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ENVIRONMENTAL IMPACT ASSESSMENT IN COASTAL HABITATS: AN EVALUATION OF PREDICTIONS

by

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A survey of environmental impact statements (EISs) prepared for coastal projects was undertaken to evaluate the degree to which environmental impact prediction changed over the 20-year period since EISs were required. Statements were evaluated for the level of technical information used in making predictions as well as the degree to which predictions were testable. Overall, the level of prediction has increased over time with a greater number of statements including more detailed predictions that are based on available technical information. Fewer statements include only general, and untestable, predictions. Eighty-eight randomly selected EISs and 17 non-randomly requested EISs were evaluated. Thirty-seven of these statements were found to have testable predictions and/or technical information adequate to allow detailed evaluation of the validity of the predictions. This additional information would greatly enhance future environmental predictive abilities.

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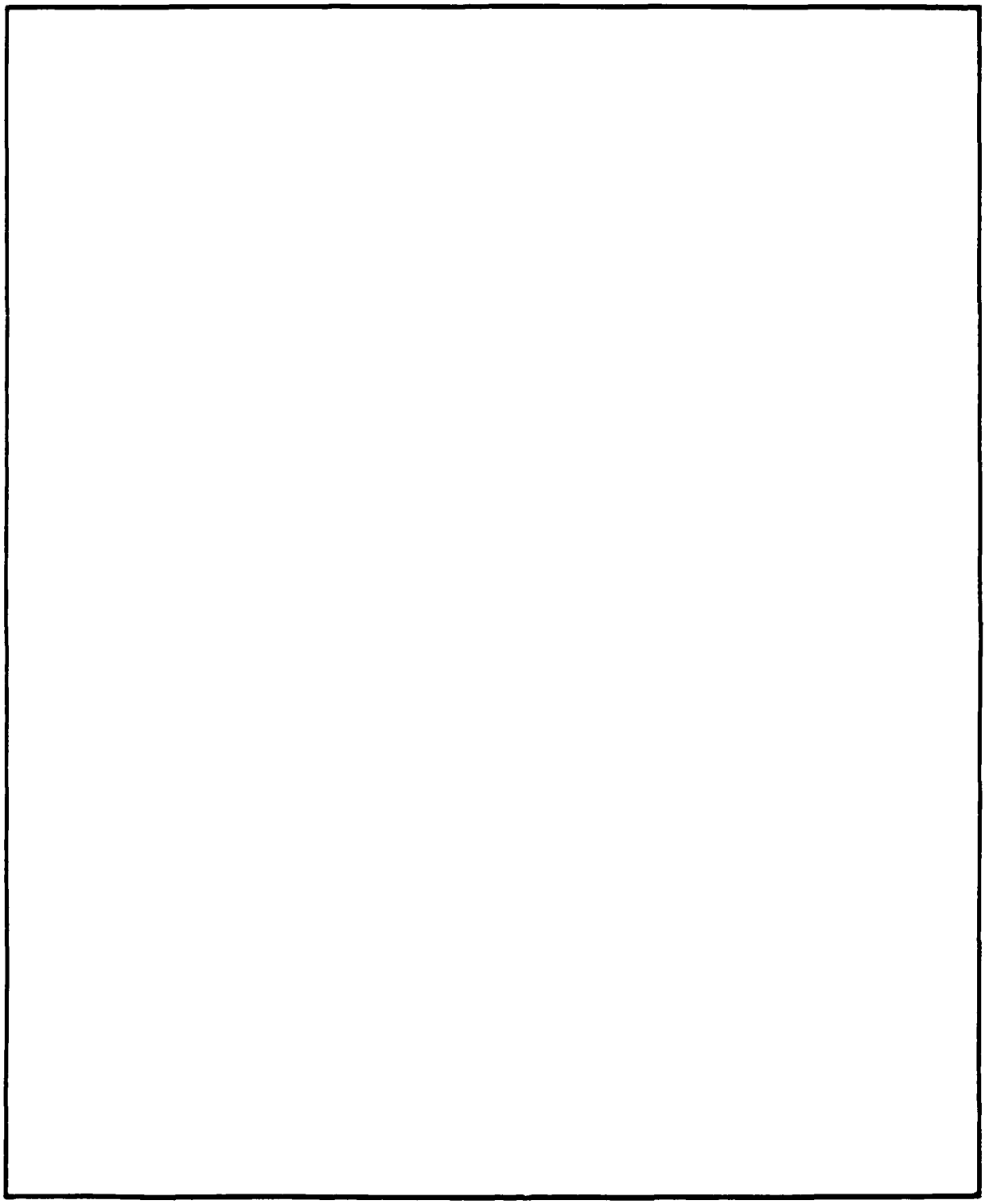

