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PRELIMINARY FEASIBILITY REPORT STAGE II, LORAIN SMALL-BOAT HARB--ETC(U)
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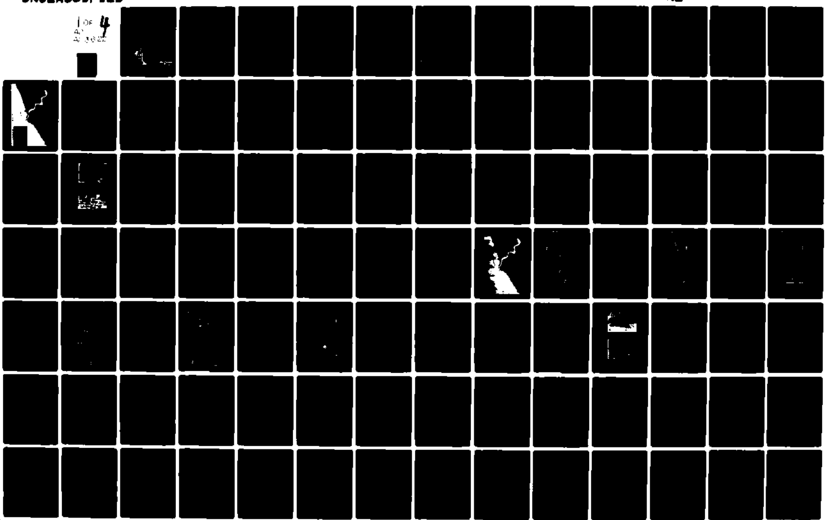
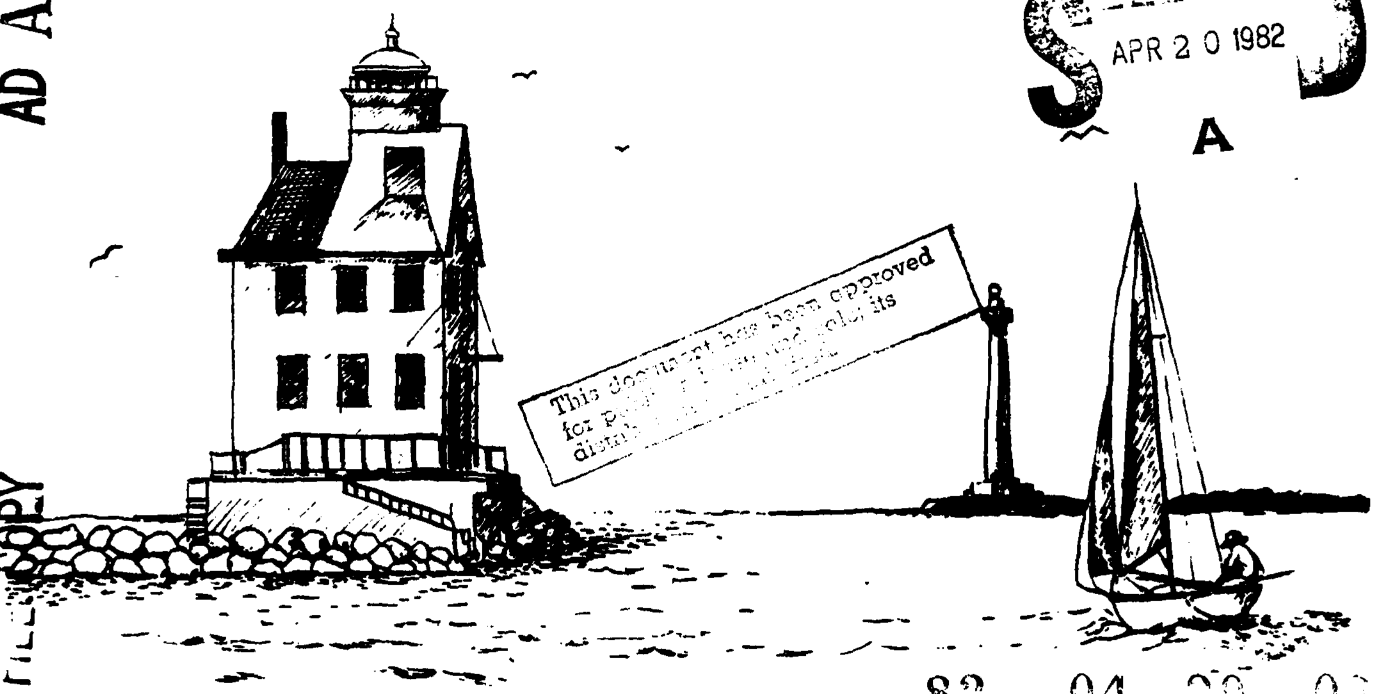


DECEMBER 1981
(REVISED MARCH 1982)

PRELIMINARY FEASIBILITY REPORT
STAGE II
LORAIN SMALL-BOAT HARBOR
LORAIN, OHIO



U. S. ARMY CORPS OF ENGINEERS BUFFALO DISTRICT

The geographical limits for the Lorain Small-Boat Harbor study include: t\ outer triangular-shaped harbor; two miles of the coastline in either directi(from the mouth of the Black River; and the Federally maintained inner harbor (from the river mouth to a point about three miles upstream). A more detailec description of existing conditions is contained in the Problem Identificatior section of this report.

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Lorain, Ohio is located on the southern shore of Lake Erie, approximately 25 miles west of Cleveland and 90 miles east of Toledo. The city is situated on both sides of the mouth of the Black River as shown in figure 1. A federally improved commercial harbor dominates the river mouth environs. A system of protective breakwaters extends offshore, and deepened river channels provide access to port facilities. Some recreational boat facilities exist in the port area, including launch ramps, a small yacht basin, and privately owned marinas of limited scale. (con't)

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SECTION A

INTRODUCTION

A general explanation of report content and organization for Stage 2 of the Lorain Small Boat Harbor study is presented in the following paragraphs. Introductory information includes descriptions of geographical setting, study authority, study purpose and scope, study participants and coordination, prior investigations, and organization of this report.

GEOGRAPHICAL SETTING

Lorain, Ohio is located on the southern shore of Lake Erie, approximately 25 miles west of Cleveland and 90 miles east of Toledo. The city is situated on both sides of the mouth of the Black River as shown in Figure 1.

A Federally improved commercial harbor dominates the river mouth environs. A system of protective breakwaters extends offshore, and deepened river channels provide access to port facilities. Some recreational boat facilities exist in the port area, including launch ramps, a small yacht basin, and privately owned marinas of limited scale.

The geographical limits for the Lorain Small-Boat Harbor study include: the outer triangular-shaped harbor; two miles of the coastline in either direction from the mouth of the Black River; and the Federally maintained inner harbor (from the river mouth to a point about three miles upstream). A more detailed description of existing conditions is contained in the Problem Identification section of this report.

STUDY AUTHORITY

In response to a resolution by the Committee on Public Works and Transportation of the House of Representatives, dated 23 September 1976, a reconnaissance study was initiated to review Lorain Harbor needs. The resolution is quoted below:

> "Resolved by the Committee on Public Works and Transportation of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report on Lorain Harbor, Ohio, published in House Document No. 166, 86th Congress, 1st Session, and other pertinent reports, with view of determining whether any modification to the recom-

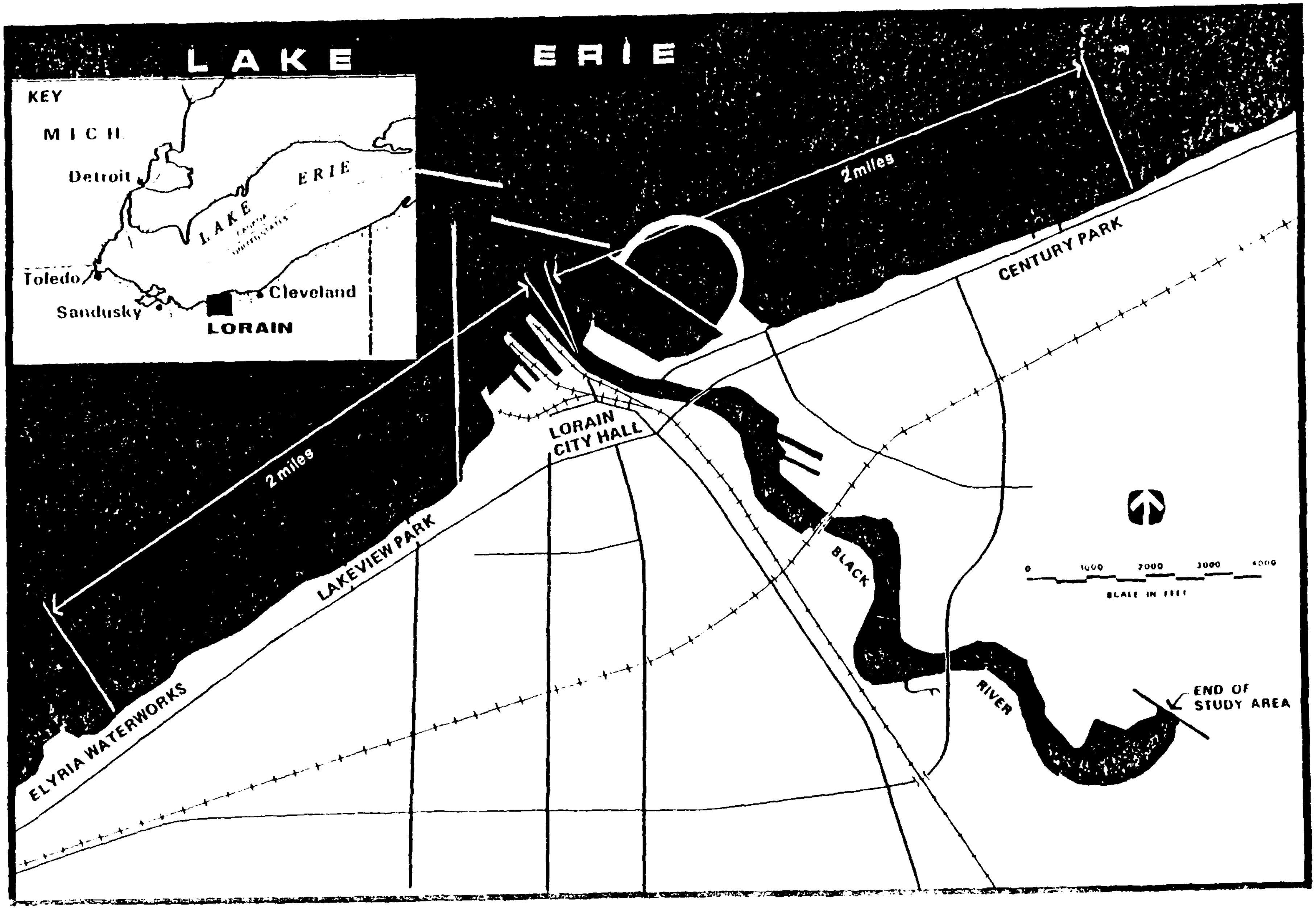


FIGURE 1 LORAIN SMALL-BOAT HARBOR STUDY AREA

mendations contained therein is advisable at the present time, including consideration of the passage and safe navigation of new and larger ships operating on the Great Lakes."

The reconnaissance report, completed in January 1979, identified excess recreational boating and fishing demands at Lorain, Ohio, and recommended the study of potential resource improvements. Authorization for this Stage 2 investigation thereby originated from the House resolution.

PURPOSE OF THE PRELIMINARY FEASIBILITY REPORT

Specific Purpose

The purpose of this Preliminary Feasibility (Stage 2) Report is to identify and analyze a wide range of alternatives for providing increased small-boat harbor capacity and concomitant recreational fishing opportunities at or near Lorain Harbor. Stage 2 planning encompasses initial identification and selection of viable resource management options applicable to study purposes. Development of alternatives is in sufficient detail to (1) identify all major components of each alternative; (2) estimate the construction cost and the annual operation and maintenance cost associated with each alternative; (3) estimate the benefits associated with each alternative; and (4) assess the environmental impacts of each alternative based upon available data.

The relationship of the Preliminary Feasibility Report to overall study effort is described in subsequent paragraphs.

Study Process

Completion of the Lorain Small-Boat Harbor Feasibility Study requires three stages (See Figure 2). These three stages are:

Stage 1	Reconnaissance Report
Stage 2	Preliminary Feasibility Report (PFR)
Stage 3	Final Feasibility Report (FFR)

Stage 1, the initial planning stage, defines the scope and character of the feasibility study and provides a guide to subsequent planning by carrying out four planning tasks, as listed in Figure 2, at a preliminary level. The emphasis in Stage 1 is on Task 1, problem identification. The Reconnaissance Report defines broad planning objectives, formulates possible alternative measures for achieving the objectives, and produces a tentative impact assessment and evaluation. The level

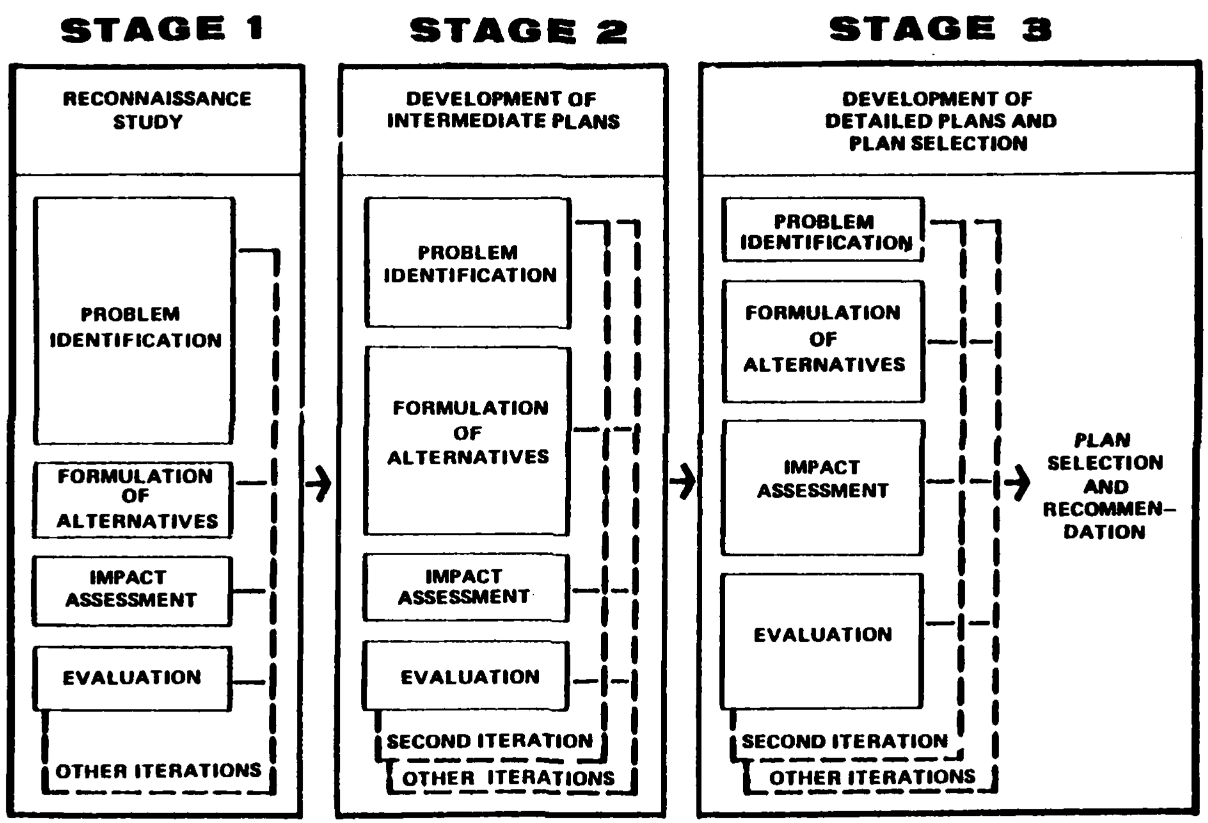


FIGURE 2 PLAN DEVELOPMENT STAGES AND TASKS

of detail is general and the planning tasks draw upon a broad data base which may be more qualitative than quantitative. The product of Stage 1 is a Reconnaissance Report document setting forth in general terms, the study scope and management actions necessary to implement the study purposes. The Reconnaissance Report for the Lorain Harbor Feasibility Study was completed in January 1979.

Stage 2, the intermediate planning stage, is accomplished by developing a range of alternatives to achieve the planning objectives without concentrating on highly detailed engineering designs. Potential impacts of these alternative plans are assessed and evaluated, concentrating on their significant consequences. Data should be sufficient to set forth and analyze alternative concepts and should narrow the choices to the most viable option available in the study area. The product of Stage 2 is a Preliminary Feasibility Report (PFR). This document is the Preliminary Feasibility Report for Lorain Small-Boat Harbor, with primary emphasis on recreational navigation.

During the final stage, Stage 3, the recommended alternatives from the PFR are studied. Detailed design, assessment, and evaluation necessitate specific data and well-defined study assumptions. The plans must be sufficiently detailed to facilitate effective choices for recommended plan implementation. A recommended plan will state the planning objectives forming the basis for the technical and institutional measures selected to accomplish resource management. Both nonstructural and structural measures are described and the means of implementing and managing specified. The product of Stage 3 is a Final Feasibility Report (FFR).

If the recommended plan is favorable for Federal involvement, then the Federal and non-Federal cost-sharing will be described. After review at Division and Washington levels, the FFR will be submitted to Congress for their action.

In each of these three stages, plans are developed through an iterative process of four tasks. These are: Task 1 -Problem Identification; Task 2 - Formulation of Alternatives; Task 3 - Impact Assessment; and Task 4 -Evaluation.

Task 1, Problem Identification, consists of defining the problems and needs of the study area with the goal of delineating the planning objectives for the feasibility study. This is accomplished by identifying concerns, analyzing the problems and needs, describing the base conditions, projecting future conditions without implementation of a plan of action, and refining the planning objectives to insure adherence to the identified problems.

Task 2, Formulation of Alternatives, consists of developing resource management systems (alternative plans of improvement) that will achieve the planning objectives. Initially, a broad range of technical and institutional measures, both structural and nonstructural, are identified. These measures are then combined to develop alternative plans that satisfy the planning objectives. Where individual planning objectives are not addressed by plans previously developed, additional measures are added to these plans to complete the resource management system. In the formulation process, the goal is to minimize conflicts and maximize compatibility by adding (or deleting) measures to the alternative plans. The National Economic Development (NED) plan which emphasizes maximum net benefits and an Environmental Quality (EQ) plan which emphasizes positive environmental measures are identified.

The Objective of Impact Assessment, Task 3, is to identify and measure the probable economic, social, and environmental effects of each alternative plan. Activities consist of analyzing each measure to determine potential sources, the incidence, and the magnitude of the environmental and social impacts of each plan. Impacts to be addressed include, but are not limited to, the following parameters: noise, displacement of people, aesthetic values; community cohesion, community growth, tax revenues, property values; public facilities and services, employment/labor force, business and industrial activities, man-made resources; natural resources, air quality, water use and quality, and regional growth.

Both quantitative and qualitative measurement of effects is necessary to evaluate impacts upon the environmental quality objective. The evaluation of qualitative measures lies within the domain of public perception. The public involvement and participation program,conducted during this study, is used to assess public perception concerning the qualitative parameters.

During Task 4 evaluation, the impacts of each alternative plan are compared to the "without project" condition to determine the beneficial and adverse contributions of each plan. Activities during evaluation include: selection of the alternative plans that best reflect criteria for the NED and EQ plans; determination of the Federal interest in each plan; and performance of a trade-off analysis to determine the contributions of the alternative plans.

SCOPE OF THE STUDY

This Stage 2 study was performed by using existing reports, available data sources, visual inspections, onsite interviews, and workshop discussions.

Alternative small-boat harbor designs were developed to a consistent level of detail. Prior reports were used as data sources for preliminary design of breakwaters, including length, height, position, and structural materials. These reports also were accessed for design data applicable to other major appurtenances. Preliminary refraction and diffraction analyses were performed for this study.

Field studies were limited to visual inspections of existing conditions and resource problems. These inspections mainly were used to validate descriptions contained in prior reports.

Cost estimates were detailed into features and subfeatures and include quantities and unit costs for all main construction items. Interviews and costing indexes in conjunction with recent Corps of Engineers estimates for similar structural elements were relied upon for cost determination.

Predictions of potential economic benefits accruing from study alternatives were developed through boating demand and land-based fishing analyses. Future demand levels were projected from current usage data, facilities inventories, and demographic correlations with existing demand levels. The predictive methodologies were compiled into report appendices.

Workshops were held as an aid to determine specific goals and to select small-boat harbor siting and design criteria. The views and recommendations of local and other non-Federal interests were attained from these workshops and from interviews and correspondence.

STUDY PARTICIPANTS AND COORDINATION

This Preliminary Feasibility Report was prepared by the Buffalo District with assistance from the North Central Division, Corps of Engineers. The consulting firm Tetra Tech, Inc., headquartered in Pasadena, California, was contracted by the Buffalo District to conduct and document this Stage 2 study. Their analyses efforts and study directions were guided and monitored by District staff.

Participation in this study by other governmental and public entities was encouraged through correspondence, telephone calls, and personal visits. Additionally, three public workshops were held during Stage 2 study efforts. These meetings were attended by individuals representing commercial, social, environmental, recreational, governmental and planning interests.

An Orientation Workshop was held on 5 November 1980. The purpose of the workshop was to describe the study process; obtain public views on potential small-boat harbor sites; and obtain input relevant to recreational boating demands and resources. An Initial Iteration Workshop was conducted on 10 December 1980. At this meeting, evaluations and tentative conclusions pertaining to site selection were presented. An Alternatives Workshop was held on 10 September 1981, to show and compare harbor design concepts. Public attitudes and preferences concerning tentative design selections were received. The minutes of these meetings are contained in Appendix D.

Direct coordination was maintained throughout the study with many agencies including: Lorain Port Authority, City of Lorain, Ohio Department of Natural Resources, Ohio Historic Preservation Office, and U.S. Fish and Wildlife Service. Summaries of all pertinent coordination efforts were incorporated into Appendix D.

PRIOR STUDIES AND REPORTS

The following is a list of previous reports on Lorain Harbor that specifically relate to the development of a small boat harbor.

Corps of Engineers Studies

Year of Report	Work Considered	Recommendation
1967-68	Construction of Small-boat harbor in west harbor	Favorable until met with public opposition
1970	Construction of 58 acres confined dredged material disposal area off the east breakwater shore-arm	Favorable
1979	Reconnaissance Report for Lorain Harbor: commercial, recreational and maritime	Favorable
1980	Preliminary Feasibility Report, with emphasis on commercial navigation needs, for Lorain Harbor	Continue into Stage 3 Study

The Preliminary Feasibility Report, Lorain Harbor, Ohio (1980) was completed under the same authorization as this small-boat harbor Stage 2 report. The 1980 report has concentrated upon commercial aspects of the harbor, rather than recreational aspects. The Reconnaissance Report on Lorain Harbor, Ohio, for Navigation Improvement (1979) has preceded both of these reports and recommended their preparation. The commercial and recreational preliminary feasibility reports were coordinated to prevent or minimize conflicting recommendations.

Studies By Others

Year of Report	Work Considered	Author Client	Result
1970	Construction of a small-boat harbor in connection with commercial docking area in the east harbor	Stanley Consultants for Lorain Port Authority	Identified need but costs were prohibitive
1978-80	Construction of a phased small-boat harbor in the east harbor basin	Stanley Consultants for Lorain Port Authority	Proposed Construction of an interim small-boat harbor in the east basin

The studies for the Lorain Port Authority completed in 1978 and 1980 have recommended recreational boat moorings and/or berths in the water area inside the east breakwater and adjacent to the diked-disposal area. Their recommendations were based more upon preliminary planning than upon detailed or specific design of facilities.

THE REPORT

In the interest of clarity of presentation and reference, this Preliminary Feasibility Report has been arranged into a Main Report and five appendices. The Main Report is written to give both the technical reviewer and the general reader a clear understanding of the study, the study results, and the key conclusions and decisions reached in possible harbor modifications in the interest of recreational navigation. The Main Report describes the resources and economy of the study area; identifies problems and needs; formulates a full range of possible harbor modification alternatives; describes economic, social, and environmental implications of the alternatives; and identifies feasible and economically justified improvements. It also includes, in summary form, the costs and benefits of the various alternatives, and the division of project responsibility between Federal and non-Federal interests of the feasible and economically justified improvements. The report provides the District's recommendations regarding further detailed study.

The five appendices present supporting data and details covering the information of the Main Report. Appendix A is a technical report of the preliminary designs and cost estimates for Lorain Small-Boat Harbor. Appendix B is a technical report of the economic evaluation for small-boat navigation benefits. Appendix C presents a similar report for economic evaluation of land-based recreational fishing benefits. Appendix D is a compilation of pertinent correspondence and summaries of public involvement, including workshops. Appendix E shows the Study Management flow chart for the remainder of the Feasibility Study. Appendix F provides the reference bibliography for the study.

SECTION B

PROBLEM IDENTIFICATION

The purpose of this section is to describe the water-related resource problems and needs, or lack thereof, which are pertinent to this study. The section presents information on the existing physical, human, and biological environment in the study area; discusses the present demand for small-boat navigation and recreational fishing facilities; reviews the planning constraints under which this study was conducted; discusses the specific planning objectives of the study and reviews the conditions that would exist if no Federal action was taken.

EXISTING CONDITIONS

Physical Environment

Location - The study area is along the south shore of Lake Erie in northcentral Ohio at a location about 25 miles west of Cleveland in the City of Lorain, Lorain County. The study site is predominated by an urban port environment with a variety of public and private structures arrayed along the lake shore and river banks.

Physiography/Topography - Local terrain is typical glacial lake plain and is relatively level. Elevations increase very gradually to the east and south, and are highest along the southern limit of Central Lowlands Physiographic Province. Surficial materials in Lorain are primarily unconsolidated Pleistocene glacial deposits. Low relief fossil beaches containing morainic features are found inland and add variety to the level land surfaces.

Geology and Soil - The bedrock of the region consists of Precambrian crystalline basement rocks which are overlain with Paleozoi metasedimentary strata at intermediate levels. Surface sediments consist of about 60 feet of glacial and lacustrine materials that were lain down during Pleistocene and later times.

Soils in the region are of the Alfisol order and are characterized by gray-brown upper horizons, clay accumulation at intermediate levels and a limy, silty clay loam texture (3)(see Appendix F for references). Water tends to move through the soil at a relatively slow rate due to the zone of clay accumulation and the level topography. This wetness produces a soil management problem and surface ponds tend to develop during periods of heavy precipitation.

Climate - The Lorain climate is classified as "humid continental" and the region is subject to both rapid changes and a wide range of diurnal and seasonal temperatures. Moderate precipitation and humidity predominate, but extremes may occur for short periods. Lake Erie has a moderating affect on local temperatures which average 27.7°F in January and 72.9°F in July.

Precipitation, in the form of rain, snow, sleet and hail, is evenly distributed throughout the year and totals about 35 inches.

Some severe weather in the form of heavy rain and snow, strong winds, tornadoes and ice storms occur from time to time. Winds average 12.8 miles per hour in Lorain and prevail from the west.

Air Quality - The Ohio Environmental Protection Agency (OEPA) has expressed some air quality concerns for the City of Lorain. The city is a non-attainment area for three of the five pollutants that have been identified by the U.S. Environmental Protection Agency as being harmful to humans in concentrations greater than established National Ambient Air Quality Standards. The three non-attainment pollutants are Total Suspended Particulates (TSP), sulphur dioxide and carbon monoxide. Concentrations of the three have at times been higher than OEPA standards, and thus the area has not attained desired air quality goals. With respect to TSP, for example, a number of major emission sources exist and occasional readings of 200 micrograms per cubic meter have been observed. Such concentrations are above the national standard of 74 micrograms per cubic meter and are among the highest levels to be found in Ohio (2).

Black River Watershed - The Black River which empties into Lake Erie just to the west of the study site drains 470 square miles beginning just south of the Lorain County line. The mainstream is formed from an East and a West Branch in the nearby town of Elyria. The East Branch drains hilly agricultural lands while the West Branch meanders through forest covered terrain. Black River water quality is affected by wastes from a variety of local municipal, industrial and agricultural sources. Sediments and effluents color the Black River and are the major source of harbor siltation in Lorain (29).

Littoral Transport - Predominant littoral currents flow from west to east due to the prevailing winds on Lake Erie. Some temporary reversals in direction occur when strong north and northeast winds develop. Patterns of erosion and accretion along the shore reflect the influence of predominant currents.

Lake Water Levels and Fluctuation - Water levels in Lake Erie vary from year to year and season to season within the 9,910 square mile area of Lake Erie. The period of November 1972 through October 1973 set a new Lake Erie high water level record of 573.51 feet on International Great Lakes Datum (IGLD-1955). This can be contrasted with a century old monthly mean stage record of 570.5 feet. Seasonal low lake levels are generally reached in late fall and winter, while high lake levels occur during summer (29). All project depths are referred to L.W.D. for Lake Erie which is 568.6 above mean water level at Father Point, Quebec.

Human Environment

Land Use - Land use patterns in Lorain reflect the industrial-commercial nature of this lake port community. A complex mix of intensive industrial, commercial, transportation related, residential, recreational and utility uses are present both in the vicinity of the proposed project and elsewhere in Lorain. Some vacant lands exist for future development both along the lake shore and the banks of the Black River.

