal areas, a total of 10 sites were selected to form a site bank. Of these, five sites represent primary or first choice disposal options. The remaining five were included to provide backup secondary disposal options in the event utilization of one or more of the primary sites proved not to be feasible. As their names imply, these 10 sites represent the five best and five second best disposal options to serve the Intracoastal Waterway channels in the St. Johns County area after the consideration of all engineering, operational, environmental, socioeconomic, and cultural factors influencing site selection. These sites are identified in Figure 4-1.



TAYLOR ENGINEERING INC
9086 CYPRESS GREEN DRIVE
JACKSONVILLE FLORIDA 32216

Figure 4-1: Site Bank, Dredged Material Management Plan, Intracoastal Waterway, St. Johns County, Florida

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DATE 9/30/89

Each of the five channel reaches has been assigned at least one primary and one secondary site. Within Reaches I and II, site SJ-14 has been designated as the primary site to serve both reaches. Considerations which determined the selection of site SJ-14 as the first choice disposal option for both Reaches I and II were addressed in a previous report under separate cover (Taylor Engineering, Inc., 1989). This report examines the overall disposal strategy which most efficiently serves the requirements of the Waterway within the southernmost reach of the previous Nassau-Duval study in combination with Reaches I and II of the St. Johns County project area. The three sites having the greatest potential for use in this area, SJ-2, SJ-14, and SJ-27, were combined with the two best alternative sites for Duval County Reach VII to form seven realistic disposal options for the three ICWW reaches under consideration. Analysis of the various options was based on: (1) the total number sites required to serve all three channel reaches; (2) the total acreage to be acquired; (3) the total length of easement needed to provide both road and pipeline access; (4) maximum pumping distance; and (5) total project cost, including costs related to acquisition, development, and operation. The analysis showed site SJ-14 to be the best overall site to serve both St. Johns County Reaches I and II, with the combination of sites SJ-2 and SJ-27 as the secondary choice to serve Reaches I and II, respectively.

To serve Reach V, two primary sites have been designated. As discussed in Section 3.1.2, beach disposal is considered to be the primary disposal strategy for this reach. However, it is also necessary to retain a backup confined upland disposal capability because of the uncertain nature of beach disposal and its inherent permitting difficulties. Therefore, beach disposal in the vicinity of Summer Haven, with the specific location and design parameters to be determined prior to each disposal event, along with confined upland disposal on the existing disposal area MSA SJ-1 were selected as the primary site combination for Reach V.

One primary and one secondary site have been selected for each of the remaining Reaches III and IV, even though no dredging of the Waterway has been performed in these reaches since 1952. However, 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 recent shoaling identified north of the Vilano Beach bridge in an area that has never

before required dredging. As discussed in Section 3.0, a primary goal of the long-range dredged material management plan for the Intracoastal Waterway is to provide a permanent infrastructure to serve all future maintenance requirements. A plan which provides no disposal capability in significant reaches of the Waterway within a rapidly developing area such as St. Augustine would not be fulfilling this program objective. Therefore, primary and secondary disposal areas have been designated to serve Reaches III and IV.

Without historical shoaling in these reaches, the determination of appropriate site acreages was accomplished by the consideration of a minimum site size. To this end, thirty acres was judged to be the minimum area within which a confined upland disposal area could be reasonably constructed in a manner consistent with program criteria. This requirement significantly reduced the number of appropriate sites within the more developed areas of St. Augustine through which Reaches III and IV pass. As a result, Sites SJ-28 and SJ-29 at the northern end of Reach III were designated to serve as primary and secondary sites, respectively, for that reach. Within Reach IV, Site SJ-30 immediately south of the eastern end of the S.R. 312 bridge was selected as the primary site. An equivalent parcel within the much larger Site SJ-20 was designated as the secondary site for Reach IV.

Additional site specific information for each primary and secondary site is presented in Appendix B. A map of each site is included showing the initial site boundaries, and major vegetation communities and land use categories as verified by field inspection under the FLUCFCS (Florida Land Use, Cover and Forms Classification System, Florida Department of Transportation, 1985). Approximate acreages of each vegetation and land use category are presented in tabular form. Accompanying site narratives summarize pertinent characteristics of each site including general physiographic and environmental conditions, vegetative communities and observed plant species which typify these communities. Also discussed are considerations relevant to specific evaluation criteria such as adjacent land use, possible buffer area configurations, potential or existing road access, and pipeline access routes.

Preliminary acreage requirements, disposal 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.

TABLE 4-1: SITE BANK, INTRACOASTAL WATERWAY,

ST. JOHNS COUNTY, FLORIDA

DISPOSAL SITES

Reach	Site Designator Location	Initial Acreage	Total Required Acreage	Required Disposal Acreage	Disposal Capacity (c.y.)	Length of Road Easement (mi)	Maximum Pumping Distance (mi)	Pipeline Easement Length (mi)	Comments
I: Palm Valley to S.R. 210 ICWW Mile 12.50 to 18.96	SJ-14 (P) ICWW Mile 19.64	200.1	200.1	114.0	1,986,431	0	8.60	1.46	Primary site for Reaches I & II; adequate capacity for both Reaches
	SJ-2 (S) ICWW Mile 14.00	151.5	174.8	104.9	1,831,180	5.11	5.68	0.72	Sized to provide entire capacity req'mt for reach
II: S.R. 210 to Deep Creek ICWW Mile 18.96 to 25.47	SJ-27 (S) ICWW Mile 19.30	29.2	26.4	18.5	245,355	0.87	5.76	0	Site capacity based on efficient use of available area
III: Deep Creek to Bridge of Lions ICWW Mile 25.47 to 37.71	SJ-28 (P) ICWW Mile 26.22	52.5	51.2	14.8	147,695	0	12.00	0	Capacity for both sites 28 & 29 based on efficient use of minimum area
	SJ-29 (S) ICWW Mile 26.52	74.3	51.1	15.0	149,200	0	12.14	0	

P - Primary site choice for reach

S - Secondary site choice for reach

DISPOSAL SITES

Reach	Site Designator Location	Initial Acreage	Total Required Acreage	Required Disposal Acreage	Disposal Capacity (c.y.)	Length of Road Easement (mi)	Maximum Pumping Distance (mi)	Pipeline Easement Length (mi)	Comments
IV: Bridge of Lions to S.R. 206 ICWW Mile 37.71 to 47.61	SJ-30 (P) ICWW Mile 39.63	29.9	29.9	8.9	65,724	0.30	8.28	0	Sized to provide maximum capacity while retaining reasonable buffer area
	SJ-20 (S) ICWW MIle 45.56	662.2	35.0	9.0	64,107	1.90	9.42	0	Site capacity based on efficient use of minimum area
V: S.R.206 to Marineland ICWW Mile 47.61 to 55.71	Beach Disposal (P) ICWW Mile 52.58	----	------	---	203,535	0	7.75	0.0	Renourishment of 1.48 miles of Beach Vicinity of Summerhaven; capacity based on repeat interval of 2.69 years
	MSA SJ-1 (P) ICWW Mile 51.54	108.8	108.8	78.5	1,367,000	3.31	4.17	0	Existing disposal area to be used in combination with beach disposal
	SJ-22 (S) ICWW Mile 52.58	325.8	262.0	159.3	2,783,135	2.75	5.84	0	To be used in combination with beach disposal

P - Primary site choice for reach

S - Secondary site choice for reach

In all cases, site disposal capacities are sufficient to meet the projected disposal requirements of the reach to be served. Referring to Table 4-1, the required disposal acreage for each site represents the area within a realistic dike configuration necessary to contain the stated disposal capacity for that site. For all sites the required dike configuration lies wholly within the delineation of useable upland (i.e., the initial site acreage). The total required acreage corresponds to the required disposal acreage plus an appropriate buffer surrounding the diked containment basin. Where possible, an upland buffer of 300 foot minimum width is provided. However, in three cases (SJ-27, SJ-30, MSA SJ-1) efficient use of limited available upland requires the reduction of this width as described in the accompanying narratives (Appendix B).

The total required primary site acreage for the 43.21 miles of channel within the St. Johns study area is approximately 390 acres. This includes 216 acres of active disposal area and 174 acres of buffer region. These acreages do not consider the area to be designated for beach disposal. The corresponding required secondary site area is 549 acres, of which 307 acres are active disposal area and 242 acres are buffer.

5.0 RECOMMENDED SCOPE OF WORK

Task 1: 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 - Determine 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, right-of-ways, 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. Tasks A, B, and C below are not applicable to the beach disposal area designated to serve Reach V. Specific requirements of this site are addressed

in Sub-Task II-D.

A. Engineering Topographic Survey - Provide site topographic information necessary for site planning, permitting, and design purposes. Horizontal and vertical control of data should include reference to established bench marks and all elevations should be referenced to NGVD. This task will be performed by the Jacksonville District, Corps of Engineers.

B. Subsurface and Soils Survey - This task will be performed by the Jacksonville District, 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 water table potential surface elevations on-site referenced to NGVD.

C. 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.

D. Beach Disposal Area (Reach V) - Obtain necessary engineering and environmental site information required for preliminary engineering design and permitting. This will include the following:

1. Analyze existing beach profile data obtained from Jacksonville District, Corps of Engineers and Florida DNR, Division of Beaches and

Shores to evaluate historical beach profile geometry and background erosion rates.

2. Define beach disposal project area.
3. Perform preliminary material compatibility analysis using newly acquired samples of native beach material and existing data on historical shoal material in Reach V Waterway channels.
4. Locate and characterize all existing public access points, bulkheads, revetments, and stormwater outfalls within project area.
5. Perform field survey and data collection to provide documentation of environmental conditions (species present, frequency of occurrence, pertinent habitat information, endangered or threatened species) within disposal project area, adjacent nearshore regions, and along proposed pipeline routes.
6. Review existing information to determine possible impact of project on sea turtle nesting.

Task III: Preliminary Design and Analysis

Using data obtained from Task II, develop site documentation, and complete preliminary design necessary to prepare permit drawings. Tasks III-A and III-B below are not applicable to the beach disposal area designated to serve Reach V. Specific requirements of this site are addressed in Sub-Task III-C.

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

1. Detailed site maps showing vegetation communities, species locations and habitats, revised usable boundaries, and wetlands 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 Historic Resources, Florida Department of State.
5. Recommend pipeline access and return water routes.

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 - Prepared by Jacksonville District, Corps of Engineers.
3. Engineering Report on Subsurface and Soils Conditions - Prepared by Jacksonville District, Corps of Engineers.
4. Preliminary design calculations and permit drawings of:
   - o Location 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 Vegetation and Buffer Area Plan
   - o Site Drainage Plans

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

C. Beach Disposal Area (Reach V)

1. Engineering - Using information obtained in Sub-Task II-D prepare the following:

   a. Preliminary design calculations and permit drawings of:
      - o Location Map
      - o Site Plan
      - o Typical Section(s)
      - o Pipeline Access Routes
      - o Locations of Public Access, Bulkheads, Revetment, Outfalls

   b. Compatibility analysis of fill with native beach material.
   c. Projected performance of beach fill

d. Detailed written text in support of (a) - (c) above.

2. Environmental - Using information obtained in Sub-Task II-D, prepare the following:
   a. Evaluation of environmental conditions within beach disposal project area, adjacent nearshore regions, and along proposed pipeline routes.
   b. Evaluation of project impacts on beach and nearshore habitats, with special emphasis on sea turtle nesting.
   c. Detailed maps of disposal project area, adjacent nearshore regions, and proposed pipeline routes showing species locations and habitats, vegetation communities, rock outcroppings, documented turtle nesting sites and other pertinent habitat information.
   d. Detailed written text in support of (a) - (c) above.

D. Agency Co-ordination - Obtain from the Florida Department of Environmental Regulation (DER) the following:

1. A binding statement defining the on-site extent of DER jurisdiction, based on site inspection by agency representatives as needed to delineate jurisdictional areas, as well as additional environmental information provided to the agency by Taylor Engineering, Inc.

2. A preliminary statement on the acceptability of the proposed site plans, based on the site engineering narrative, permit drawings, and environmental report, as well as the above statement of agency jurisdiction.

Task IV: Site Management Plans

Prepare a site management plan for each primary site in the Site Bank as modified by the results of Task I. Tasks A, B, and C below are not applicable to the beach disposal area designated to serve Reach V. Specific requirements of this site are addressed in Sub-Task IV-D. 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

D. Beach Disposal Area (Reach V) - The site management plan for the beach disposal area will address the long-range implications of continued use of the site; specifically, the assessment of project performance, and the continuing modifications in project design and operational criteria in response to project performance.

Task V: Cost Considerations

This task will be performed for all primary sites, including the beach disposal site for Reach V. Evaluate the following for each primary site:

A. Site Improvement Costs
B. Site Operation Costs
C. Site Maintenance Costs

Task VI: Documents and Deliverables

The following project documents will be prepared and submitted for each primary site:

A. Permit drawings and accompanying engineering narrative

B. Subsurface and soils report, prepared by Jacksonville District, Corps of Engineers (not applicable to beach disposal area, Reach V).

C. Environmental Report

D. Site Management Plan

E. Cost Report

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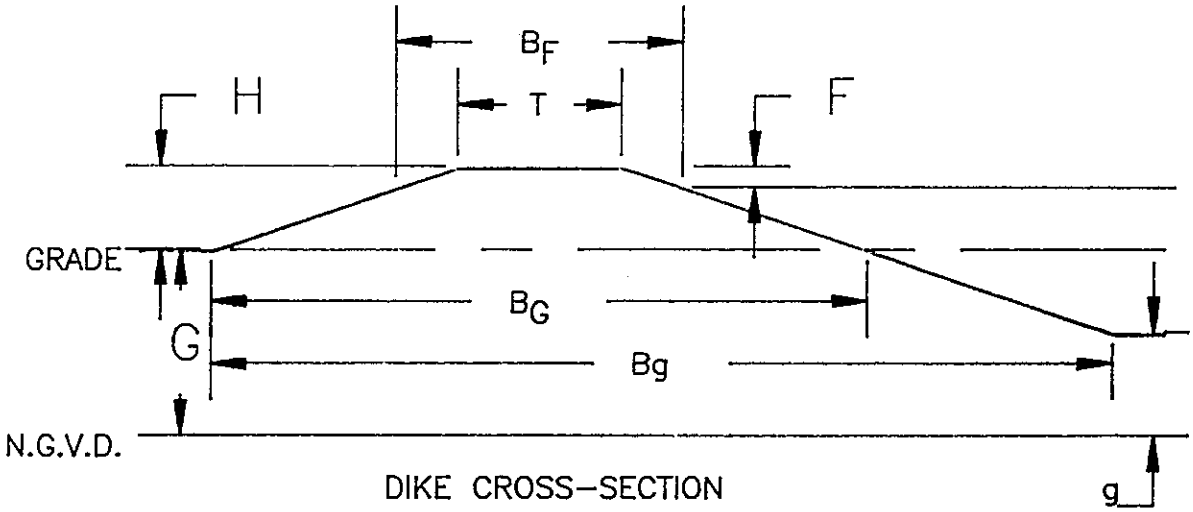
A P P E N D I X A

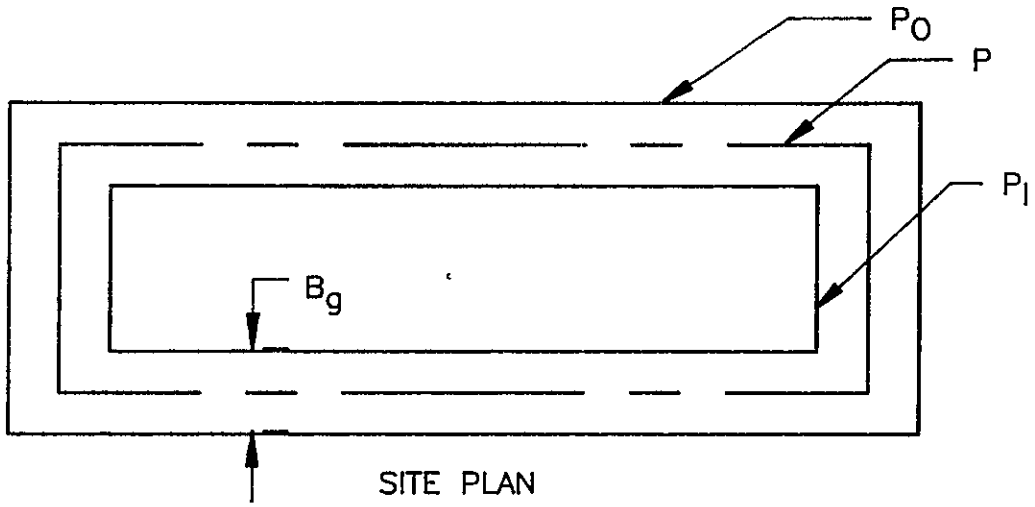
DIKE REQUIREMENTS

AND

DISPOSAL CAPACITY ANALYSIS



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.