PREFACE

This report outlines the results of a study conducted under Work Unit 32556 of the Environmental Impact Research Program (EIRP), which is sponsored by the Headquarters, US Army Corps of Engineers (HQUSACE), through the US Army Engineer Waterways Experiment Station (WES). The EIRP is managed by the WES Environmental Laboratory (EL).

This report was prepared by Dr. Courtney T. Hackney of the University of North Carolina at Wilmington. Dr. Mark W. LaSalle served as WES contract monitor for this study under the general supervision of Mr. Edward J. Pullen, Chief, Coastal Ecology Group, Environmental Resources Division (ERD), EL. Technical critiques were provided by Drs. Mark W. LaSalle and Douglas G. Clarke, and Mr. Edward J. Pullen (WES), and Dr. Thomas J. Fredette, US Army Engineer Division, New England. The report was edited by Mrs. Janean Shirley of the WES Information Technology Laboratory.

Dr. Roger T. Saucier was Program Manager, EIRP. Technical monitor for the work was Dr. John Bushman, HQUSACE. Dr. Conrad J. Kirby was Chief, ERD, and Dr. John Harrison was Chief, EL.

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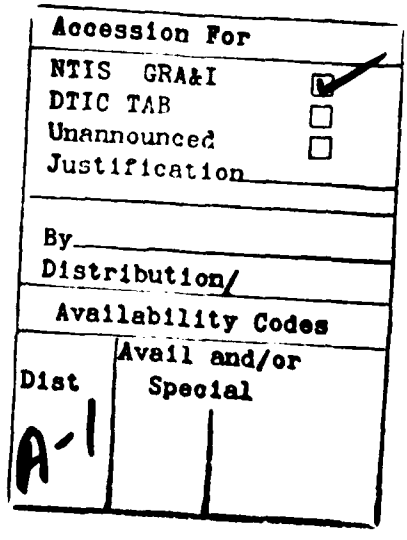

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ENVIRONMENTAL IMPACT ASSESSMENT IN COASTAL HABITATS: AN EVALUATION OF PREDICTIONS

PART I: INTRODUCTION

Background

1. Since implementation of the National Environmental Policy Act in 1969, the US Army Corps of Engineers has conducted thousands of environmental analyses nationwide, primarily in the form of environmental impact statements (EISs) and environmental assessments (EAs). From the beginning, when even the style was uncertain, to the present, when such documents are routine, the process and accompanying documents have evolved. The degree to which these documents and associated processes have improved, however, has heretofore not been addressed. Have these documents improved? Do they now better evaluate potential ecological risks versus potential economic benefits? While it can be stated with a degree of certainty that Corps procedures regarding EIS preparation are now detailed and well established, and that Corps personnel are better trained to prepare such documents, important technical questions remain.

Purpose and Scope

2. The main objective of this study was to evaluate the degree to which impact prediction has changed over the 20-year period since EISs have been required. As part of this analysis, several aspects of impact prediction were evaluated, including the level of technical information used in making predictions and the degree to which predictions were testable. A secondary objective of this study was the identification of projects for which there were adequately testable predictions and/or those for which an adequate body of technical information (baseline) existed which could be used to test the validity of predictions.

3. The scope of the survey of EISs used for this analysis was restricted exclusively to coastal zone projects and, as much as possible, included projects from each of 18 coastal Corps Districts/Divisions and each of five categories of projects (identified below) recognized by the Corps. The main part of the survey was further restricted to consideration of only final versions of statements (FEISs), when available. Given the large number of EISs produced over this 20-year period, a subsample of EISs was selected for analysis.