Lorain County Regional Planning Commission documents show that transportation related land uses predominate in the vicinity of the study area, with a 34.3 percent portion of land totals. Other significant uses include residential with 27.8 percent, public/quasi-public with 10 percent and retail with 5.5 percent (9).

Demography - Recent population figures indicate that Lorain County has about 275,000 persons (1980), while the City of Lorain has slightly more than 82,000 persons (1978) in residence. These figures are the result of a growth rate which has slowed from 47 percent in the 1950's to a projected rate of only 0.8 percent for the period 1970-2020. Growth has been associated in the past with increased industrialization and may be expected to be so in the future. The Northeast Ohio Demographic and Economic Projections 1970-2020 predicts that the population of the city in 2020 will be over 100,000.

Housing - Housing types, ages and values vary considerably in the Lorain area. In general, the housing in the immediate vicinity of the proposed project is of low to moderate market value. Many units are over 40 years old and a number are in need of repair. About half of the units are owner occupied and the others are rented. Rents in the project area are somewhat lower than for the same size unit elsewhere in Lorain.

Business and Industry - Lorain, due to it's location at a juncture between lake, rail and highway systems and other lesser factors, has developed a diverse business-industrial base. In normal economic times (mid 1970's), plants in the city have employed over 24,000 workers with an annual payroll in excess of $250 million.

The city has been a major port for a considerable period. It has facilities for shipping and receiving bulk cargo. A major ship building firm is located on the Black River, just upstream of the main commercial docks, where repair and winter shelter for lake carriers is provided.

The economic dependance of the City upon the port is evident in that an average of over 7 million tons of iron ore is moved through Lorain each year. Upwards of 15,000 persons, both in and surrounding Lorain, have employment which is dependent upon this supply.

Industrial activity includes the manufacuring of steel pipe, ships, automobile components and vehicles, chemicals, building materials and electronic equipment.

Employment and Income - Employment in a variety of manufacturing activities has been and is projected to be the single largest source of employment for Lorain residents. Over 40 percent of the available labor force is presently employed in more than 55 plants that manufacture primary metals, transportation equipment and other products. This percent and overall number of workers are not expected to change significantly over the comming decades (29). Other sectors such as services, education, and government employ smaller numbers of workers and will show slight increases in the future.

The latest mean family income figures, published by the Ohio Department of Economic and Community Development, for 1978, show Lorain County with an average of $19,409. This level is a bit above the State's published 1978 average of $18,505 and is most likely a result of the urban-industrialized nature of the county.

Transportation - Lorain's development is a product of its location along key water, land and air routes. It's future is, in part, dependent upon maintaining and improving its transportation services and facilities.

Lorain is a busy lake port with facilities for receiving bulk cargos such as iron ore, limestone and gypsum. A major new pelletized iron ore terminal was opened by Republic Steel Corp. in May 1980, and other such port improvements are being considered for the future.

An extensive highway and road network serves the Lorain-Elyria area. These include Interstate 80 and 90 which are nearby and Interstate 71 which is about 15 miles east of the metropolitan area.

Several airports serve Lorain including a county facility to the south and Hopkins International Airport located about 20 miles to the east in Cleveland.

Utilities - Water supply for the City of Lorain is obtained from Lake Erie. Mains which range from 4 to 24 inches serve the city from a water works located near downtown Lorain.

The City has separate sanitary and storm wastewater collection systems. Sanitary effluent outfalls into Lake Erie subsequent to exiting a secondary treatment facility. Some tertiary treatment for phosphates also occurs in the area.

Electric power is provided to Lorain by Ohio Edison Company. Most of the power network is built above ground except for some new subdivisions. These use buried cable and are located well away from the proposed project area.

Natural gas is available in Lorain but the demand exceeds the supply and no new customers are presently being accepted. The area in the vicinity of the proposed project is served by Columbia Natural Gas of Ohio.

The Lorain Telephone Company, a division of Centel, provides telephone service to residents of the City of Lorain.

Recreation - Lake related leisure time activities are an important element in Lorain's recreational pursuits. Pleasure boating, fishing, swimming, walking, and running activities are commonly observed on or near the lakeshore. A shortage of fishing piers open to the public exists in the area. As a result, a number of structures such as the dike disposal area and groins located in Century Park east of Lorain Harbor are being utilized by the general public (see Photo 1). Residents also use privately owned and built seawall structures for fishing. Most of these structures are also used by the public to observe harbor and lake activities.

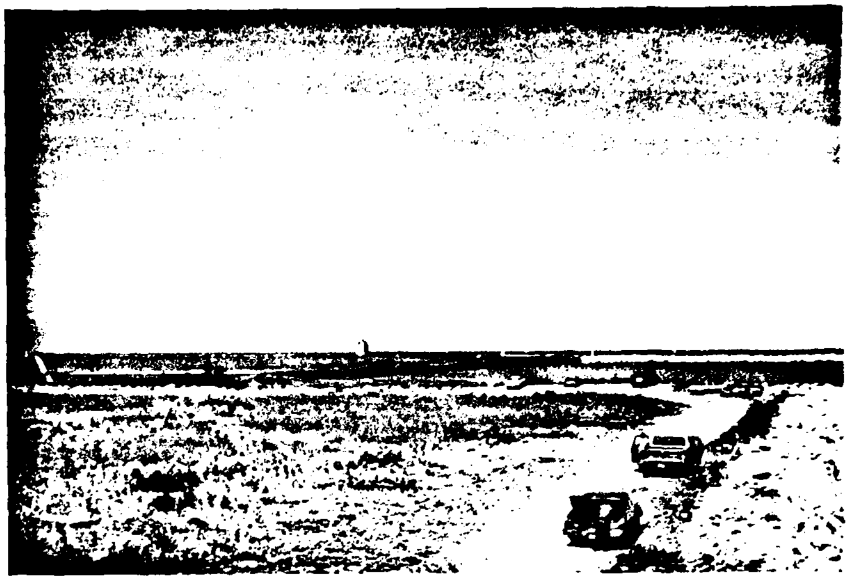


PHOTO 1
DIKED DISPOSAL AREA WITH SHORE IN FOREGROUND

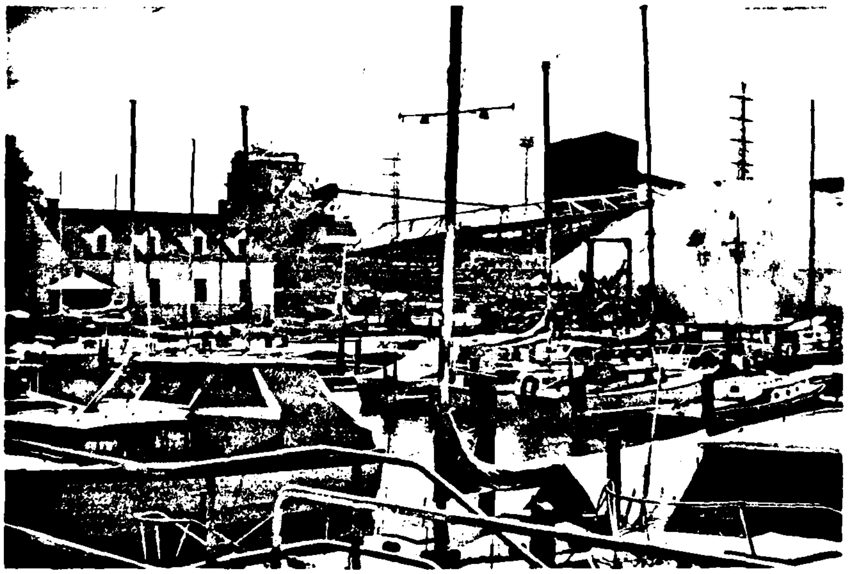


PHOTO 2
LORAIN YACHT HARBOR BASIN

Approximately 5,400 small boats were registered in Lorain County during the mid 1970's. The Port Authority has indicated that the needs of such craft and their operators are of concern, since demands for launching and berthing facilities exceed supply. The principal marina within Lorain Harbor is the Lorain Yacht Basin, located at the foot of Lakeside Avenue, which has about 70 slips for boats up to approximately 30 ft in length (see Appendix B for further details) (see Photo 2).

The City and County of Lorain maintain over 50 parks, several golf courses, lake-front facilities, neighborhood parks and play lots, swimming pools and a variety of other recreational facilities. However, Lorain area recreational and open space availability is generally lower than standards proposed by the National Recreation and Park Association for a city of the size of Lorain. The planning standards, developed during the mid 1970's, indicate that the region lacks over 200 acres of leisure and open space.

Cultural Resources - The Regional Preservation Archaeologist in Cleveland, persons at the Western Reserve Historical Society, Cleveland, and the Lorain County Regional Planning Commission, Elyria, have stated that no known archaeological sites nor registered historical buildings are known to exist in the immediate vicinity of the study site within the proposed project site. However, the Lorain Lighthouse, located at the outer-end of the West Breakwater, is relatively close to the study area. This structure is listed in the National Register of Historic Places. It will not be adversely impacted by project actions.

Bilological Environment

Wetlands and Water Quality - Marshes and other wetland areas occur intermittently along the Black River and in a few isolated places along the Lake Erie shoreline. The outer harbor area contains no wetlands. The closest wetland to the outer harbor is probably the marsh near the 21st bridge, on the Black River, approximately 1.5 miles from the outer harbor area. The water quality of Lorain Harbor and the lower Black River is seriously degraded (32). This is the result of pollutant input from a number of sources, including the U.S. Steel Plant on the Black River, other industrial sources, the Lorain and Elyria sewage treatment plants, a chemical waste dump near the Black River in Elyria, and agricultural and urban runoff. The sediments of both the inner and outer harbor are polluted, but those of the inner harbor have higher levels of the following parameters: volatile solids, COD, nitrogen, phosphorous, oil and grease, iron, chlorine, lead, and zinc (32).

Benthic Community - The bottom sediments of the harbor are composed of a mixture of clay, organic silts, and sand and rock fragments, with fine material (clay and silts) predominant (11) (28).

The benthic fauna is dominated by sludgeworms of the genus *Limnodrilus* (Oligochaeta:Tubificidae) and by fly larvae and pupae of the genera *Chironomus* and *Procladius* (Chironomidae). Also present are the fingernail clams, *Sphaerium* and *Pisidium* (Heterodonta: Sphaeridae), the flatworms *Dugesia* (Turbellaria: Planariidae), the amphipods *Crangonyx* and *Gammarus* (Gammaridae), the Oligochaete *Branchiura*, and the leech *Helobdella* (Hirudrinea: Glossiphoniidae) (11) (28).

The abundance of benthic fauna is moderately high, with total organism density on the order of several thousand per square meter, but not as high as in the inner harbor, where density is on the order of several tens of thousands per square meter (11). The bottom sediments of the outer harbor are less polluted than those in the inner harbor, and are rated as moderately polluted by the classification of Wright (11).

These benthic organisms are the principal food source for most of the fish species that are common in the shallow waters of the area (8).

Fish - Table 1 is a list of the fishes occurring in the nearshore Lorain area. There is evidence (5) that most of these species also spawn in the vicinity of the outer harbor. The most important species (by virtue of their abundance and/or their importance in the local commercial or sport fishery) likely to spawn in shallow water around Lorain are yellow perch, rainbow smelt, gizzard shad, freshwater drum, white bass, emerald and sportail shiner, and walleye. Most of these species also inhabit the deeper, offshore waters (34). This is particularly true of yellow perch, gizzard shad, freshwater drum, rainbow smelt, and walleye; the yellow perch is the major component of the commercial fishery there.

Waterfowl and Shorebirds - Lorain is located in a major bird migration area. Waterfowl (including both diving and dabbling ducks) and shorebirds are moderately abundant and diverse in the area. Most commonly present for at least a portion of the year are ring-billed gulls, herring gulls, Bonaparte's gulls, black ducks, mallards, teals, canvas-backs mergansers,

TABLE 1

COMMON NEARSHORE FISH OF THE LORAIN AREA

Common Name	Scientific Name
Bluegill°+	Lepomis macrochirus
Carp°*	Cyprinus carpio
Channel Catfish°*	Ictalurus punctatus
Emerald Shiner°*	Notropis atherinoides
Freshwater Drum°+	Aplodinotus grunniens
Gizzard Shad °*	Dorosoma cepediamum
Goldfish°*	Carassius auratus
Logperch	Percina caprodes
Longnose Dace	Rhininchthys cataractae
Mottled Sculpin	Cottus bairdi
Quillback°*	Carpiodes cyprinus
Rainbow Smelt°*+	Osmerus mordax
Smallmouth Bass°+	Micropterus salmoides
Spottail Shiner°	Notropis hudsonius
Stonecat	Noturus miurus
Troutperch°	Percops omiscomaycus
Walleye°*+	Stizostedion vitreum vitreum
White Bass°*+	Morone chrysops
White Crappie+	Pomoxis annularis
White Sucker°*	Catostomus commersoni
Yellow Perch°*+	Perca flavescens

°Spawns near study area * Commercial in Lake Erie + Sport at Lorain buffleheads, goldeneyes, scaups, common loons, horned grebes, great blue herons, spotted sandpipers and killdeer (14) (15). The Black River vicinity is the prime bird area in Lorain (10), but rafts of ducks are common in the offshore waters, particularly in the fall. Duck rafts are also seen near the Diked Disposal Area and offshore of the study area (10). As the weather gets colder in the early winter, many of these birds move to the Ohio Edison warm water discharge just west of Lorain Harbor entrance channel.

Gulls are common in the harbor area, resting and feeding on the breakwaters and nearby waters. Due to the lack of suitable beach or marsh habitat, the study area is seldom used by shorebirds, but an occassional gull, spotted sandpiper, or killdeer may be found there (10).

The area supports considerable recreational waterfowl hunting in the fall, mostly from the breakwaters near the harbor, but also from offshore boats.

Endangered Species - No species on the U.S. Fish and Wildlife Service list of endangered and threatened wildlife and plants (31), or on the Ohio Department of Natural Resources list of endangered wild animals (17), is known to occur in the project area. Three fish species from the Ohio list of endangered wild animals are known from the upper Black River, but have not been found in the harbor area. These are the silver lamprey (*Ichthyomyzon unicuspis*), the big mouth shiner (*Notropis dorsalis*), and the blacknose shiner (*Notropis heterolepis*) (32). The channel darter (*Percina copeland*), also on the Ohio list of endangered wild animals, has been found in the west harbor but not in the east harbor (project area). No birds or other wildlife species officially listed as endangered are known to occur in the Lorain vicinity.

PROBLEMS, NEEDS, AND OPPORTUNITIES

The Port Authority of Lorain is extremely interested in an expanded small-boat harbor capacity. The Corps of Engineers has previously (1968) developed recommendations for a new small-boat harbor in the west basin at the foot of Brownell Avenue, but that improvement plan was discontinued from further investigation because of local opposition to project siting in the west basin. Presently, local citizens interest groups, and institutions complain of immediate need for additional mooring locations. At the initial public workshop for this study on 5 November 1980, local boaters, fishermen, marina and marine supply proprietors, public officials and citizens expressed their desires for a small-boat harbor at Lorain and requested that construction of this project be undertaken at the earliest possible date. These factors indicate a need for enlarged small-boat harbor capacity at Lorain Ohio.

Recreational Boating

As a part of the Stage 2 planning effort, summaries of existing boat user-demand were developed from 1970 and 1980 Ohio State boat registration computer tape data. The State boat registration files provided the County of registration, the principal lake user area, and the type and size of the craft. The existing boating activity in Lorain County is characterized by the registration data as presented in Table 2. (Details of this analysis are described in Appendix B).

In deriving projections of future recreational boat user-demand, a statistical model was developed based on County boat ownership registration correlated with various socioeconomic characteristics including population, income, ethnicity, and travel distance. The user-demand was projected to the year 1040 in 10-year intervals. The projected demand includes both current and potential latent demand considerations. Potential recreational facility needs in Lorain were determined by summing the capacities of existing facilties and then subtracting from the projected demand.

Based on median value facility demand projections presented in Table 3, the total facility need at Lorain is estimated to exceed 600 slips by the year 1990. Projection of future fleet mix by type and size of craft is based on current facility use percentages which are applied to the demand projections. The future fleet mix by type and size of craft are summarized in Tables 4 and 5, respectively.

TABLE 2

CHARACTERISTICS OF EXISTING BOATING ACTIVITY IN LORAIN COUNTY BY PERCENT

Type of Boat	Size of Boat (Ft. of Length)				
	Under 16	16-25	26-39	40-64	TOTAL
Outboard	4%	2%	-	-	6%
Inboard/ Outdrive	1%	16%	5%	-	22%
Inboard	-	6%	1%	1%	8%
Cruiser	-	24%	15%	1%	40%
Sailboat	1%	8%	7%	-	16%
Auxiliary Sailboat	-	5%	3%	-	8%
Total	6%	61%	31%	2%	100%

TABLE 3

PROJECTED FLEET USER DEMAND SUMMARY-LORAIN HARBOR
1990-2040

	1990	2000	2010	2020	2030	2040
Trailered Boats[1]	5,635	6,279	6,858	7,470	8,034	8,571
Transient Boat Slips[2]	6	10	11	12	14	15
Permanent Boat Slips	639	1,014	1,127	1,247	1,351	1,463

NOTE:

1. Based on 90% of Lorain Market Demand Area of Lake Erie Registered Boats under 16 Ft.

2. Based on 1% of Total Demand for Slip Space.

TABLE 4
PROJECTED FLEET MIX BY TYPE[1]
1990-2040

TYPE[2]	1990	2000	2010	2020	2030	2040
Outboard	38	61	68	75	81	88
In/Outboard	141	223	248	274	298	322
Inboard	51	81	90	100	108	117
Sail	102	162	180	200	216	234
Auxillary Sail	51	81	90	100	108	117
Cruiser	256	406	451	489	540	585
TOTAL	639	1,014	1,127	1,247	1,351	1,463

NOTE:

1. Based on Projected Current and Latent Demand Median Values.
2. Fleet Mix Percentages Derived from MRI Data, adjusted for field observations, (October, 1981).

TABLE 5

PROJECTED[1] FLEET MIX BY SIZE[2]
1990-2040

Year	Under 16 ft.	16/26 ft.	26/40 ft.	40/65 ft.	65/over	Total
1990	38	390	198	13	0	639
2000	61	619	314	20	0	1,014
2010	68	687	349	23	0	1,127
2020	75	760	387	25	0	1,247
2030	81	824	419	27	0	1,351
2040	88	892	454	29	0	1,463

Note:

1. Based on Projected Current and Latent Demand Median Values.
2. Fleet Mix Percentages Derived from MRI Data, adjusted for field observations (October, 1981).

The analysis also indicates that an appreciable demand exists for additional transient berths and launching facilities. Currently, 2 boat slips at City of Lorain facilities are used for daily transient demand. The transient facility projected daily need is summarized in Table 3. Estimates of the number of trailered boats were developed by associating trailerings to small-boat sizes. State boater registration statistics indicate that 90 percent of all boats under 16-feet are trailered, and that 44 percent of all registered boats are under 16 feet.

The existing demand for additional permanent facilities is so great, that the Lorain Port Authority has recently constructed (August, 1981), a temporary 600-foot floating tire breakwater in the east basin of Lorain's Lake Erie Harbor. The breakwater project provided temporary single point moorage space for approximately 36 small-crafts. The floating breakwater project is expected to last 6 to 10 years.

Public Safety

Lorain Harbor can currently function as a small-boat harbor of refuge. However, boats seeking to escape dangerous lake conditions are inconvenienced by unavailability of appropriate docking space, conflicts with commercial ship traffic, and vertical clearance limitations at the Erie Avenue Bridge when closed. A new small-boat harbor could eliminate much of this functional inconvenience, and could improve the comfort and safety offered to boaters seeking refuge.

Recreational Fishing

As a result of comments at the initial public workshops and interviews with the Lorain Harbor master and president of a local fishing club, interest in land based fishing improvements at Lorain was well substantiated. The 1979 creel census, Ohio Department of Natural Resources, has shown the most utilized shore facilities on Ohio's Lake Erie shore to be at Cleveland and Lorain.

The capacity method for determining land-based fishing demand is employed as a consequence of demonstrated facility shortages within an area of high urbanization. The capacity method is appropriate when the participation rate for a given activity is determined by the facility supply rather than the total demand levels. This condition was confirmed by projecting potential usage assuming an unlimited supply of fishing facilities. These projections were based on Lorain County population growth predictions.

The future potential usage was extrapolated from the historic correlations between population and fishing licenses sold within the same area, and between fishing licenses sold and annual fisher-days. Further explanation of this analysis is contained in Appendix C. The land based fishing facilities at Lorain Harbor in 1975-1977 only satisfied 50 percent of potential demand. City plans to provide facilities at the diked disposal area would increase supply by 85%; however, the potential demand would continue to grow with the population. The estimated supply satisfies only 49 percent of the demand expected in the year 1990. The percentage of satisfied demand then continually decreases as populations grow and new facilities remain unprovided.

Facility capacities were based on the length of available fishing areas divided by the expected density of fishermen. The density is defined by the number of feet between individual fishermen on a fish "Run Day". Density estimations at future facilities were derived from existing usage relative to factors of accessibility, quality of fishing, and quality of the environment.

Planning Constraints

During this Stage 2 study, planning constraints were identified concerning site location, berthing capacity, environmental aspects, and commercial conflicts. Each constraint is described in subsequent paragraphs.

Site Location - The authority for this study specifically focuses upon Lorain Harbor, which is administered by the City of Lorain and is wholly within city limits. As a result, siting efforts were focused upon the port and its nearby vicinity. The study area generally was confined within city limits since the City of Lorain has identified itself as an interested, non-Federal sponsor. Subject to these guidelines, geographical study boundaries were carefully chosen to preclude omission of potentially advantageous small-boat harbor sites. Citizen remarks at the Orientation Workshop were responsible for extending the westerly limit past the initially proposed two mile distance from the Black River mouth. This has accomodated local desire for including the Beaver Creek location into the study area.

Berthing Capacity - This preliminary stage of study has required professional judgements of appropriate sizing for the small-boat harbor. As study progresses into subsequent stages, the finding of previous reports and the investigation of new data may cause alterations of the initial judgements.

Harbor siting evaluations were based upon a minimum berthing capacity of 400 slips. Upon selection of the most advantageous site, alternative harbor layouts were devised for capacities of both 300 and 600 slips. These sizes were selected because experience demonstrates their potential for generating favorable benefit/cost (B/C) ratios and because propitious harbor sites seemingly accomodate these capacities.

Environmental Concerns - The desire to protect valuable wetlands from unnecessary destruction is emphasized by a variety of laws and guidelines. A planning constraint which insures compliance with appropriate wetland protection stipulations is iterated in response to the overt public concern for these unique wildlife areas. This specifically includes requirements of Section 404 of the Federal Water Pollution Control Act, as amended, and of Executive Order 11990, issued 24 May, 1977.

Commercial Conflicts - Recreational harbor improvements are constrained from severely conflicting with existing or planned commercial uses of Lorain Harbor. The desire to promote viable commercial uses in priority over recreational uses is indicated by the Lorain Port Authority.

Any Federally shared small-boat harbor improvements must allow some alternative for accomodating potential commercial improvements as described in the Preliminary Feasibility Report on Lorain Harbor Ohio (commercial study completed in October 1980). Notably, the Riverside Park Cut commercial channel alternative must receive consideration when studying potential recreational harbor alternatives within the port boundaries. This cut places the main channel at or near a water site (east basin of outer harbor) which the Lorain Port Authority has selected for interim development as a small-boat mooring basin.

National Objectives

Federal policy, as developed by the President's Water Resources Council, requires that alternative water and related resource plans be formulated in accordance with the national objectives of National Economic Development (NED) and Environmental Quality (EQ). Therefore, in accordance with the guidance established in Engineering Regulation 1105-2-200, Multiobjective Planning Framework", dated 10 November 1975, this study will be consistent with the planning requirements of the Water Resources Council "Principles and Standards" (P&S) and related policies. In accomplishing the study, equal consideration will be given to the P&S objectives of NED and EQ described below:

<u>National Economic Development</u> (NED) - National Economic Development is achieved by increasing the value of the nation's output of goods and services and improving economic efficiency.

<u>Environmental Quality</u> (EQ) - Environmental Quality is achieved by the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems.

<u>Specific Planning Objectives</u>

Specific planning objectives are the National, State, and local water and related land resources management needs (opportunities and problems) specific to a study area that can be addressed to enhance National Economic Development and Environmental Quality. Based on a review of the directives established related to multi objective planning, previous reports developed for a small-boat harbor at Lorain, Ohio, statements by individuals in the private sector, input from officials at many levels of government and an analysis of the problems and needs of the study area, as discussed previously, the specific planning objectives for the Lorain Ohio small-boat harbor project are identified as follows:

a. Appreciable recreational boating demand exists in the area which, according to the Lorain Port Authority, is presently unfulfilled due to a lack of adequate harbor facilities. Therefore, one objective of this study will be to provide a recreational harbor facility for shallow draft recreational craft.

b. Hazards to small-boat navigation exist due to the limited small-boat facilities at Lorain Harbor. The 30 mile reach between Federally maintained Rocky River and Vermilion has two other privately maintained inlets, Beaver Creek and Avon Basin that are not considered dependable harbors of refuge. Therefore, the second objective of this study will be to provide an improved harbor-of-refuge for light draft recreational craft at Lorain Harbor.

c. Due to excessive demand for shore based recreational fishing in Lorain Harbor, another objective of this study will be to incorporate, if justified, such facilities in the project as are necessary to augment land-based recreational fishing opportunities of the area.

d. Any development that modifies existing wetland, archeological, or historical lands within the area will posess severe environmentl concern. Therefore, one objective of this study will be to minimize or eliminate any adverse environmental impacts resulting from this project. When viable opportunities for environmental enhancement are discovered, they will be incorporated into improvement plans.

e. Lorain Harbor is primarily a commercial port. A costly and hazardous condition could be created by a poorly conceived flow of commercial and recreational craft. Therefore, this study will attempt to provide safe commercial and recreational traffic routing.

f. The maintenance of national strength and satisfactory levels of living will be achieved by increased national income and productivity. This study will strive to maintain or improve the economic status of the area. This objective can be met by planning a harbor for which derived benefits exceed project costs.

Condition If No Federal Action Taken

Population is projected to increase in Lorain County. This is expected to put increased pressures upon existing recreational facilities. Boating and fishing facilities presently are at capacity according to the Lorain Port Authority. The City of Lorain is interested in relieving some of this stress, but apparently lacks sufficient funding abilities to undertake any but temporary measures to create any increased small-boat moorings (i.e., the floating breakwater described previously in this section).

Significant expansion of existing marinas at Lorain is restricted by either land and water ownership conflicts or by physical limitations. Marinas within Lorain Harbor, notably the Lorain Yacht Basin and Seaway Marina, have fully utilized available land and water areas. Acquisition of adjacent areas is unrealistic due to commercial valuations or public facility uses (sewage treatment plant, U.S. Coast Guard Station, industrial development, and commercial ship channel). To the west of the harbor, marinas on Beaver Creek have some areas available for expansion, but these areas are inland and require water access under a railroad bridge and a highway bridge with vertical clearances of about five feet. Therefore, the type of vessels using these facilities generally is limited to trailerable power boats. Also, major expenditures are required before this area has an all-weather entrance.

Without Federal cooperation, conditions will remain essentially unchanged from present conditions. Marine related businesses and small-boat industries will not grow appreciably. Local and regional recreational use of Lake Erie will not increase to fuller resource potential.

Individuals will pursue non-water related recreation or will experience objectionalbe crowding conditions. Boaters will purchase small trailerable boats even if larger non-trailerable boats are preferred. Still, convenience of launching will limit this activity.

Regional boating and fishing facilities will not accommodate demand transfer from Lorain, since these facilities also will experience capacity usage. In general, an opportunity for appropriate and desirable recreational use of Lake Erie at Lorain, Ohio may be missed.

SECTION C

FORMULATION OF ALTERNATIVE PLANS

This section of the Preliminary Feasibility Report documents the formulation and evaluation of alternative site plans for meeting the small-boat harbor needs at Lorain, Ohio. Following subsections present form-umulation rationale, evaluation criteria, conceptual site layouts, and comparative screening results.

PLAN FORMULATION RATIONALE

The objective of this Stage 2 investigation is to identify the best general plan(s) for satisfying the recreational boating needs at Lorain Harbor based on physical constraints, the desires and preferences of local interests for recreational boating, and consistency with sound engineering, economic and environmental principles. In this process, an interative procedure that provides for increased levels of refinement in design and critique and evaluation by the principal study participants (i.e. - Corps of Engineers, and the Lorain Port Authority) is used to narrow the range of alternatives assessed in further detail. The procedure also allows for review and comments by the general public at informal meetings, workshops and public meetings.

Investigation of other water resources problems and needs, such as other types of recreation, commercial uses, water quality, sedimentation, erosion and/or flooding, is limited to a level of refinement necessary to adequately assess potential impacts of each on recreational boating. Information on existing or planned commercial harbor uses is derived largely from the Lorain Harbor Stage 2 report completed in October 1980.

General Formulation and Evaluation Criteria

Federal policy on multiobjective planning, derived from both legislative and executive authorities, establishes and defines the national objectives for water resource planning, specifies the range of impacts that must be assessed, and sets forth the conditions and criteria which must be applied when evaluating plans. Plans must be formulated to meet the needs of the area with due regard to benefits and costs, both tangible and intangible, and effects on the ecology and social well-being of the community.