Width of Dike at Grade, B_G

$$B_G = 2HS + T \tag{1}$$

Width of Dike at Excavated Grade, B_g

$$B_g = 2HS + T + (G - g)\,S \tag{2}$$

Width of Dike at Depth of Freeboard and Ponding, B_F

$$B_F = 2FS + T \tag{3}$$

Volume of Dike Material Required, V_{MR}

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

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

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

Volume of Disposal Capacity, V_D

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

Depth of Excavation, $(G - g)$

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

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

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

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

APPENDIX B

SITE BANK

APPENDIX B - SITE BANK
PRIMARY SITES

Site: SJ-14
Reach I: Palm Valley to S.R. 210; ICWW Mile 12.50 to Mile 18.96
Reach II: S.R. 210 to Deep Creek; ICWW Mile 18.96 to Mile 25.47
Site Location: ICWW Mile 19.64

Site SJ-14 is a 200 acre parcel located immediately south of S.R. 210, approximately 1.5 miles from the Palm Valley bridge over the Intracoastal Waterway (Figure 4-1). It is within the extensive land holdings of the Danov Corporation (D.D.I. Inc., J.E. Davis) known as the Dee Dot Ranch. The site lies along an upland ridge between Dry Swamp and a north-south oriented slough that ultimately drains east into the Cabbage Swamp system. Elevation within the site ranges between +15 and +25 feet NGVD with the higher elevations located along the central dirt road that bisects the site. Soils are poorly drained Myakka fine sand, typical of flatwoods areas.

Vegetation on the site consists of planted slash pine (Pinus elliottii), and isolated depressions with characteristic wetland species (Figure B-1). The planted pines are young, being approximately 2 inches dbh (diameter at breast height). Signs indicate that these stands were planted in 1985. Ground cover includes wiregrass (Aristida stricta), saw palmetto (Serenoa repens), gallberry (Ilex glabra), and bracken fern (Pteridium aquilinium). In other areas, different grasses including little blue maidencane (Amphicarpum muhlenbergianum) are prevalent, especially near depressions or wetlands. The site is scattered with numerous depressional wetlands. Most of those visited were forested with cypress (Taxodium ascendens), cabbage palm (Sabal palmetto), slash pine (Pinus elliottii), and red maple (Acer rubrum) occurring in various mixtures. Often a narrow band of wet prairie surrounded the wetlands although this was not mapped. At least one wetland was connected to a probable DER-jurisdictional wetland (Dry Swamp) by way of a ditch. A small, water-filled borrow pit was also observed on-site, and contained some fringing wet meadow species.

Considerations which resulted in the designation of Site SJ-14 as the primary site to serve both Reaches I and II are discussed in Section 4.2. Using a realistic dike configuration, capacity adequate to serve both reaches is attained within a

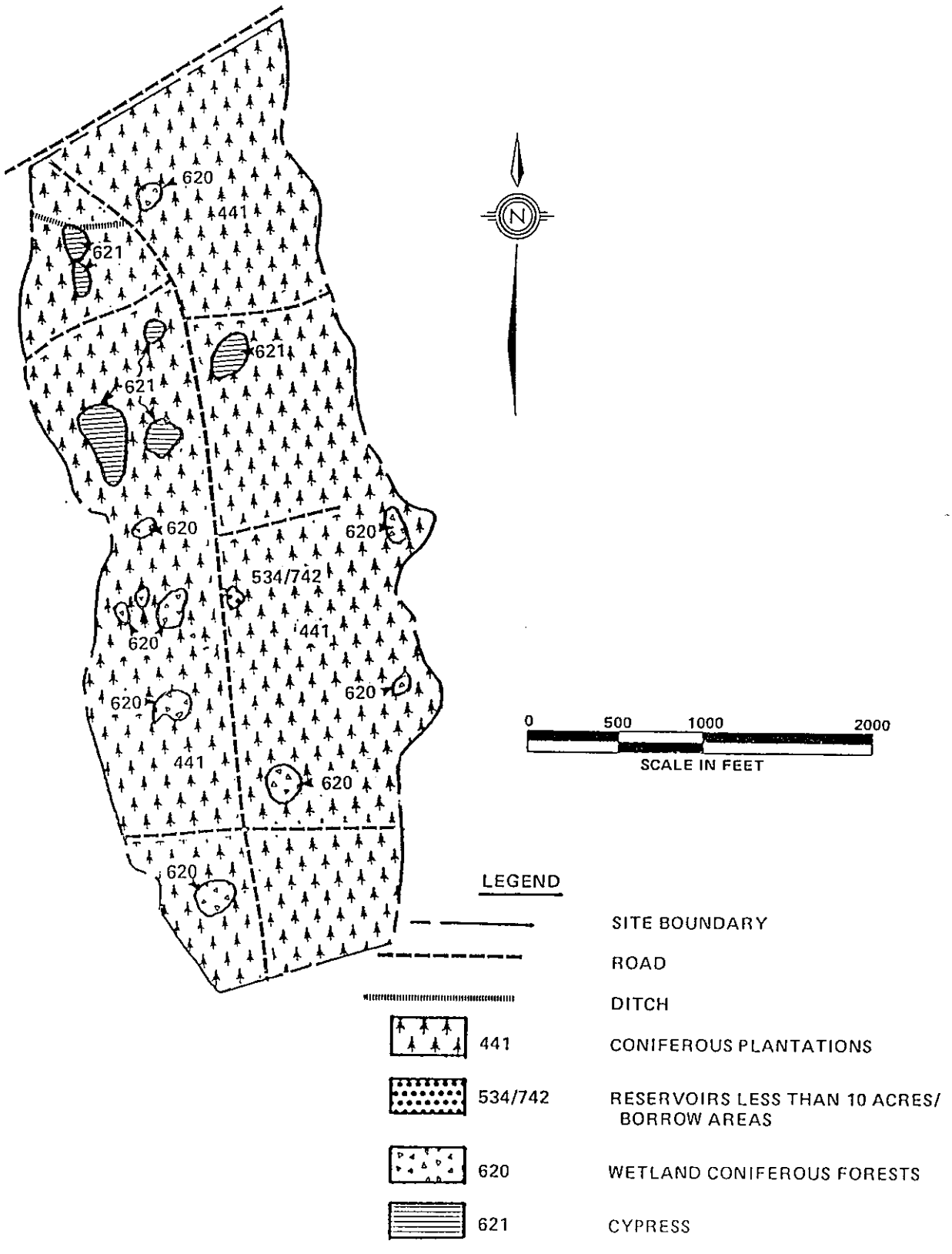


FIGURE B-1: Vegetation Communities and Land Use Types on Site 14, St. Johns County, Florida, as of July 20, 1989

WAR 1989.

Table B-1: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-14 of St. Johns County, Florida, July 20, 1989

Map ID No.*	Name	Approximate Acreage
441	Coniferous Plantations	191.2
534/742	Reservoirs Less Than 10 Acres/ Borrow Areas	0.2
620	Temperate Hardwood	4.1
621	Coniferous Plantations	4.6
	Total	200.1

*Florida Department of Transportation 1985.

disposal area of 114 acres. Addition of a 300 foot buffer region surrounding the diked area as well as providing separation from S.R. 210 results in portions of the buffer lying outside of the irregular initial site boundaries. This preliminary configuration places the one probable DER-jurisdictional wetland within the buffer area; however, a number of small isolated wetland depressions would be impacted by containment basin construction. No additional road access would be required as the site adjoins the right-of-way for S.R. 210. Pipeline access would be possible within the state road right-of-way, or immediately adjacent to the right-of-way, if joint use is not permitted. An upland distance of approximately 1.5 miles lies between the site and the ICWW at the Palm Valley bridge. A maximum pumping distance of 8.6 miles constitutes the only significant disadvantage of Site SJ-14. As discussed in Section 4.2, it was decided that the potentially increased operational costs associated with a greater pumping distance are offset by the decreased cost of acquiring, developing and maintaining a single disposal area rather than two smaller sites.

Site: SJ-28
Reach III: Deep Creek to Bridge of Lions; ICWW Mile 25.47 to Mile 37.71
Site Location: ICWW Mile 26.22

Site SJ-28 is a 52.5 acre site comprising the majority of the upland area confined between the marshes of the Tolomato River (ICWW) to the east and southeast and Marshall Creek to the south and west (Figure 4-1). the site is entirely contained within the privately owned Marshall Creek Wildlife Preserve (Genesis Ltd.). This area is apparently associated with the Marshall Creek Hunting Club, a group of private cabins and trailers on individual parcels centered immediately to the north of the site. Because of access difficulties the site was surveyed primarily from the public road which passes through the center of the site before turning northward to the hunting club.

The vegetation which occurs on site (Figure B-2) is characterized by the varying soil types, including Paola fine sand, Orsino fine sands, and a mixture of Tavares-Zolfo and Sparr sands. The Paola fine sand soil occurs in the center of the site. This soil type is excessively well-drained and is nearly level to gently sloping.

FIGURE B-2: Vegetation Communities and Land Use Types on Site 28, St. Johns County, Florida, as of July 10, 1989

WAR 1989.

Table B-2: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-28 of St. Johns County, Florida, July 10, 1989

Map ID No.*	Name	Approximate Acreage
423	Oak-Pine-Hickory	52.5
	Total	52.5

*Florida Department of Transportation 1985.

Sand pine (Pinus clausa), live oak (Quercus virginiana), myrtle oak (Quercus myrtifolia), and saw palmetto (Serenoa repens) were observed, and arecommon on this well-drained soil type. The vegetation on the Orsino fine sand, a moderately well-drained soil, is similar to that of the Paola fine sand, but withhigher diversity. Southern magnolia (Magnolia grandiflora), American holly (Ilex opaca), and pignut hickory (Carya glabra) are more common in the southern and western portions of the site.

The capacity calculated for site SJ-28 (148,000 c.y., Table 4-1) greatly exceeds the disposal requirement for Reach I (8,800 c.y.). The site capacity is based on the efficient utilization of a minimum area, rather than on merely meeting the minimal requirement. The dike height was limited to 10 feet so that excavation of the containment area interior could provide sufficient dike material. Providing a 300 buffer region surrounding the 14.8 acre diked disposal area results in a total site requirement of 51.2 acres. Use of this site would require the relocation of the existing unpaved public road to an alternate upland route immediately outside the buffer area.

Within Reach III both Site SJ-28 and the secondary site within the same reach suffer from the operational disadvantage of a maximum pumping distance potentially exceeding 12 miles. This results from the lack of adequate and appropriate upland sites within the more developed areas of St. Augustine which comprise the central and southern portions of this reach. Site SJ-28 was selected over SJ-29 as the primary site for Reach III based on two considerations. First, it is at present the more isolated of the two sites, with minimal adjacent land use conflicts and more limited use of the access road. Secondly, it offers slightly improved pipeline access. Neither site would require additional pipeline easement to be acquired since both border directly on waters of the State (T.I.I.F.). However, accessing site SJ-28 would involve the crossing of up to 1500 feet of salt marsh, while SJ-29 may require up to 3000 feet of marsh crossing. Determination of actual pipeline routes must necessarily await Phase II.

Site: SJ-30

Reach IV: Bridge of Lions to S.R. 206; ICWW Mile 37.71 to Mile 47.61

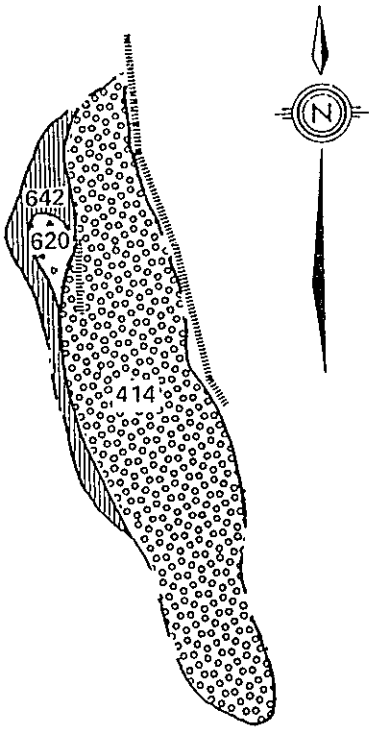
Site Location: ICWW Mile 39.63

Site SJ-30 is a 30-acre peninsula of land known as Fisher's Island, located just south of the State Road 312 bridge east of the Matanzas River (ICWW) on Anastasia Island (Figure 4-1). The site ranges in elevation from +5 to +10 feet NGVD. The soils on the site consist mostly of Adamsville variant fine sand in the northern and southern ends, with an area of Smyrna fine sand in the central portion of the peninsula. Smyrna fine sand is somewhat poorly drained and supports flatwoods vegetation. The Adamsville variant has been modified by early settlers. The pre-existing vegetation of those areas consisted of oaks, cedar and holly.

The vegetation communities observed on-site (Figure B-3) do not conform with the pattern predicted by the soil types. In general, the site is dominated by slash pine (Pinus elliottii), but contains a significant number of oaks (Quercus virginiana and Quercus laurifolia). The entire peninsula is classified as a pine-mesic oak community (414). Understory species include saw palmetto (Sernoa repens), wax myrtle (Myrica cerifera), and yaupon (Ilex vomitoria). There appear to be no significant wetlands on the peninsula, but an area on the north end is a transitional wetland community. This area has a slash pine canopy and a needle rush (Juncus roemerianus) groundcover. A tidal drainage ditch or channelized creek occurs on the east side of the peninsula. A short north-south oriented ditch occurs in the northern part of the peninsula and may be under DER-jurisdiction partway into the peninsula's interior. A band of salt marsh 800 to 2000 feet in width separates the site from the Matanzas River.

No disposal requirement has been established in Reach IV for which site SJ-30 has been designated the primary site. The estimated disposal capacity for the site is based on providing maximum capacity while retaining a reasonable buffer. Restricting the disposal area to the central 8.9 acres and limiting the dike height to 8 feet above grade results in a disposal capacity of 66,000, while still retaining a minimum buffer of 150 feet surrounding the diked area.

The surrounding upland areas are essentially undeveloped; therefore no apparent



LEGEND

SITE BOUNDARY

DITCH

414 PINE – MESIC OAK

620 WETLAND CONIFEROUS FORESTS

642 SALTWATER MARSHES

0 500 1000 2000

SCALE IN FEET

FIGURE B-3: Vegetation Communities and Land Use Types on Site 30, St. Johns County, Florida, as of July 10, 1989

WAR 1989.