PART II: METHODS

4. A random sampling of FEISs was conducted for use in addressing the major objective of the study. To avoid bias, either of topic or geographic area, in selecting EISs for inclusion in the sample, statements were selected randomly from the computerized list of EISs maintained by Corps Headquarters. Projects are listed by title along with information on the project type and dates of available documents (EIS, FEIS, supplemental EIS (SEIS)). Projects are classified into five major categories: flood damage protection (FDP; e.g., levee construction-maintenance), navigation (NAV, e.g., ship channel construction-maintenance), shore protection (SP, e.g., beach renourishment), permit (PER; e.g., dredge and fill applications from private and/or government entities), and miscellaneous (MIS, e.g., aquatic plant control).

5. A subsample of projects was selected from a total of 894 possible FEISs listed as available from coastal Corps Districts/Divisions. Because EISs are listed by project title, it was not always possible to distinguish between coastal and inland projects, particularly for FDP projects which may cover any portion of a given river system. Projects were accepted in the sample only when this distinction was clear. A total of 219 FEISs (24.4 percent of the total) from NAV, SP, PER, and MIS categories were selected and requested from respective District offices. Of those statements requested, 88 (40 percent) were obtained and included in the analysis (Table A1, Appendix A). In some cases Districts did not respond to the request (4 of 18 Districts) or indicated that copies of requested statements were not available. Dates of final versions of some statements did not always correspond to that shown on the Corps list. A summary of statements produced, requested, and received is provided in Table 1.

6. For each statement examined, information was collected on the level of predictions made (none provided, general, specific), the testability of predictions, and any applicable comments made by commenting agencies. Those projects for which testable predictions were made were identified for possible further study (second study objective). Levels of predictions, other than "none provided," were defined as: general predictions that are impossible to test with no available site-specific data useful for future comparisons; specific and general, predictions based on some sort of baseline data with which hypotheses could be developed and tested: and testable specific, detailed predictions based on good baseline data, which would allow development and testing of hypotheses.

7. A non-random sampling of EISs was conducted in order to identify additional projects useful for addressing the second objective of the study. In addition to specifically requested EIS statements, respondents were asked to provide copies of additional EISs or EAs for which adequate information was available which would be useful in evaluating the precision of the predictions. Seventeen such statements were received (Table B1, Appendix B).

Table 1
Numbers and Proportions (Percent) of FEISs Produced and Requested, by Coastal District, and Numbers Received for Analysis

District	Produced	Random Sample		Non-Random
		Requested	Received	
New England	62 (6.9)	15 (6.8)	8	1
New York	80 (8.9)	10 (4.6)	0	0
Philadelphia	36 (4.0)	12 (5.5)	0	0
Baltimore	38 (4.3)	11 (5.0)	0	0
Norfolk	38 (4.3)	10 (4.6)	6	3
Wilmington	44 (4.9)	12 (5.5)	8	2
Charleston	24 (2.7)	7 (3.2)	6	2
Savannah	27 (3.0)	8 (3.7)	3	0
Jacksonville	76 (8.5)	24 (11.0)	13	0
Mobile	79 (8.8)	14 (6.4)	13	0
New Orleans	54 (6.0)	17 (7.8)	3	1
Galveston	60 (6.7)	11 (5.0)	9	4
Los Angeles	42 (4.7)	6 (2.7)	0	0
San Francisco	46 (5.1)	15 (6.8)	(Received too late to include in analysis)	
Portland	47 (5.3)	7 (3.2)	6	2
Seattle	47 (5.3)	12 (5.5)	12	2
Alaska	38 (4.3)	12 (5.5)	0	0
Pacific Ocean	56 (6.3)	16 (7.3)	1	0
TOTAL	894	219	88	17

PART III: RESULTS AND DISCUSSION

8. Except for the proportion of FDP statements, the random sampling design adequately reflected the distribution of environmental statements over time (Figure 1), between project types (Figure 2), and across Districts (Table 1). A disproportionate number of statements were produced from 1974-1977 (Figure 1) and many were written for projects already accomplished, currently underway, or for continuing work such as maintenance dredging. After 1977, statements usually addressed new projects. For the most part, FDP statements involve freshwater projects which were not included in this analysis. There were some discrepancies between the dates listed on EISs received and the dates recorded by Headquarters, US Army Corps of Engineers. However, as used to generate Figure 1, these usually involved no more than a difference of 1 year and did not greatly affect the distribution over time.