The formulation of a plan, including the screening of alternatives, must of necessity be within the context of an appropriate framework and set of criteria. A planning framework is established which requires the systematic preparation and evaluation of alternative solutions to problems, under the objectives of National Economic Development (NED) and Environmental Quality (EQ). The process requires that the impacts of a proposed action be measured and the results displayed or accounted for in terms of contributions to four accounts: *NED, EQ, Regional Development (RD), and* Social Well-Being (SWB). The formulation process must be conducted without bias as to structural and non-structural measures.

Within the overall planning framework are other more specific criteria relative to policies, technical engineering, economic principles, social and environmental values and local conditions. These criteria, noted as "Technical", "Economic" and "Socio-economic and Environmental" are listed as follows:

Technical Criteria

a. Design wave and lake level should be based on the recreational boating season which is assumed to extend from April to November on Lake Erie.

b. A coincident 200-year design frequency, using the 20-year recurrence significant deep water wave height in combination with the ten-year lake level, should be used for design of structures.

c. Overtopping of protective works for the design condition would be permitted to the extent that the residual interior wave shall be limited to a height consistent with safe and efficient operation of the marina facility.

Economic Criteria

a. Tangible benefits should exceed project economic costs.

b. Each separable unit of improvement or purpose should provide benefits at least equal to its cost unless justifiable on a non-economic basis.

c. Each plan, as ultimately formulated, should provide the maximum net benefits possible within the formulation framework.

d. The costs for alternative plans of development should be based on preliminary layouts, estimates of quantities, and 1981 unit prices.

e. The benefits and costs should be in comparable economic terms to the fullest extent possible.

f. A 50-year economic life and 7-5/8 percent interest rate are used for the economic evaluation.

g. The base case for comparison of alternatives plans is the "do-nothing" (no-action) plan.

Socio-economic and Environmental Criteria

The criteria for socio-economic and environmental consideration in water resource planning are prescribed by Sec. 102 of the National Environmental Policy Act of 1969 (PL 91-190) and Section 122 of the River and Harbor Act of 1970, (PL 91-611). These criteria prescribe that all significant adverse and beneficial economic, social, and environmental effects of planned developments be considered and evaluated during plan formulation. In addition, Executive Order 11990 dated 24 May 1977 directs that each agency shall provide leadership and take action to minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. Executive Order 11988, Floodplain Management, discourages Federal agencies from undertaking projects in a floodplain or that would encourage development in a floodplain.

Design and Other Considerations for Harbor and Marina Layout

Channels

a. Depth of Entrance Channel: 8 feet below Low Water Datum (El. 568.6 on IGLD-1955)

b. Depth of Interior Channels: 6 feet below LWD

c. Channel Widths: Minimum width of 100 feet for entrance and interior channels

Harbor Location

a. The small-boat harbor should be located such that facilities are easily accessed from land and water.

b. Advantage should be taken of areas which minimize dredging and wave protection requirements.

Wave Requirements

a. All-Weather Harbor: For the design wave condition, breakwaters and channels will be designed to limit wave heights to three feet in the entrance channel and one foot in the mooring area.

Spoil Disposal

a. Polluted spoil disposal, if any, is assumed to be dumped into the Diked Disposal area or upon approved land sites.

b. Unpolluted material can be dumped at approved Lake Erie sites.

Traditional Cost-Sharing

a. General Navigation Features - First costs for general navigation features such as breakwaters and entrance and interior access channels will be cost-shared 50 percent Federal and 50 percent non-Federal. Annual maintenance costs and aids to navigation are 100 percent Federal.

b. Recreational Breakwater Fishing - First costs would be shared 50 percent Federal and 50 percent non Federal, and annual operation and maintenance costs would be 100 percent non-Federal.

c. Support Facilities - Support facilities such as excavation for dockage and access areas, dock construction, construction of service facilities and launching ramps are 100 percent non-Federal. These costs are considered to be self-liquidating and, therefore, are not included in determination of the economic viability of the plan.

DEVELOPMENT OF ALTERNATIVE PLANS

Under this study authority, increased capacity for smallboat berthing was identified as the primary recreational resource need. As possible solutions to addressing this primary need, an array of structural and non-structural solutions was initially developed. Descriptions of the development process and features of initial plan concpets are described in following subsections.

Method Of Developing Alternative Plans

The first step in the alternatives development stage encompassed specific selection of small-boat harbor sites. Potential sites were identified from maps, photographs and visual reconnaissance. Equally important methods of identifying potential sites involved interviews and information obtained at the Orientation Workshop.

A total of five potential small-boat harbor sites were identified during the site selection phase of the Stage 2 study. Additionally, opportunities for non-structural solutions were researched. The five sites varied in location and characteristics. General site locations included the Black River (inner harbor), the east and west basins of the outer harbor, the open coast, and a stream mouth remote from the commercial harbor (Beaver Creek). This latter location was added as a direct result of comments at the Orientation Workshop; even though the original study limits required expansion to include this type of geographical environment. The five site locations are depicted in Figure 3. The non-structural alternative is located on lands adjacent to the Municipal Pier.

Site comparisons were accomplished by developing a single, conceptual harbor layout at each location. Then the characteristics of each site plan were assessed in terms of its ability to satisfy planning objectives and evaluation criteria as outlined in previous subsection of this report. The goal of this assessment was selection of a site or sites which merit further development of preliminary design plans for more detailed analysis in this Stage 2 study.

Alternative Site No. 1 - Inside East Breakwater

The site comparison plan for this alternative features a breakwater 900 feet long, a water area of 38 acres, a land area of 23 acres, and a berthing capacity for 600 boats (see Figure 4). On a comparative basis, Federal costs for construction are estimated to be $1.0 million, and non-Federal costs to be $5.0 million. Principal advantages for this site are derived from existing water conditions and depths and from planned uses of adjacent lands.

The existing system of outer breakwaters produces relatively quiescent waters here, thereby reducing the mass and height requirements for new structures to protect the small-boat basin. The basin shape is nearly rectangular and has sufficient depth to eliminate dredging

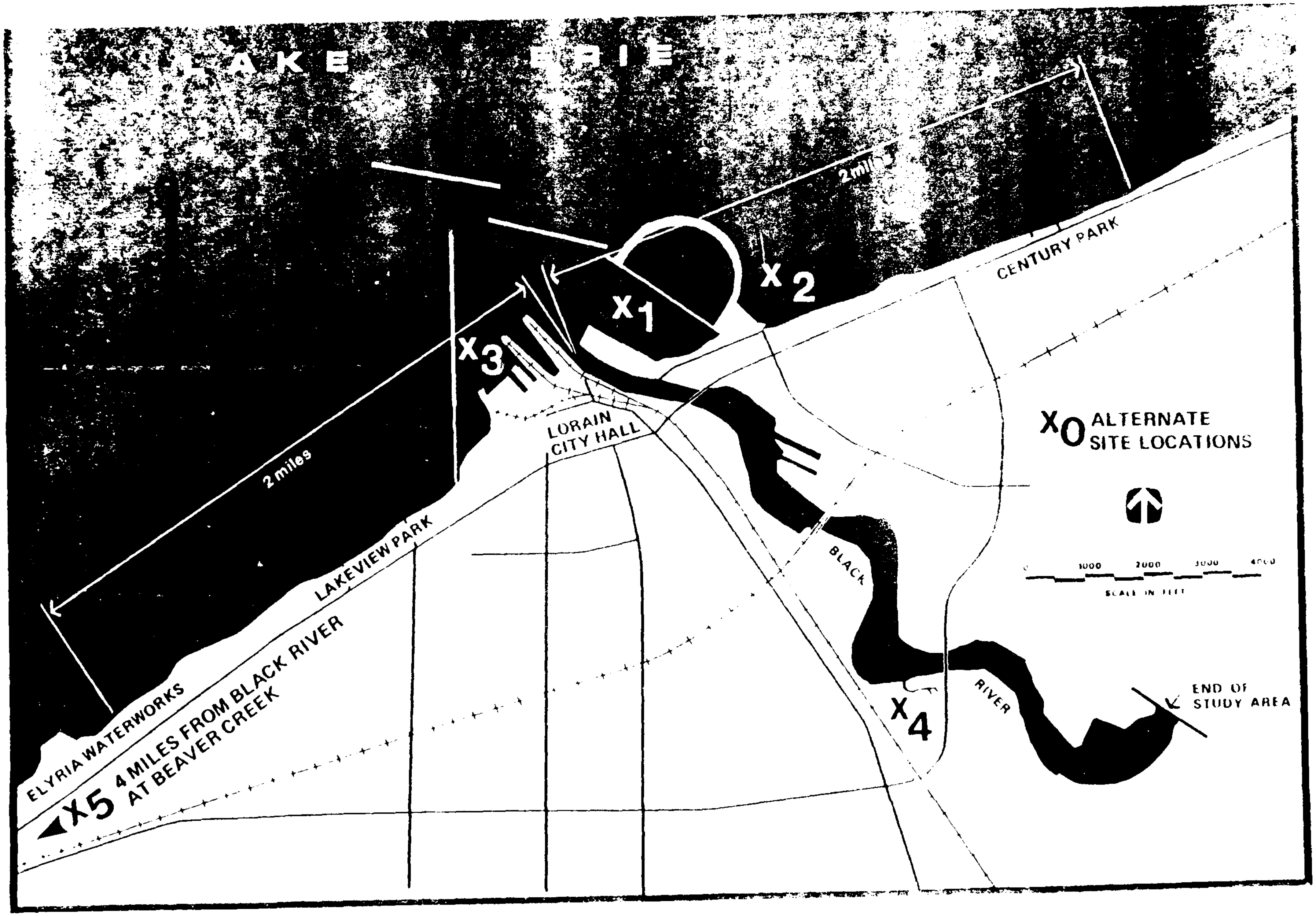


FIGURE 3 ALTERNATIVE SITE LOCATIONS

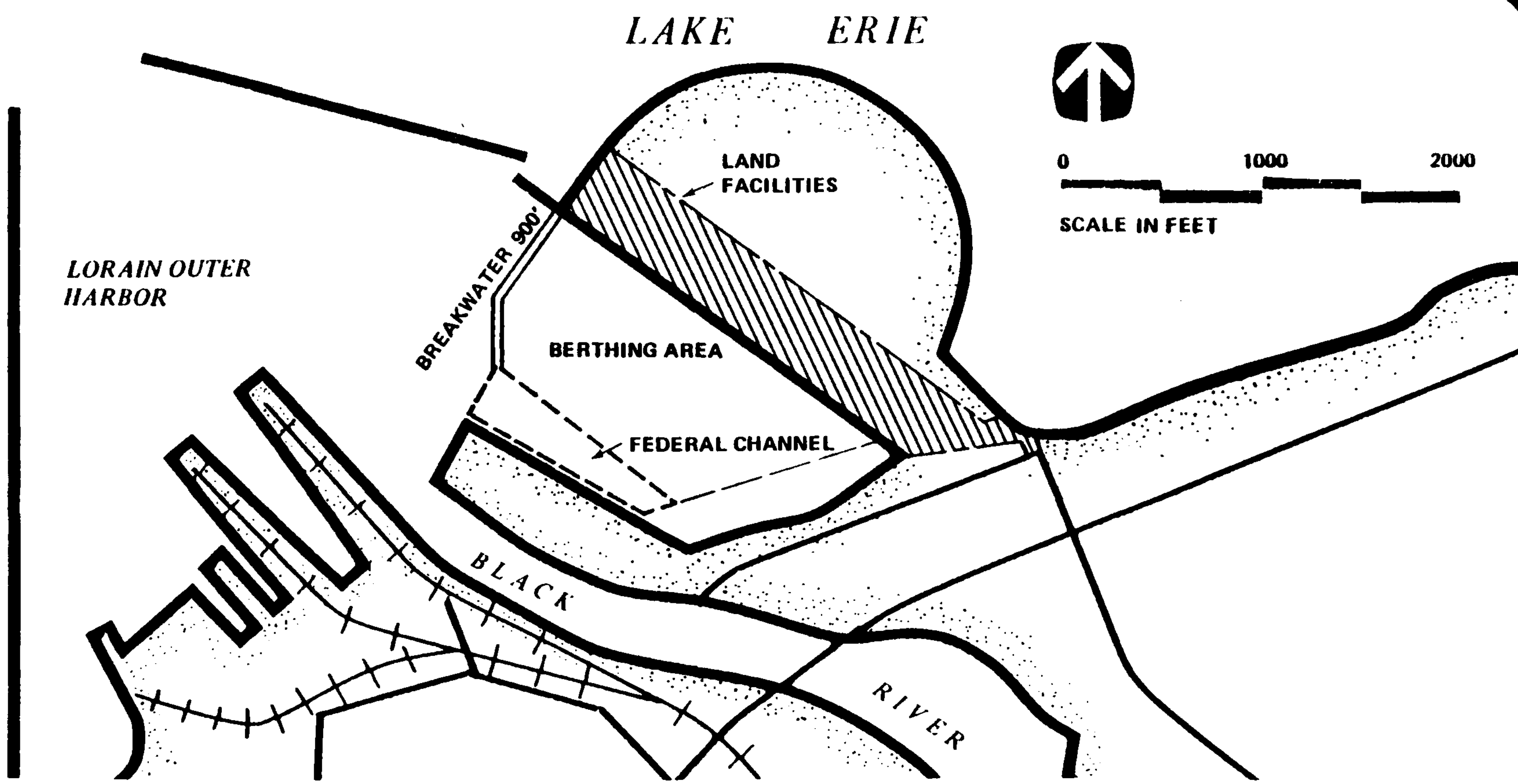


FIGURE 4 ALTERNATIVE SITE 1 INSIDE EAST BREAKWATER

needs. The easterly and westerly edges of the basin are protected by steel sheetpiling. The southerly edge is composed of a sandy shore. These basin characteristics are condusive to cost savings and efficient use of land/water areas. Marina parking is conveniently located along one side of the geometrically favorable berthing area. The land support facilities are placed upon a portion of the Diked Disposal Area, with remaining portions planned as a city park. The park's completion is scheduled to be approximately concurrent with construction of a small-boat harbor under this study authority. A marina should compliment the overall water-oriented theme of the park. Major street systems are within close proximity to the site. No major environmental problems are anticipated at this site.

A possible conflict with commercial port improvements could occur if the Riverside Park cut is selected from the range of alternatives presented in the Preliminary Feasibility Report for Lorain Harbor. However, reduction of basin size and structural protection from ship wake could accommodate the commercial conflict.

The presence of a water pollution control facility on adjacent lands to the west of the boat basin causes some concern for aesthetic qualities. Summer winds often place the boat basin generally downwind of this land area, but the modern and efficient operational aspects of the facility, particularly with regard to odor control, diminish potential problems. The city's determination to maintain and, if possible, to improve upon odor control is evidenced by their intentions to place a park on the Diked Disposal Area. The facility's proximity to commercial and residential uses undoubtedly has influenced past city decisions to implement state-of-the-art odor control devices.

<u>Alternative Site No. 2 - East of Diked Disposal Area</u>

The conceptual plan at this site, like that of Alternative Site No. 1, makes use of future lands created by the Diked Disposal Area. Fifteen acres of land support facilities are placed there and along the southern edge of the 600 slip berthing area (see Figure 5). Two shore-connected breakwaters measuring 1900 feet and 700 feet in length, are necessary to diminish effects of the open lake wave forces. The westerly edge of the basin is composed of large rock rip-rap. The southerly edge requires construction of a low bulkhead to create land facility areas by disposal of nearshore dredge material. Remaining water areas have sufficient depth without dredging. Total construction costs are

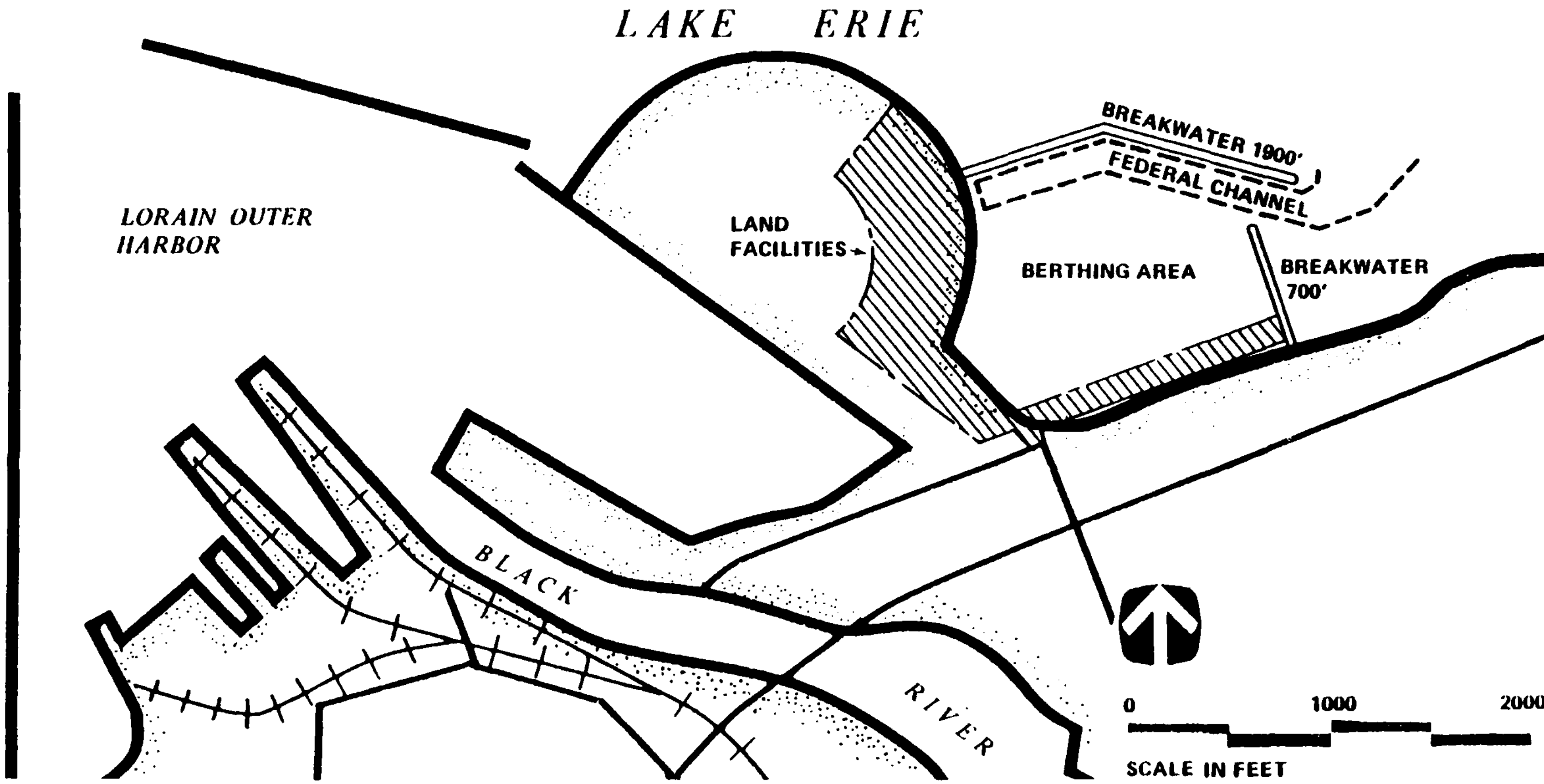


FIGURE 5 ALTERNATIVE SITE 2 EAST OF DIKED DISPOSAL AREA

approximated as $4.4 million for Federal share and $10.4 million for non-Federal share.

As in Alternative Site No. 1, this site plan has advantages with regard to complimenting the city's plan for an adjacent park, and nearby major street systems provide ready access to the facility.

The southerly edge of the basin abutts private properties, but the conceptual plan does not require their acquisition. Instead, this plan would provide relief from threatening erosional conditions along this shoreline. Judicious alignment of the breakwaters avoids the aggravation of erosional conditions along other shorelines.

The location of Alternative Site No. 2 completely outside of existing harbor boundaries does prevent conflicts between recreational and commercial facilities. However, since there is no barrier between the open lake waters and the small-boat harbor breakwaters, costs are greatly escalated by the relatively massive protection requirements. Breakwater heights and armor rock size needs are increased. Also, water depths are greater and breakwaters are comparitively lengthy. Excessive cost is the singular, significant disadvantage of this site. No major environmental problems seem likely.

Alternative Site No. 3 - Inside West Breakwater

The conceptual small-boat harbor layout at this site features a 15 acre land area and a 30 acre water area with capacity for 425 berths (see Figure 6). Both the land and water areas have irregular shapes in order to avoid adjacent commercial uses.

Major structural elements of this plan include elevation of the west breakwater to prevent wave overtopping, and construction of a bulkhead along the northern edge of the large land facility area located next to the west breakwater. Nearly the entire berthing area is dredged, with disposal occurring behind the new bulkhead to raise land areas there.

Conceptual cost estimates for project construction are $1.5 million for Federal interests and $7.0 million for non-Federal interests. Non-Federal costs are increased by basin dredging and land acquisition requirements. Land purchases must occur along a power generating site and within a residential area. Local opposition to construction of a small boat harbor at this site resulted in the Corps to discontinue an authorized small-boat harbor study at this location.

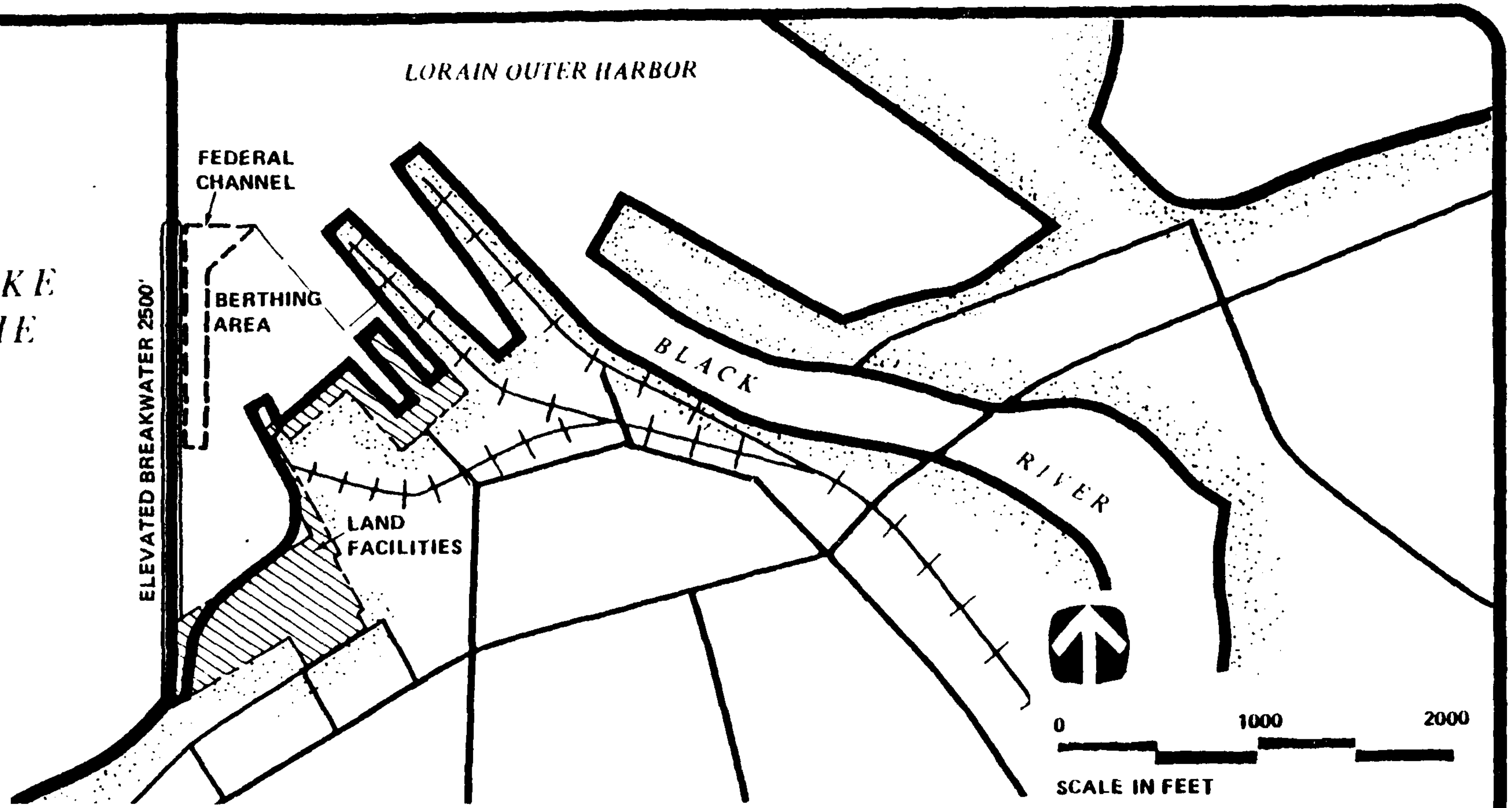


FIGURE 6 ALTERNATIVE SITE 3 INSIDE WEST BREAKWATER

Other disadvantages are created by the inefficient orientation of land and water areas. A practicable system of roads, parking, and berthing layout is difficult to attain. Also, there is no readily available alternative to increasing berthing capacity.

The site location does interfere with commercial operations, most notably the infringement upon lands used by a power generating company. Also, this water area is heavily used by sport fishers, both from land and boats. Its popularity is partially attributable to unique fishing conditions caused by the outflow of cooling waters from the power generating plant.

Alternative Site No. 4 - Black River at 21st Street

The features of this comparitive site plan include a single breakwater of 150- foot length, a 20 acre water area for 400 boat slips, and a 20 acre land area (see Figure 7). The water area, characterized as a wetland, must be dredged to project depths. The adjacent commercial channel must be widened into the opposite river bank.

Construction costs are estimated to be $5.1 million for Federal interests and $11.7 million for non-Federal interests. These high costs are largely associated with breakwater construction and dredging.

This site is relatively close to major highways and streets. However, access to land facilities is hampered by surrounding high bluffs. Steep road grades are considered as a detriment, especially for boat trailering. The water access route to Lake Erie traverses a lengthy portion of inner harbor commercial channels and passes under the bascule bridge at Erie Avenue. Additional water use conflicts are created by the boat basin's infringement upon an existing turning basin, although this is mitigated by channel widening into the opposite riverbank.

The destruction of wetlands is considered a serious environmental mental impact, requiring analyses of tradeoffs and possible mitigation measures. Unknown archaeological sites may exist in the area, requiring further investigation. Surrounding commercial and industrial land uses detract from the aesthetics of this site.

Alternative Site No. 5 - Beaver Creek

Within the city limits of Lorain, this site has exhibited unique shoreline characteristics as a low-lying

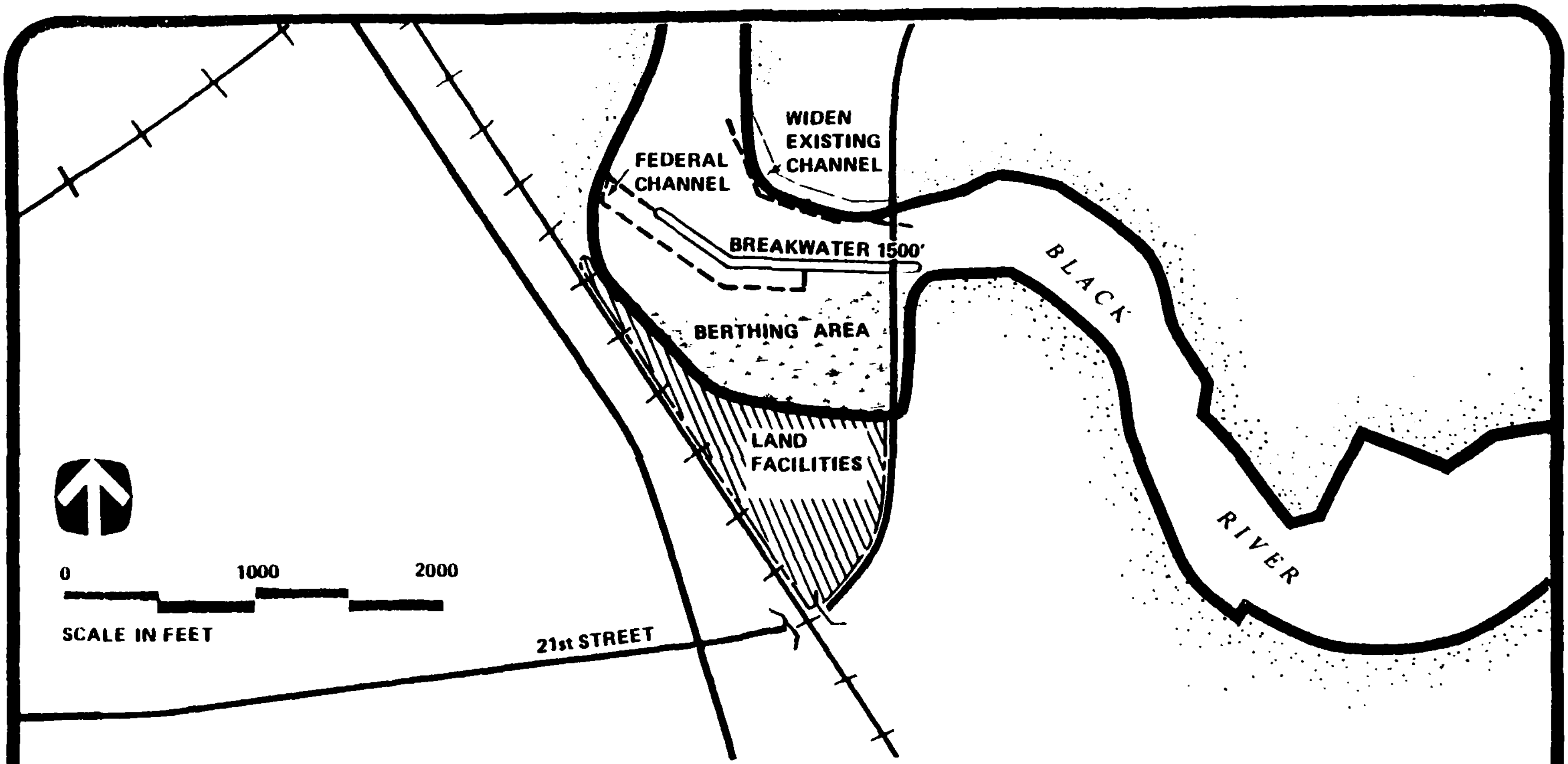


FIGURE 7 ALTERNATIVE SITE 4 BLACK RIVER AT 21st STREET

area abounding a creek which is remote from the Black River. These characteristics have induced private development of marina facilities along Beaver Creek. The potential enlargment of berthing capabilities at or near this site is investigated as a solution to identified resource needs.