Table B-3: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-30 of St. Johns County, Florida, July 10, 1989

Map ID No.*	Name	Approximate Acreage
414	Pine-Mesic Oak	25.3
620	Wetland Coniferous Forests	0.9
642	Saltwater Marshes	3.7
	Total	29.9

*Florida Department of Transportation 1985.

land use conflicts restrict the use of site SJ-30 as a dredged material disposal site. The proximity of a municiple sewage treatment plant may limit future residential development in the area. Road access to the site is by means of an unimproved dirt trail which enters the site from the north (S.R. 312) by first crossing a narrow band of transitional wetland. The primary purpose for this access appears to be the dumping of trash (e.g., roofing material, old cars, appliances, etc.). The site is located toward the northern end of Reach IV; therefore, the maximum pumping distance is potentially in excess of 8 miles. No additional pipeline easement would be needed to access the site; however, the pipelines would have to be brought across approximately 800 feet of marsh.

Site: Beach Disposal Area
Reach V: S.R. 206 to Marineland; ICWW Mile 47.61 to Mile 55.71
Site Location: ICWW Mile 52.58 (vicinity Summerhaven)

Preliminary design for the proposed beach disposal area (Figure 4-1) is based on disposal of the mean volume of material historically dredged within the vicinity of Matanzas Inlet per maintenance event. No bulking of the material is assumed; however, an allowable over dredging factor of 1.15 is applied. The resulting disposal volume is 202,600 c.y. of material to be placed on the beach, with a mean frequency of 1 disposal event every 2.69 years.

Specific design parameters (e.g., berm crest width, berm crest elevation, beach profile slope), as well as specific disposal location would be subject to final design considerations. However, a representative beach fill was determined by assuming values for these parameters based on previous COE design for similar projects. These include a berm crest width of 50 feet, a berm crest elevation of +8.0 feet NGVD, and a beach slope of 1:10 above MHW, and a 1:20 slope below MHW, extending seaward to intersect with the pre-existing profile.

This representative design was applied to Florida Department of Natural Resources (DNR) beach profiles for the vicinity of Summerhaven, extending southward from a point immediately south of the COE constructed revetment (DNR profiles R-200 to R-207). The beach fill design which resulted from this procedure had a total project length of 1.48 miles. Following construction of the initial beach filling

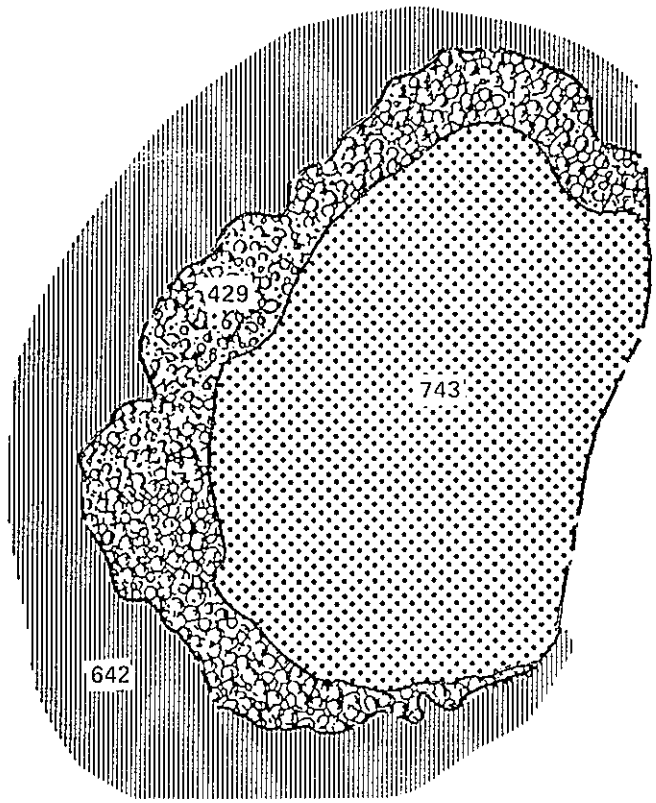
project, succeeding beach disposal operations would be subject to modification based on the performance of the previous disposal.

Site: MSA SJ-1
Reach V: S.R. 206 to Marineland; ICWW Mile 47.61 to Mile 55.71
Site Location: ICWW Mile 51.54

Site MSA SJ-1 is a active disposal area located immediately west of the Waterway adjacent to the northern confluence of the Matanzas River and the inlet by-pass channel of the ICWW (Figure 4-1). The site is a 109 acre area of upland within three larger contiguous disposal easements, MSA SJ-1, SJ-1A, and SJ-1C. It contains a diked disposal area covering 41 acres. The dikes are presently constructed to a crest elevation of +33 ft NGVD, or approximately 21 feet above the upland site grade immediately to the south of the existing containment basin. This area was last used for disposal of maintenance material in 1987. The containment basin is now at or near the capacity provided by the existing dikes, with only a minor depression remaining adjacent to the outlet weirs.

Pioneer vegetation that has grown on the dredged material include sea oats (Uniola paniculata), camphorweed (Heterotheca subaxillaris), sandspur (Cenchrus sp.), and pricklypear cactus (Opuntia sp.). Outside of the diked disposal area is a fringe of thick shrub vegetation (see Figure B-4). This zone of vegetation consists of wax myrtle (Myrica cerifera) and silverling (Baccharis halimifolia). Other components of this community are pokeweed (Phytolacca americana) and ragweed (Ambrosia artemisiifolia). The shrub fringe grades into smooth cordgrass (Spartina alterniflora), saltgrass (Distichlis spicata), and black rush (Juncus roemerianus) marsh.

Re-development of the site would first require the removal of approximately 1.4 m.c.y. of predominantly fine to medium quartz sand to re-establish a mean site grade of +12 feet NGVD. Reconstruction of an expanded dike configuration (78.5 acres) of standard cross-sectional geometry would result in a disposal capacity of 1.37 m.c.y. This configuration provides an upland buffer region, 50 to 150 feet in width, surrounding the containment basin.



LEGEND

SITE BOUNDARY

429 WAX MYRTLE

642 SALTWATER MARSHES

743 BARREN LAND, DREDGE DISPOSAL AREA

0 500 1000 2000

SCALE IN FEET

FIGURE B-4: Vegetation Communities and Land Use Types on Site MSA SJ–1, St. Johns County, Florida as of August 22, 1989

WAR 1989.

Table B-4: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site MSA SJ-1, St. Johns County, Florida, August 1989

Map ID No.*	Name	Approximate Acreage
429	Wax Myrtle	37.8
743	Dredged Material Disposal Area	71.4
	Total	108.8

*Florida Department of Transportation 1985.

The location of site MSA SJ-1, central within Reach V and immediately adjacent to the Waterway, limits the maximum potential pumping distance to approximately 4.2 miles. No additional pipeline easement is required. Providing adequate road access to the site would require improving the existing logging road which presently enters the site by crossing approximately 200 feet of high salt marsh. This marsh crossing is contained within disposal easement MSA SJ-1C. As a result of the extensive timber holdings west of the disposal easements, a road access easement of approximately 3.3 miles in length would be required to provide vehicle entry from U.S. Route 1.

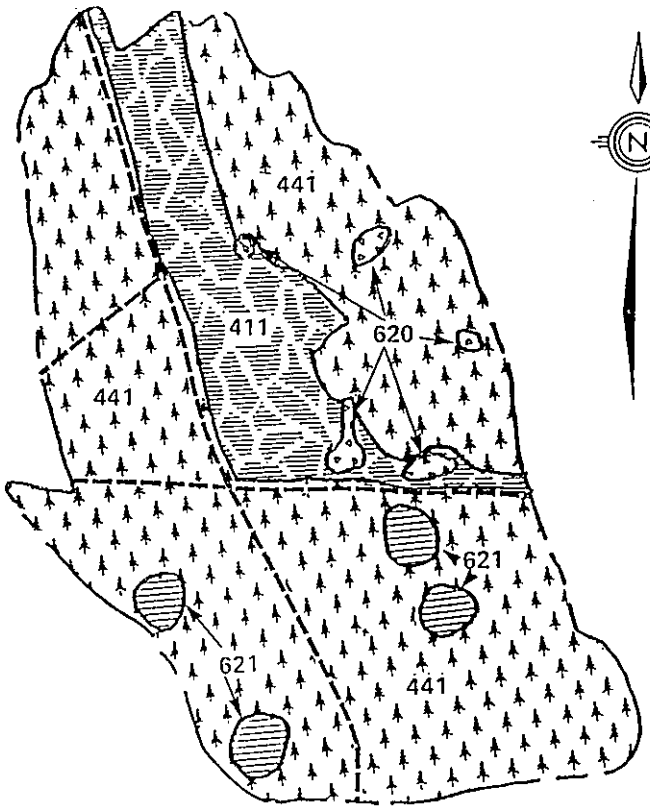
SECONDARY SITES

Site: SJ-2
Reach I: Palm Valley to S.R. 210; ICWW Mile 12.50 to Mile 18.96
Site Location: ICWW Mile 14.00

Site SJ-2 is a 152 acre parcel within the extensive land holdings of the Davov Corporation (J.E. Davis) known as the Dee Dot Ranch. It lies approximately 0.5 miles west of the Intracoastal Waterway, 3.0 miles south of the headwaters of Pablo Creek and 4.5 miles north of S.R. 210 (Figure 4-1). The site is located on a ridge between two low areas to the east and west and two narrow drainage sloughs north and south of the site. The topography ranges from slightly above +15 feet NGVD to +10 feet NGVD. The soils which dominate the site, Myakka fine sand and Immokalee fine sand, are poorly drained flatwoods soils.

Vegetation communities found on the property include pine flatwoods, pine plantation, and forested wetlands (Figure B-5). The majority of the vegetation is planted in slash pine of various ages. The youngest stand, located in the northeast, was planted in 1984 and was 2 to 3 inches dbh (diameter at breast height). It had an understory of saw palmetto (Serenoa repens) and gallberry (Ilex glabra). Other stands had slash pine in the 8 to 9 inches dbh range. In some areas, pond pine (Pinus serotina) was intermixed with slash pine (Pinus elliotii). A creek drainage forms the boundary along the southern end of the site. Two cypress areas in the southwest portion of the parcel are contiguous with the creek floodplain wetlands, probably making them DER-jurisdictional wetlands. A number of other wetlands occur on-site and are dominated by pond cypress (Taxodium ascendens) or a mixture of pond cypress (Taxodium ascendens) with slash pine. These appear to be isolated wetlands.

Site SJ-2 represents the only candidate site north of S.R. 210 with sufficient contiguous upland to provide capacity sufficient to satisfy the disposal requirement of Reach I (1.83 m.c.y., Table 4-1). This capacity corresponds to the maximum realistic dike configuration wholly contained within the delineated upland. The identified DER-jurisdictional wetlands on-site would be avoided. Addition of a 300 foot buffer region surrounding the diked area results in a total required site area of 174.8 acres. Existing road access is via a minimal private ranch road.



LEGEND

SITE BOUNDARY

ROAD

411 PINE FLATWOODS

441 CONIFEROUS PLANTATIONS

620 WETLAND CONIFEROUS FORESTS

621 CYPRESS

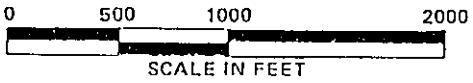


FIGURE B-5: Vegetation Communities and Land Use Types on Site 2, St. Johns County, Florida, as of July 19, 1989

WAR 1989.

Table B-5: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-2 of St. Johns County, Florida, July 19, 1989

Map ID No.*	Name	Approximate Acreage
411	Pine Flatwoods	24.6
441	Coniferous Plantations	121.4
620	Wetland Coniferous Forests	1.4
621	Cypress	4.1
	Total	151.5

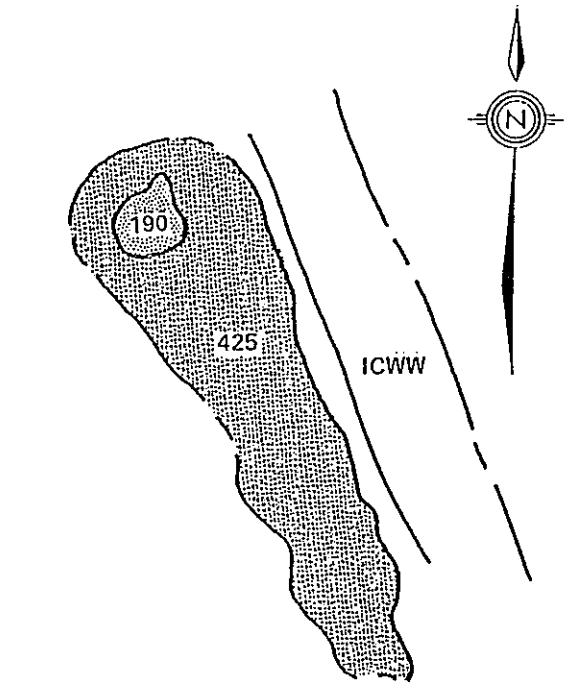
*Florida Department of Transportation 1985.

Acquisition of a road easement of approximately 5.1 miles in length extending northward from S.R. 210 would be required. The required pipeline access easement would be approximately 0.7 mile in length. Although little or no marsh exists along the Waterway in the vicinity of site SJ-2, the intake and outline pipeline would necessarily cross a wetland slough under probable DER-jurisdiction. The central location of the site within Reach I results in a maximum pumping distance of approximately 5.7 miles.

Site: SJ-27
Reach II: S.R. 210 to Deep Creek; ICWW Mile 18.96 to Mile 25.47
Site Location: ICWW Mile 19.40

Site SJ-27 is a relatively small area of upland (29.2 acres) located approximately 0.4 south of S.R. 210 immediately adjacent to the Waterway (Figure 4-1). The topography of the site is nearly level and the soils primarily consist of St. Augustine fine sand with a clayey substratum. This soil is considered somewhat poorly drained and is typical of low, flat areas located landward of estuaries along the ICWW. The site is separated from adjacent uplands to the north by an unnamed tidal creek and a smooth cordgrass (Spartina alterniflora) marsh. However, the site is accessible from S.R. 210 via a culverted causeway. The oak hammock community which constitutes 94 percent of the site (Figure B-6) contains live oak (Quercus virginiana), and in lesser numbers, slash pine (Pinus elliottii). Southern red cedar (Juniperus silicicola) and cabbage palm (Sabal palmetto) also are common. An open field is located in the north-central portion of the site. Small laurel oaks (Quercus laurifolia) and slash pines occur in the area; however, Bahia grass (Paspalum notatum) and prickly pear cactus (Opuntia sp.) are most abundant.

Of the 29.2 acres which constitute site SJ-27, 24.7 acres lie within existing disposal easements (MSA 228 and 229). The site capacity of 245,000 c.y. exceeds the reach requirement of 124,000 c.y., and is based on the efficient use of the available area. The diked containment basin (18.5 acres) would be wholely contained within the existing disposal easements. The acquisition of an additional 7.9 acres would be required to provide a 200 foot buffer area along the western side of the diked area. A 200 foot buffer to the south is provided within the existing easements. To the east a minimal upland buffer separating the diked area from the



LEGEND

SITE BOUNDARY

190 OPEN LAND

425 TEMPERATE HARDWOODS

0. 500. 1000 2000

SCALE IN FEET

FIGURE B-6: Vegetation Communities and Land Use Types on Site 27, St. Johns County, Florida, as of July 10, 1989

WAR 1989.

Table B-6: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-27 of St. Johns County, Florida, July 10, 1989

Map ID No.*	Name	Approximate Acreage
190	Open Land	1.6
425	Temperate Hardwoods	27.6
	Total	29.2

*Florida Department of Transportation 1985.

adjacent Waterway is provided by the irregular contours of the upland area. A minimal road easement of less than 0.1 mile would be required, with the remaining 0.3 miles of road access provided within existing disposal easements. Although the site is located at the northern end of Reach II, its proximity to the Waterway limits maximum pumping distance to 5.8 miles.