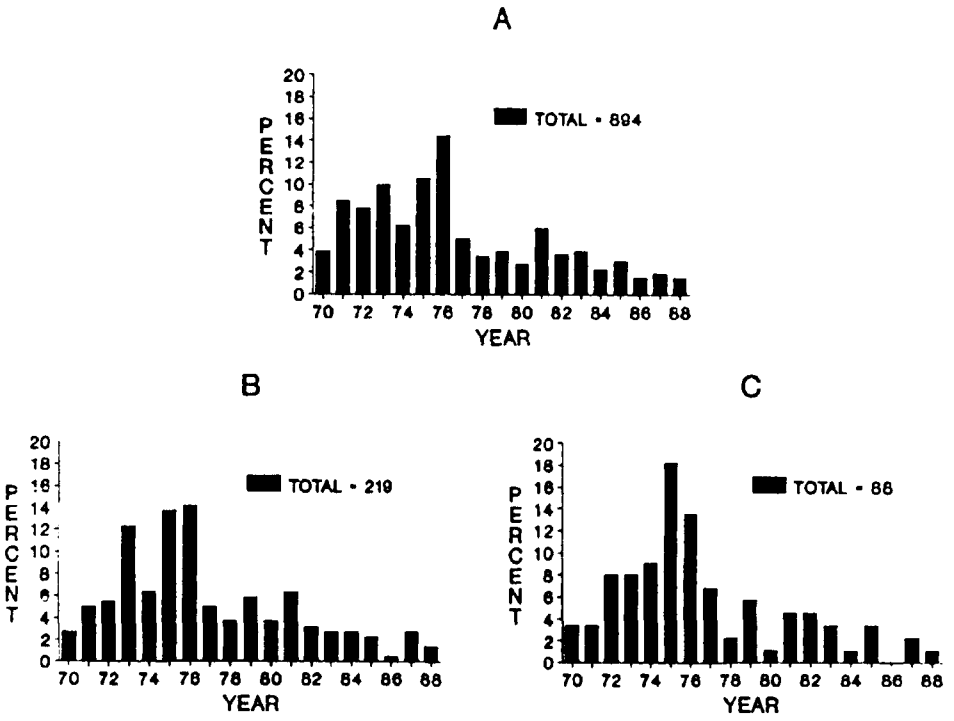

Figure 1. Proportions, by year, of (a) total numbers of FEISs produced by coastal Districts, (b) numbers of FEISs randomly selected for analysis, and (c) numbers of FEISs received for analysis

9. Based on pure numbers, EISs have become more predictive (Figure 3). In early years (1970-74), 80.6 percent of the statements provided only general predictions. General predictions are defined as those difficult or impossible to test or those not based on site-specific data. Statements such as "turbidity levels are not expected to increase significantly," were the highest level of prediction found in many of these early documents. There was a steady decline in this category of predictions by 1985-89, when no document contained only general predictions (Figure 3).