Unfortunately, major railroad and highway bridges of limited vertical water clearance (about 4 feet) preclude advantageous use of low-lying areas landward of the crossings. Sufficient water areas for planning objectives are attainable only by constructing large protective structures in Lake Erie (see Figure 8). A 2900-foot shore-connected breakwater, a 1200-foot riprap wall, and bulkheading of land facility areas, in conjunction with dredging needs, cause this alternative to be the most costly. Creation of a 600 boat marina (33 water acres and 18 land acres) costs Federal interests about $5.1 million and non-Federal interests about $14.8 million. These costs include land acquisition.

First costs seem to outweigh advantages of non-commercial conflicts and convenience to major highways. In fact, safe land access is detrimentally affected by the necessity of a railroad crossing between the highway and parking facilities.

The projection of a breakwater far lakeward of surrounding land forms is likely to cause erosional problems at adjacent shores and adversely affect railroad uses there. Sedimentation is possible within the boat basin since the creek empties into quiet harbor waters.

Even though existing land uses include private marinas, the natural habitat areas are relatively valuable and some are characterized as wetlands or transition zones. The nearshore environment also is relatively productive and natural.

<u>Alternative Site No. 6 - Non-structural</u>

A non-structural alternative is defined in this study as one requiring no new construction activities within water areas, yet differs from "no-action" by implementing some means of increasing boating storage and launching capabilities. Essentially, existing facilities are upgraded or enhanced by management and/or landward improvement methods. Some limitations on expansion of existing facilities is presented in Section B, "Condition If No Federal Action Taken."

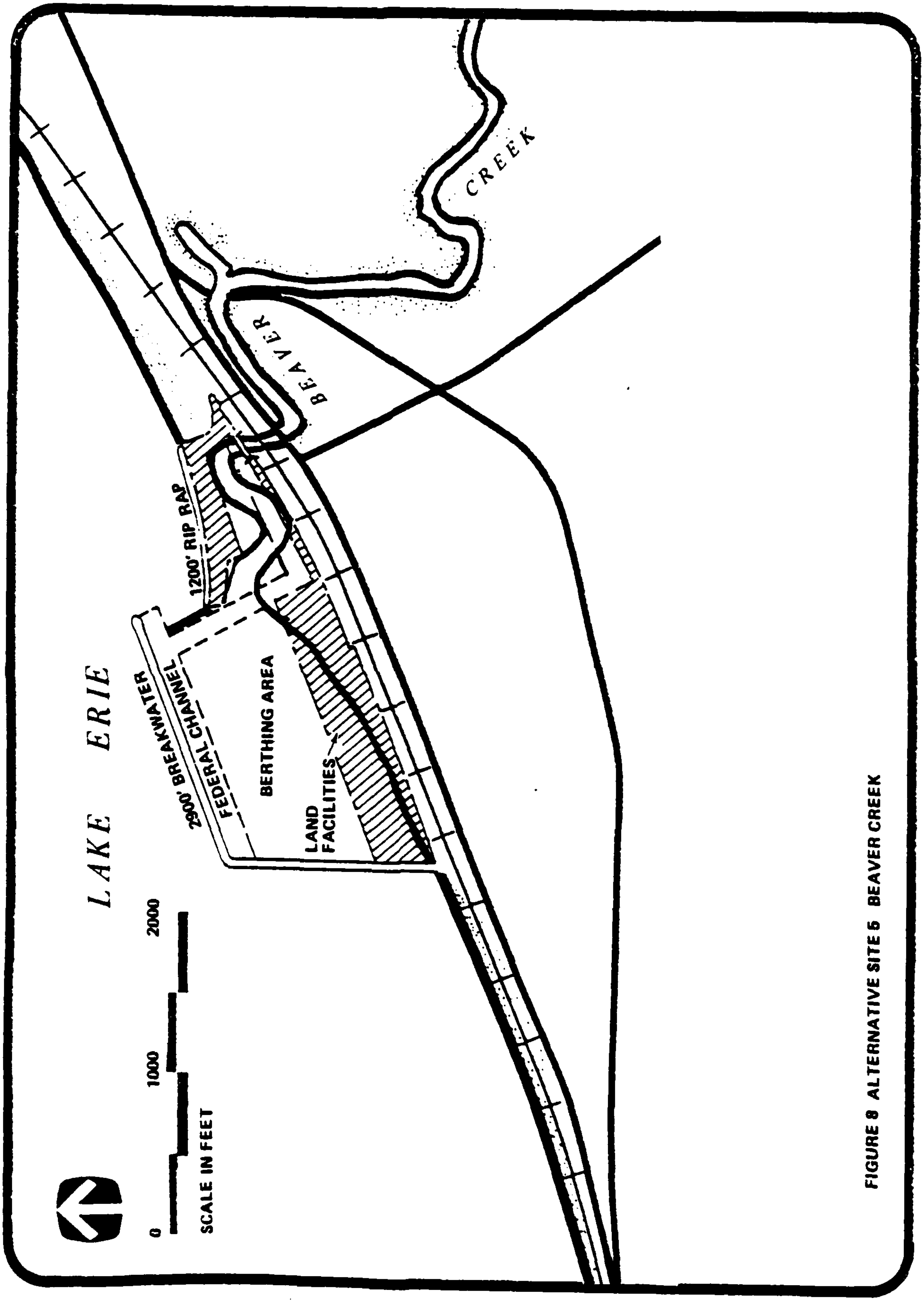


FIGURE 8 ALTERNATIVE SITE 5 BEAVER CREEK

The non-structural alternative encompasses a new dry-storage boat facility at the existing Municipal Pier launch ramps (see Figure 9) in conjunction with preferential use by large motor boats and sailboats of the existing public Yacht Basin at the Black River mouth. The new dry-storage facility is located on public land areas and is envisioned as including a modern,automated type launching apparatus within an enclosed building containing stacked motor boats up to lengths of around 22 feet. Total dry-storage capacity for 400 boats is provided at a total cost of about $2.0 million, with no Federal cost sharing.

The very low implementation costs are offset by several functional disadvantages. Most obviously, the facility limits the fleet mix which is accommodated and presents inconveniences to users. During peak demands, delays are probable for launching activities. This also is a potential souce of problems when inclement weather conditions cause a convergence upon the facility as a place of refuge.

The storage and launch facility encroaches upon adjacent commercial and recreational uses. Some lands used by a power generating company are needed to acquire adequate area for parking and structures. The Municipal Pier is heavily used as a land-based sport fishing facility. Increased boating activity may restrict continuation of recreational fishing at this site. In general, the exclusion of wet slips for dry-storage improvements is not preferable to most recreational boaters, and potential enhancements of associated recreation activities often are lost.

Comparison of Alternative Sites

The six alternative sites are compared for purposes of selecting the superior small-boat harbor location at Lorain. Comparisons are made in terms of engineering, economic, environmental, and social characteristics exhibited by each alternative. As described earlier in this report, further development of preliminary plans is done for the selected site.

Public opinion and input on the various site characteristics was invited at the Interim Public Workshop (see Appendix D). At this workshop, site descriptions and planning analyses were presented along with tentative site selection conclusions. Active interaction with workshop participants was recorded, and pertinent comments were used to aid site comparison efforts.

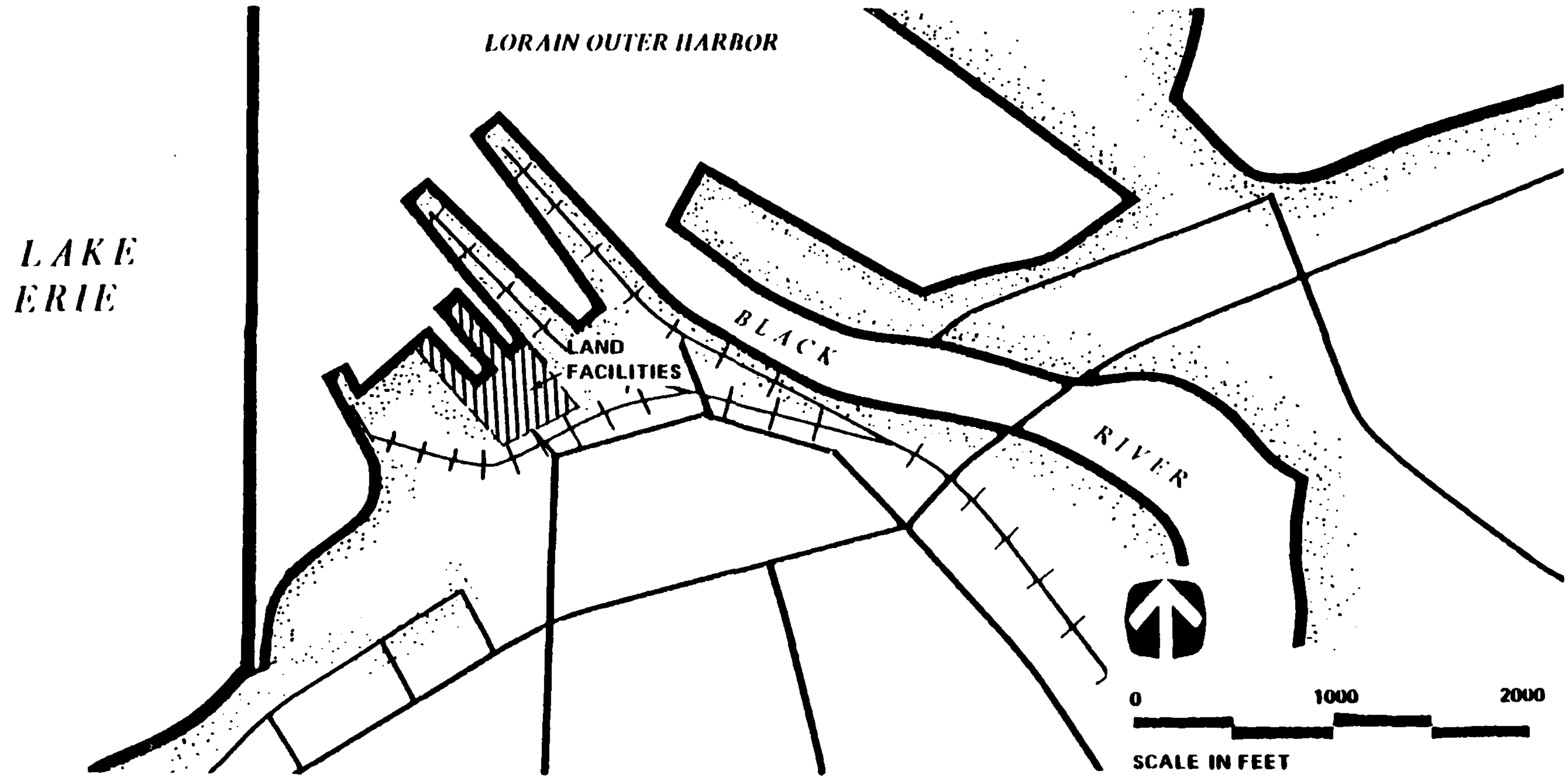


FIGURE 9 ALTERNATIVE SITE 6 NON–STRUCTURAL

Engineering Comparisons. Engineering factors generally encompass the small-boat harbor's ability to provide all-weather access, efficient land and water use, functional convenience, and maintainability. Alternative Site No. 1, Inside East Breakwater, has an engineering advantage over all other sites. Safety is enhanced by its location within the existing outer-harbor area rather than on an open lake exposure or at an inner-harbor location (Black River at 21st Street) which conflicts with commercial traffic. Unlike the other outer-harbor alternative, Inside West Breakwater, the land and water areas are geometrically oriented for convenient and efficient development. The potential sedimentation and erosional problems of some other sites, notably the Beaver Creek Alternative, are avoided. The East of Diked Disposal Area Alternative rates slightly lower than Alternative Site No. 1 because the gains relative to shore erosion protection are outweighed by the difficult harbor entrance requirements under severe wave conditions. The non-structural alternative rates poorly because of its limited flexibility to meet future fleet mix demands and its inconvenient operational aspects, especially during peak usage periods.

Economic Comparisons. Economic evaluation factors involve total costs to Federal and non-Federal interests with relation to berthing capacity and concomitant benefits. Alternative Site No. 6, Non-structural, has higher net benefits than other sites, as demonstrated by Table 5A, but Site No. 1 has comparable net benefits considering the probable data accuracy.

The benefit and cost data summarized in Table 5A is derived from methods other than those described in Appendices A and B. The level of accuracy attained for site selection purposes is lessened by the conceptual nature of the small-boat harbor plan at each site. Benefits were derived by first finding the ratio of a site concepts' harbor capacity to the "Geneva-On-The-Lake" harbor capacity and then factoring that ratio with the annual benefit valuation for "Geneva-On-The-Lake", which is a recently completed and similar small-boat harbor study at Lake Erie. Recent Corps studies in the Lorain, Ohio area generally were referenced for cost information

TABLE 5A

ECONOMIC COMPARISONS OF SITES

Conceptual Estimates

ALTERNATIVE SITE	COST ($ MILLION) FEDERAL	Local	B/C Ratio	($Thousands) Net Benefit
#1 Inside East Breakwater	1.1	4.7	3.7	440
#2 East of Diked Disposal Area	4.4	10.4	0.9	(-)60
#3 Inside West Breakwater	1.3	7.0	2.4	270
#4 Black River at 21st Street	5.1	11.7	0.6	(-)350
#5 Beaver Creek	5.1	14.8	0.8	(-)200
#6 Non Structural	0.0	2.0	--	450

The net benefits and B/C ratio of Alternative Site No. 1 are very high and significantly exceed those of Site No. 3 which exhibits the only other favorable economic statistics. Alternative Site No. 1 is the best economic plan with Federal involvement since costs are lower than other structural plans and benefits are high, approximately equalling the net benefits of the non-structural alternative.

Environmental Comparisons. The potential for site development impacts upon wildlife, water quality and wetlands largely constitute the basis for environmental comparisons. All sites except Black River at 21st Street and Beaver Creek exhibit slight or minimal adverse impacts. The Black River site results in wetland destruction and the Beaver Creek site is located in a more natural environment than sites located within outer Lorain Harbor. Major environmental concerns are not manifest for those sites in the vicinity of the Diked Disposal Area or outer harbor.

Social Comparisons. Within this general category, the sites were compared on the basis of land use compatibility, visual aesthetics, business enhancement, and archaeological/historical impacts. The Inside East Breakwater site and East of Diked Disposal Area site rate higher than other alternatives. Both are compatible with adjacent land uses and enhance the attractiveness of a planned city park. Their capacity for 600 berths provides long-term benefits to marine related business activity.

The East of Diked Disposal Area site, Beaver Creek site, and Black River at 21st Street site create additional business activity during construction as a result of higher expenditures for project implementation. The Inside West Breakwater site and the Non-structural site interfere with important recreational fishing areas. The Non-structural site presents the lowest contribution to business activity, recreational enhancement, and aesthetics.

Site Selection Results. The Inside East Breakwater site possesses overall superiority and excellent potential for implementation. This site exhibits responsiveness to all evaluation criteria, and the B/C ratio and net benefits are highest of any structural plan as shown in Table 5A. Construction costs for both Federal and non-Federal interests are lower than any other structural alternatives costs. Local support for this site is evident from city and Port Authority decisions to create an "interim" temporary marina there.

In summary, the Inside East Breakwater site provides an opportunity to utilize an advantageous water area (existing depths, wave protection, and shoreline armoring are favorable), to enhance a future recreational park without encumbering social or environmental conflicts. No other site encompasses these important planning considerations without incurring substantially higher construction costs. Therefore, Site 1 in the East Basin was selected as the preferred site for further study in response to the recreational boating needs in the Lorain, Ohio area.

SECTION D

ASSESSMENT AND EVALUATION OF PRELIMINARY PLANS

Comparisons of six possible sites for improving small-boating conditions at Lorain, Ohio indicated the relative advantages of developing preliminary harbor plans at the Site 1 location inside the east breakwater. (See Photos 3 and 4). As presented in the previous report section, this site demonstrated the greatest potential for meeting the planning objectives. Subsequent to this site selection, a total of five preliminary harbor plans were developed at Alternative Site No. 1, Inside East Breakwater.

A range of preliminary plans with a variety of physical capacities were developed. Two plans accommodate the possible commercial channel realignment cut through Riverside Park. These options induce planning continuity in later study stages by evaluating project response to a variety of possible situations.

This section provides a summary of the engineering design, economic evaluation, and environmental assessment of the five preliminary small-boat harbor plans at the Inside East Breakwater site. The alternatives are:

Alternative Plan 1 - 300 slips without Riverside Park Cut

Alternative Plan 2 - 600 slips without Riverside Park cut

Alternative Plan 3 - 300 slips with Riverside Park cut

Alternative Plan 4 - 600 slips (300 wet + 300 dry) with Riverside Park cut

Alternative Plan 5 - 600 slips (detached breakwater) without Riverside Park cut

In addition, the basis of comparison for the above structural plans is: Alternative Plan 6 - No Action (Do Nothing). Appendices A through C to this report provide details of the engineering and economic analyses associated with the five structural preliminary plans. These appendices are:

PHOTO 3
SELECTED SITE – VIEW TOWARD NORTHWEST
SHORE IN FOREGROUND

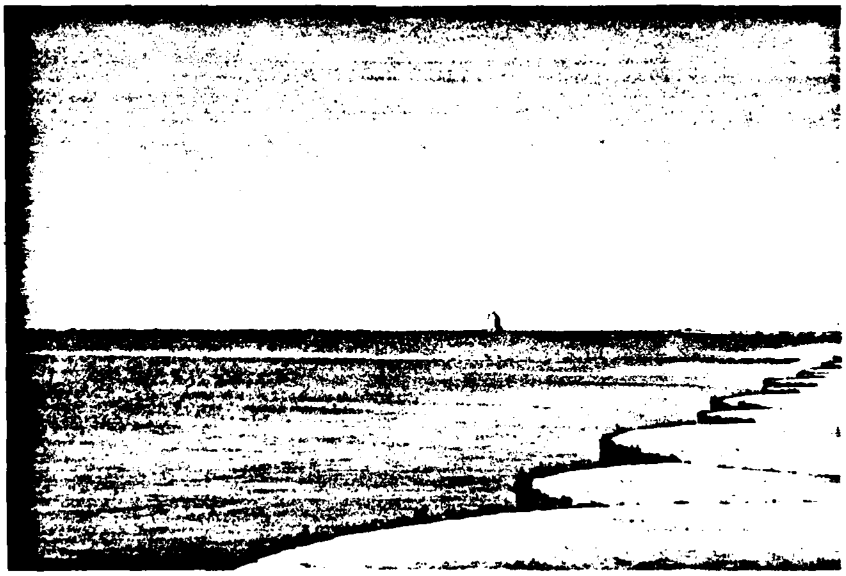


PHOTO 4
SELECTED SITE – VIEW FROM EAST BREAKWATER
FLOATING TIRE BREAKWATER TRAVERSES WATER AREA

Appendix A - Preliminary Design and Costs
Appendix B - Recreational Boating Analyses
Appendix C - Land-Based Fishing Analyses

STANDARD FEATURES OF ALTERNATIVE PLANS

Certain features of the alternative small-boat harbor plans are common to all. These features are presented below to minimize repetitiveness in plan descriptions.

Entrance and Interior Channels

The entrance channel for each alternative is designed for depths of 8 feet below Low Water Datum (LWD = 568.6 IGLD-1955) and widths of at least 125 feet, exceeding the minimum allowable by 25 ft. These dimensions are selected to provide safe navigation for the projected fleet and to provide two-way boat traffic within the channel. Protective breakwaters are implemented to limit waves at the entrance to 3 foot heights.

The interior channels and mooring basin are designed for depths of 6 feet (below Low Water Datum) and minimum widths of 100 feet. Wave heights in these channels are limited to one foot.

Breakwaters

All breakwaters exhibit a two-layer design, with a bedding and core of smaller rock overlain by armor stone. Side slopes are IV:1.5H. The breakwater designs consider wave sources from: 1) wind waves, 2) wave overtopping of outer breakwaters, 3) deep water waves diffracted at the outer harbor entrance, 4) ship generated waves, and 5) reflected waves.

Mooring Basins

As described in the planning constraints section, basin design capacities of 300 and 600 slips were selected to aid Stage 3 study evaluations of precisely desired capacities. These sizes were chosen with intent of allowing planners to extrapolate and interpolate costs, benefits, impacts, etc. during their initial efforts for refining proper harbor capacity in the next study stage.

The site selected for plan formulation (Inside East Breakwater) has some physical qualities allowing basins to be enlarged beyond the minimum area required to contain either 300 or 600 slips without incurring additional costs or disadvantages. Specifically, existing depths are relatively constant except nearshore and are sufficient to preclude dredging. Also, the breakwater lengths required to complete the containment and protection of the mooring basin do not appreciably change as basin areas increase. This is due to the site's rectangular geometry contained on three sides by stable land forms.

As a result of these unique characteristics, mooring basins for the small-boat harbor plans were sized to accommodate at least 600 slips or at least 300 slips, but minimum basin areas were exceeded to the extent practicable without incurring appreciable cost increases. This allows room for maneuvering basins, future enlargement, etc. without artificially limiting basin size. Also, if any plan demonstrates a need for increased slip capacity (over the 300 or 600 slips) to acquire a viable economic return, this can be assessed within Stage 2. This slight deviation from planning constraints provides greater assurance that a potentially viable plan at this site is not overlooked.

Service Facilities

A public dock and service facilities such as fuel and pumpout stations, available to all on an equal basis, is incorporated into each plan. Additionally, restrooms, parking, utilities, and administration building are provided.

Each plan has provisions for boat launching ramps. The ramps are three lanes wide and access an interior channel.

The costs of marina and appurtenant features are considered to be self-liquidating and, therefore, are not included in evaluation of the project's economic efficiency. Preliminary estimates of quantities and costs for these items are presented to aid the sponsoring agency in its decisions on plan selection and participation.

Land Ownership

All land and water areas for each alternative plan and construction access are publicly owned and administered by offices of the City of Lorain. Access improvements to the site will occur as part of other City projects, including park development on the Diked Disposal Area.

ALTERNATIVE PLAN 1 - 300 SLIPS WITHOUT RIVERSIDE PARK CUT

Description of Plan 1

Plan 1 would provide an all-weather small-boat harbor with a 300 slip capacity, but would preclude a commercial channel realignment through Riverside Park. The layout and project features for Plan 1 are shown in Figure 10.

Two rubblemound breakwaters would be required to protect the channels and mooring basin. A 900-foot east breakwater would extend perpendicularly from the Diked Disposal Area, and a 200-foot west breakwater would extend from the opposite shoreline and lakeward of the east breakwater. Each would have a crest height of 9 feet (LWD) (see Appendix A for design details). The resultant basin area provides ample room for 300 berths, fairways, interior channels, and three launching ramps. The entrance channel and main interior channel form the westerly and southerly boundaries of the mooring basin.

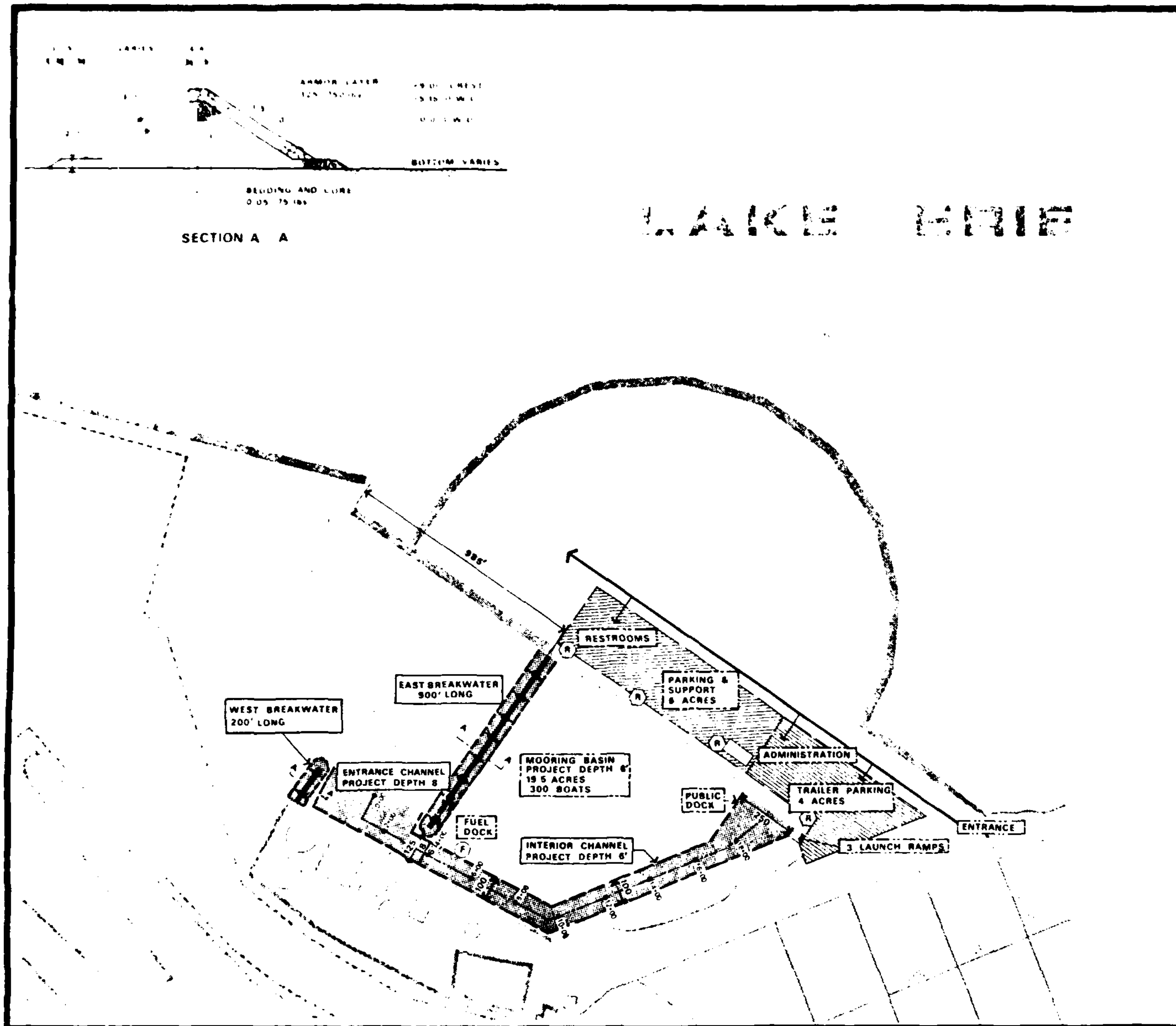
Along the easterly edge of the mooring basin, land support facilities are located upon the as yet unfilled Diked Disposal Area. This includes a total of 10 acres for parking, restrooms, and administration building. Vehicular access to the parking area is via a widened Colorado Avenue.

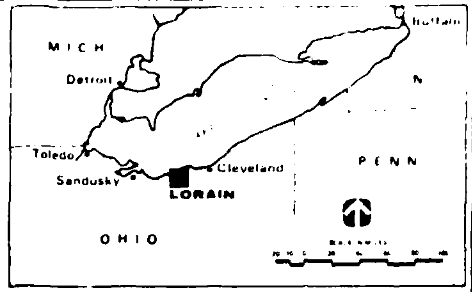
No dredging is anticipated for project construction since existing depths vary between 14 to 6 feet below LWD. No major treatment of existing shorelines is expected. The easterly and westerly shores are protected by steel sheetpiling. The southerly shore is a "natural" sand beach which is further stabilized by the new east breakwater. The rubblemound breakwater and beach are likely to attenuate energy reverberations within the basin.

Land-based recreational fishing facilities would include a four-foot wide concrete cap and handrail on top of both breakwaters. A rock width of about two feet would flank each side of the walkway. This would induce safe and convenient fishing opportunities.