Site: SJ-29
Reach III: Deep Creek to Bridge of Lions; ICWW Mile 25.47 to Mile 37.71
Site Location: ICWW Mile 26.52

Site SJ-29 is a 74 acre site located within the uplands immediately west of the marshes associated with the Tolomato River (ICWW), south of Marshall Creek and north of Stokes Creek (Figure 4-1). The site lies immediately north of a low-density residential area, and is accessible by the public roads which serve that development.

Within the site the predominant soil type is a mixture of Tavares-Zolfo and Sparr sands. This soil type is nearly level to gently sloping and considered somewhat poorly drained. The second most abundant soil type is Cassia fine sand which has similar physical properties to Tavares-Zolfo-Sparr. The upland communities within site SJ-29 consist of a longleaf pine-xeric sandpine community and a pine-mesic oak community (Figure B-7). The longleaf pine-xeric sandpine habitat contains sandpine (Pinus clausa), tarflower (Befaria racemosa), and myrtle oak (Quercus myrtifolia). The pine-mesic oak community, located in the eastern half of the site, contains slash pine (Pinus elliottii), gallberry (Ilex glabra), and saw palmetto (Serenoa repens). The on-site wetlands appear to be isolated. They contain a mixture of hardwood species including red maple (Acer rubrum) and sweetgum (Liquidambar styraciflua).

The preliminarily defined capacity of site SJ-29 (149,000 c.y.) greatly exceeds the disposal requirement of Reach III (8,800 c.y.) which it is intended to serve. The capacity of the site is based on the efficient utilization of a minimum area, and closely corresponds to the capacity achieveable with the primary site within the same reach. Including a 300 foot buffer region surrounding the 15 acre diked disposal area results in a total required site area of 51.1 acres. The

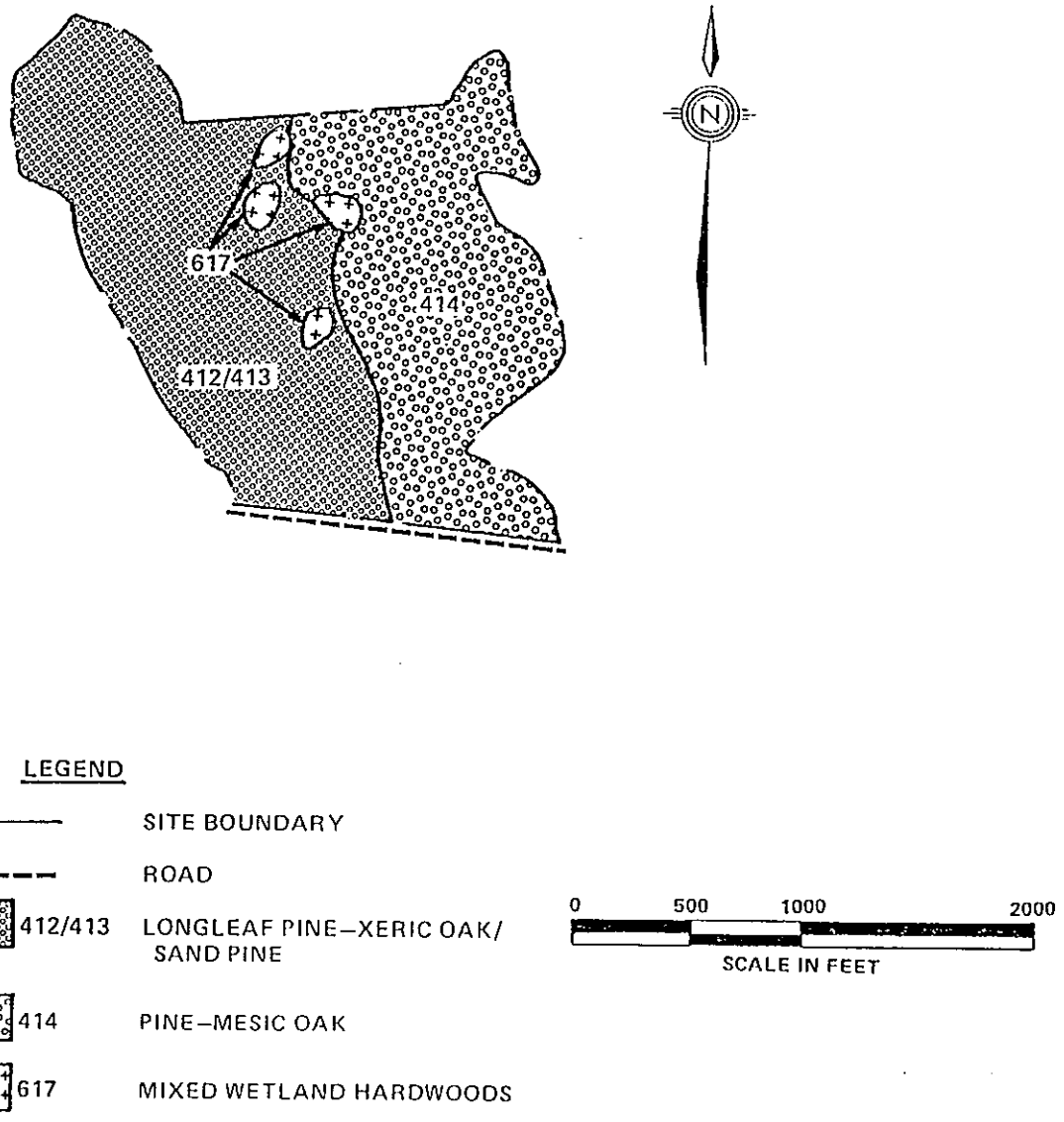


FIGURE B-7: Vegetation Communities and Land Use Types on Site 29, St. Johns County, Florida, as of July 10, 1989

WAR 1989.

Table B-7: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-29 of St. Johns County, Florida, July 10, 1989

Map ID No.*	Name	Approximate Acreage
412/413	Longleaf Pine-Xeric Oak/Sand Pine	40.4
414	Pine-Mesic Oak	32.1
617	Mixed Wetland Hardwoods	1.8
	Total	74.3

*Florida Department of Transportation 1985.

considerations which led to the designation of site SJ-29 as the secondary site within Reach III are discussed in the narrative describing the primary site, SJ-28.

Site: SJ-20
Reach IV: Bridge of Lions to S.R. 206; ICWW Mile 37.71 to Mile 47.61
Site Location: ICWW Mile 45.56

Site SJ-20 is a 662 acre site located predominantly on a large peninsula bounded by the Matanzas River (ICWW) to the east and Moses Creek to the south and east (Figure 4-1). Access to this site was specifically denied; therefore, site information is based on resource materials (National Wetland Inventory Maps, USFWS, 1987; Soil Survey of St. Johns County, SCS, 1983) and aerial photography interpretation.

The topography of the site ranges from +10 feet NGVD along the eastern edge of the site to +25 feet NGVD in the northwest corner. The predominant soil type is Cassia fine sand, a nearly level, somewhat poorly drained soil. The natural vegetation (Figure B-8) that would occur on a soil of this type is slash pine (Pinus elliottii), running oak (Quercus pumila), sand pine (Pinus clausa), occasional longleaf pine (Pinus palustris), and saw palmetto (Serenoa repens). Based on the photographic signature, a portion of this soil type appears to have a pine overstory, and a portion appears to be a saw palmetto prairie with very little cover in pine. Within the palmetto prairie there are a number of wetlands that appear to be isolated. These wetlands probably consist of herbaceous cover with only temporary standing water. The FLUCFCS classification for these wetlands is most likely wet prairies (643). There is a wetland system north of the string of wet prairies, at the northern site boundary, that appears to be DER-jurisdictional, eventually connecting with waters of the State (Matanzas River). The western site boundary borders a tributary of the Matanzas River named Moses Creek. The soils adjacent to the creek are moderately to excessively well-drained and the elevations are greater than the eastern half of the site. The vegetation on this portion of the site probably is similar to that of the eastern portion but may reflect more xeric conditions. The dominant trees include sand pine and sand live oak (Quercus geminata) and myrtle oak (Quercus myrtifolia).

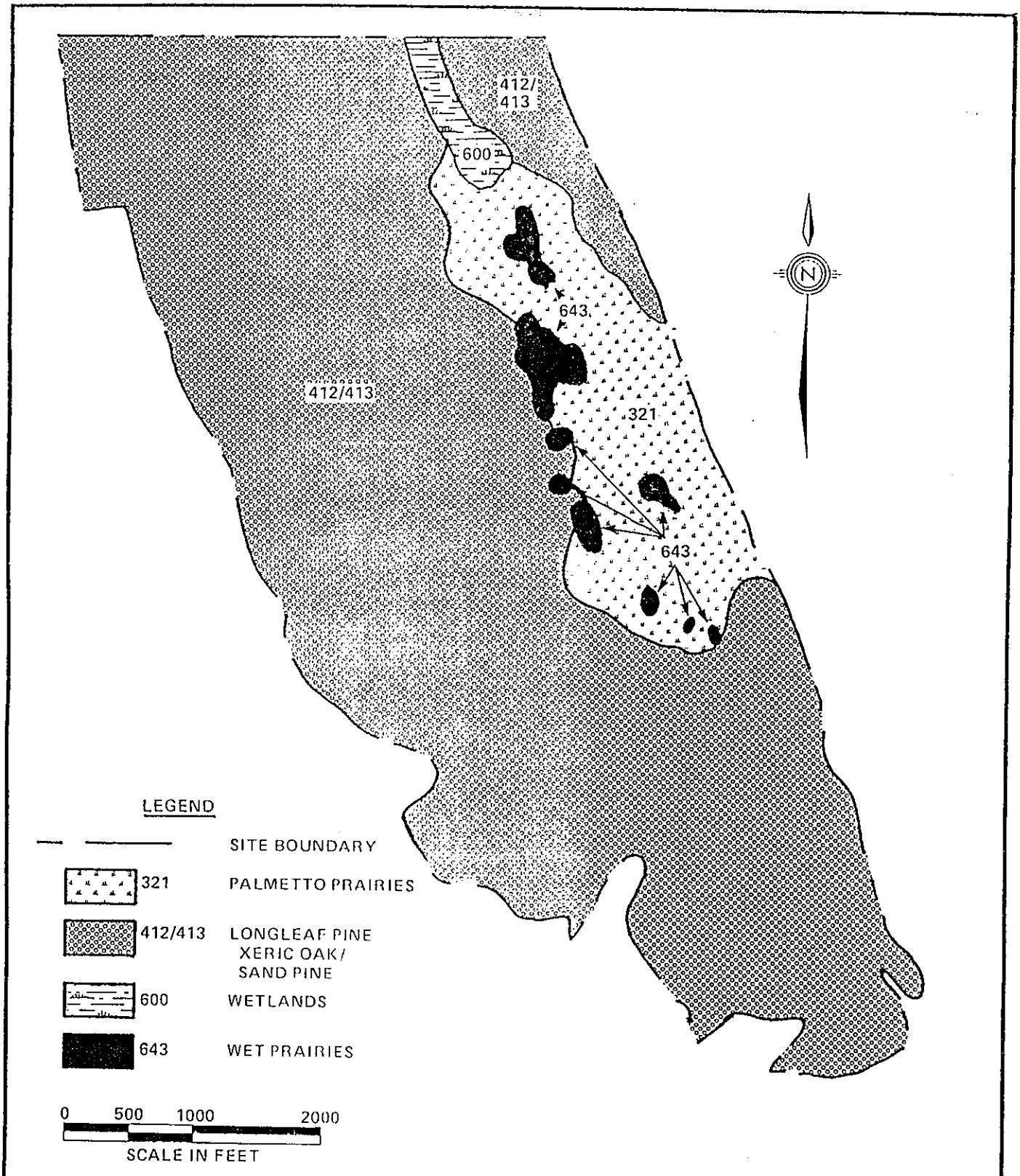


FIGURE B-8: Vegetation Communities and Land Use Types on Site 20, St. Johns County, Florida, September 1989

WAR 1989.

Table B-8: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-20 of St. Johns County, Florida

Map ID No.*	Name	Approximate Acreage
321	Palmetto Prairies	93.3
412/413	Longleaf pine-xeric oak/Sand pine	546.6
600	Wetlands	8.9
643	Wet Prairies	13.4
	Total	662.2

*Florida Department of Transportation 1985.

No disposal requirement has been determined for Reach IV. Therefore, the disposal area to be placed within SJ-20 is based on matching the maximum potential capacity for site SJ-30, the primary site serving the same reach of the Waterway. Including a 300 foot buffer region surrounding the diked disposal area results in a total required site area of 35 acres. Specific location of the disposal area within the larger tract must await field inspection; however, the most operationally desireable location would be in the southern portion of the site near the area in which minimal marsh (less than 300 feet) separates the upland from the Waterway. With the site in this location, the maximum potential pumping distance would be approximately 9.4 miles. The entire site is under single ownership and remains essentially undeveloped. To service the site a road access easement of approximately 1.9 miles would be needed, and improvements to the minimal trail which now exists would be required.

Site: SJ-22
Reach V: S.R. 206 to Marineland; ICWW Mile 47.61 to Mile 55.71
Site Location: ICWW Mile 52.58

Site SJ-22 is a 326 acre parcel within the extensive timberlands which lie west of the Waterway in the vicinity of Matanzas Inlet (Figure 4-1). The site is located between two wetland creek systems that drain to the coastal marshes along the Matanzas River. The property is located approximately 1 mile west of the river and is separated from it by a broad salt marsh. Site elevations range from +10 to +15 feet NGVD. Soils on the site include Myakka and St. Johns depressional soils in wetlands, and Myakka, Smyrna, St. Johns, and Cassia fine sands in upland communities.