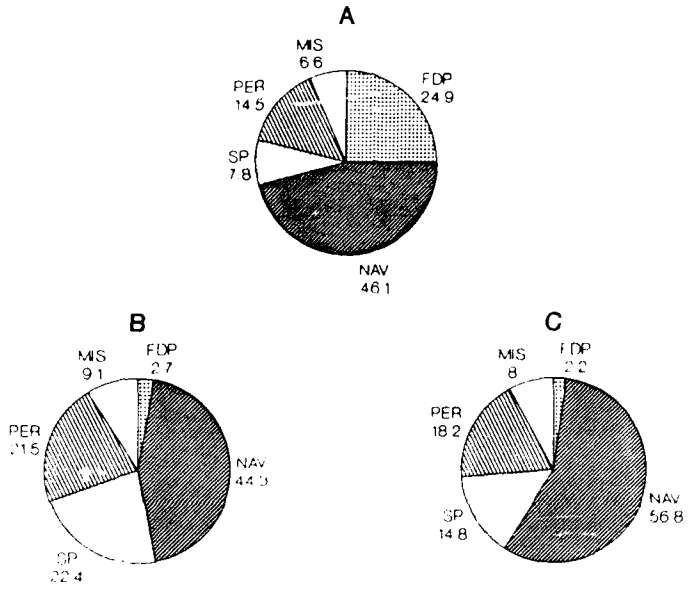

Figure 2. Proportions, by project type, of (a) total numbers of FEIS produced by coastal Districts, (b) numbers of FEISs randomly selected for analysis, and (c) numbers of FEISs received for analysis. FDP = flood damage protecton, NAV = navigation, SP shore protection, PER = permit, MIS = miscellaneous

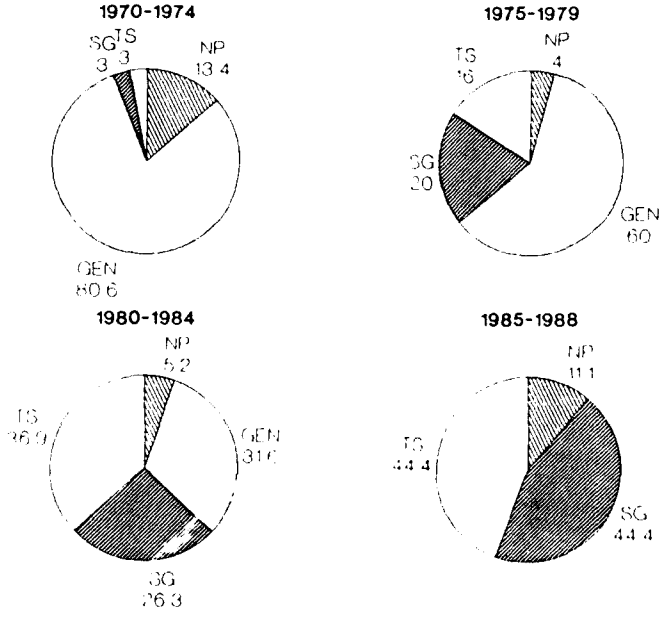

Figure 3. Level of predictions in environmental statements during 5-year increments. N = 30 from 1970-74, N = 50 from 1975-79, N = 19 from 1980-84, and N = 9 from 1985-5. NP = no predictions, GEN = general only, SG = specific and general, TS = testable specific

10. By the 1980s, environmental statements included many specific predictions, many of which were testable. General statements were still made but contained either site-specific information that made the appropriateness of general statements meaningful or actually predicted levels of change expected. The final category of predictions (testable specific) was a matter of degree. Such statements contained hard data and/or quantitative predictions which could be examined and evaluated. A large number of dredging projects benefited from detailed site-specific sediment analyses and models that allowed real predictions. The proportion of environmental statements that contained specific predictions increased to almost half of all documents by the 1980-84 period (Figure 3).

11. While a certain degree of temporal bias remains, largely because today's statements concern mainly new projects, there has been a significant increase in the quality of environmental statements, at least as related to the degree of certainty contained in predictions. There will always be some degree of randomness in such an analysis that cannot be avoided. In some cases specific predictions are inappropriate and make little sense, while in others, testable predictions are easy to make. For example, when marshes are being filled or dredged, a prediction that a certain number of acres will be destroyed is certain and easily made.

12. During examination of EIS documents an effort was made to also review letters submitted by various agencies and individuals. Although not recorded in a statistically testable manner, there was a definite indication of increased detail in EIS documents with increased public awareness. The more controversial the project, the more public interest and more EIS documentation. In all cases, approval of the project was made, but there is no way to ascertain the changes or alteration in the final document or plan caused by public comment. It was also impossible to determine the number of projects for which final EIS documents were not prepared because documentation of the project was inadequate to recommend approval. This subject deserves further examination.