Cost Estimate for Plan 1

The detailed cost estimates for Plan 1 are presented in Appendix A. Estimated project costs and annual charges are summarized in the following Tables 6 and 7, which show a breakdown of the Federal and non-Federal share





VICINITY MAP

NOTES:

1. ALL ELEVATIONS REFER TO LOW WATER DATUM (L.W.D.) ELEVATION 568.6 FEET ABOVE MEAN WATER LEVEL AT FATHER POINT, QUEBEC (IGLD 1955)
2. D.W.L. DESIGN WATER LEVEL

LEGEND:

- COMPONENTS OF THE GENERAL NAVIGATION PROJECT (COST SHARED ITEMS AT 50% FEDERAL AND 50% NON FEDERAL)
- COMPONENTS OF THE NAVIGATION PROJECT WHICH ARE A NON FEDERAL RESPONSIBILITY
- (F) FUEL DOCKS
- (R) RESTROOMS

0 100 200 300 500
SCALE IN FEET

BUFFALO DISTRICT
CORPS OF ENGINEERS
BUFFALO, NEW YORK

LORAIN, OHIO
SMALL BOAT HARBOR
PRELIMINARY FEASIBILITY REPORT

ALTERNATIVE 1

DESIGNED | DRAWN | TRACED | CHECKED | SUBMITTED | RECOMMENDED | DATE

FIGURE 10
300 SLIP CAPACITY WITHOUT RIVERSIDE PARK CUT

TABLE 6

ESTIMATE OF TOTAL PROJECT COST FOR ALTERNATIVE PLAN1 AND FEDERAL AND NON-FEDERAL SHARE (1981 PRICE LEVELS)

		AMOUNT $		TOTAL $	
TOTAL PROJECT COSTS:					
1. Lands, and Damages	:	220,000			
2. Breakwaters	:	1,390,000			
3. Recreational Facilities	:	200,000	1/		
4. Aids to Navigation	:	70,000	2/		
5. Engineering and Design	:	191,000			
6. Supervision and Administration	:	207,000			
TOTAL PROJECT COST	:			2,278,000	
FEDERAL SHARE:					
50 Percent of Items 2,3, 5 and 6	:	994,000			
100 Percent of Item 4	:	70,000			
Total Federal Share of Project Costs	:			1,064,000	
NON-FEDERAL SHARE					
100% of Item 1	:	220,000			
Cash Contribution (50 Percent of Items 2, 3, 5, & 6)	:	994,000			
Total Non-Federal Share of Project Costs	:			1,214,000	3/

1/ To provide walkway and handrail on the Breakwater for fishing.

2/ Cost includes necessary Engineering and Design and Supervision and Administration.

3/ Does not include costs for self-liquidating features of the project, such as docks, launching ramps, and public service facilities. The estimated non-Federal cost for these self-liquidating features is $1,938,000.

TABLE 7

ESTIMATED INVESTMENT COST AND ANNUAL CHARGES FOR ALTERNATIVE PLAN 1 (1981 Price Levels) 1/

ITEM	Navigation $	Recreation $	Total $
TOTAL INVESTMENT FOR THE PROJECT:			
Total Investment	2,028,000	250,000	2,278,000
TOTAL ANNUAL CHARGES FOR THE PROJECT:			
Interest	154,600	19,100	173,700
Amortization	4,000	500	4,500
Maintenance	28,600	5,400	34,000
Total Annual Charges	187,200	25,000	212,200
FEDERAL SHARE:			
Total Investment Cost			
Total Investment	939,000	125,000	1,064,000
Annual Charges			
Interest	71,600	9,600	81,200
Amortization	1,900	200	2,100
Maintenance	28,600 2/	-0-	28,600
Total Annual Charges	102,000	9,800	111,900
NON-FEDERAL SHARE			
Total Investment Cost			
Total Investment	1,089,000 3/	125,000	1,214,000
Annual Charges			
Interest	83,000	9,600	92,600
Amortization	2,100	200	2,300
Maintenance	-0-	5,400 4/	5,400
Total Annual Charges	85,100	15,200	100,300

(Footnotes):

1/ 7-5/8 percent interest rate, 50-year life (i =0.07625, amort. =0.00198.

2/ 100 percent Federal for general navigation.

3/ Excludes $1,938,000 for self-liquidating costs.

4/ 100 percent non-Federal.

of these costs for Plan 1. Total costs for major navigation structures and land-based fishing facilities are estimated to be $2,278,000, with total annual charges of $212,200.

In addition to these shared items, a non-Federal expenditure of about $1,938,000 is expected for self-liquidating items such as boat slips, parking, buildings, launch ramps, and docks. Estimates of these items are shown in Appendix A.

Economic Evaluation of Plan 1

A detailed discussion of the projected recreational boating demand, fleet mix, and recreational boating benefits for Lorain Small-Boat Harbor is presented in Appendix B. Thorough explanation of land-based fishing demands and benefits is contained in Appendix C. Summaries of procedures used to develop benefit valuations based on future demand/supply relationships is presented in Section B, "Problems, Needs, and Opportunities." These procedures include data projections through expected project life.

Table 8, following, summarizes the annual charges, annual benefits, net benefits, and benefit/cost ratios for Plan 1. Net navigation benefits are $190,800 per year, and the benefit/cost ratio for navigation is 2.0. Net recreational fishing benefits are $12,900 per year, and the benefit/cost ratio for fishing is 1.5.

Environmental Assessment of Alternative 1

Construction of breakwaters would cover approximately 2.1 acres of benthic habitat. This would not be large impact, since the sediments in this area are polluted and the benthic community is characteristic of a moderately polluted bottom (11).

Loss of bottom habitat due to breakwater construction also has a potential for an impact on fish populations, since several fish species feed and spawn in shallow sandy areas in the Lorain vicinity. The most common species that feed on the bottom community in this area are likely to be yellow perch, freshwater drum, and channel catfish. Most common spawners are probably yellow perch, rainbow smelt, spottail shiner, and gizzard shad.

For several reasons, however, loss of bottom habitat due to breakwater construction should not significantly impact fish species. First, the area covered by the breakwaters would be small relative to the total amount

TABLE 8

SUMMARY OF BENEFITS AND COSTS

FOR ALTERNATIVE PLAN 1 a/

ITEM	Navigation	Recreationl Fishing	Total Project
Average Annual Benefit	$ 378,000	$ 37,900	$415,900
Average Annual Cost			
Federal	102,100	9,800	111,900
Non-Federal	85,100	15,200	100,300
TOTAL	187,200	25,000	212,200
Net Benefits	$ 190,800	12,900	$203,700
Benefit/Cost Ratio	2.0	1.5	2.0

a/ 300 slips without allowance for a future Riverside Park Channel for deep-draft commercial navigation.

of such area available in the vicinity. Second, the population that spawn in the area are not likely to be limited by spawning space. Third, yellow perch, one of the most abundant species using the area and the most important species in the local sport and commercial fisheries, has been shown to be very flexible in its feeding, changing its diet depending on what food types are available (22). It is likely that the other fish species feeding in the area have a similar flexibility.

In addition to covering bottom habitat, breakwater construction tion would create rocky, rubblemound habitat suitable for algal and invertebrate growth, and for shelter, feeding and spawning habitat for fish. Alternative 1 would create approximately 0.9 acres of such habitat. Fish species most likely to make use of this rocky habitat are yellow perch, white bass, freshwater drum, channel catfish, and walleye. Assuming no significant negative impact of loss of bottom habitat on these species, there is some potential for an increase in their populations near the new breakwaters. Since the amount of new breakwater required by this alternative is not large compared to the amount of such breakwater habitat already existing in the outer harbor, the increase in fish populations in the area in general will probably not be great.

Harbor construction activities should cause temporary disruption of the bottom habitat in the area, and temporarily drive many fish from the area. Conditions should return to normal relatively soon after the end of construction.

Small boat use and operation of the fuel dock in the harbor would probably result in some oil, gas, and sewage spills, with an adverse effect on water quality. This effect will probably not be large, however, in relation to the already degraded water quality in the outer harbor area. The potential for a health hazard due to impaired water quality is small, because bathers make little use of the area at present and this use is unlikely to increase significantly in the future. Approximately 1100 feet of lake shoreline forms the landward boundary of the small boat harbor. This shoreline currently supports few valuable environmental resources, either aquatic or terrestrial; no wetlands are present.

Alternative 1 should not affect any species on the U.S. Fish and Wildlife Service list of endangered and threatened species (31) or on the Ohio Department of Natural Resourse's list of endangered wild animals (17), as none are known to occur in the project area.

The addition of a new 300 boat harbor at Lorain, as called for in Alternative 1, will significantly improve recreational opportunities in the area and augment existing public service facilities. The degree of impact is dependent on harbor capacity and is greatest with a larger facility. Additional positive effects of a minor nature include small increases in property value for the portion of Lorain located closest to the new harbor, along with a growth in tax revenue. These effects result from a perceived improvement in project area aesthetics which accompany harbor development and which make harbor area property more desirable.

The City Engineer's Office in Lorain has indicated that Colorado Avenue, the access route to the proposed marina, will already have been approved prior to the start of any construction activities associated with this action. Two street improvement programs, the first in connection with the State Route 611 Project and a second in association with the development of a park at the present Diked Disposal site, will provide all needed access to the lakefront. These two sets of preceeding improvements will preclude the need for additional project related changes to the harbor access route. Expected impacts will, as a result, be limited to those associated with minor increases in traffic noise and vehicle emissions which will develop in proportion to the size of the facility which is selected.

Some rather small employment/labor force and business/industrial effects will develop with Alternative 1. Facility construction may produce a small increase in local demand for building material, construction labor and related service. Other minor effects include changes in local food supply and transportation. Fish caught in the lake by persons operating boats from the new harbor will add somewhat to local food supplies. Some very minor number of pleasure trips may be shifted away from conventional travel modes to vessels which use the new harbor. Positive physical and mental health benefits to harbor users may be generated as a result of improved leisure opportunities afforded by the facility. In addition, positive public safety effects will result from increases in Lorain's capacity as a harbor-of-refuge for small crafts.

Mitigation Needs for Plan 1

No mitigation measures have been identified by any entity as a requirement for Plan 1. In general, the habitat formed by the breakwater seems to offset any minor losses incurred by burial of existing biological habitat. All adverse impacts seem minor in comparison to expected social benefits derived from project implementation. Coordination with concerned and responsible agencies will be maintained throughout future study stages.

Implementation of Plan 1

Although the benefit/cost ratios for Plan 1 exceed unity, the harbor layout does not make full use of available land and water area. The comparative economy (cost-per-slip) of some other plans causes Plan 1 to be rejected by local interests. Also, this plan cannot be implemented if a decision is made to create a commercial channel realignment through Riverside Park. This plan was rejected by local interests when presented to them at a public meeting.

ALTERNATIVE PLAN 2 - 600 SLIPS WITHOUT RIVERSIDE PARK CUT

Description of Plan 2

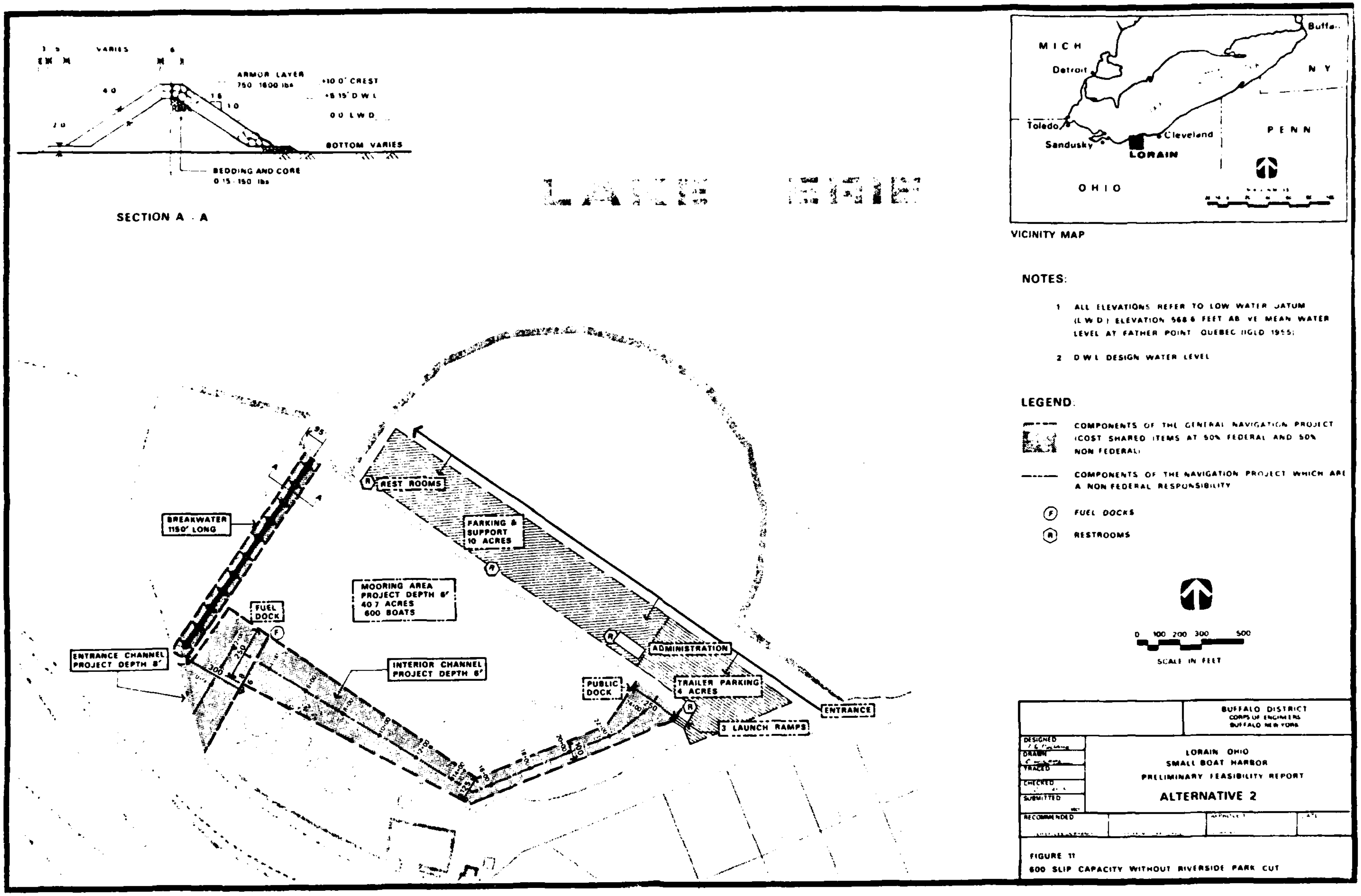
Plan 2 would provide an all-weather small-boat harbor with at least a 600 slip capacity, but would encroach into the possible commercial channel realignment through Riverside Park. Figure 11 displays the harbor layout and project features for Plan 2.

A single rubblemound breakwater of 1150-foot length bounds the northerly edge of the basin area inside the existing shore-connected east breakwater.

The new breakwater has a crest height of 10 feet above LWD. It protects a water area of about 40 acres which provides ample space for wide entrance and interior channels, fairways, slips, three launch ramps, and public docks. The 300-foot wide entrance channel opens onto the existing commercial channel at a location just outside the inner harbor. This aggravates potential vessel traffic congestion, but seems acceptable to the Lorain Port Authority.

Plan 2 makes full and efficient use of available land and water geometry. Land support facilities extend along the easterly basin boundary (on the Diked Disposal Area). The Diked Disposal Area is expected to be filled in about 10 more years and should support low density loading. Total project land area of 14 acres is accessed via Colorado Avenue.

Existing water depths range from 18 to 6 feet below LWD and eliminate dredging requirements. The existing shorelines are as described in Plan 1, and they provide good harbor edges.


SECTION A - A
ARMOR LAYER 750 - 1600 lbs
+10.0' CREST
+5.15' D W L
0.0 L W D
BOTTOM VARIES
BEDDING AND CORE 0.15 - 150 lbs
VARIES
LAKE ERIE
VICINITY MAP
MICH
Detroit
Toledo
Sandusky
Cleveland
LORAIN
OHIO
PENN
N Y
Buffa..
NOTES:
1 ALL ELEVATIONS REFER TO LOW WATER DATUM (L W D) ELEVATION 568.6 FEET ABOVE MEAN WATER LEVEL AT FATHER POINT QUEBEC (IGLD 1955)
2 D W L DESIGN WATER LEVEL
LEGEND.
COMPONENTS OF THE GENERAL NAVIGATION PROJECT (COST SHARED ITEMS AT 50% FEDERAL AND 50% NON FEDERAL)
COMPONENTS OF THE NAVIGATION PROJECT WHICH ARE A NON FEDERAL RESPONSIBILITY
FUEL DOCKS
RESTROOMS
0 100 200 300 500
SCALE IN FEET
BREAKWATER 1150' LONG
REST ROOMS
PARKING & SUPPORT 10 ACRES
MOORING AREA PROJECT DEPTH 8' 40.7 ACRES 600 BOATS
FUEL DOCK
ENTRANCE CHANNEL PROJECT DEPTH 8'
INTERIOR CHANNEL PROJECT DEPTH 8'
ADMINISTRATION
PUBLIC DOCK
TRAILER PARKING 4 ACRES
ENTRANCE
3 LAUNCH RAMPS
BUFFALO DISTRICT
CORPS OF ENGINEERS
BUFFALO NEW YORK
LORAIN OHIO
SMALL BOAT HARBOR
PRELIMINARY FEASIBILITY REPORT
ALTERNATIVE 2
DESIGNED
DRAWN
TRACED
CHECKED
SUBMITTED
RECOMMENDED
FIGURE 11
600 SLIP CAPACITY WITHOUT RIVERSIDE PARK CUT

Land-based recreational fishing facilities would include a handrail and a four-foot wide concrete cap on the widened breakwater crest (8 feet). The breakwater crest would be widened by two feet to safely accommodate this recreational feature.

Cost Estimate for Plan 2

Detailed cost estimates for Plan 2 are contained in Appendix A. Estimated project costs and annual charges are summarized in the following Tables 9 and 10, which show a breakdown of the Federal and non-Federal share of costs for Plan 2. Total costs for major navigation structures and land-based fishing facilities are estimated to be $2,929,000, with total annual charges of $273,400.

Additionally, a non-Federal cost of about $3,500,000 is estimated for self-liquidating items necessary to create an operational marina within the major navigation structures. This estimate is detailed in Appendix A.

Economic Evaluation of Plan 2

The projected recreational boating demand, fleet mix, and annual benefits are detailed in Appendix B. A thorough discussion of recreational fishing demand, value, and benefits is presented in Appendix C. Summaries of these analyses, including annual charges, annual benefits, net benefits, and benefit/cost ratios is contained in Table 11. For Plan 2, net navigation benefits are $479,500 per year, and the benefit/cost ratio is 2.9. Net recreational fishing benefits are $25,100 per year, and the associated benefit/cost ratio is 1.9.

Environmental Assessment of Alternative 2

The environmental effects of Alternative 2 would be similar to those of Alternative 1, except as follows.

Under Alternative 2, breakwater construction would cover approximately 2.6 acres of bottom habitat, with a corresponding increase in impacts relative to Alternative 1 (2.1 acres). This impact would probably still not be significant, for the reasons discussed for Alternative 1. Rubblemound breakwater construction for Alternative 2 would introduce approximately 1.2 acres of rocky habitat to the area, with a slightly greater potential for a beneficial effect on fish populations near the new breakwater than Alternative 1 (0.9 acres).

TABLE 9

ESTIMATE OF TOTAL PROJECT COST FOR ALTERNATIVE PLAN 2 AND FEDERAL AND NON-FEDERAL SHARE (1981 PRICE LEVELS)

		AMOUNT $		TOTAL $	
TOTAL PROJECT COSTS:					
1. Lands, and Damages	:	308,000			
2. Breakwaters	:	1,859,000			
3. Recreational Facilities	:	210,000	1/		
4. Aids to Navigation	:	35,000	2/		
5. Engineering and Design	:	248,000			
6. Supervision and Administration	:	269,000			
TOTAL PROJECT COST	:			2,929,000	
FEDERAL SHARE:					
50 Percent of Items 2,3, 5 and 6	:	1,293,000			
100 Percent of Item 4	:	35,000			
Total Federal Share of Project Costs	:			1,328,000	
NON-FEDERAL SHARE					
100% of Item 1	:	308,000			
Cash Contribution (50 Percent of Items 2, 3, 5, & 6)	:	1,293,000			
Total Non-Federal Share of Project Costs	:			1,601,000	3/

1/ To provide walkway and handrail on the Breakwater for fishing.

2/ Cost includes necessary Engineering and Design and Supervision and Administration.

3/ Does not include costs for self-liquidating features of the project, such as docks, launching ramps, and public service facilities. The estimated non-Federal cost for these self-liquidating features is $3,500,000.

TABLE 10

ESTIMATED INVESTMENT COST AND ANNUAL CHARGES FOR ALTERNATIVE PLAN 2 (1981 Price Levels)1/

ITEM	Navigation $	Recreation $	Total $
TOTAL INVESTMENT FOR THE PROJECT:			
Total Investment	2,667,000	262,000	2,929,000
TOTAL ANNUAL CHARGES FOR THE PROJECT:			
Interest	203,400	20,000	223,400
Amortization	5,300	600	5,900
Maintenance	37,600	6,500	44,100
Total Annual Charges	246,300	27,100	273,400
FEDERAL SHARE:			
Total Investment Cost			
Total Investment	1,197,000	131,000	1,328,000
Annual Charges			
Interest	91,300	10,000	101,300
Amortization	2,400	300	2,700
Maintenance	37,600 2/	-0-	37,600
Total Annual Charges	131,000	10,300	141,600
NON-FEDERAL SHARE			
Total Investment Cost			
Total Investment	1,470,000 3/	131,000	1,601,000
Annual Charges			
Interest	112,100	10,000	122,100
Amortization	2,900	300	3,200
Maintenance	-0-	6,500 4/	6,500
Total Annual Charges	115,000	16,800	131,800

(Footnotes):

1/ 7-5/8 percent interest rate, 50-year life (i = 0.07625, amort. = 0.00198.

2/ 100 percent Federal for general navigation.

3/ Excludes $3,500,000 for self-liquidating costs.

4/ 100 percent non-Federal.

TABLE 11

SUMMARY OF BENEFITS AND COSTS

FOR ALTERNATIVE PLAN 2 a/

ITEM	Navigation	Recreationl Fishing	Total Project
Average Annual Benefit	$ 725,800	$ 52,200	$778,000
Average Annual Cost			
Federal	131,300	10,300	141,600
Non-Federal	115,000	16,800	131,800
TOTAL	246,300	27,100	273,400
Net Benefits	$ 479,500	$ 25,100	$ 504,600
Benefit/Cost Ratio	2.9	1.9	2.8

a/ 600 slips without allowance for a future Riverside Park Channel for deep-draft commercial navigation.

Since Alternative 2 would support 600 boats as compared to the 300 of Alternative 1, there is a greater potential for an adverse impact on water quality. This greater impact primarily would occur because approximately twice the water area would be affected under Alternative 2 (40.5 acres) as under Alternative 1 (19.5 acres). For the reasons discussed under Alternative 1, however, the resulting impact on water quality in the outer harbor would probably be minor.

Increases in recreational opportunities and public service facilities are the significant positive impacts of Alternative 2. Both will be increased as a direct result of adding a 600 boat harbor at Lorain. The degree of beneficial impact increases with harbor capacity.

Access route (Colorado Avenue) impacts are predicted to be relatively minor, as presented under Alternative 1. This is due to improvements along Colorado Avenue which are planned for completion well before small-boat harbor construction begins.

Other lesser impacts upon socio-economic factors, such as employment and business activity, are expected to be the same as those for Alternative 1.

Mitigation Needs for Plan 2

As with Plan 1, no mitigation requirements have been identified for Plan 2. Thus far, all entities seemed satisfied that adverse environmental impacts are of little concern, and opinions relative to this harbor location are supportive.

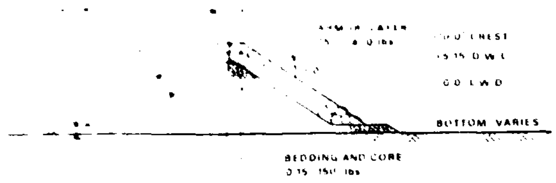
Implementation of Plan 2

The benefit/cost ratio for Plan 2 is very high and total costs are very favorable. Local interests view the cost per slip as most favorable. This plan presents a very good opportunity for implementation if the Riverside Park commercial channel cut is not constructed.

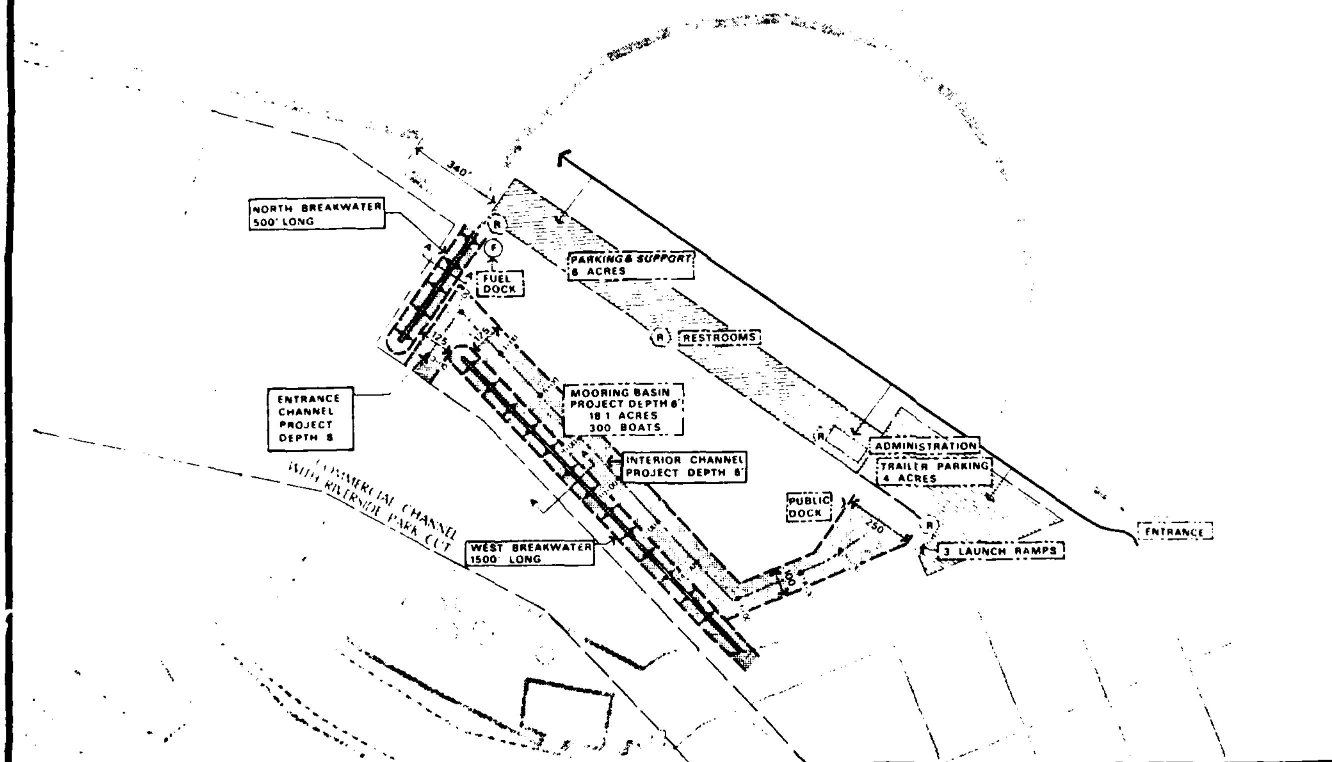
ALTERNATIVE PLAN 3 - 300 SLIPS WITH RIVERSIDE PARK CUT

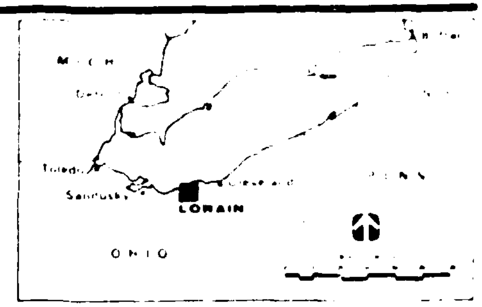
Description of Plan 3

Plan 3 would provide a 300 slip small-boat harbor with all- weather capability. This harbor concept would allow the commercial channel cut through Riverside Park. Figure 12 displays the layout and features of Plan 3.



SECTION A A





VICINITY MAP

NOTES

1. ALL ELEVATIONS REFER TO LOW WATER DATUM (L.W.D.) ELEVATION 568.6 FEET ABOVE MEAN WATER LEVEL AT FATHER POINT QUEBEC (IGLD 1955)
2. D.W.L. DESIGN WATER LEVEL

LEGEND

COMPONENTS OF THE GENERAL NAVIGATION PROJECT (COST SHARED ITEMS AT 50% FEDERAL AND 50% NON FEDERAL

COMPONENTS OF THE NAVIGATION PROJECT WHICH ARE A NON FEDERAL RESPONSIBILITY

(F) FUEL DOCKS

(R) RESTROOMS

0 100 200 300 500

SCALE IN FEET

BUFFALO DISTRICT
CORPS OF ENGINEERS
BUFFALO NEW YORK

LORAIN OHIO
SMALL BOAT HARBOR
PRELIMINARY FEASIBILITY REPORT

ALTERNATIVE 3

DESIGNED
DRAWN
TRACED
CHECKED
SUBMITTED
RECOMMENDED
APPROVED
DATE

FIGURE 12
300 SLIP CAPACITY WITH RIVERSIDE PARK CUT

A 1500-foot west breakwater parallels the new commercial channel, and a 500-foot breakwater bounds the northerly mooring basin edge. These breakwaters each have crest heights of 10 feet above LWD. A mooring basin of about 18 acre size results from this breakwater configuration. An entrance channel opens onto the commercial channel and is 125 feet wide. The main interior channel also is 125 feet wide until it parallels the southerly shore. Then the channel narrows to 100 feet wide and joins a 250 foot wide boat launching area. The commercial channel is about 500 feet wide at its juncture with the marina entrance. As in Plan 2, the Lorain Port Authority seems to view this condition as acceptable.