Vegetation in the upland areas of the property is mostly planted slash pine (Pinus elliottii) (Figure B-9). The northern quarter of the site is planted in young pine (4 to 7 inches dbh) and has ground cover of saw palmetto (Serenoa repens) and bracken fern (Pteridium aquilinum). In older planted pine areas, the trees average 6 to 9 inches dbh and commonly have an understory of saw palmetto (Serenoa repens) and gallberry (Ilex glabra). Some areas of the property are vegetated with a mixture of slash pine (Pinus elliottii) and oak with other hardwoods. A hammock containing pignut hickory (Carya glabra), live oak (Quercus virginiana), and cabbage palm (Sabal palmetto) occurs in the southeastern portion of the site. A number of

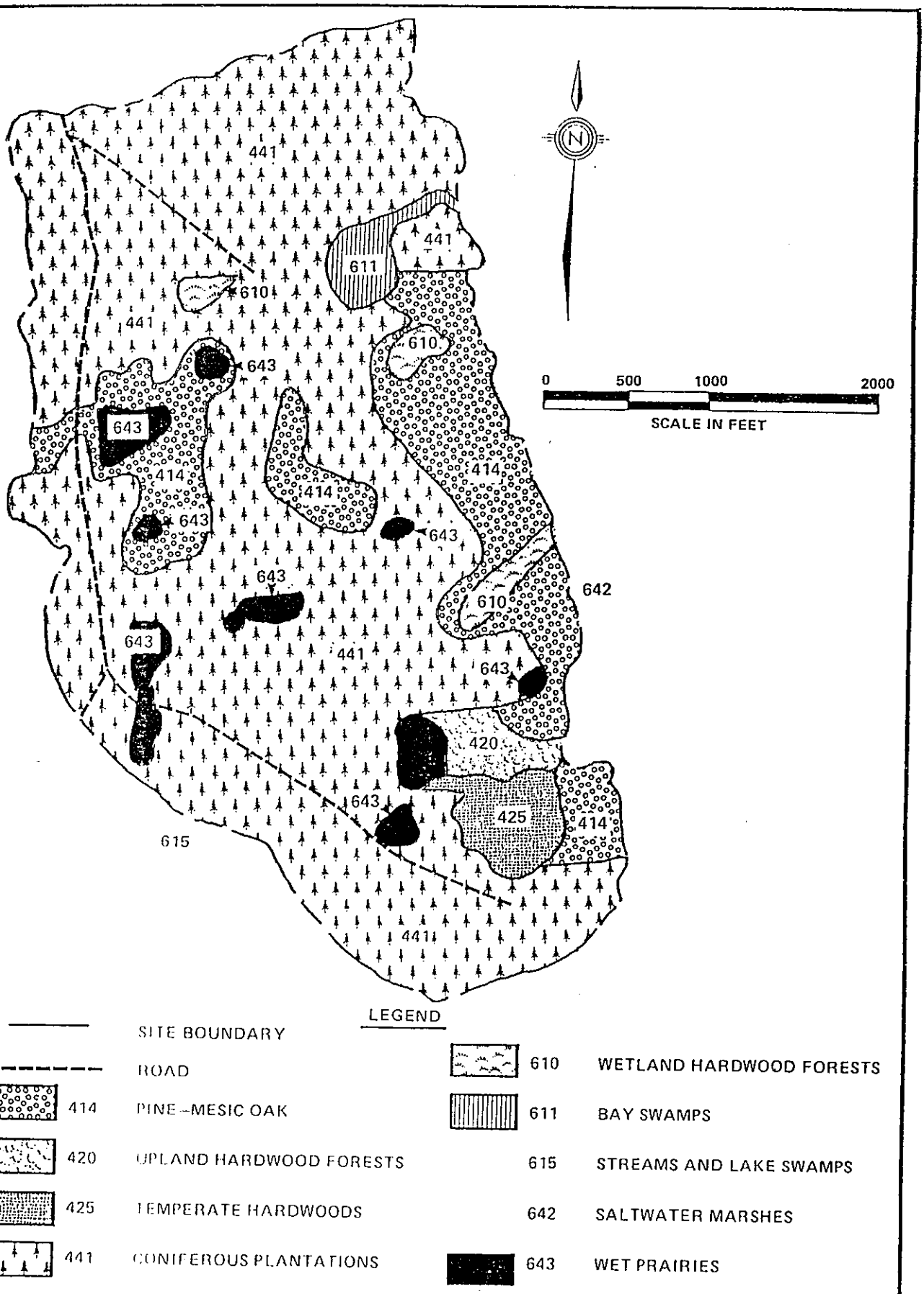


FIGURE B-9: Vegetation Communities and Land Use Types on Site 22, St. Johns County, Florida, as of August 25, 1989

WAR 1989.

Table B-9: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-22 of St. Johns County, Florida, August 25, 1989

Map ID No.*	Name	Approximate Acreage
414	Pine-Mesic Oak	55.2
420	Upland Hardwood Forests	5.1
425	Temperate Hardwood	7.6
441	Coniferous Plantations	236.0
610	Wetland Hardwood Forests	5.5
611	Bay Swamps	4.9
643	Wet Prairies	11.5
	Total	325.8

*Florida Department of Transportation 1985.

wet prairies are scattered throughout the site. They are typically vegetated with sand cordgrass (Spartina bakeri) but also contain some tree cover such as blackgum tupelo (Nyssa sylvatica), swamp bay (Persea palustris), and slash pine (Pinus elliottii). Two wetlands clearly drain to DER-jurisdictional areas, making them likely to be considered jurisdictional as well. One area is a bayhead in the northeastern portion of the site, and the other is a forested wetland adjacent to the riverine marshes on the east.

Site SJ-22 is the secondary upland disposal site within Reach II intended to complement the primary strategy of beach disposal. Therefore, the projected capacity of the site was determined by the maximum realistic utilization of the site while avoiding the areas of DER-jurisdictional wetland mentioned above. Including a 300 foot buffer region completely surrounding the 160 acre diked disposal area results in a total required site acreage of 262 acres. The corresponding capacity of the site is 2.78 m.c.y., or approximately 40% of the projected disposal requirement for Reach V.

Because of the extensive timber holdings which surround site SJ-22, establishing road access to the site from U.S. Route 1 will require the acquisition of 2.75 miles of road easement. Pipeline access will involve no additional easement, but will require the crossing of up to 4000 feet of salt marsh. Maximum potential pumping distance is less than 6 miles.

APPENDIX C

CANDIDATE SITES

Site SJ-5

Site SJ-5 is a 98 acre parcel that has been mostly cleared and planted in grasses presumably for pasture (Table C-2). The site occurs on a low ridge between two wetlands. It ranges in elevation between +10 to +15 ft. NGVD. The soils on the site consist of poorly drained sands (Smyrna and Myakka) typical of flatwoods.

Vegetation communities on-site include pasture, a man-made pond, ditches and fence rows with trees and shrubs, and forested wetlands (Figure C-2). The property is bound on the north and northwest by Flo's Ford, an intermittent creek drainage. The pastures are vegetated with Bahia grass (Paspalum notatum), a variety of other grasses and weedy plants including sedge (Cyperus sp.) in low spots, and dog fennel (Eupatorium capillifolium). Wax myrtle (Myrica cerifera) has invaded portions of the unused pasture area. An oval-shaped pond is located in the center of the site and has emergent cattails (Typha sp.) growing along its margins. A number of forested wetlands occur on the property and are vegetated by slash pine (Pinus elliotii) and pond cypress (Taxodium ascendens) as well as a variety of hydric hardwoods. A series of small ditches may interconnect some of these isolated wetlands to the adjacent creek drainage.

Wildlife observations while on-site included two Osprey nests, one located along the creek drainage in the northwest part of the site and the other in the central part of the property near the pond. A Southeastern kestrel was also observed perched on powerlines running through the area.

Table C-2: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-5 of St. Johns County, Florida, July 19, 1989

Map ID No.*	Name	Approximate Acreage
211	Improved Pastures	92.7
534	Reservoirs Less Than 10 Acres	1.4
620	Wetland Coniferous Forests	4.3
	Total	98.4

*Florida Department of Transportation 1985.

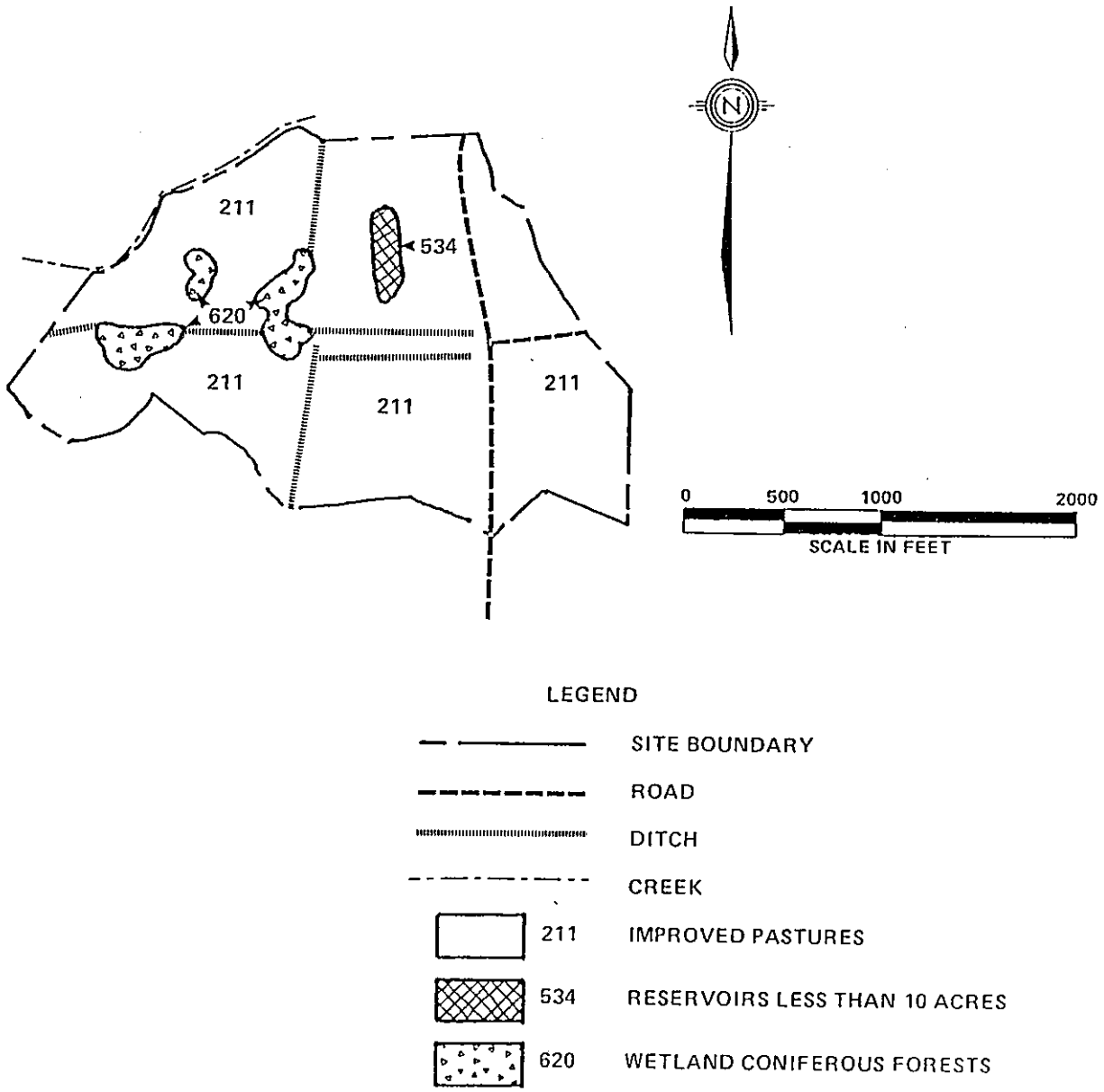


FIGURE C-2: Vegetation Communities and Land Use Types on Site 5, St. Johns County, Florida, as of July 19, 1989

WAR 1989.

Site SJ-6

This 76 acre parcel is located on Dee Dot Ranch just south of Site SJ-8 (Table C-3) and is about 0.25 mile west of the ICWW. A creek drainage borders the site to the east, and the site is nearly surrounded by wetlands to the north, west and south. Like the other sites in the area, this property is located on poorly drained Myakka fine sands which formerly supported pine flatwoods. The site is on a low ridge between +10 to 15 ft. NGVD and drains off to surrounding wetlands. The area had been cleared and used as pasture until 1986 when it was planted in slash pine (Pinus elliottii) (Figure C-3). The pines are currently 2 to 3 ft. dbh and there is an understory of Bahia grass (Paspalum notatum), dog fennel (Eupatorium sp.), and wax myrtle (Myrica cerifera). A small pond with hydric trees species and shrubs border the shallow areas along the pond margins. A residence and barn are also located on the property.

Table C-3: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-6 of St. Johns County, Florida, July 19, 1989

Map ID No.*	Name	Approximate Acreage
110	Residential, Low Density	1.2
260	Other Open Lands	3.6
441	Coniferous Plantations	71.7
	Total	76.5

*Florida Department of Transportation 1985.

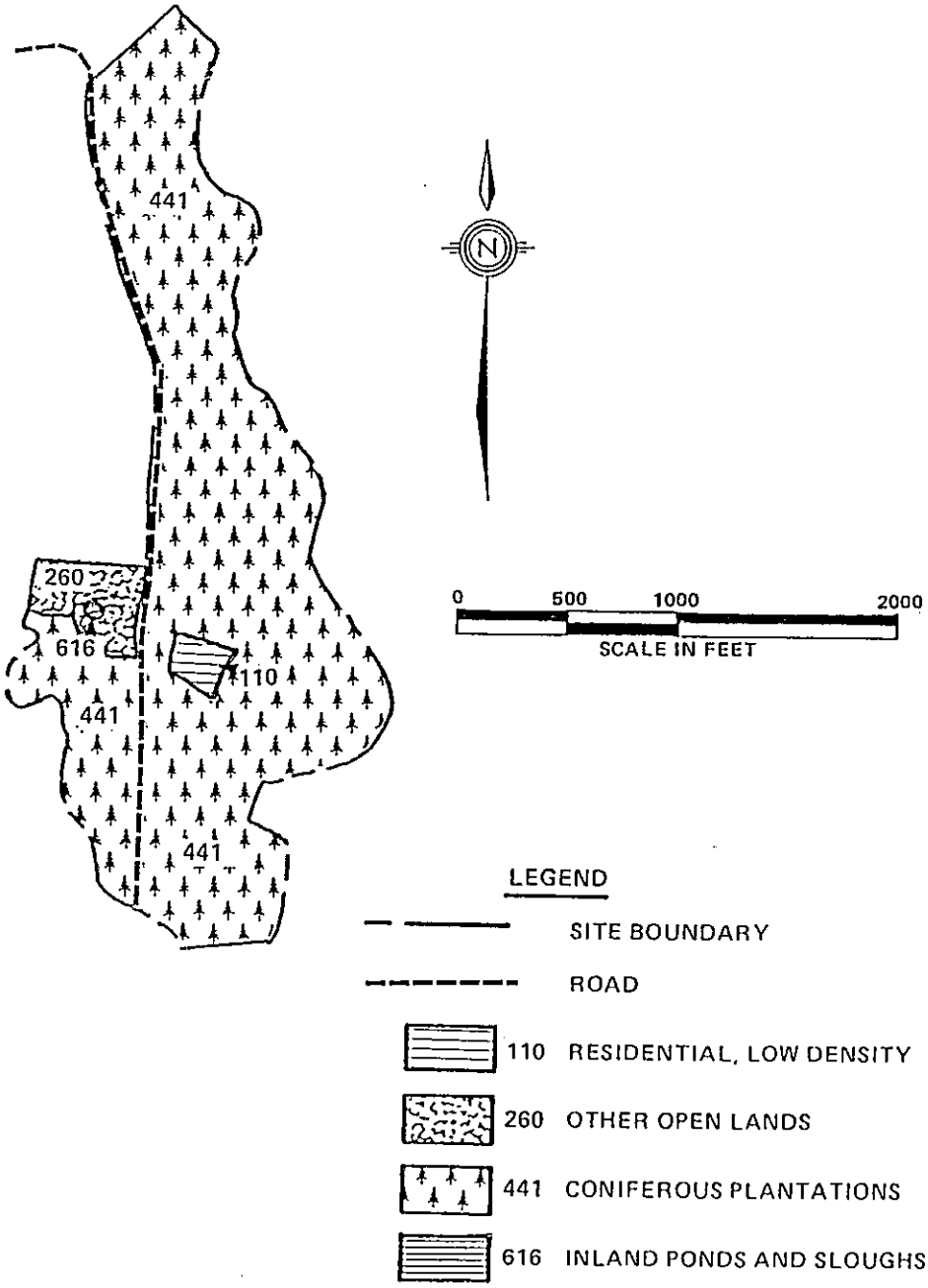


FIGURE C-3: Vegetation Communities and Land Use Types on Site 6, St. Johns County, Florida, as of July 19, 1989

WAR 1989.

Site SJ-8

Site SJ-8 is located just south of a wetland drainage that forms the southern boundary of Site SJ-5 and covers 60 acres (Table C-4). It is about 0.25 mile west of the ICWW opposite Palm Valley Landing. The property is between +10 and +15 ft. NGVD and is underlain by Myakka fine sand which historically supported a flatwoods vegetation community on poorly drained soils.

Nearly the entire site is in slash pine (Pinus elliottii) plantation (Figure C-4). In some areas, slash pine and pond pine (Pinus serotina) are intermixed and there is a thick ground cover of saw palmetto (Serenoa repens) and gallberry (Ilex glabra). Three isolated wetlands were identified on the property. The two wetlands located in the northwest and southwest portions of the site are wet prairies. The other wetland located east of the road is a forested wetland with a blackgum tupelo (Nyssa sylvatica) and slash pine (Pinus elliottii) canopy.