13. An evaluation of the precision of predictions made is not possible without field examination and/or verification. Adequate evaluation of precision would also require a good source of baseline information with which to compare post-project effects. All of the 17 non-random statements (Appendix B) and 20 of the randomly selected statements (Appendix A) received from Districts appear to meet these requirements and cover a range of project types which are commonly encountered as well as all regions of the country. The Corps would benefit greatly from detailed evaluation of these and other similar projects. These analyses could provide a base of valuable technical information on major projects which would lend credence and support to future predictive statements regarding environmental impact.

PART IV: SUMMARY

14. Overall, the answer to the main question addressed by this survey is yes, impact prediction has improved over the 20 years of EIS preparation in terms of both the level of technical information used in making predictions as well as the degree to which these predictions are testable. To a large degree this change has been driven by increased pressure from resource agencies for more detailed analyses of potential impacts as well as increased interest on the part of the Corps to consider the effects of its activities. Variation that still exists in the quality of predictions can, to some degree, be explained by the level of interest from place to place.

15. A second important result of this survey was the identification of a large number of projects having testable predictions and/or enough information to allow evaluation of predictions. Included in this group are projects covering a wide range of activities (dredging, disposal, habitat creation) within all major areas of the country. The Corps would benefit greatly from in-depth evaluations of these projects, which would provide valuable information to aid in future impact predictions.

APPENDIX A: LIST OF RANDOMLY SELECTED ENVIRONMENTAL IMPACT STATEMENTS

Table A1
Randomly Selected Environmental Impact Statements Received for Analysis

Title	Year	Project Type*
New England Division		
Bucks Harbor, Machiasport, ME (ES)	1971	NAV
Cape Cod Canal, Bourne and Sandwich, MA (O&M)	1977	NAV
Maintenance dredging of Guilford Harbor, Guilford, CT (EA)	1981	NAV
Proposed improvement dredging of Point Judith Harbor and Pond, Galilee, RI	1976	NAV
Cliff Walk, Newport, RI (ES)	1970	SP
Oak Bluff Town Beach (ES)	1971	SP
Addition to Unit No. 4, Salem Harbor Electric Generating Station, Salem, MA (ES)	1972	PER
Cape Cod Canal, Bourne and Sandwich, MA, Bridges	1979	MIS
Norfolk District		
Aberdeen Creek - Gloucester County, Virginia (maintenance dredging)	1974	NAV
Albemarle and Chesapeake Canal and the Dismal Swamp Canal Routes of the ICW, Virginia and North Carolina (maintenance dredging)	1975	NAV
Norfolk Disposal Site - an assessment of the ecological impact of open ocean disposal of materials dredged from a highly industrialized estuary**	1981	NAV
Virginia Beach erosion control project	1975	SP
Willoughby Spit and Vicinity - Norfolk, VA, hurricane protection and beach erosion control study	1983	SP
Hampton roads and the harbors of Norfolk and Newport News, VA - collection and removal of debris**	1982	MIS
Wilmington District		
Maintenance dredging from Back Sound to Lookout Bight, North Carolina**	1975	NAV
Maintenance of Cape Fear River above Wilmington, NC	1976	NAV
Maintenance of the waterway connecting Pamlico Sound and Beaufort Harbor, North Carolina**	1976	NAV
Maintenance of Wilmington Harbor, North Carolina	1977	NAV
Neuse River, North Carolina, channel extension to Streets Ferry	1975	NAV
Beach erosion control and hurricane wave protection, Carolina, beach and vicinity, New Hanover County, North Carolina	1981	SP
Broad Creek, Beaufort County, North Carolina flood control	1970	FDP

(Continued)

* NAV = navigation; SP = shore protection; PER = permit; MIS = miscellaneous; FDP = flood damage protection.