Plan 3 utilizes all non-commercial water areas adjacent to the Diked Disposal Area. Land support facilities are located on the contiguous portions of the Diked Disposal Area.

Land-based recreational fishing facilities (concrete cap and handrail) would be provided on the 500-foot north breakwater. The west breakwater would not include fishing facilities because it is located far from the parking areas, has excessive length, and is in an area of historically poor fishing success. Adjacent commercial and recreational uses are expected to suppress any noticeable increase in fishing quality there.

Cost Estimates for Plan 3

Appendix A contains detailed cost estimates for Plan 3. The following Tables 12 and 13, show a breakdown of summarized costs for Federal and non-Federal interests. Total costs for all items except self-liquidating features are an estimated $4,046,000, with total annual charges of $378,300. Self-liquidating features are estimated to cost $1,975,000, and all of this is considered a non-Federal charge. A detailed estimate of self-liquidating costs for Plan 3 is contained in Appendix A.

Economic Evaluation of Plan 3

The recreational boating and fishing analyses, as contained in Appendix B and C, respectively, are summarized for Plan 3 in Table 14. Based upon a 300 slip capacity, net navigation benefits are $11,400 per year, and the benefit/cost ratio is 1.0. Net recreational fishing benefits are $9,200 per year, and the corresponding benefit/cost ratio is 1.8.

TABLE 12

ESTIMATE OF TOTAL PROJECT COST FOR ALTERNATIVE PLAN 3
AND FEDERAL AND NON-FEDERAL SHARE (1981 PRICE LEVELS)

		AMOUNT $	TOTAL $
TOTAL PROJECT COSTS:			
1. Lands, and Damages	:	220,000	
2. Breakwaters	:	2,912,000	
3. Recreational Facilities	:	92,000 1/	
4. Aids to Navigation	:	70,000 2/	
5. Engineering and Design	:	361,000	
6. Supervision and Administration	:	391,000	
TOTAL PROJECT COST	:		4,046,000
FEDERAL SHARE:			
50 Percent of Items 2,3, 5 and 6	:	1,878,000	
100 Percent of Item 4	:	70,000	
Total Federal Share of Project Costs	:		1,948,000
NON-FEDERAL SHARE			
100% of Item 1	:	220,000	
Cash Contribution (50 Percent of Items 2, 3, 5, & 6)	:	1,878,000	
Total Non-Federal Share of Project Costs	:		2,098,000 3/

1/ To provide walkway and handrail on the Breakwater for fishing.

2/ Cost includes necessary Engineering and Design and Supervision and Administration.

3/ Does not include costs for self-liquidating features of the project, such as docks, launching ramps, and public service facilities. The estimated non-Federal cost for these self-liquidating features is $ 1,975,000.

TABLE 13

ESTIMATED INVESTMENT COST AND ANNUAL CHARGES FOR ALTERNATIVE PLAN 3 (1981 Price Levels)1/

ITEM	Navigation $	Recreation $	Total $
TOTAL INVESTMENT FOR THE PROJECT:			
Total Investment	3,930,000	116,000	4,046,000
TOTAL ANNUAL CHARGES FOR THE PROJECT:			
Interest	299,700	8,800	308,500
Amortization	7,800	200	8,000
Maintenance	59,100	2,700	61,800
Total Annual Charges	366,600	11,700	378,300
FEDERAL SHARE:			
Total Investment Cost			
Total Investment	1,890,000	58,000	1,948,000
Annual Charges			
Interest	144,100	4,400	148,500
Amortization	3,700	100	3,800
Maintenance	59,100 2/	-0-	59,100
Total Annual Charges	206,900	4,500	211,400
NON-FEDERAL SHARE			
Total Investment Cost			
Total Investment	2,040,000 3/	58,000	2,098,000
Annual Charges			
Interest	155,600	4,400	160,000
Amortization	4,100	100	4,200
Maintenance	-0-	2,700 4/	2,700
Total Annual Charges	159,700	7,200	166,900

(Footnotes):

1/ 7-5/8 percent interest rate, 50-year life (i =0.07625, amort. =0.00198.

2/ 100 percent Federal for general navigation.

3/ Excludes $1,975,000 for self-liquidating costs.

4/ 100 percent non-Federal.

TABLE 14

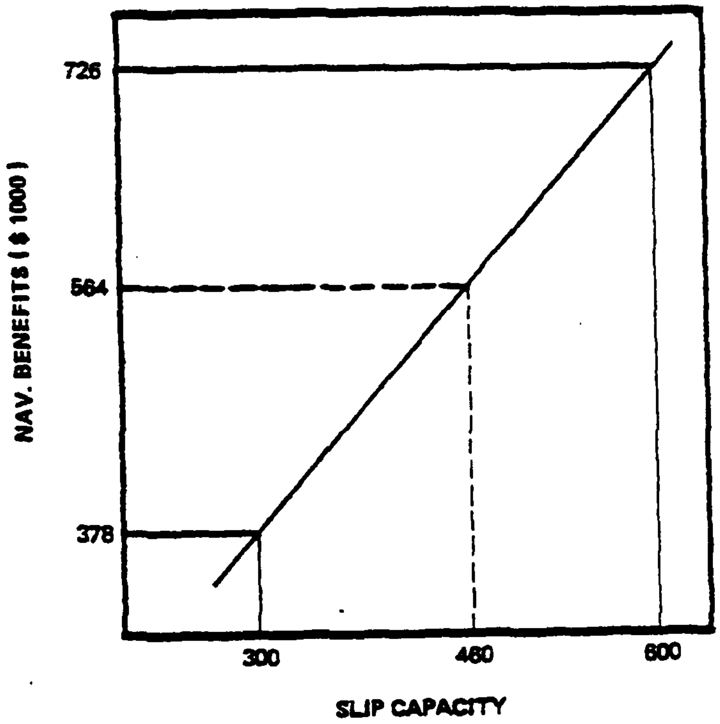
SUMMARY OF BENEFITS AND COSTS

FOR ALTERNATIVE PLAN 3 a/

ITEM	Navigation	Recreationl Fishing	Total Project
Average Annual Benefit	$ 378,000	$ 20,900	$398,900
Average Annual Cost			
Federal	206,900	4,500	211,400
Non-Federal	159,700	7,200	166,900
TOTAL	366,600	11,700	378,300
Net Benefits	$ 11,400	$ 9,200	$ 20,600
Benefit/Cost Ratio	1.0	1.8	1.1

a/ 300 slip capacity with allowance for a commercial channel through Riverside Park.

As described in the Standard Features portion of this report section, mooring density can be increased without difficulty by more fully utilizing basin water areas. A cursory analysis of benefits which would accrue from maximized water slip density is necessary to fully judge economic viability of Plan 3. Idealized mooring usage of water areas other than interior channels and launching areas yields a basin capacity for 460 slips (35 slips per acre on 11.5 acres). The resulting changes in economic analyses for Plan 3 is approximated by the following:



EXTRAPOLATED NAVIGATION BENEFITS

PLAN 3 WITH 460 SLIP OPTION

Annual Benefits	-	\$564,000
Annual Costs	-	\$366,600
Net Benefits	-	\$197,400
B/C Ratio	-	1.5

These changes in economic results can be obtained without sacrificing safety or necessary harbor functions.

Environmental Assessment of Alternative 3

The environmental effects of Alternative 3 would be similar to those of Alternative 1, except as follows.

Under Alternative 3, breakwater construction would cover approximately 3.9 acres of bottom habitat, with a corresponding increase in impacts relative to Alternative 1 (2.1 acres). This impact will probably still not be significant, for the reasons discussed for Alternative 1.

Rubblemound breakwater construction for Alternative 3 would introduce approximately 1.6 acres of rocky habitat to the area.

Alternative 3 would provide mooring space for at least 300 boats, so that the potential for an adverse impact on water quality is about the same as that discussed under Alternative 1.

Alternative 3 will produce positive impacts on recreational opportunities and public service facilities in the Lorain area. Both of these will increase as a result of the addition of a 300 boat harbor.

Access route (Colorado Avenue) impacts are predicted to be relatively minor, as presented under Alternative 1. This is due to improvements along Colorado Avenue which are planned for completion well before small-boat harbor construction begins.

Other lesser socio-economic impacts are expected to be the same as for Alternative 1, see that section for details.

Mitigation Needs for Plan 3

As impacts of this Plan are similar to Plans 1 and 2, again no mitigation requirements or desires have been expressed by any group or individual.

Implementation of Plan 3

This plan can be implemented even with the possible Riverside Park commercial channel realignment. The low benefit/cost ratio for the 300 slip configuration can be overcome by maximizing use of the mooring area to 460 slips. Boating demand results of this Stage 2 indicate that a small-boat harbor of even larger size would be fully utilized. Local interests view this plan favorably if the Riverside Park cut is made.

ALTERNATIVE PLAN 4 - 600 SLIPS WITH RIVERSIDE PARK CUT

Description of Plan 4

Plan 4 is identical to Plan 3 except a dry-storage facility has been added to insure capacity for at least 600 boats. The dry-storage facility is conceptualized as providing for 300 power boats with lengths about 22 feet or less. The facility would include a covered storage building, integrated hoist system, public dock, and parking (see Figure 13).

All other features remain similar to Plan 3, including provision for the Riverside Park cut and recreational fishing.

Cost Estimate for Plan 4

Cost details, as presented in Appendix A, are summarized in the following Tables 15 and 16, which include breakdowns between Federal and non-Federal share. Total estimated costs are $4,101,000 with total annual costs of $382,700.

Since the dry-storage facility is a self-liquidating item, its cost is not included in the tables except as footnoted. Detailed estimates of self-liquidating costs for Plan 4 are contained in Appendix A. The total estimated cost for self-liquidating items is $3,125,000, with the dry-storage facility accounting for about $1,000,000 of this.

Economic Evaluations of Plan 4

The economic analyses for Plan 4, as presented in detail within appropriate appendices, is summarized in Table 17. Based on a total capacity of 600 boats (300 wet slips + 300 dry slips), the net navigation benefits are $354,800 per year, and the navigational benefit/cost ratio is 2.0. Recreational fishing creates an annual benefit of $9,200, and the corresponding benefit/cost ratio is 1.8.

Plan 4 is economically viable without increasing its wet slip capacity to 460 slips as in Plan 3. Therefore, further analysis was deemed unnecessary.

Environmental Assessment of Alternative 4

The environmental effects of Alternative 4 would be the same as those of Alternative 3. No mitigations have been identified as necessary.

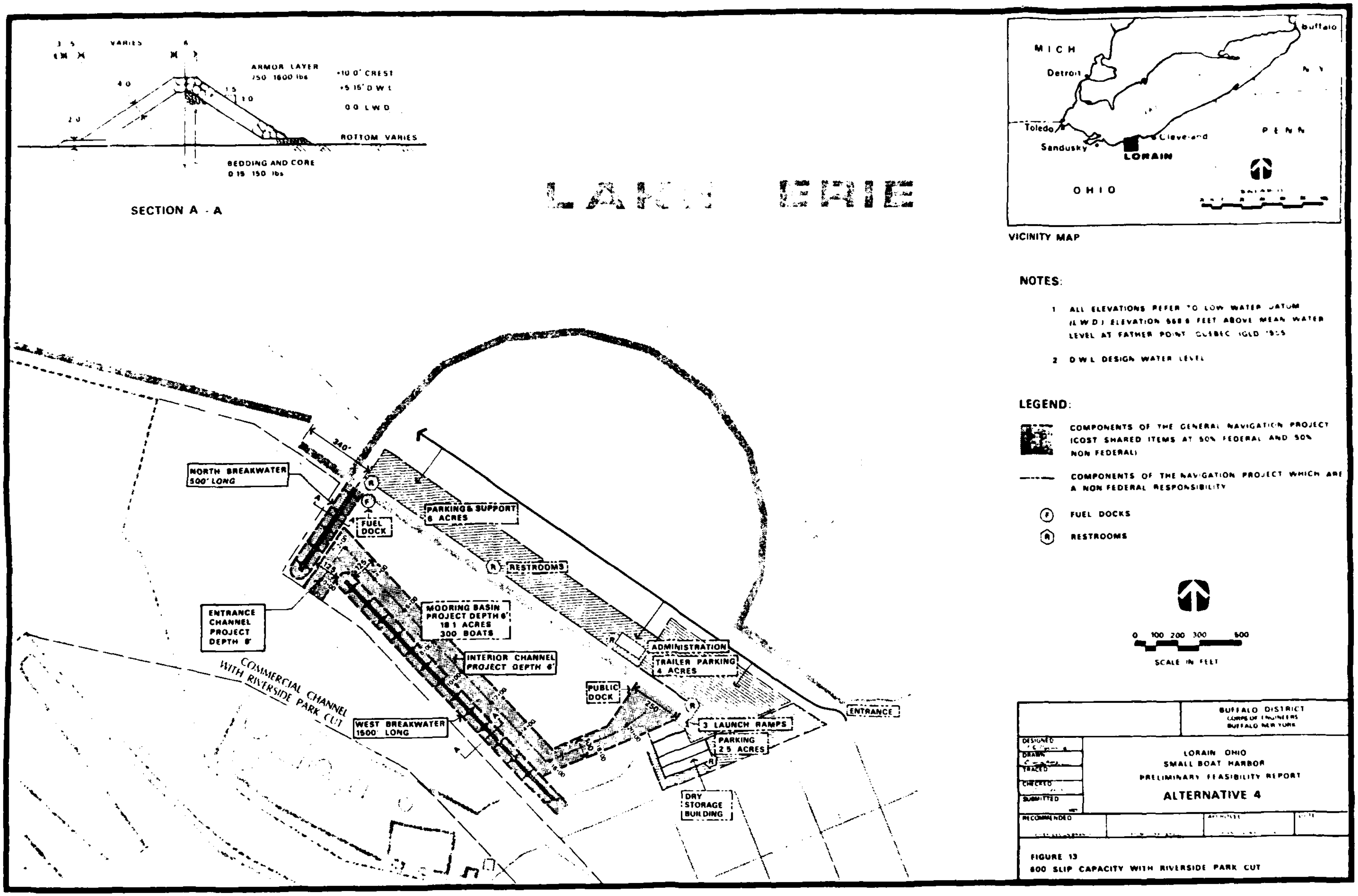

SECTION A - A
ARMOR LAYER
750 1600 lbs
+10.0' CREST
+5.15' D W L
0.0 L W D
BOTTOM VARIES
BEDDING AND CORE
0.15 150 lbs
VARIES
LAKE ERIE
MICH
Detroit
Toledo
Sandusky
Cleveland
LORAIN
OHIO
PENN
N Y
Buffalo
VICINITY MAP
NOTES:
1. ALL ELEVATIONS REFER TO LOW WATER DATUM (L W D) ELEVATION 568.6 FEET ABOVE MEAN WATER LEVEL AT FATHER POINT, QUEBEC (IGLD 1955)
2. D W L DESIGN WATER LEVEL
LEGEND:
COMPONENTS OF THE GENERAL NAVIGATION PROJECT (COST SHARED ITEMS AT 50% FEDERAL AND 50% NON FEDERAL)
COMPONENTS OF THE NAVIGATION PROJECT WHICH ARE A NON FEDERAL RESPONSIBILITY
F FUEL DOCKS
R RESTROOMS
0 100 200 300 500
SCALE IN FEET
NORTH BREAKWATER 500' LONG
240'
FUEL DOCK
PARKING & SUPPORT 8 ACRES
RESTROOMS
ENTRANCE CHANNEL PROJECT DEPTH 8'
MOORING BASIN PROJECT DEPTH 6' 18.1 ACRES 300 BOATS
INTERIOR CHANNEL PROJECT DEPTH 6'
COMMERCIAL CHANNEL WITH RIVERSIDE PARK CUT
WEST BREAKWATER 1500' LONG
PUBLIC DOCK
ADMINISTRATION
TRAILER PARKING 4 ACRES
3 LAUNCH RAMPS
PARKING 2.5 ACRES
DRY STORAGE BUILDING
ENTRANCE
BUFFALO DISTRICT
CORPS OF ENGINEERS
BUFFALO NEW YORK
LORAIN OHIO
SMALL BOAT HARBOR
PRELIMINARY FEASIBILITY REPORT
ALTERNATIVE 4
DESIGNED
DRAWN
TRACED
CHECKED
SUBMITTED
RECOMMENDED
FIGURE 13
600 SLIP CAPACITY WITH RIVERSIDE PARK CUT

TABLE 15

ESTIMATE OF TOTAL PROJECT COST FOR ALTERNATIVE PLAN 4
AND FEDERAL AND NON-FEDERAL SHARE (1981 PRICE LEVELS)

		AMOUNT $	TOTAL $
TOTAL PROJECT COSTS:			
1. Lands, and Damages	:	275,000	
2. Breakwaters	:	2,912,000	
3. Recreational Facilities	:	92,000 1/	
4. Aids to Navigation	:	70,000 2/	
5. Engineering and Design	:	361,000	
6. Supervision and Administration	:	391,000	
TOTAL PROJECT COST	:		4,101,000
FEDERAL SHARE:			
50 Percent of Items 2,3, 5 and 6	:	1,878,000	
100 Percent of Item 4	:	70,000	
Total Federal Share of Project Costs	:		1,948,000
NON-FEDERAL SHARE			
100% of Item 1	:	275,000	
Cash Contribution (50 Percent of Items 2, 3, 5, & 6)	:	1,878,000	
Total Non-Federal Share of Project Costs	:		2,153,000 3/

1/ To provide walkway and handrail on the Breakwater for fishing.

2/ Cost includes necessary Engineering and Design and Supervision and Administration.

3/ Does not include costs for self-liquidating features of the project, such as docks, launching ramps, dry storage and public service facilities. The estimated non-Federal cost for these self-liquidating features is $3,125,000, including $1,000,000 for the dry storage facility.

TABLE 16

ESTIMATED INVESTMENT COST AND ANNUAL CHARGES FOR ALTERNATIVE PLAN 4 (1981 Price Levels) 1/

ITEM	Navigation $	Recreation $	Total $
TOTAL INVESTMENT FOR THE PROJECT:			
Total Investment	3,985,000	116,000	4,101,000
TOTAL ANNUAL CHARGES FOR THE PROJECT:			
Interest	303,900	8,800	312,700
Amortization	8,000	200	8,200
Maintenance	59,100	2,700	61,800
Total Annual Charges	371,000	11,700	382,700
FEDERAL SHARE:			
Total Investment Cost			
Total Investment	1,890,000	58,000	1,948,000
Annual Charges			
Interest	144,100	4,400	148,500
Amortization	3,700	100	3,800
Maintenance	59,100 2/	-0-	59,100
Total Annual Charges	206,900	4,500	211,400
NON-FEDERAL SHARE			
Total Investment Cost			
Total Investment	2,095,000 3/	58,000	2,153,000
Annual Charges			
Interest	159,800	4,400	164,200
Amortization	4,300	100	4,400
Maintenance	-0-	2,700 4/	2,700
Total Annual Charges	164,100	7,200	171,300

(Footnotes):

1/ 7-5/8 percent interest rate, 50-year life (i =0.07625, amort. =0.00198.

2/ 100 percent Federal for general navigation.

3/ Excludes $3,125,000 for self-liquidating costs.

4/ 100 percent non-Federal.

TABLE 17

SUMMARY OF BENEFITS AND COSTS

FOR ALTERNATIVE PLAN 4 a/

ITEM	Navigation	Recreationl Fishing	Total Project
Average Annual Benefit	$ 725,800	$ 20,900	$746,700
Average Annual Cost			
Federal	206,900	4,500	211,400
Non-Federal	164,100	7,200	171,300
TOTAL	371,000	11,700	382,700
Net Benefits	$ 354,800	$ 9,200	$364,000
Benefit/Cost Ratio	2.0	1.8	2.0

a/ 600 slip capacity with allowance for a commercial navigation channel through Riverside Park.

Increases in recreational opportunity and public service facilities are the two significant effects of adding a new 600 boat harbor at Lorain.

Access route (Colorado Avenue) impacts are predicted to be relatively minor, as presented under Alternative 1. This is due to improvements along Colorado Avenue which are planned for completion well before small-boat harbor construction begins. A number of lesser effects are expected to be the same as those for Alternative 1, see that section for details.

Implementation of Plan 4

This plan can be implemented in conjunction with Riverside Park cut possibilities. The economic viability of the project appears assured. Local interests were amenable to the dry-storage feature as a method of increasing overall capacity and supplying storage options for smaller craft.

ALTERNATIVE PLAN 5 - 600 SLIPS (DETACHED BREAKWATER)

Description of Plan 5

Plan 5 would provide an all-weather recreational harbor with a 600-slip capacity and would conflict with the possible commercial channel realignment through Riverside Park. The project features and harbor layout for Plan 5 are depicted in Figure 14.

Plan 5 essentially is an alteration of Plan 2, except the detached breakwater concept allows a separation of recreational and commercial traffic at the marina entrance. A 200-foot wide waterway between the easterly end of the detached breakwater and the westerly end of the main breakwater provides this separated entrance. This reorientation of breakwaters (relative to Plan 2) reduces the water area for mooring and interior channels, but sufficient size certainly remains for 600 slips and all access channels. All other features, land and water, are similar to Plan 2, including an alternate entrance directly connected to the existing commercial channel. Rubblemound breakwater crests are 10 feet above LWD, and dredging remains unncessary.

Recreational fishing is limited to the 800-foot main breakwater which is connected to the Diked Disposal Area. Plan 5 also features an 8-foot wide breakwater crest where fishing walkways are provided.

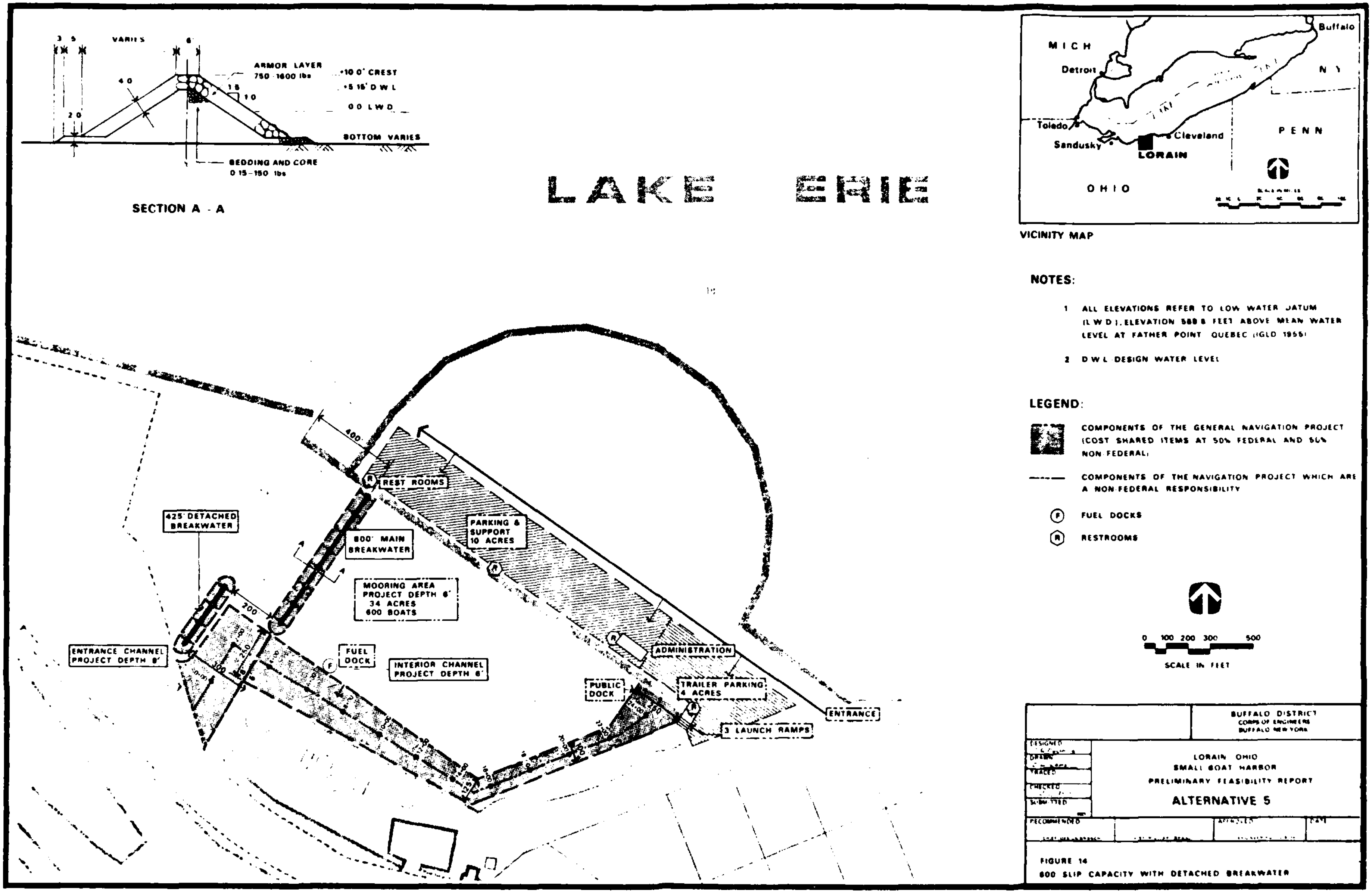


FIGURE 14
600 SLIP CAPACITY WITH DETACHED BREAKWATER

AD-A113 622 CORPS OF ENGINEERS BUFFALO NY BUFFALO DISTRICT F/G 13/2
PRELIMINARY FEASIBILITY REPORT STAGE II, LORAIN SMALL-BOAT HARB--ETC(U)
MAR 82

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2 OF 4
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A113622

Cost Estimate for Plan 5

Appendix A contains detailed cost estimates for Plan 5. Summaries of project costs and annual charges are shown in following Tables 18 and 19. These tables also separate the Federal and non-Federal cost shares for Plan 5. Total costs for major navigation structures and recreational fishing are estimated as $3,627,000, and total annual charges are estimated as $337,800.

The non-Federal cost of about $3,500,000 is estimated for self-liquidating items necessary for an operational marina. This cost is in addition to costs presented in the previous paragraph. A detailed presentation of self-liquidating costs for Plan 5 is presented in Appendix A.

Economic Evaluation of Plan 5

A detailed analysis of projected recreational boating demand, fleet mix, and annual benefits is contained in Appendix B. A similarly detailed analysis of recreational fishing benefits is presented in Appendix C. These analyses are summarized in the following Table 20, which includes annual charges, annual benefits, and benefit/cost ratios for Plan 5. The net navigation benefits are $407,900 per year, and the navigation benefit/cost ratio is 2.3. Net land-based fishing benefits are $13,600 per year, and the benefit/cost ratio for recreational fishing is 1.7.

Environmental Assessment of Alternative 5

The environmental effects of Alternative 5 would be similar to those of Alternative 1, except as follows.

Under Alternative 5, breakwater construction would cover approximately 2.7 acres of bottom habitat, with a corrsponding increase in impacts relative to Alternative 1 (2.1 acres). This impact will probably still not be significant, for the reasons discussed for Alternative 1.

Rubblemound breakwater construction for Alternative 5 would introduce approximately 1.3 acres of rocky habitat into the area, with a greater potential for a beneficial effect on fish populations near the breakwaters than under Alternative 1 (0.9 acres).

Since Alternative 5 would support 600 boats as compared to the 300 of Alternative 1, there is a greater potential for an adverse impact on water quality. For the reasons discussed under Alternative 1, however, the

TABLE 18

ESTIMATE OF TOTAL PROJECT COST FOR ALTERNATIVE PLAN 5
AND FEDERAL AND NON-FEDERAL SHARE (1981 PRICE LEVELS)

		AMOUNT $	TOTAL $
TOTAL PROJECT COSTS:			
1. Lands, and Damages	:	308,000	
2. Breakwaters	:	2,414,000	
3. Recreational Facilities	:	158,000 1/	
4. Aids to Navigation	:	105,000 2/	
5. Engineering and Design	:	309,000	
6. Supervision and Administration	:	334,000	
TOTAL PROJECT COST	:		3,627,000
FEDERAL SHARE:			
50 Percent of Items 2,3, 5 and 6	:	1,607,000	
100 Percent of Item 4	:	105,000	
Total Federal Share of Project Costs	:		1,712,000
NON-FEDERAL SHARE			
100% of Item 1	:	308,000	
Cash Contribution (50 Percent of Items 2, 3, 5, & 6)	:	1,607,000	
Total Non-Federal Share of Project Costs	:		1,915,000 3/

1/ To provide walkway and handrail on the Breakwater for fishing.

2/ Cost includes necessary Engineering and Design and Supervision and Administration.

3/ Does not include costs for self-liquidating features of the project, such as docks, launching ramps, and public service facilities. The estimated non-Federal cost for these self-liquidating features is $ 3,500,000.