Table C-4: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-8 of St. Johns County, Florida, July 19, 1989

Map ID No.*	Name	Approximate Acreage
441	Coniferous Plantations	58.5
620	Wetland Coniferous Forests	0.9
643	Wet Prairies	1.0
	Total	60.4

*Florida Department of Transportation 1985.

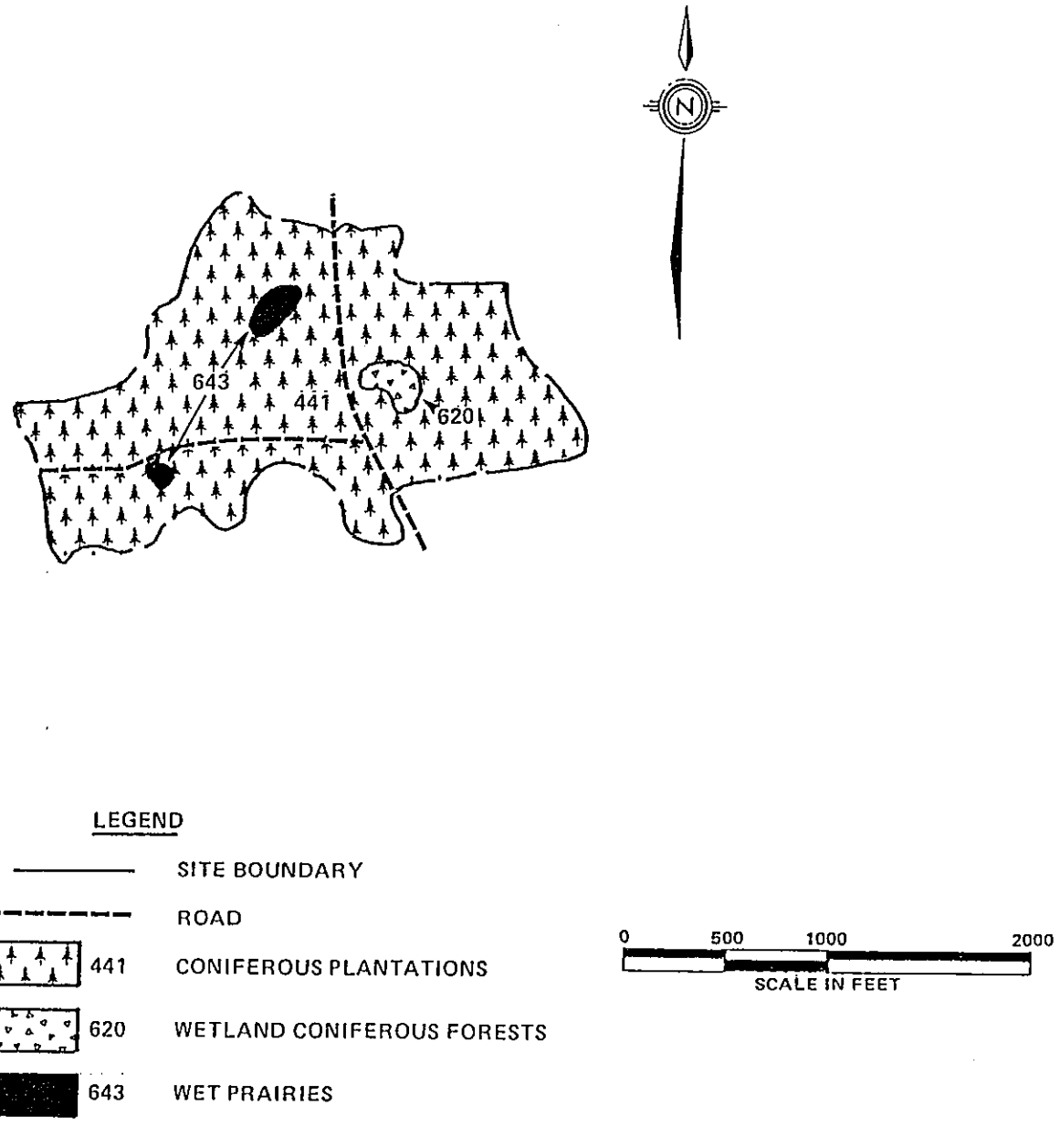


FIGURE C-4: Vegetation Communities and Land Use Types on Site 8, St. Johns County, Florida, as of July 19, 1989

WAR 1989.

Site SJ-10

Site SJ-10 is 61 acres in size (Table C-5) and lies immediately adjacent to the ICWW north of County Road 210. The southern tip of the property borders a small channelized creek. Soils on Site SJ-10 are characterized as St. Augustine fine sand, a rather poorly drained soil type, which is topographically nearly level.

The prevalent vegetation community (Figure C-5) on the site is temperate hardwoods. This community is a low hammock dominated by live oak (Quercus virginiana) and cabbage palm (Sabal palmetto). Slash pine (Pinus elliottii) is a less frequent component. Common understory species include yaupon (Ilex vomitoria), American beautyberry (Callicarpa americana), and muscadine grape (Vitis rotundifolia). Several barren sand areas are interspersed in this community. Two locations (2 acres) have been planted in slash pine. The only wildlife sighting of note was the observation of a gopher tortoise burrow in one of the small, open sandy patches.

Table C-5: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-10 of St. Johns County, Florida, August 22, 1989

Map ID No.*	Name	Approximate Acreage
425	Temperate Hardwood	59.1
441	Coniferous Plantations	2.3
	Total	61.4

*Florida Department of Transportation 1985.

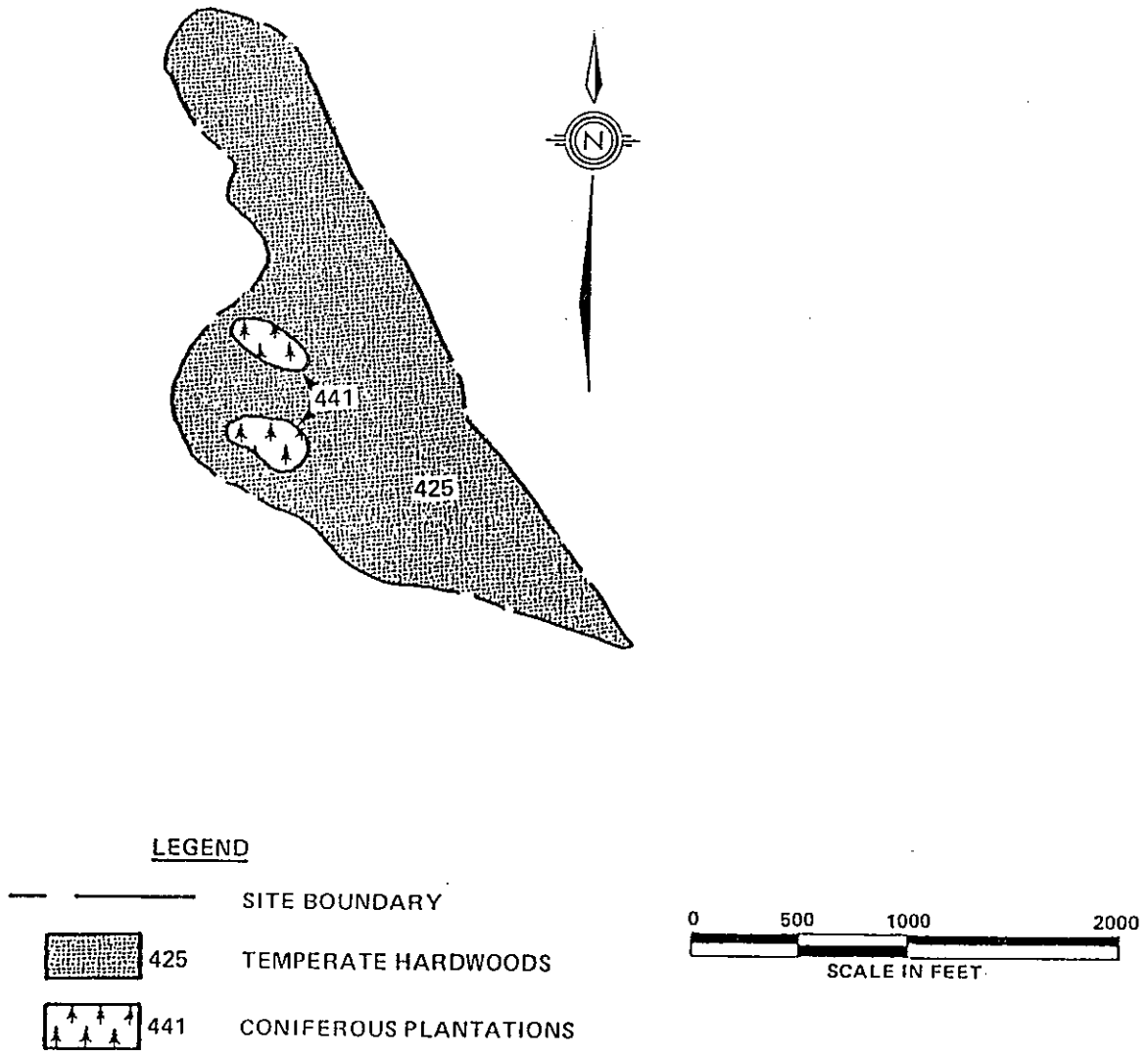


FIGURE C-5: Vegetation Communities and Land Use Types on Site 10, St. Johns County, Florida, as of August 22, 1989

WAR 1989.

Site SJ-11

Site SJ-11 is a 232 acre parcel (Table C-6) located just north of Deep Creek. The site ranges in elevation between +10 and +15 ft. NGVD. The site is bounded on the east by Cabbage Swamp and is approximately 0.75 mile west of the ICWW at Spanish Landing. The soils are poorly-drained Myakka and Immokalee fine sands typical of flatwoods.

The site is dominated by slash pine (Pinus elliottii) plantation in the uplands (Figure C-6). The planted pines generally range from 6 to 8 inches dbh. In some areas slash pine was interspersed with pond pine (Pinus serotina). The understory includes saw palmetto (Serenoa repens), gallberry (Ilex glabra), myrtle oak (Quercus myrtifolia), and fetterbush (Lyonia lucida). The area has a number of small and large wet prairies. These are vegetated mostly with grasses such as sand cordgrass (Spartina bakeri), broom sedge (Andropogon sp.), and reed (Phragmites sp.). Some trees are scattered in these wetlands including slash pine (Pinus elliottii), blackgum tupelo (Nyssa sylvatica), and swampbay (Persea palustris). All wetlands except the western-most appear to be isolated.

Table C-6: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-11 of St. Johns County, Florida, July 20, 1989

Map ID No.*	Name	Approximate Acreage
441	Coniferous Plantations	114.3
643	Wet Prairies	117.8
	Total	232.1

*Florida Department of Transportation 1985.

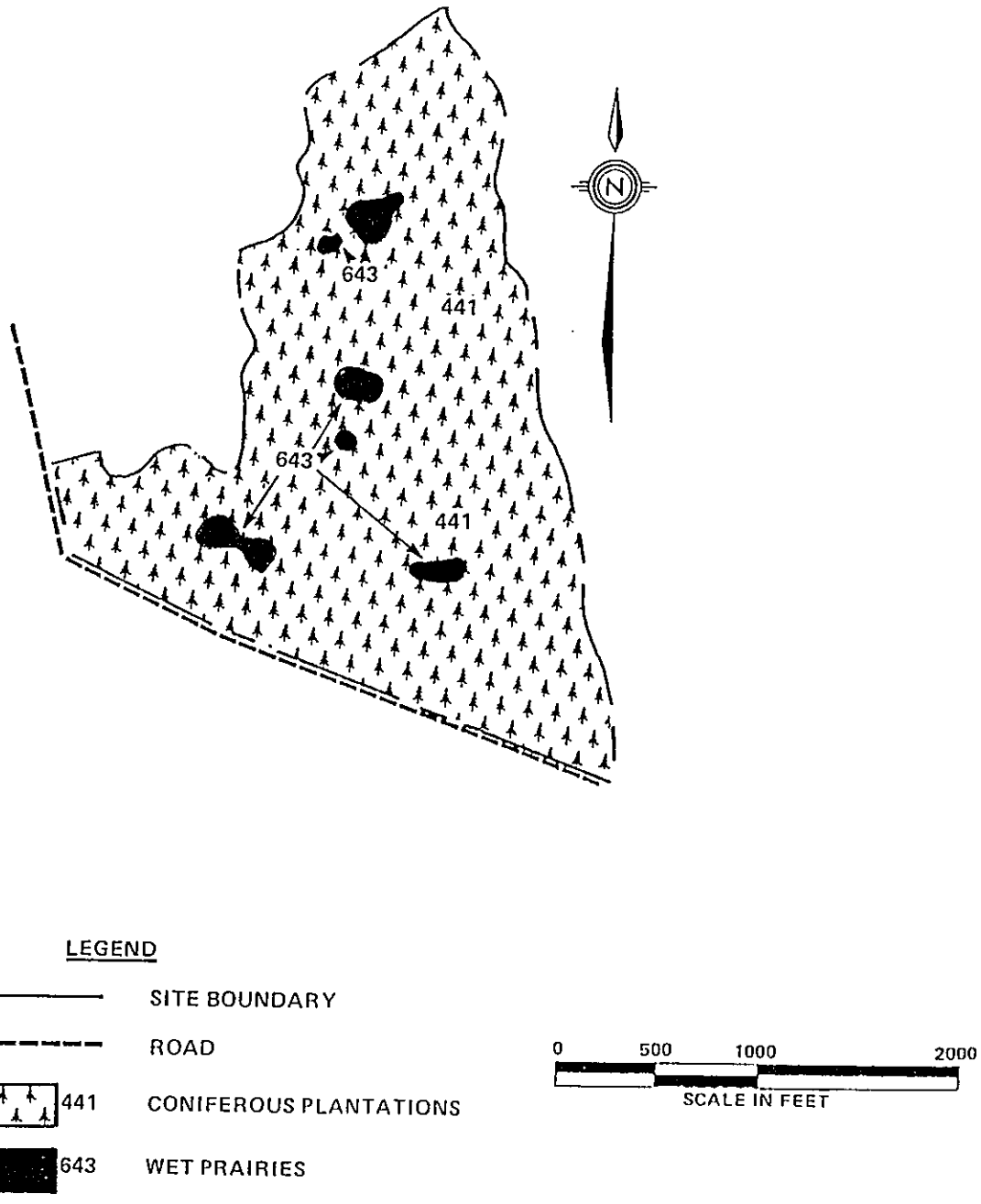


FIGURE C-6: Vegetation Communities and Land Use Types on Site 11, St. Johns County, Florida, as of July 20, 1989

WAR 1989.

Site SJ-12

This 252 acre parcel (Table C-7) is located between Deep Creek and the northern branch of Sweetwater Creek, approximately .6 mile from the ICWW. Elevations on the site range from above the 15 ft. contour to just above the 5 ft. contour. The highest portion of the site is located in the southwestern portions. The site contains a variety of soil types from moderately well-drained Orsino fine sand to very poorly drained Myakka fine sand, depressional.

Vegetation communities include planted pine, palmetto prairie, temperate hardwood, fallow cropland, and scattered wetlands (Figure C-7). The hammock vegetation (425) is dominated by live oak (Quercus virginiana) but also contains water oak (Quercus nigra), some slash pine (Pinus elliottii), and a variety of other hardwoods. It occurs in the northern portion of the site. Planted slash pine is the dominant cover type on the property. Some areas have a mixture of sand pine with an understory of saw palmetto and myrtle oak. A fire recently burned a large section of pine removing the canopy and creating a saw palmetto prairie. A number of wet prairies and forested wetlands are mostly in the central and western part of the property. A large area used for field crop production is located in the northwestern portion of the site. Several ditches drain from this area to a constructed pond near the northern creek system. A low area appears to cut across the field, and drainage may discharge into the pond system by way of this ditch. It appears that the pond discharges to the nearby creek system.