** Document contains testable predictions.

(Sheet 1 of 4)

Table A1 (Continued)

Title	Year	Project Type
Wilmington District (continued)		
Coastal Engineering Research Facility at Duck, NC	1973	MIS
Charleston District		
Maintenance dredging of Georgetown Harbor, Georgetown County, South Carolina	1976	NAV
Charleston Harbor deepening project, Charleston Harbor and Shipyard River, South Carolina	1976	NAV
Maintenance dredging of Atlantic intracoastal waterway, South Carolina	1976	NAV
Hunting Island Beach, South Carolina	1975	SP
Application by AMOCO Chemicals Corp. for a permit to dredge in the Cooper River and adjacent waters and construct a chemical plant and associated facilities*	1976	PER
Marine terminal on the Wando and Cooper Rivers, Charleston County, SC	1977	PER
Savannah District		
Belleville Point, McIntosh County, Georgia, navigation study*	1984	NAV
Closure of Academy Creek Brunswick Harbor, Georgia	1973	NAV
Little River development plan (EA)	1974	MIS
Jacksonville District		
Crown Bay Channel, St. Thomas Harbor, Virgin Islands - channel improvement for navigation	1979	NAV
Boot Key Harbor, Florida (Navigation Section 107)*	1978	NAV
Fernandina Harbor (maintenance dredging)	1974	NAV
San Juan Harbor, Puerto Rico (maintenance dredging)	1974	NAV
Intracoastal waterway, Jacksonville to Miami (maintenance dredging)	1973	NAV
Miami, Florida Harbor - navigation	1972	NAV
Bal Harbor, Florida, partial beach restoration - beach erosion control and hurricane protection project	1972	SP
Beach erosion control project, Duval County, Florida	1974	SP
Beach erosion and hurricane surge protection project - Dade County, Florida*	1975	SP
Beach erosion control project review study for Pinellas County, Florida*	1985	SP
Beach erosion control and shore protection study, Indian River, Florida*	1981	SP
Punta Gorda Isles, Inc., Section 15 (permit application), Punta Gorda, Florida	1977	PER
Residential development near Marco Island, Florida*	1983	PER

(Continued)

* Document contains testable predictions.

Table A1 (Continued)

Title	Year	Project Type
Mobile District		
Breakwater at Eastpoint, FL	1983	NAV
Cadet Bayou, Hancock County, Mississippi	1979	NAV
Maintenance dredging of the Gulf intracoastal waterway from Pearl River, Louisiana-Mississippi to Apalachee Bay, Florida	1976	NAV
East Pass Channel, Okaloosa County, Florida (maintenance dredging)	1975	NAV
Apalachicola Bay, Florida (maintenance dredging)	1974	NAV
Panacea Harbor, Florida (maintenance dredging)	1974	NAV
Channel from Apalachicola to Two Mile and breakwater at Two Mile, Apalachicola Bay, Florida	1973	NAV
Bayou Coden, Alabama, navigation	1971	NAV
Choctachatchee River and Holmes Creek, Florida, permit application for snag removal by Florida Game and Fresh Water Fish Commission	1972	PER
Permit application by Radcliff Materials, Inc., dredging of dead-reef shells, Mobile Bay, Alabama	1973	PER
Permit application by Chevron Oil, dredging of a slip to accomodate a drilling barge for gas and oil exploration. Mobile River Delta, Baldwin County, Alabama*	1975	PER
Proposed pipeline and wastewater outfall in Mobile Bay, Alabama from the Theodore Industrial Park*	1979	PER
Construction of a bulk coal and grain handling facility, Theodore Ship Channel, western shore of Mobile Bay, Mobile County, Alabama	1985	PER
New Orleans District		
Mississippi River Outlets, Vicinity of Venice, LA*	1976	NAV
LaRose to Golden Meadows, LA, hurricane protection (formerly Grand Isle, LA, and the vicinity hurricane protection)	1973	FDP
Hurricane Protection Project - New Orleans to Venice, LA (supplemental) (SEIS)*	1985	MIS
Galveston District		
Deepwater channel and multipurpose terminal near Brownsville in Cameron County, Texas	1982	NAV
Gulf intracoastal waterway, Texas (tributary channel to Aransas Pass) (supplement) (SEIS)	1977	NAV
Maintenance dredging, Galveston Harbor and Channel, Texas (Galveston Harbor Channels)	1975	NAV
Maintenance dredging - Cedar Bayou Channel, Texas	1975	NAV

(Continued)

* Document contains testable predictions.