TABLE 19

ESTIMATED INVESTMENT COST AND ANNUAL CHARGES FOR ALTERNATIVE PLAN 5(1981 Price Levels)1/

ITEM	Navigation $	Recreation $	Total $
TOTAL INVESTMENT FOR THE PROJECT:			
Total Investment	3,430,000	197,000	3,627,000
TOTAL ANNUAL CHARGES FOR THE PROJECT:			
Interest	261,600	15,000	276,600
Amortization	6,800	400	7,200
Maintenance	49,500	4,500	54,000
Total Annual Charges	317,900	19,900	337,800
FEDERAL SHARE:			
Total Investment Cost			
Total Investment	1,614,000	98,000	1,712,000
Annual Charges			
Interest	123,000	7,500	130,500
Amortization	3,200	200	3,400
Maintenance	49,500 2/	-0-	49,500
Total Annual Charges	175,700	7,700	183,400
NON-FEDERAL SHARE			
Total Investment Cost			
Total Investment	1,817,000 3/	98,000	1,915,000
Annual Charges			
Interest	138,600	7,500	146,100
Amortization	3,600	200	3,800
Maintenance	-0-	4,500 4/	4,500
Total Annual Charges	142,200	12,200	154,400

(Footnotes):

1/ 7-5/8 percent interest rate, 50-year life (i =0.07625, amort. =0.00198.

2/ 100 percent Federal for general navigation.

3/ Excludes $3,500,000 for self-liquidating costs.

4/ 100 percent non-Federal.

TABLE 20

SUMMARY OF BENEFITS AND COSTS

FOR ALTERNATIVE PLAN 5 a/

ITEM	Navigation	Recreationl Fishing	Total Project
Average Annual Benefit	$ 725,800	$ 33,500	$759,300
Average Annual Cost			
Federal	175,700	7,700	183,400
Non-Federal	142,200	12,200	154,400
TOTAL	317,900	19,900	337,800
Net Benefits	$ 407,900	$ 13,600	$421,500
Benefit/Cost Ratio	2.3	1.7	2.2

a/ 600 slip capacity without Riverside Park cut but with detached breakwater.

resulting impact on water quality in the outer harbor in general, or on public health, would probably be minor.

Recreational opportunities and public service facilities, are expected to increase as a direct result of the addition of a new 600 boat harbor at Lorain.

Access route (Colorado Avenue) impacts are predicted to be relatively minor, as presented under Alternative 1. This is due to improvements along Colorado Avenue which are planned for completion well before small-boat harbor construction begins.

Mitigation Needs for Plan 5

Again, no measures are identified as necessary to mitigate the minor adverse impacts associated with the small-boat harbor plan.

Implementation of Plan 5

From a benefit/cost perspective, Plan 5 appears to be economically feasible. Ultimately, however, Federal and non-Federal entities must decide if the operational advantages at the marina entrance are worth the cost increases relative to Plan 2. Plan 5, like Plans 1 and 2, competes for a water area which has potential use as a commercial channel realignment.

ALTERNATIVE PLAN 6 - No Action

The conditions which will exist if no Federal action is taken basically are described in the Problem Identification section of this report. Privately owned marinas seem constrained from attaining significantly larger capacities. Launching facilities will remain crowded, inducing people to avoid trailered boat useage in the area. The City of Lorain's attempts to provide some temporary mooring capacity probably will be limited so that slip demands continue to outstrip supply.

The marine industry and business in the area will be suppressed from potential growth. People desiring the larger non-trailerable boats will be induced to own smaller craft or search for slip space at other more distant locations.

Land-based fishing opportunities will be increased after filling of the Diked-Disposal Area, but demands will continue to create crowding. The outer-harbor area inside the east breakwater will be inaccessable at the more favorable fishing sites.

In general, the City of Lorain, a large SMSA, may lose an opportunity to enhance its recreational use of Lake Erie at Lorain, Ohio. Local users will continue to experience overcrowding at existing facilities. Demands for boating and fishing recreation will far exceed opportunities for fulfillment.

SECTION E

COMPARISON OF PLANS

During the initial iteration of study planning, a total of 6 locations were considered as possible sites for small-boat harbor improvements at Lorain, Ohio. Of these, the Inside East Breakwater site was selected primarily because of cost and function advantages (see Section C). At this site, 5 structural alternatives were studied in-depth, and their ability to provide all-weather protection for either 300 or 600 boats was evaluated. A sixth alternative, "No-Action," was considered as a basis-of-comparison plan. Engineering, economic, and environmental aspects of these alternative plans at the selected site are presented in Section D.

A systems of accounts matrix for the detailed alternative plans is presented in Table 21. Comparisons of costs, benefits, economic efficiency, and impacts are provided in the table. Each plan's functionability and potential for implementation also is described. Additional economic comparisons are provided in Tables 21A and 21B.

TRADE-OFF ANALYSIS

Of the structural plans, two would provide at least 300 slips and three would provide at least 600 slips. All five structural plans would encompass a 3-lane launch facility for trailered boats and would enhance breakwater fishing opportunities. The sixth alternative, "no-action," would not undertake any improvement of recreational boating or fishing facilities.

Trade-Offs for "No-Action" vs. Structural Alternatives

The "no-action" plan would not meet any portion of the regional and local excess demand for recreational boating and land-based fishing. No monetary investment would occur by governmental entities, except the "temporary" measures introduced by the City of Lorain may be renewed. This would entail replacement and repair of a floating-tire breakwater system for mooring recreational craft. Conversely, the five structural plans would require monetary investment to gain an increased recreational use of Lake Erie at Lorain, Ohio.

Trade-Offs for the Five Structural Alternatives

The structural alternatives vary in costs, benefits, size, and function. One common feature is the avoidance

TABLE 21
SUMMARY OF EFFECTS FOR ALTERNATIVE PLANS

	PLAN 1	PLAN 2	PLAN 3	PLAN 4	PLAN 5	NO ACTION
A. PLAN DESCRIPTION	300 berth all-weather facility with 1100 feet of breakwater fishing. Interferes with Riverside Park Cut commercial channel alt.	600 berth all-weather facility with 1150 feet of breakwater fishing. Interferes with Riverside Park Cut commercial channel alt.	300 berth all-weather facility with 500 ft of breakwater fishing. Allows Riverside Park Cut commercial channel alt.	300 dry berth plus 300 wet berth all-weather facility with 500 ft. of breakwater fishing Allows Riverside Park Cut commercial channel alt.	600 berth all weather facility with 800 ft of breakwater fishing. Two entrances via detached breakwater. Interferes with Riverside Park Cut commercial channel alt.	do nothing
B. SIGNIFICANT IMPACT						
1. National Economic Development						
a. Beneficial Impacts						
1. Annual Benefits	($)	($)	($)	($)	($)	
Navigation	378,000	725,800	378,000	725,800	725,800	-
Fishing	37,900	52,200	20,900	20,900	33,500	
2. Net Benefits	($)	($)	($)	($)	($)	
Navigation	190,800	479,500	11,400	354,800	407,900	-
Fishing	12,900	25,100	9,200	9,200	13,600	
3. Benefit/Cost Ratio						
Navigation	2.0	2.9	1.0	2.0	2.3	-
Fishing	1.5	1.9	1.8	1.8	1.7	-

TABLE 21
SUMMARY OF EFFECTS FOR ALTERNATIVE PLANS
CONTINUED

	PLAN 1	PLAN 2	PLAN 3	PLAN 4	PLAN 5	NO ACTION
b. Adverse Impacts	($)	($)	($)	($)	($)	
(1) Total Project Investment 1/						
Federal	1,064,000	1,328,000	1,948,000	1,948,000	1,712,000	-
Non-Federal	1,214,000	1,601,000	2,098,000	2,153,000	1,915,000	-
Total	2,278,000	2,929,000	4,046,000	4,101,000	3,627,000	-
(2) Self-Liquidating Costs 2/						
Non-Federal	1,938,000	3,500,000	1,975,000	3,125,000	3,500,000	-
(3) Annual Charges 3/						
Federal	111,900	141,600	211,400	211,400	183,400	-
Non-Federal	100,300	131,800	166,900	171,300	154,400	
Total	212,200	273,400	378,300	382,700	337,800	
2. ENVIRONMENTAL QUALITY						
Beneficial Impacts						
(1) Colonizable benthic habitat created (surface area of breakwater system below average lake level).	0.9 acres	1.2 acres	1.6 acres	1.6 acres	1.3 acres	
Adverse Impacts						
(1) Aquatic habitat disrupted (area occupied by break-waters).	2.1 acres	2.6 acres	3.9 acres	3.9 acres	2.7 acres	
(2) Water quality impaired in mooring basin.	19.5 acres	40.7 acres	18.1 acres	18.1 acres	34.0 acres	
(3) Air quality degraded during construction	minor, temporary	minor, temporary	minor, temporary	minor, temporary	minor, temporary	-
(4) Terrestrial impacts	none	none	none	none	none	-

TABLE 21
SUMMARY OF EFFECTS FOR ALTERNATIVE PLANS
CONTINUED

	PLAN 1	PLAN 2	PLAN 3	PLAN 4	PLAN 5	NO ACTION
3. Social Well-Being						
a. Beneficial Impacts (1) Recreational, Educational and Cultural Opportunities	Increased boating and fishing	Same as Plan 1	Same as Plan 1	Same as Plan 1	Same as Plan 1	None
(2) Enhancement of health, safety, and community well-being	Improved mental health for persons making use of new boating facilities Increased safety from expanded harbor-of-refuge.	Same as Plan 1	Same as Plan 1	Same as Plan 1	Same as Plan 1	None
(3) Public and agency acceptability	Unfavorable	Favorable	Favorable, if Riverside Park cut occurs	Favorable, but prefer Plan #3	Favorable, but prefer less costly Plan #2	Unfavorable
b. Adverse Impacts						
(1) Degraded recreational, educational, and cultural opportunities.	None	None	None	None	None	None

TABLE 21
SUMMARY OF EFFECTS FOR ALTERNATIVE PLANS
CONTINUED

	PLAN 1	PLAN 2	PLAN 3	PLAN 4	PLAN 5	NO ACTION
(2) Deterioration of quality of life, health and safety.	Temporary air, water & noise polution during construction. Noise pollution throughout project life. Potential hazard to swimmers in close proximity to pleasure craft. Increased boating creates safety hazard at entrance into commercial shipping lanes.	Same as Plan 1	Same as Plan 1	Same as Plan 1	Same as Plan 1 except marina entrance creates less safety hazard in commerical shipping lanes	No increase in Lorain's harbor-of-refuge capacity for small craft. Hazards to swimmers in close proximity to small boat traffic will not in-increase.
(3) Injurious displacement of people and community dis-ruption	None	None	None	None	None	None
4. Regional Development						
(a) Beneficial Impacts (1) Value of in-creased income.	Some increased income to local businesses.	Same as Plan 1	Same as Plan 1	Same as Plan 1	Same as Plan 1	None
(2) Quality of increased employment	Some increases in local employment	Same as Plan 1	Same as Plan 1	Same as Plan 1	Same as Plan 1	None

1. Includes costs for major navigation features and for land-based fishing facilities.
2. Includes costs for docks, berths, public service facilities, and launch ramps.
3. Does not include self-liquidating costs since they are not used to determine economic efficiency.

TABLE 21A

COMPARISON OF NAVIGATION COSTS AND BENEFITS

ITEM	Alt. #1	Alt. #2	Alt. #3	Alt. #4	Alt. #5
Annual Benefits	$ 378,000	$ 725,800	$ 378,000	$ 725,800	$ 725,800
Project Investment					
Federal	939,000	1,197,000	1,890,000	1,890,000	1,614,000
Non-Federal	1,089,000	1,470,000	2,040,000	2,095,000	1,817,000
TOTAL	$2,028,000	$2,667,000	$3,930,000	$3,985,000	$3,430,000
Annual Charges					
Federal	102,100	131,300	206,900	206,900	175,700
Non-Federal	85,100	115,000	159,700	164,100	142,200
TOTAL	$ 187,200	$ 246,300	$ 366,600	$ 371,000	$ 317,900
Net Benefits	$ 190,800	$ 479,500	$ 11,400	$ 354,800	$ 407,900
B/C Ratio	2.0	2.9	1.0	2.0	2.3

TABLE 21B

COMPARISON OF RECREATIONAL FISHING COSTS AND BENEFITS

ITEM	Alt. #1	Alt. #2	Alt. #3	Alt. #4	Alt. #5
Annual Benefits	$ 37,900	$ 52,200	$ 20,900	$ 20,900	$ 33,500
Project Investment					
Federal	125,000	131,000	58,000	58,000	98,000
Non-Federal	125,000	131,000	58,000	58,000	98.000
TOTAL	$ 250,000	$ 262,000	$ 116,000	$ 116,000	$ 197,000
Annual Charges					
Federal	9,800	10,300	4,500	4,500	7,700
Non-Federal	15,200	16,800	7,200	7,200	12,200
TOTAL	$ 25,000	$ 27,100	$ 11,700	$ 11,700	$ 19,900
Net Benefits	$ 12,900	$ 25,100	$ 9,200	$ 9,200	$ 13,600
B/C Ratio	1.5	1.9	1.8	1.8	1.7

of large, adverse impacts upon the physical or social environment. The trade-offs deal more directly with compatibility to commercial harbor plans and with economic efficiencies.

Plans #1, #2, and #5 are capable of being implemented only if the existing commercial channel is not re-aligned through Riverside Park. Plan #1 is designed to berth 300 boats, while Plans #2 and #5 are assured of having capacity for 600 boats. Plans #1 and #2 each provide about 1150 feet of breakwater for land-based fishing. Plan #5 has 800 feet of breakwater fishing. Of these three plans, Plan #1 is least expensive with total project investment costs of $2,278,000. Plan #2 is only slightly more expensive ($2,929,000) but boat capacity doubles. Plan #5 is most costly ($3,627,000) but has an added feature of allowing recreational and commercial traffic separation at the entrance channel. Self-liquidating costs for Plan #1 are $1,938,000, while the larger Plans #2 and #5 each require $3,500,000 for these costs.

Plans #3 and #4 differ from other structural alternatives primarily because provisions are made to accommodate a possible commercial channel cut through Riverside Park. Plan #4 is identical to Plan #3 except that a dry-storage facility is added to ensure total capacity for 600 boats (300 wet slips and 300 dry slips). Plan #3 has only the wet slips. Both plans provide 500 feet of breakwater for land-based fishing. Total investment costs are $4,046,000 for Plan #3 and $4,101,000 for Plan #4. The dry-storage facility is considered a self-liquidating item. Therefore, Plan #3 displays lower self-liquidating costs of $1,975,000. Self-liquidating costs for Plan #4 equal $3,125,000.

From this, Plan #1 is determined to be the least expensive plan for 300 slip capacity. Plan #2 is demonstrated as the least expensive 600-slip alternative, and Plan #4 the most expensive. In general, accommodations for the Riverside Park cut do increase costs for a small-boat harbor at the selected site.

RATIONALE FOR PLANS ELIMINATED FROM FURTHER STUDY (Plans #1 and #4)

Based on the District's need to maintain flexibility in future planning stages, at least one plan representing a 600 slip capacity and one plan representing a 300 slip capacity should remain after the initial screening process. Also a plan which accommodates the possible Riverside Park cut channel should continue into Stage 3. A single plan could accomplish one or more of these needs.

Plans #1 and #4 are not required for future study evaluations. The rationale for eliminating these two plans is described in following paragraphs.

Alternative Plan #1 - 300 Slips without Riverside Park Cut

Plan #1 is supplanted by the relative advantages of Plan #2. The boating demand analysis indicates that a 600 slip marina is preferable to a smaller size. In this instance, the total cost differential between Plan #1 and #2 is so slight that prudent planners would not prefer the smaller mooring area of Plan #1. The breakwater length is approximately equal between the two plans, creating similar land-based fishing opportunities. The water area just northerly of the breakwater in Plan #1 is better utilized as additional mooring area in Plan #2. No other use of this area is probable if Plan #1 is implemented, therefore, resource opportunities are wasted under this plan.

Alternative Plan #4 - 600 Slips with Riverside Park Cut

Plan #4 has the same major navigation features of Plan #3. The only difference is that Plan #4 has a dry-storage facility to insure a 600 slip capacity. This feature is a non-Federal cost item, and non-Federal interests desire the widest choices possible for timing and sizing dry-storage capacity. Eliminating Plan #4 in favor of Plan #3 allows this flexibility because Plan #3 demonstrates economic viability without dry-storage capacity. If wet slip density is increased, the B/C ratio for Plan #3 becomes 1.5.

An interesting aspect of the dry-storage concept is its adaptability to any of the alternative plans, thereby generating additional or expansion capacity. This planning approach seems more logical than continued study of an otherwise similar plan. Although Plan #4 is eliminated, the dry-storage option should be evaluated for plans carried into the next study phase.

RATIONALE FOR PLANS WARRANTING FURTHER STUDY
(Plans #2, 3, and #5)

Alternative Plan 2 - 600 Slips without Riverside Park Cut

Plan 2 demonstrates the best benefit/cost ratio and cost-per-slip value of any plan. This plan is viable, implementable, and functional. Total costs are lower than any other plan with comparably sized mooring basin. The basin size is determined by efficient use of available water area and certainly possesses capabilities for expansion beyond 600 slips if warranted by future study phase results or by demand realized subsequent to construction. Otherwise the relatively large water area provides opportunities for maneuvering or perhaps a sailing area for small-craft (15-feet or less). Costs would not be reduced by sizing the mooring area to the minimum required to berth 600 boats.

Alternative Plan 3 - 300 Slips with Riverside Park Cut

Plan #3 maximizes the use of water area available for small-boat berthing if the Riverside Park cut channel is implemented. No other plan can improve upon the mooring area size under this circumstance. Plan #3 displays a very marginal benefit/cost ratio (1.0) when analyzed for a 300 slip configuration. However, as described in Section D, the economic analysis of this plan demonstrates potential for a benefit/cost ratio of 1.5 by maximizing use of available mooring area to 460 slips. If subsequent study efforts indicate that additional navigational benefits are required, dry-storage options applicable to any of the plans, could be refined and specifically added to Plan #3.

Plan #5 - 600 Slips with Detached Breakwater

Plan #5 is chosen for further consideration because it provides an additional safety and convenience feature to the otherwise similar Plan #2. The separation of commercial and recreational vessel traffic at the marina entrance is desirable, but major navigation costs are about 25% higher than Plan #2. Since the economic efficiency of Plan #5 is relatively high despite cost additions (B/C = 2.3), its implementability seems most related to public and administrative opinion of the trade-off between increased expenditures and functional ease of the separated entrance. This trade-off requires further evaluation in the next study phase.

Alternative Plan #6 - No-Action Plan

The no-action plan is carried forward as an alternative course of action in the event that more detailed studies show structural and/or non-structural plans cannot be implemented because of the absence of engineering, economic, environmental, financial, social, or political viability. Also, the no-action plan is used as a basis-of-comparison in evaluating the structural plans.

RATIONALE FOR CANDIDATE NED PLANS

In selecting the National Economic Development (NED) plan, candidate plans must not only satisfy the planning objectives and evaluation criteria; they must also maximize net benefits. Based on existing data, costs, and benefits, the NED plan is Plan #2 with net benefits of $505,200 per year for small-boat navigation and recreational fishing. The simplicity of function and economy of design causes this plan's benefit/cost ratios and net benefits to be highest of all plans. As described previously, opportunities exist for creating larger economic advantage by maximizing berthing density and adding a dry-storage facility as future demands may dictate the need. Plan #2 has larger water area for such expansion than any other plan.

RATIONALE FOR CANDIDATE EQ PLANS

Recognizing that environmental quality has both natural and human manifestations, an EQ Plan addresses the planning objectives in the way which emphasizes aesthetic, ecological, and cultural contributions. Beneficial EQ contributions are made by preserving, maintaining, restoring, or enhancing the significant cultural and natural environmental attributes of the study area. Determination of EQ benefits involves subjective analysis, underscoring the need for interdisciplinary planning with extensive public input to place values on the environmental contributions of plans. Designating an EQ Plan involves measuring the environmental changes related to different plans and selecting the plan which, based on public input, contributes to or is most harmonious with environmental objectives. This means that candidate EQ Plans must make net positive contributions to the components of the EQ account. At a minimum, an alternative plan must make net positive contributions to the EQ account in order to be designated the EQ Plan.

In some studies, it may be impossible to develop a plan that meets the minimum requirements for designating an EQ Plan; i.e., a plan that makes net positive contributions to the EQ account. In those cases, the plan which is least damaging to the environment will be identified.

This study identifies no plan which meets the minimum requirements for designating an EQ Plan. All plans appear to create only slight damages to the relatively disturbed environment. However, Plan #3 seems to have the fewest long-term impacts since the affected water area and number of slips is less than other plans (see Table 21). Water quality impacts caused by inhibited circulation patterns and by increased boating are expected to be less noticable. Also, the amount of land area committed to the project instead of the proposed park is less. Therefore, Plan #3 is selected as the least - environmentally - damaging (LED) plan.

SECTION F

STUDY MANAGEMENT

This section provides an outline of the principal activities required to complete the Final Feasibility Study (Stage 3), the methodologies to be used, the contemplated public involvement activitie' and the study schedule. As explained earlier, the primary study goal of Stage 2 has been to evaluate a wide range of alternatives that would satisfy the small-boat harbor planning objectives. This evaluation has included selection of alternative plans for further consideration and determination of probable project viability based upon factors including economics and implementation. Presently, the evaluation has indicated three structural plans (Plans #2, #3, and #5) and the no-action plan (Plan #6) should be considered further in Stage 3 as candidates for the "Selected Plan." The management plan presented below has assumed that at least one structural plan will continue to warrant further consideration.

STAGE 3 METHODOLOGY

Refinement of Plans #2, #3, and #5 receives great emphasis in Stage 3. Principal considerations in this refinement are: determining desired slip capacities, laying out more precise mooring site plans, conducting a bathymetric survey, evaluating useage of the Diked Disposal Area for land facilities and updating demand analyses for recreational boating and fishing. Additionally, coordination between Lorain Harbor commercial and recreational studies is maintained to insure mutual compatibility of alternative selections.

The result of Stage 3 is a recommendation as to whether or not there are feasibile alternatives for constructing a small-boat harbor in the Lorain, Ohio area. The results will be presented in a separate volume in the Final Feasibility Report and Environmental Impact Statement on Lorain Harbor. The scheduled interrelationship between the recreational navigation study and other ongoing studies at Lorain Harbor are depicted in Figure 15. The Study Flow Network showing activities involved in the Phase 3 study is presented in Appendix E. Future involvement of the interdisciplinary team is described in following paragraphs.

Coastal and General Engineering

Refine the considered alternatives layouts for the marina facility, giving special emphasis to desired

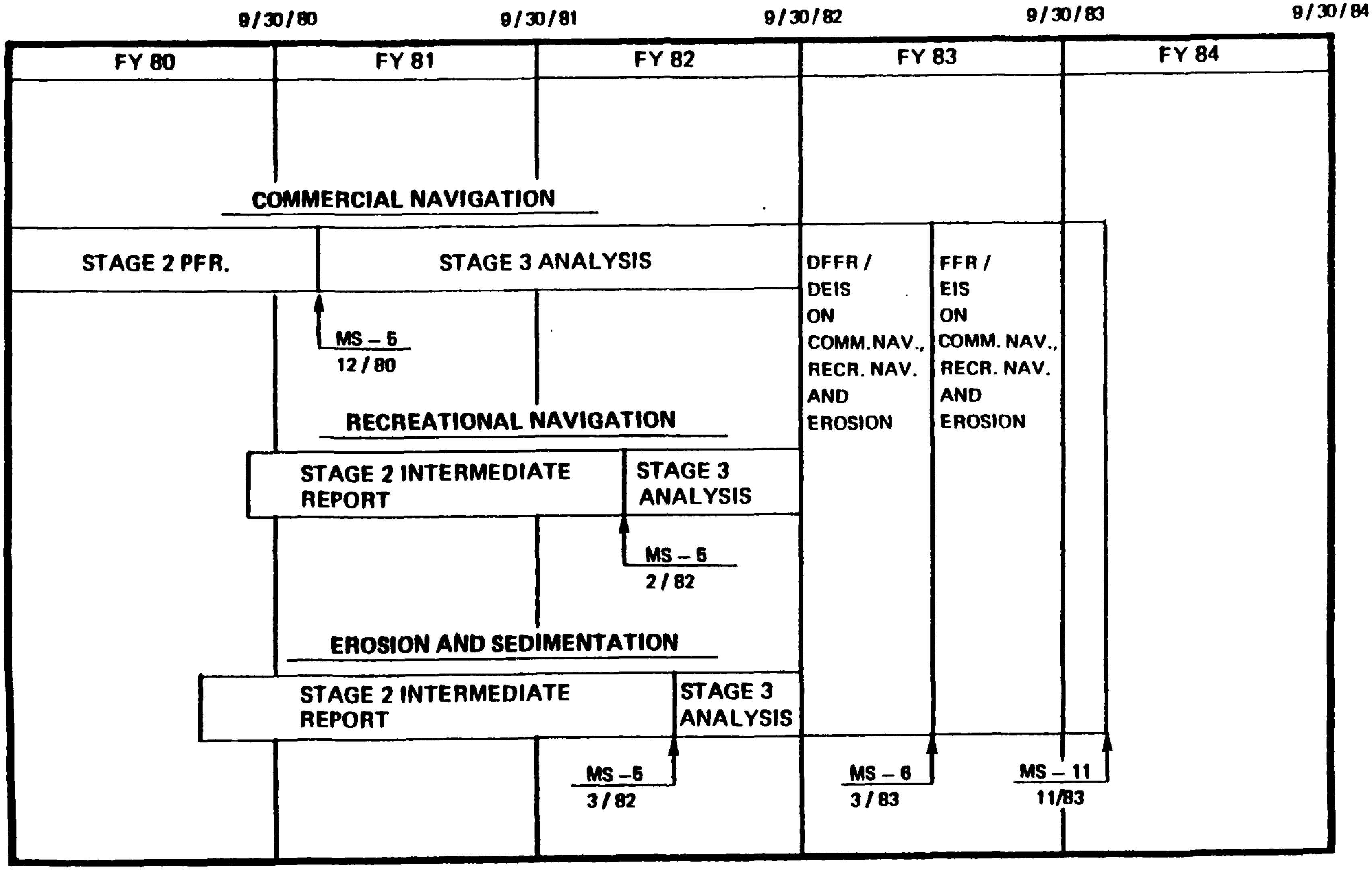


FIGURE 15 PROPOSED SCHEDULE OF MAJOR ACTIVITIES FOR LORAIN HARBOR STUDY

berthing density. Review wave refraction/defraction analysis and breakwater/channel designs based on agency and user input. Update the Corps' analysis of expected completion date for filling the Diked Disposal area, and/or estimate percent filling achieved by project construction. Conduct a bathymetric survey, especially nearshore and at expected breakwater locations. Utilize new data to update cost estimates.

Environmental

Collect data for a Section 404 analysis and survey potential social conflicts along adjacent shoreline properties. This is expected to be of minor consequence based upon evaluations and input during Stage 2. Coordinated efforts with Fish and Wildlife Service representatives must be continued. An Environmental Impact Statement (EIS) specifically addressing the small-boat harbor aspect of the Lorain Harbor improvements will be prepared as appropriate.

Foundations & Materials

Substantiate bottom sediment conditions as contained in the recent Stanley report for City of Lorain. Sample analyze potential load-bearing capacity of sediments within the Diked Disposal area.

Economics

If demographic data from the 1980 census becomes available, it should be the basis for updating the demand analysis produced during Stage 2 studies. Otherwise efforts are restricted to review and refinement of Stage 2 predictions by more fully researching field data on local fleet mix and land-based fishing usage.

Project Management and Planning

The project manager primarily coordinates efforts of the interdisciplinary team. Another important aspect of this study is maintaining continuity between the recreational and commercial phases of the Lorain Harbor study.

PUBLIC INVOLVEMENT AND COORDINATION FOR STAGE 3

A public meeting and workshop are scheduled during the refinement and assessment tasks of Phase 3 study. Coordination includes continued interrelationship with multiple Federal, state, and local agencies and with marine business and interest groups. Principal among these are the U.S. Fish and Wildlife Service, the

Lorain Port Authority, Ohio Department of Natural Resources, and City of Lorain.

Stage 3 Study Schedule

The milestone dates shown on the Study Flow Network are crossreferenced to Table 22.

TABLE 22

MILESTONE SCHEDULE FOR THE LORAIN SMALL-BOAT HARBOR FEASIBILITY STUDY

Milestone 1/ and Date										
1	2	3	4	5	6	7	8	9	10	11
10/77	4/79	1/82	2/82	3/82	3/83	4/83	5/83	6/83	9/83	11/83

1/ Milestones

1 - Study Initiation

2 - Approval of Recon Report

3 - Submit Stage 2 Report

4 - Stage 2 Checkpoint

5 - Complete Action on MFR

6 - Submit Draft Report DEIS

7 - Stage 3

8 - Complete Action on MFR

9 - Coordinate Draft Report/EIS

10 - Submit Final Report/

11 - Division Engineer Notice

Milestones 6 through 11 occur simultaneously with the commercial portion of the Lorain Harbor Feasibility Study and are further explained in appropriate sections of the October 1980 Corps' report on Lorain Harbor. Overall completion of Phase 3 is scheduled for November 1983.