Table C-7: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-12 of St. Johns County, Florida, July 20, 1989

Map ID No.*	Name	Approximate Acreage
215	Field Crops	11.9
321	Palmetto Prairies	36.8
425	Temperate Hardwood	17.2
441	Coniferous Plantations	175.2
534	Reservoirs Less Than 10 Acres	0.3
620	Wetland Coniferous Forests	0.6
621	Cypress	5.1
643	Wet Prairies	4.7
	Total	251.8

*Florida Department of Transportation 1985.

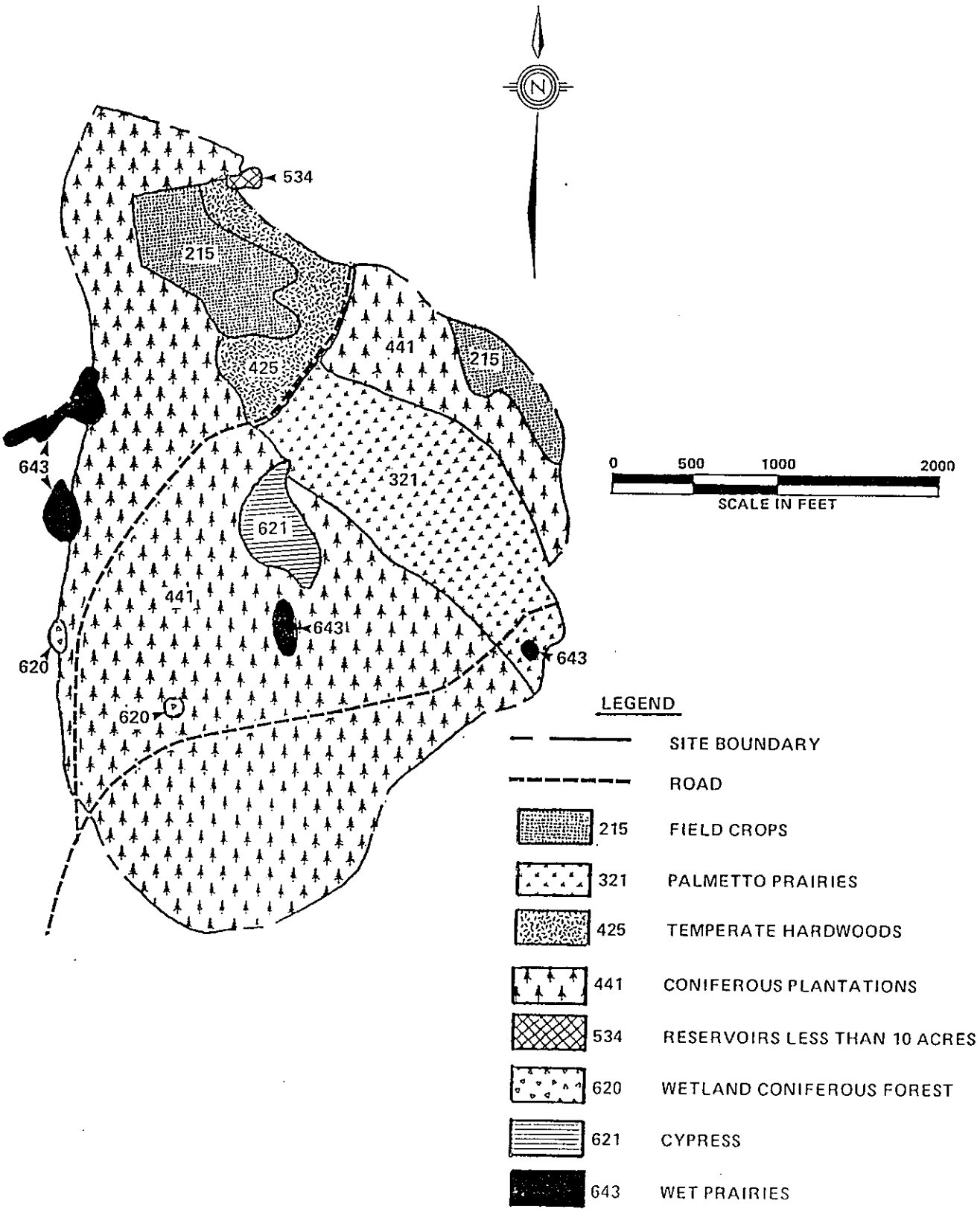


FIGURE C-7: Vegetation Communities and Land Use Types on Site 12, St. Johns County, Florida, as of July 20, 1989

WAR 1989.

Site SJ-19

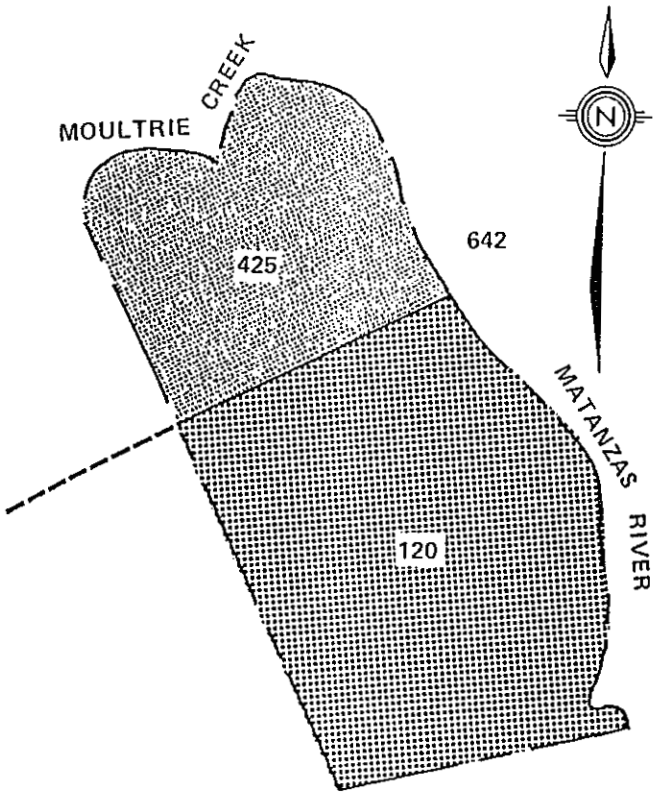
Site SJ-19 is located just south of the confluence of Moultrie Creek and the Matanzas River. This 89.5-acre parcel is considerably reduced in suitable acreage because the southern two-thirds of the site has converted to single-family residential home sites (Table C-8). Only the northern third remains undeveloped. The elevation of the site ranges from +10 to +25 ft. NGVD. The entire parcel consists of excessively drained Astatula fine sand, and this soil type is typically vegetated by hardwood hammock species.

The single vegetation community found on-site was classified as temperate hardwood hammock (425) (Figure C-8). Common components of the community include laurel oak (Quercus laurifolia), live oak (Quercus virginiana), and redbay (Persea borbonia). In some areas, pignut hickory (Carya glabra) and southern red cedar (Juniperus silicicola) are forest dominants. Understory and groundcover species are saw palmetto (Serenoa repens) and yaupon (Ilex vomitoria).

Table C-8: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-19 of St. Johns County, Florida, July 10, 1989

Map ID No.*	Name	Approximate Acreage
120	Residential, Medium Density	58.0
425	Temperate Hardwoods	31.5
	Total	89.5

*Florida Department of Transportation 1985.



LEGEND

SITE BOUNDARY

ROAD

120 RESIDENTIAL

425 TEMPERATE HARDWOODS

642 SALTWATER MARSHES

0 500 1000 2000

SCALE IN FEET

FIGURE C-8: Vegetation Communities and Land Use Types on Site 19, St. Johns County, Florida, as of July 10, 1989

WAR 1989.

Site SJ-21

Site SJ-21 is located just north of an unnamed creek system draining to the Matanzas River and covers 150 acres (Table C-9). The property is .50 mile west of the Matanzas River at Cedar Landing. Elevations on-site range from approximately +20 ft. NGVD to approximately +5 ft. NGVD. The highest areas are in the west and northwest sections of the property. The site contains a variety of soil types ranging from very poorly drained, Wesconnett fine sand in some wetlands in the north-central portion of the site, to excessively drained Astatula fine sand along the southern boundary. Most of the site consists of somewhat poorly drained, Cassia fine sand.

Like the soils, a variety of vegetation communities occur on the property (Figure C-9). Pine flatwoods are the most prevalent community, ranging from scrubby flatwoods in the west where the understory contains myrtle oak (Quercus myrtifolia) and rusty lyonia (Lyonia ferruginea), to a low flatwoods containing slash pine (Pinus elliottii), pond pine (Pinus serotina), and swamp bay (Persea palustris) with a thick ground cover of saw palmetto (Serenoa repens).

In places where scrub vegetation is dominant and pine canopy cover is low, these areas are mapped as coastal scrub. A large hammock area occurs on-site, adjacent to the southern creek drainage. These sandy soils are vegetated with oaks (Quercus laurifolia and Quercus virginiana), southern red cedar (Juniperus silicicola), and southern magnolia (Magnolia grandiflora).

Three isolated wetlands occur on the property and are vegetated by sand cordgrass (Spartina bakerii). Two low wetland areas on-site appear to be part of the creek system to the south and, as such, are probably DER-jurisdictional. One wetland coniferous forest area occurs adjacent to the marshes associated with the Matanzas River system. This is a low flatwoods dominated by slash pine (Pinus elliottii) but also containing some wetland hardwoods and having scattered blackrush (Juncus roemarianus) as the ground cover. A 3 acre cypress wetland occurs in the north-central portion of the site and is part of a wetland system that continues northward off site.

Two small areas occur in the hammock area that were not mapped separately due to their size, but had been previously cleared. Some oyster shell and pottery fragments were observed on the ground, perhaps indicating the existence of an archaeological site.

Table C-9: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-21 of St. Johns County, Florida, August 25, 1989

Map ID No.*	Name	Approximate Acreage
322	Coastal Scrub	38.4
411	Pine Flatwoods	68.7
425	Temperate Hardwood	28.9
427	Live Oak	4.8
615	Stream and Lake Swamps	0.7
620	Wetland Coniferous Forests	3.9
621	Cypress	3.2
643	Wet Prairies	1.4
	Total	150.0

*Florida Department of Transportation 1985.

Site SJ-1

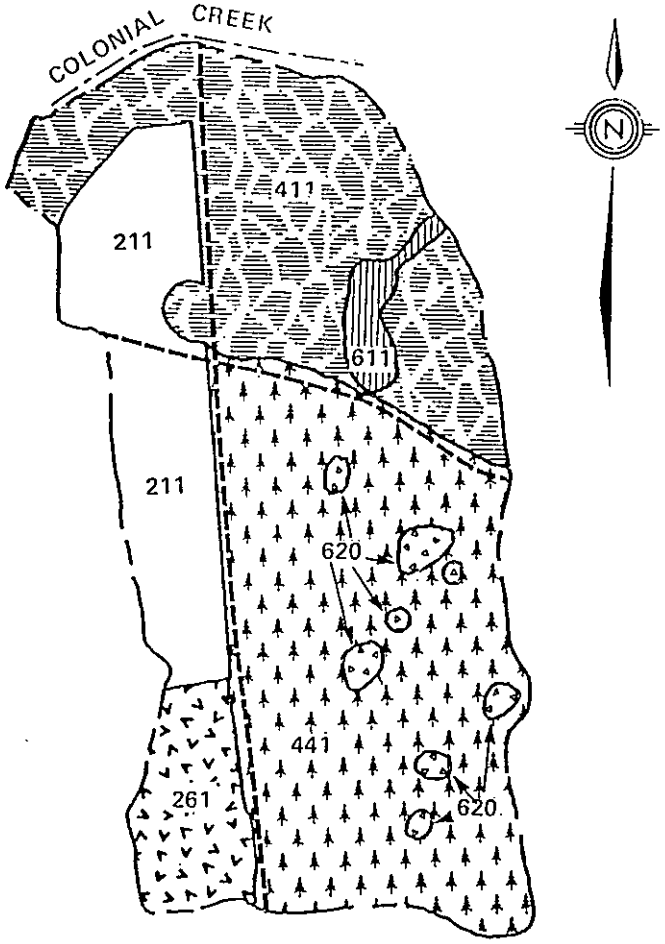
Site SJ-1, located on Dee Dot Ranch, consists of 156 acres and is located 0.5 miles west of the Intracoastal Waterway (ICWW) and 2.5 miles south of the mouth of Cabbage Creek (Table C-1). The parcel is located on a ridge between two low areas east and west of the site and two narrow drainage sloughs north and south of the site. The topography ranges from slightly above +15 ft. National Geodetic Vertical Datum (NGVD) to +10 ft. NGVD. The soils, Myakka fine sand and Immokalee fine sand, are poorly drained flatwoods soils which dominate the property.

Vegetation on the site is a mixture of flatwoods, plant pine plantation, forested wetlands, improved pasture, and cropland (Figure C-1). Low flatwoods are found along the north part of the site. The low flatwoods drop off slightly toward the creek drainage along the north and northeastern borders. A tall thick understory is prevalent along the margins of the flatwoods near these drainages. Some hardwoods are interspersed in the slash pine dominated forest, including swamp bay (Persea palustris). A loblolly bay (Gordonia lasianthus) dominated wetland is located within the flatwoods and drains to the northeast into the creek system via a poorly defined pathway. The western half of the site is in improved pasture dominated by Bahia grass (Paspalum notatum) or fallow cropland. The southeastern portion of the site is planted in young slash pine (Pinus elliotii) [ranging from 1 to 2 inches diameter at breast height (dbh)]. Within the young pine plantation community at least eight wetlands occur. The wetlands appear to be isolated based on aerial photography; however, photographic signatures indicate this area is quite low in some places and it is possible that jurisdictional connections exist. The wetlands appear to be forested, probably with a mixture of cypress (Taxodium ascendens) and slash pine (Pinus elliottii).

Table C-1: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-1 of St. Johns County, Florida, July 19, 1989

Map ID No.*	Name	Approximate Acreage
211	Improved Pastures	27.1
261	Fallow Crop Land	11.6
411	Pine Flatwoods	44.1
441	Coniferous Plantations	66.4
611	Bay Swamps	3.2
620	Wetland Coniferous Forests	3.1
	Total	155.5

*Florida Department of Transportation 1985.



LEGEND

— ———		SITE BOUNDARY
- - - - - - -		ROAD
	211	IMPROVED PASTURES
	261	FALLOW CROP LAND
	411	PINE FLATWOODS
	441	CONIFEROUS PLANTATIONS
	611	BAY SWAMPS
	620	WETLAND CONIFEROUS FORESTS

FIGURE C-1: Vegetation Communities and Land Use Types on Site 1, St. Johns County, Florida, as of July 19, 1989

WAR 1989.