Table A1 (Concluded)

Title	Year	Project Type
Galveston District (Continued)		
Maintenance dredging, Trinity River and tributaries, Texas - Anahuac Channel and channel to Liberty*	1975	NAV
Freeport Harbor, Texas (modifications to 36-ft navigation project)	1974	NAV
Corpus Christi Beach, Texas (restoration project) (ES)	1975	SP
Crude oil and natural gas production in navigable waters along the Texas coast	1972	PER
Neches River and tributaries, Texas, saltwater barrier on Neches River at Beaumont, TX	1975	MIS
Portland District		
Umpqua River jetty extension	1976/77	NAV
Columbia and Lower Willamette River environmental statement*	1975	NAV
Chetco, Coquille, and Rogue River Estuaries and Port Orford	1975	NAV
Channel Extension, Siuslaw River and Bar, Lane County, Oregon	1973	NAV
West Hayden Island marine industrial park - Portland, OR	1987	PER
Lower Columbia River bank protection project, Oregon and Washington	1972	MIS
Seattle District		
Grays Harbor and Chehalis River navigation project, operation and maintenance	1975	NAV
Grays Harbor, Chehalis and Hoquiam Rivers, Washington Channel improvements for navigation*	1982	NAV
Upper Columbia River Basin (ES)	1970	NAV
Elliott Bay small craft harbor*	1987	NAV
East Bay Marina	1980	NAV
Seattle Harbor navigation project	1979	NAV
Westhaven Cove (Westport Marina), small boat basin expansion	1978	NAV
Channel improvements for navigation, Blair and Sitcum Waterways, Tacoma Harbor, Washington	1977	NAV
Ediz Hook beach erosion control, Port Angeles, Washington	1972	SP
Kaiser Steel, Grays Harbor, Washington	1976	PER
Weyerhauser export facility at DuPont	1982	PER
Unconfined open water disposal sites for dredged material, Phase 1 (Central Puget Sound)	1988	PER
Pacific Ocean Division		
Hawaii Kai Marina, Oahu, Hawaii*	1975	PER

* Document contains testable predictions.

APPENDIX B: NON-RANDOM ENVIRONMENTAL IMPACT STATEMENTS

Table B1
Non-Random Environmental Impact Statements
Received for Analysis

Title	Year	Statement Type
New England Division		
Rockport Harbor, Old Harbor, and Pigeon Cove, Rockport, MA	1983	EA
Norfolk District		
Albermarle and Chesapeake Canal and the Dismal Swamp Canal routes of the Atlantic ICW, Virginia and North Carolina (maintenance dredging), Lower North Landing River, Virginia	1980	EA*
Improvements to navigation, Tyler's Beach, Isle of Wight County, Virginia	1981	EA
Tangier Island shoreline erosion control - Accomack County, Virginia	1987	EA
Wilmington District		
Atlantic Harbor Refuge, Core Sound, North Carolina	1971	EIS
Maintenance of Atlantic Intracoastal Waterway, North Carolina	1975	EIS
Charleston District		
Cooper River Rediversion Project, Charleston Harbor, South Carolina	1975	EIS
Murrells Inlet navigation project, Georgetown County, South Carolina	1976	EIS
New Orleans		
Oyster shell dredging in Atchafalaya Bay and adjacent waters, Louisiana	1987	EIS
Galveston District		
Corpus Christi Ship Channel, Texas, 45-ft project, inner harbor reach	1982	EIS
Maintenance dredging, Corpus Christi Ship Channel, Texas	1979	EIS
Taylors Bayou, Texas, drainage and flood control project	1975	EIS
Mouth of Colorado River (diversion features)	1981	EIS
Portland District		
Channel maintenance dredging, Coos Bay	1976	EIS
Jetty extension, Siuslaw River, Oregon	1982	EIS
Seattle District		
Everett Harbor and Snohmish River Navigation Project, Everett, WA	1975	EIS
Grays Harbor, Washington, navigation improvement project	1989	EIS

NOTE: EA = environmental assessment; EIS = environmental impact statement.

* Draft statement.