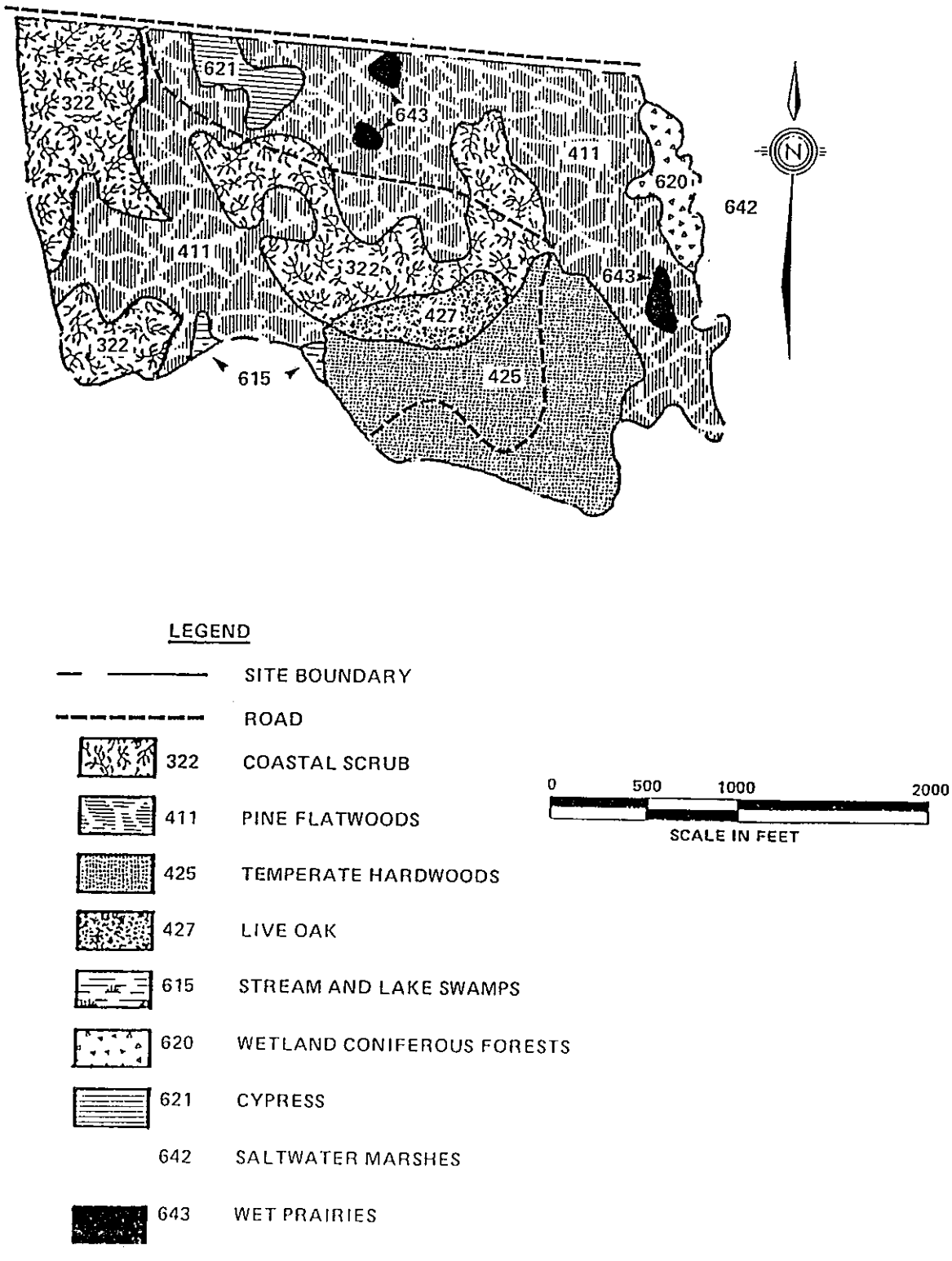


FIGURE C-9: Vegetation Communities and Land Use Types on Site 21, St. Johns County, Florida, as of August 25, 1989

WAR 1989.

Site SJ-23

Site SJ-23 is a 125 acre tract (Table C-10) east of Faver-Dykes State Park and immediately north of Pellicer Creek where it empties into the Matanzas River. The area is known as Hemming Point. The elevation of the property ranges from below the 15 ft. contour in the northwest to the 5 ft. contour as it slopes off toward Pellicer Creek to the south and the Matanzas River to the east. Soils on the site range from poorly drained flatwoods soils in the northwest to excessively drained or moderately well-drained Astatula and Tavares soils in the south.

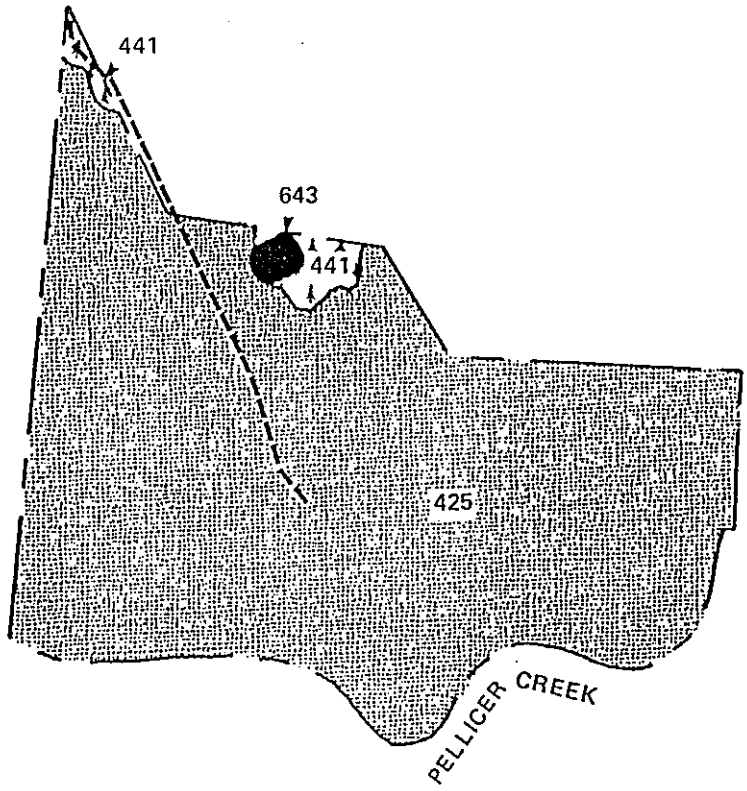
Site vegetation is predominately temperate hammock (Figure C-10) although there is a great deal of variation in the mixture of species found there. In the northwest portion, a greater percentage of the canopy is slash pine (Pinus elliotti) mixed with live oak (Quercus virginiana). In other areas of the forest, oaks predominate with almost no pines, but the canopy contains a variety of other hardwoods, including southern red cedar (Juniperus silicicola), southern magnolia (Magnolia grandiflora), and red bay (Persea borbonia). The extreme northwest corner of the site has a slash pine plantation cover type.

A wet prairie is located along the northern border near the center of the site, and it is surrounded by a young planted pine community.

Table C-10: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-23 of St. Johns County, Florida, August 25, 1989

Map ID No.*	Name	Approximate Acreage
425	Temperate Hardwoods	121.5
441	Coniferous Plantations	2.7
643	Wet Prairies	0.8
	Total	125.0

*Florida Department of Transportation 1985.



LEGEND

SITE BOUNDARY

ROAD

425 TEMPERATE HARDWOODS

441 CONIFEROUS PLANTATIONS

643 WET PRAIRIES

0. 500 1000 2000

SCALE IN FEET

FIGURE C-10: Vegetation Communities and Land Use Types on Site 23, St. Johns County, Florida, as of August 25, 1989

WAR 1989.

Site SJ-26

Site SJ-26 lies south of County Road 210 adjacent to the ICWW. The topography of the site is nearly level and the soils primarily consist of St. Augustine fine sand with a clayey substratum. This soil is considered somewhat poorly drained and is typical of low, flat areas located landward of estuaries along the ICWW.

Site SJ-26 is 20 acres in size (Table C-11) and the primary community type (Figure C-11) is a live oak (Quercus virginiana) dominated hammock. Less common components of the oak hammock community include southern red cedar (Juniperus silicicola) and red maple (Acer rubrum). Wax myrtle (Myrica cerifera) and yaupon (Ilex vomitoria) are the primary constituents of the understory. Slash pine (Pinus elliottii) occurs with low frequency in the northern portion of the site but becomes more frequent in the southern portion.

Two areas on the site are classified as open land. These areas have an open canopy and are vegetated with dog fennel (Eupatorium sp.), winged sumac (Rhus coppalina), and various lawn grasses. Scattered small southern red cedar (Juniperus silicicola) and cabbage palm (Sabal palmetto) are found in this community.

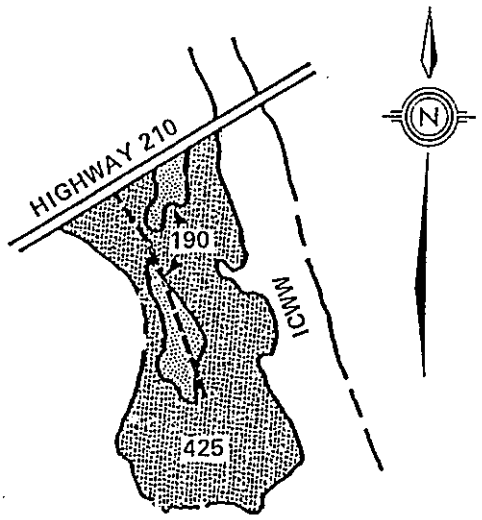
The wetlands adjacent to the site to the west are dominated by black rush (Juncus roemerianus) and southern willow (Salix caroliniana). The marsh east of the site (along the ICWW) contains cabbage palm (Sabal palmetto), southern red cedar (Juniperus silicicola), and marsh elder (Iva frutescens).

The site is accessible from a north-south dirt road off of County Road 210, and portions of the site have been used as a dumping ground for trash.

Table C-11: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-26 of St. Johns County, Florida, July 10, 1989

Map ID No.*	Name	Approximate Acreage
190	Open Land	2.4
425	Temperate Hardwoods	17.2
	Total	19.6

*Florida Department of Transportation 1985.



LEGEND

SITE BOUNDARY

ROAD

190 OPEN LAND

425 TEMPERATE HARDWOODS

0 500 1000 2000

SCALE IN FEET

FIGURE C-11: Vegetation Communities and Land Use Types on Site 26, St. Johns County, Florida, as of July 10, 1989

WAR 1989.

Site SJ-32

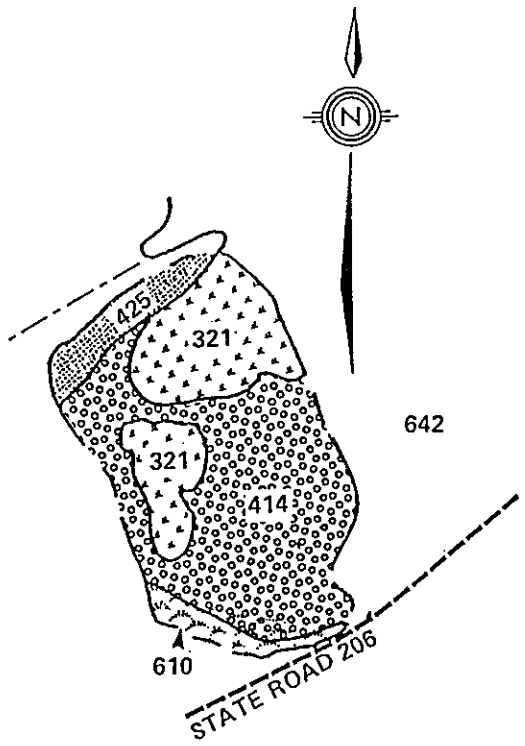
This site is located just north of the State Road 206 bridge west of the Matanzas River. The 34 acre parcel is known as Braddocks Point (Table C-12). The soils on the site include both poorly drained sands (Myakka and Ona) and somewhat poorly drained sands (Cassia).

Vegetation on the property is pine-mesic oak (414) with large well-drained areas in low scrub (321) (Figure C-12). Vegetation along the drainage to the north is temperate hammock. A narrow slough of forested wetland vegetation separates this parcel from the road. This wetland is probably under DER jurisdiction.

Table C-12: Approximate Acreage of the Florida Land Use Cover and Forms Classification System* Types Found on Site SJ-32 of St. Johns County, Florida, July 10, 1989

Map ID No.*	Name	Approximate Acreage
321	Palmetto Prairies	10.0
414	Pine-Mesic Oak	19.3
425	Temperate Hardwoods	2.6
610	Wetland Hardwood Forests	1.8
	Total	33.7

*Florida Department of Transportation 1985.



LEGEND

		SITE BOUNDARY
		ROAD
		CREEK
	321	PALMETTO PRAIRIES
	414	PINE – MESIC OAK
	425	TEMPERATE HARDWOODS
	610	WETLAND HARDWOOD FORESTS
	642	SALTWATER MARSHES

0 500 1000 2000

SCALE IN FEET

FIGURE C-12: Vegetation Communities and Land Use Types on Site 32, St. Johns County, Florida, as of July 10, 1989

WAR 1989.

APPENDIX D

SITE BANK OWNERSHIP

TABLE D-1: SITE BANK OWNERSHIP

Site #	Map Panel No.	Section/ Township/Range	Property Record No.	Parcel Size (Acres)	Assessed Value (Taxed Value)	Owner
SJ-2	4A/N&S	32/3/29	061880	38.0	-----	Danov Corporation P.O. Box 2088 Jacksonville, FL 32203-2088
	4A/N&S	31/3/29	061870	598.0	-----	Same as above.
	4B/N	5/4/29	066450	213.0	-----	Same as above.
	4B/N	6/4/29	066460	652.0	-----	Same as above.
SJ-14	4B/S	55/04/29	069630	609.0	$380,630. (73,520.)	D.D.I. Inc. P.O. Box B Jacksonville, FL 32203-0297
	4B/S	61/04/29	069710	42.0	-----	Same as above.
	4B/S	57/04/29	069670	257.0	-----	Same as above.
		32/04/29	068160	399.0	-----	Same as above.
SJ-20	5F/29X	42/08/30	184400	1198.0	----- (168,132.)	Kittredge Investments 693 N. Orange Ave., Suite 200 Orlando, FL 32801-1342

Site #	Map Panel No.	Section/ Township/Range	Property Record No.	Parcel Size (Acres)	Assessed Value (Taxed Value)	Owner
SJ-22	5G/SX	39/09/30	187270	597.0	$373,130. (85,860.)	Rayonier Timberlands Operating Company P.O. Box 728 Fernandina Bch, FL 32034-0728
	5G/SX	40/09/30	187280	301.78	188,630. (41,230.)	Same as above.
	5G/SX	41/09/30	187290	115.0	-----	Same as above.
SJ-27	4B/55X	27-28/4/29	067880	67.20	----- (121,010.)	W.D. Manning 4040 Ricker Rd. Jacksonville, FL 32211
	4B/55X	27/4/29	067590	54.0	----- (4950.)	D.D.I. Inc. P.O.Box B Jacksonville, FL 32203-0297
	4B/55X	28/4/29	067890	4.0	----- (80.)	D.D.I. Inc. P.O. Box B Jacksonville, FL 32203-0297
SJ-28	4C/61S	44,54,59/5/29	071980	117.60	88,200. (70,210.)	Genesis Ltd. One San Jose Blvd. Suite #7 Jacksonville, FL 32217-7580

Site #	Map Panel No.	Section/ Township/Range	Property Record No.	Parcel Size (Acres)	Assessed Value (Taxed Value)	Owner
SJ-29	4C/61S	57/5/29	072080	52.5	$ 39,380. (9630.)	Alden Road Ltd. Partnership One San Jose Place Suite #7 Jacksonville, FL 32217
	4C/61S	58/5/29	072090	64.5	48,380. (38,940.)	Same as above.
	4C/61S	45,58,59/5/29	071990	30.4	29,550. (18,120.)	Dennis M. Doyle, Jr. 4201 Baymeadows Rd. Jacksonville, FL 32217
	4C/61S	48,3/5/29	074170	136.0	159,060.	Stokes Landing Ltd. 5209 San Jose Blvd., Suite 201 Jacksonville, FL 32207-7663
SJ-30	5E/N&S	29/07/30	162210	172.89	668,700.	Marion Ryman & Barnett Banks & Thompson Bros. Realty, Inc. P.O. Drawer 3807 St. Augustine, FL 32085-3807
MSA SJ-1	5G/N	14/9/30	186640	200.0	-----	Trustees of the Internal Improvement Fund State of Florida