SECTION G

CONCLUSIONS

CONTINUATION OF STUDY INTO STAGE 3

There is sufficient excess boating facilities demand in the vicinity of Lorain Harbor to support full utilization of new marina facilities, if constructed. The optimal site for such construction is in the Outer Harbor adjacent to the East Breakwater Shorearm (Site 1). In addition, unmet demand for land-based recreational fishing opportunities also exists at Lorain Harbor.

Based on the preliminary studies performed and the favorable outcome of these studies, there is a high potential for Federal involvement in constructing a small-boat harbor that incorporates features for providing breakwater fishing at Site 1. In addition, the Lorain Port Authority - potential local sponsor for the project - has informally stated that it supports these projects and intends to provide the "Items of Local Cooperation." Therefore, it is concluded that the detailed Stage 3 Feasibility Study for potential recreational navigation and breakwater fishing improvements at Site 1 in Lorain Harbor should be performed.

POSSIBLE CHANGE IN ALTERNATIVES CARRIED INTO STAGE 3

This Preliminary (Stage 2) Report identifies Alternative Plans 2, 3, and 5, for further study. Since completion of the report in December 1981, the Buffalo District has preliminarily concluded that a new commercial navigation channel through Site 1 and Riverside Park is not economically justified, and thus not implementable. If the "Riverside Park Cut" is ultimately eliminated from the commercial navigation study, Alternative Plan 3 (which incorporates the Riverside Park Cut) will not be included in the Stage 3 studies of recreational navigation. In this case, only Alternatives 2 and 5 will be considered in Stage 3.

STAGE 3 STUDIES AND SCHEDULE

The principal Stage 3 activities and schedule are presented in Section F, "Study Management," of the report. One significant change from the activities listed in Section F regards the Economic analysis to be performed in Stage 3. Recent guidance from Buffalo District's higher headquarters states that the "Small Boat Formula" used to determine the recreational navigation benefits in Stage 2 is no longer acceptable. Therefore, the District will use an alternative method for calculating recreational navigation benefits in Stage 3. The affect of this change in benefit analysis and economic justification and, therefore, project feasibility is unknown at this time.

SECTION H

RECOMMENDATION

In view of the above conclusions, it is recommended that the District proceed with Stage 3 investigations of recreational navigation and breakwater fishing needs at Lorain Harbor. This effort shall be limited to further detailed study of Alternative Plans 2 and 5 (possibly Plan 3) at Site 1 in the Outer Harbor adjacent to the East Breakwater Shore Arm.

This recommendation is predicated on the intent of the Lorain Port Authority to provide the following "Items of Local Cooperation" (NOTE that the ultimate Items are subject to changes that reflect cost-sharing and financial arrangements which are satisfactory to the President and the Congress):

a. Provide without cost to the United States all lands, easements, and rights-of-way required for construction and subsequent maintenance of the project and for aids to navigation upon the request of the Chief of Engineers including suitable areas determined by the Chief of Engineers to be required in the general public interest for initial and subsequent disposal of spoil, and also necessary retaining dikes, bulkheads, and embankments, therefore, or the cost of such retaining works;

b. Hold and save the United States free from damages due to the construction and subsequent maintenance of the improvements except for damages due to the fault or negligence of the United States or its Contractors;

c. Provide and maintain necessary access roads, mooring facilities, and parking and service areas including a launching ramp, all essential sanitary facilities, and an adequate public landing or wharf, with provisions for the sale of motor fuel, lubricants, and potable water, available to all on equal terms;

d. Provide and maintain depths in the service channels to principal docks and berthing areas commensurate with those provided in the Federal project;

e. Accomplish without cost to the United States such relocations or alterations of utilities as necessary for project purposes;

f. Establish rules to control the use, growth, and development of the harbor and related facilities with the understanding that public facilities will be open to all on equal terms;

g. Reserve spaces within the harbor adequate for the accommodation of transient craft;

h. Establish regulations prohibiting discharge of pollutants into the waters of the harbor area by users thereof, which regulations shall be in accordance with applicable laws or regulations of Federal, State, and local authorities responsible for pollution prevention and control;

i. Contribute in cash 50 percent of that portion of the first cost of Federal construction allocated to recreational navigation and recreational fishing, exclusive of aids to navigation, to be paid in a lump sum prior to initiation of construction, or in installments over the construction period at a rate proportionate to the proposed or scheduled expenditure of Federal funds, as required by the Chief of Engineers, the final apportionment of cost to be made after actual costs have been determined; (NOTE: This percentage of cost-sharing is subject to the satisfaction of the President and the Congress.)

j. Bear all costs for maintenance, operation and replacement of those modifications required for recreational fishing facilities;

k. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646 approved 2 January 1971) in acquiring land, easements, and rights-of-way for construction and subsequent maintenance of the project and inform affected persons of pertinent benefits, policies, and procedures in connection and said Act; and

l. Comply with Section 601 of Title VI of the Civil Rights Act of 1964 (P.L. 88-352) and Department of Defense Directive 5500.11 issued pursuant thereto and published in Part 300 of Title 32, Code of Federal Regulations, in connection with the construction and operation of the project.

And provided further, that the improvement for recreational navigation may be undertaken independently of providing public recreational fishing facilities whenever the required local cooperation for navigation has been furnished.

GEORGE P. JOHNSON
Colonel, Corps of Engineers
District Engineer

APPENDIX A

DESIGN AND COSTS

APPENDIX A

DESIGN AND COSTS

TABLE OF CONTENTS

SECTION 1

INTRODUCTION

This technical appendix documents work performed in the preparation of preliminary engineering designs, cost estimates, and other related work for improvements to the small-boat navigation at Lorain, Ohio. Primary emphasis has been on development of quantitative design parameters (waves and lake levels) and on alternative engineering solutions at the selected small-boat harbor site.

This appendix is divided into a total of six sections. In addition to this introduction, Section 2 provides design lake level analyses, Section 3 presents design wave analyses, Section 4 contains miscellaneous design considerations, Section 5 shows detailed design of protective works, and Section 6 presents quantity and cost estimates for the alternative plans.

Design and cost details are based upon existing information. No new field studies were performed other than personal interviews or telephone conversations with local officials and business representatives.

SECTION 2

LORAIN SMALL BOAT HARBOR - DESIGN LAKE LEVEL

For this preliminary study, a 200 year coincident wave-lake level is used for design wave, and lake levels are considered to be independent and multiplicative events. The following combination is used for design:

- o 10 year recurrence event of lake levels, and
- o 20 year recurrence event for waves

The design lake level is determined using "Standardized Frequency Curves for Design Water Level Determination on the Great Lakes", by the Detroit District C.O.E., May 1979.

The 10 year recurrence event is determined by adding:

1. The 10 year maximum annual mean level for Lake Erie found on Figure 1 to be 572.7 ft. or 4.1 ft. above Low Water Datum (LWD = 568.6 IGLD), and

2. The one year frequency occurrence maximum short-term fluctuation found by interpolating between Figure 2 for Marblehead, Ohio and Figure 3 for Cleveland, Ohio. Since Lorain is approximately equidistant between these stations, the one year peak rise is (1.2 + 0.9)/ 2 = 1.05 ft.

Therefore, the 10 year design peak lake level is:

572.7 + 1.05 = 573.75 ft or 5.15 ft above LWD.

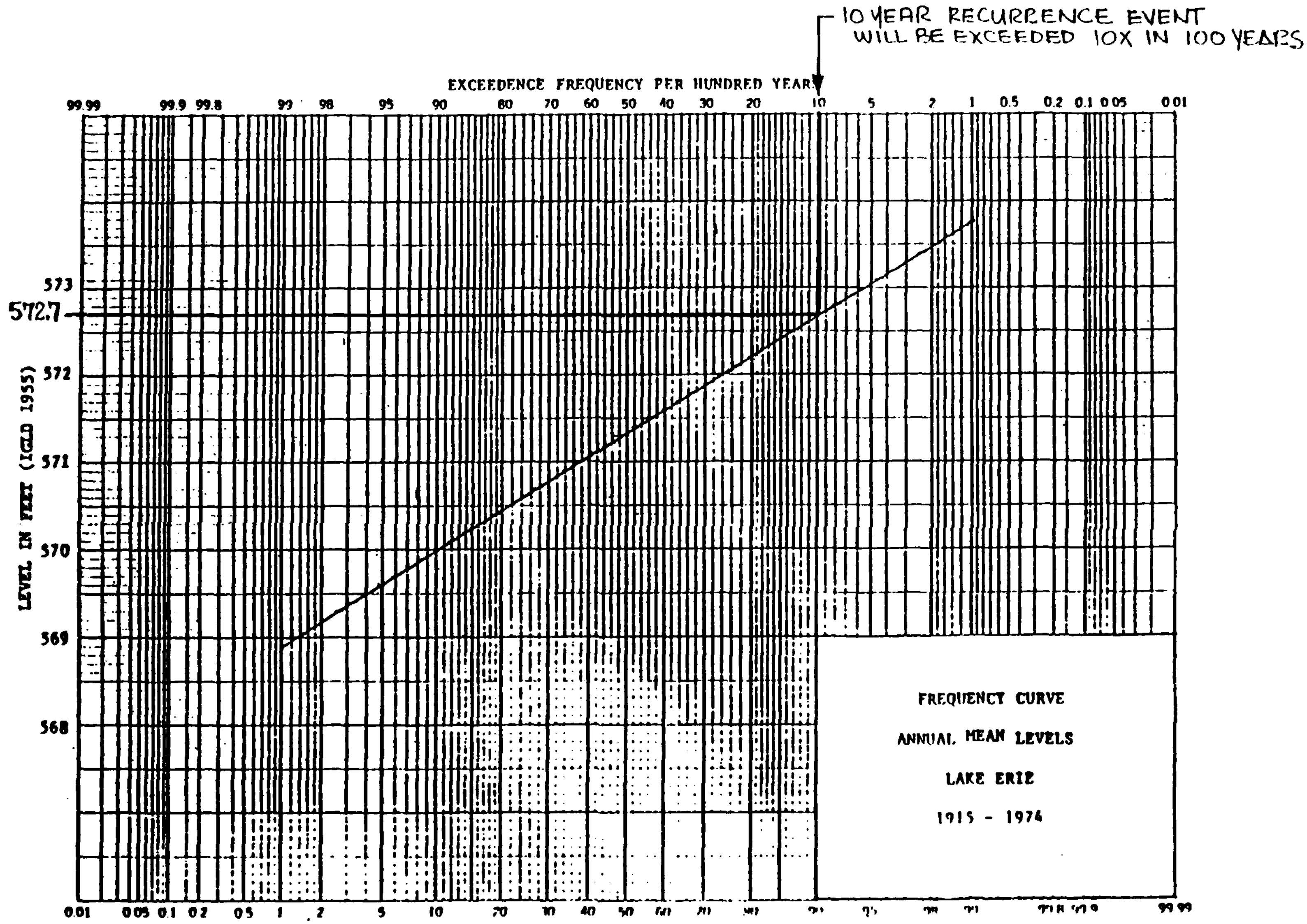

10 YEAR RECURRENCE EVENT
WILL BE EXCEEDED 10X IN 100 YEARS
EXCEEDENCE FREQUENCY PER HUNDRED YEARS
99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
LEVEL IN FEET (IGLD 1955)
573
572.7
572
571
570
569
568
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80
99.99
FREQUENCY CURVE
ANNUAL MEAN LEVELS
LAKE ERIE
1915 - 1974

FIGURE 1

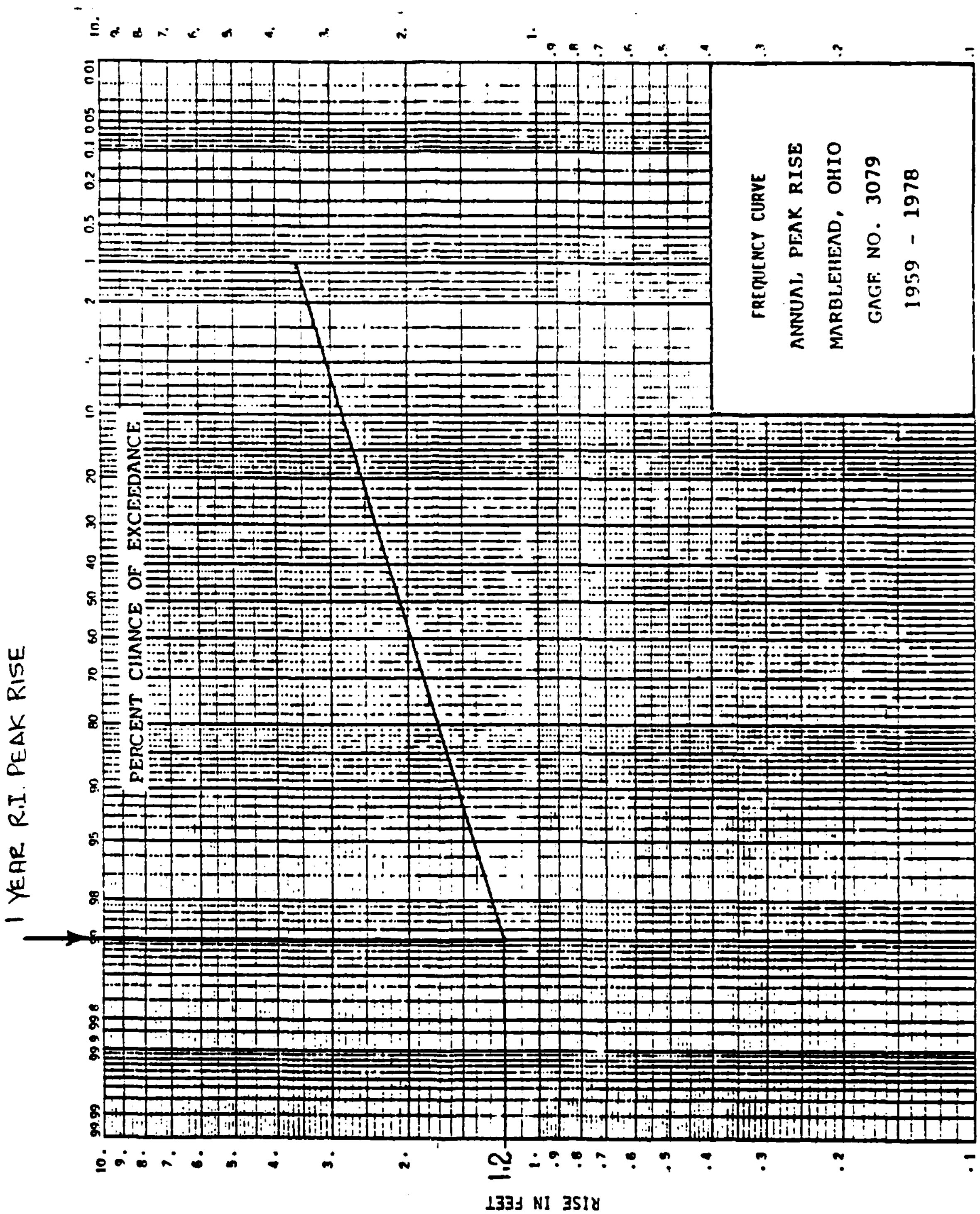
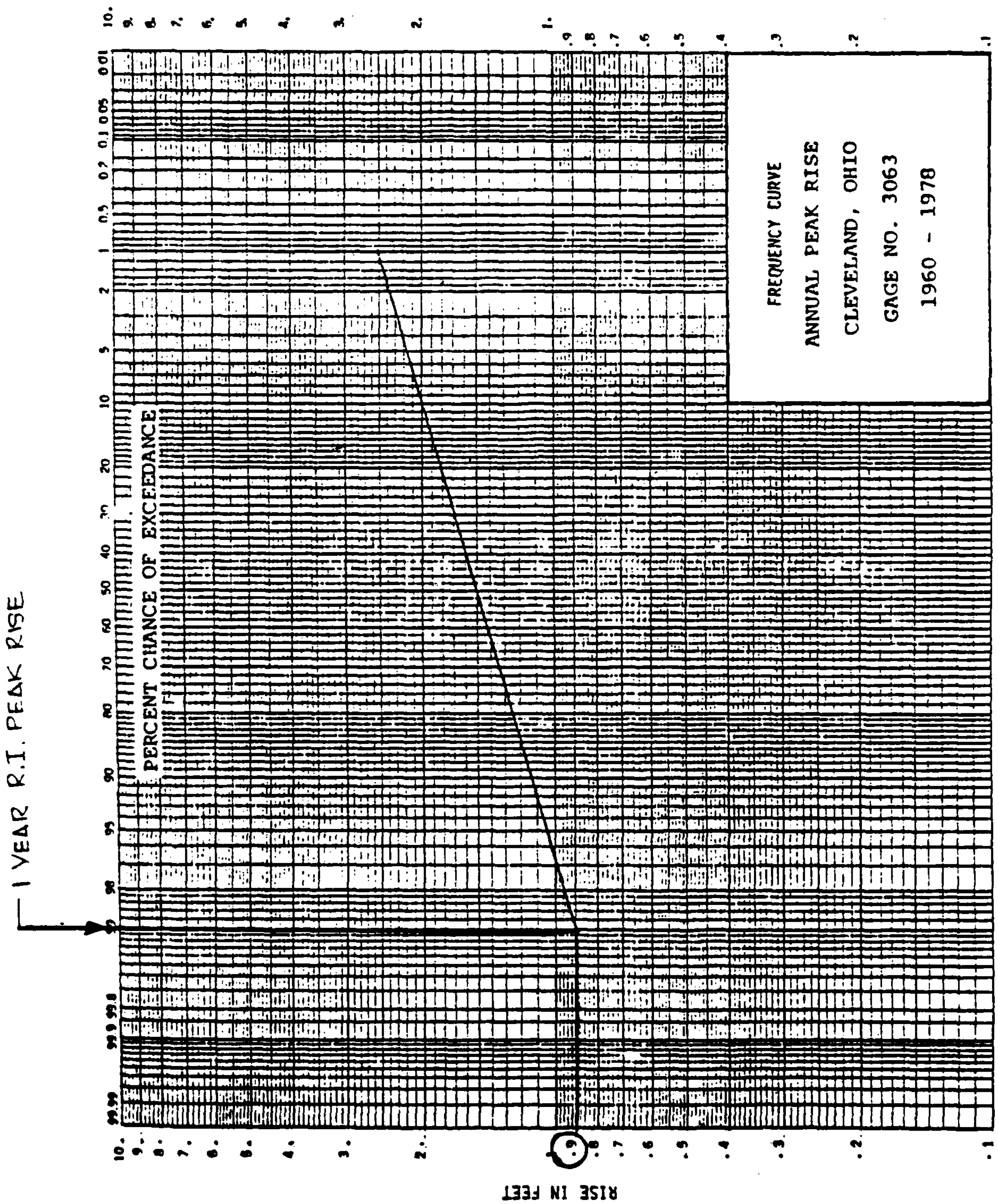

FREQUENCY CURVE
ANNUAL PEAK RISE
MARBLEHEAD, OHIO
GAGE NO. 3079
1959 - 1978
PERCENT CHANCE OF EXCEEDANCE
RISE IN FEET
1 YEAR R.I. PEAK RISE
1.2

FIGURE 2



FREQUENCY CURVE
ANNUAL PEAK RISE
CLEVELAND, OHIO
GAGE NO. 3063
1960 - 1978
PERCENT CHANCE OF EXCEEDANCE
RISE IN FEET
1 YEAR R.I. PEAK RISE

FIGURE 3

SECTION 3

LORAIN SMALL-BOAT HARBOR - WAVE ANALYSIS

Possible sources of waves occurring at the small-boat harbor site which need to be studies for design are:

1. Wind waves generated within the limits of the outer harbor navigation structures;

2. Wave overtopping of the outer breakwater navigation structures and reforming within the harbor;

3. Deep water waves diffracted at the harbor entrance;

4. Ship generated waves within the harbor; and

5. Reflected waves within the harbor.

DESIGN DEEPWATER WAVES

The 20 year recurrence event is determined using publication TR H-76-1 "Design Wave Information for the Great Lakes - Report 1 - Lake Erie" by Waterways Experimental Station, January 1976.

From the table of extreme estimates for Grid Point 8 -Lorain, OH (reproduced on Figure 4), the 20 year R.I. waves and associated periods (Table 1 and 2) are:

	APPROACH CLASS 1		APPROACH Class 2		APPROACH CLASS 3	
SEASON	Ho	To	Ho	To	Ho	To
Winter	9.8	7.4	10.8	7.5	10.5	8.1
Spring	4.6	5.6	5.9	6.0	7.5	6.9
Summer	6.2	6.2	4.6	5.5	8.2	7.2
Fall	9.2	7.2	9.5	7.1	9.8	7.8
DIRECTION	N thru ENE		WNW thru N		WS thru WNW	

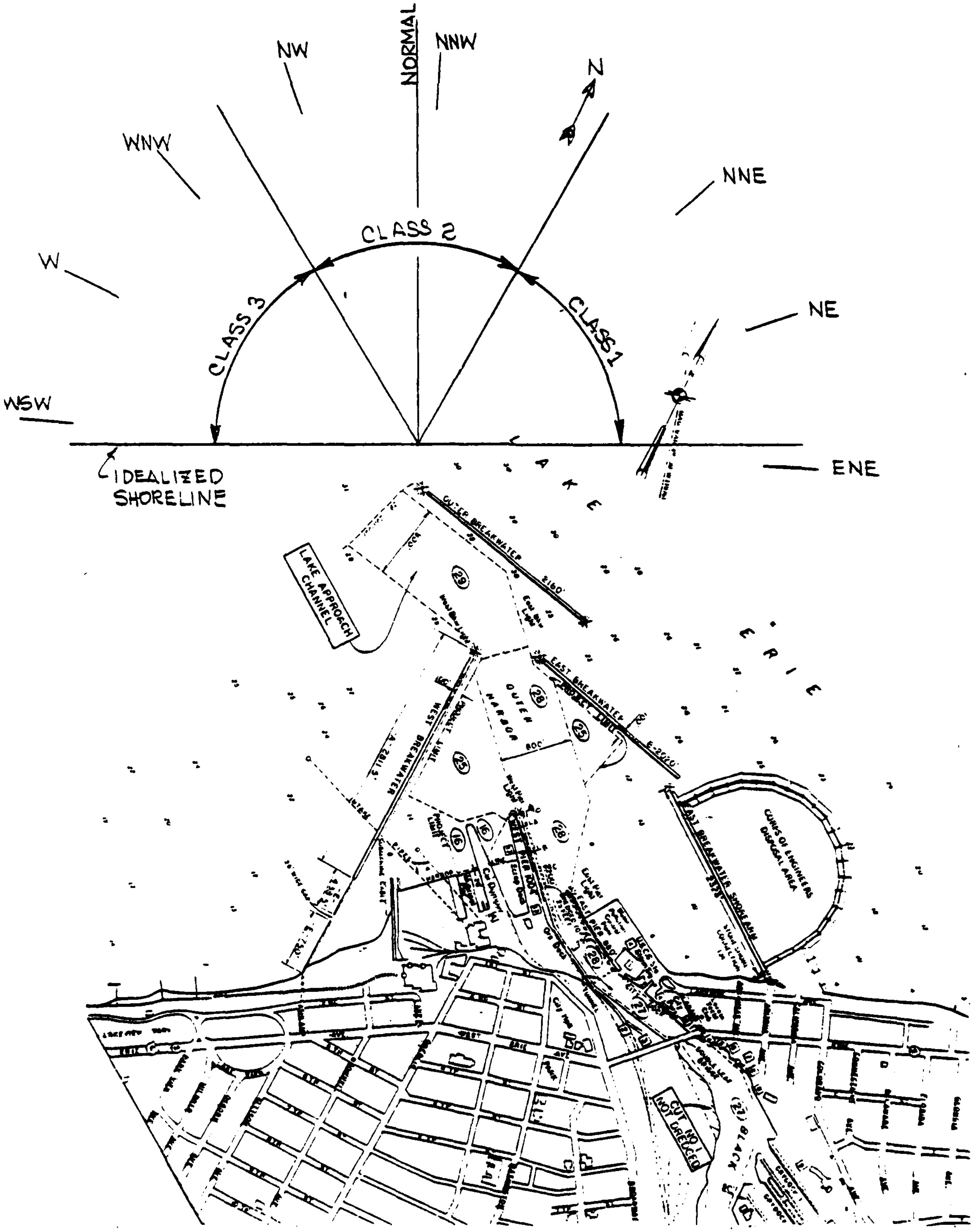

NORMAL
NW
NNW
N
WNW
NNE
CLASS 2
W
CLASS 3
CLASS 1
NE
WSW
ENE
IDEALIZED SHORELINE
LAKE ERIE
LAKE APPROACH CHANNEL
OUTER BREAKWATER
EAST BREAKWATER
WEST BREAKWATER
OUTER HARBOR
CORPS OF ENGINEERS DISPOSAL AREA
CUT NO 1 NOT DREDGED
BLACK

FIGURE 4

TABLE 1

TABLE OF EXTREMES ESTIMATES
GRID LOCATION 11, 8 LAT=41.57 LON=82.12 LORAIN OH
SHORELINE GRID POINT 8

WINTER

	ANGLE CLASSES 1	2	3	ALL
5	7.2(0.6)	8.9(0.4)	9.5(0.2)	10.3(0.6)
10	8.5(0.7)	9.8(0.5)	9.8(0.2)	10.9(0.8)
20	9.8(0.9)	10.8(0.7)	10.5(0.3)	11.7(1.0)
50	11.8(1.1)	12.1(0.8)	10.8(0.3)	13.2(1.2)
100	13.1(1.3)	13.1(0.9)	11.2(0.4)	14.3(1.4)

SPRING

	ANGLE CLASSES 1	2	3	ALL
5	3.6(0.3)	3.6(0.5)	5.9(0.4)	6.1(0.5)
10	3.9(0.4)	4.6(0.7)	6.9(0.5)	7.2(0.7)
20	4.6(0.6)	5.9(0.8)	7.5(0.6)	8.2(0.9)
50	5.9(0.7)	7.5(1.0)	8.9(0.8)	9.6(1.1)
100	6.6(0.8)	8.9(1.2)	9.8(0.9)	10.7(1.2)

SUMMER

	ANGLE CLASSES 1	2	3	ALL
5	3.6(1.3)	3.6(0.7)	5.9(1.2)	6.3(1.3)
10	4.9(1.7)	4.3(1.0)	7.2(1.6)	7.6(1.8)
20	6.2(2.1)	4.6(1.2)	8.2(1.9)	8.9(2.2)
50	8.2(2.6)	5.6(1.5)	9.8(2.4)	10.6(2.8)
100	9.5(3.0)	6.2(1.8)	11.2(2.8)	11.9(3.2)

FALL

	ANGLE CLASSES 1	2	3	ALL
5	7.9(0.3)	7.5(0.4)	8.9(0.2)	9.4(0.4)
10	8.5(0.4)	8.5(0.5)	9.5(0.3)	10.0(0.6)
20	9.2(0.5)	9.5(0.7)	9.8(0.4)	10.8(0.7)
50	10.2(0.6)	10.8(0.8)	10.8(0.5)	11.8(0.9)
100	10.8(0.7)	11.8(0.9)	11.2(0.5)	12.5(1.0)

TABLE 2

GRID LOCATION 11, 8 LAT=41.57 LON=82.12 LORAIN OH

GRID POINT NUMBER 8

SIGNIFICANT PERIOD BY ANGLE CLASS AND WAVE HEIGHT

WAVE HEIGHT (FT)	ANGLE CLASS 1	2	3
1	2.3	2.3	2.4
2	3.6	3.5	3.7
3	4.5	4.5	4.7
4	5.3	5.2	5.4
5	5.8	5.7	6.0
6	6.1	6.0	6.4
7	6.5	6.3	6.7
8	6.8	6.6	7.1
9	7.1	6.9	7.5
10	7.5	7.3	7.9
11	7.8	7.6	8.2
12	8.1	7.9	8.6
13	8.4	8.2	9.0
14	8.8	8.5	9.3
15	9.1	8.8	9.7
16	9.4	9.1	10.1
17	9.8	9.4	10.4
18	10.1	9.7	10.8
19	10.4	10.0	11.2
20	10.8	10.3	11.6
21	11.1	10.7	11.9
22	11.4	11.0	12.3
23	11.7	11.3	12.7
24	12.1	11.6	13.0
25	12.4	11.9	13.4

Design Deepwater Wave (Ho)

The stone size for the protective marina breakwaters are designed to withstand the maximum 20 year recurrence wave, regardless of season. Therefore:

Class 1:Ho = 9.8'; To = 7.4 sec.

Class 2:Ho = 10.8'; To = 7.5 sec.

Class 3:Ho = 10.5'; To = 8.1 sec.

The crest heights for the entrance structures are designed to allow overtopping which would generate a maximum interior wave of 3.0 feet in the entrance channel. The crest heights of marina protective structures are designed to allow no more than a 1.0 foot high transmitted wave in the mooring area. Since the interior wave is only of concern during the boating season, the maximum waves which have a 20 year recurrence during the spring, summer, or fall are used for crest height analysis. These are:

Class 1:Ho = 9.2'; To = 7.2 sec.

Class 2:Ho = 9.5'; To = 7.1 sec.

Class 3:Ho = 9.8'; To = 7.8 sec.

In both cases, the design deepwater wave, Ho, must be refracted, diffracted, and shoaled past the outer harbor entrance structures to points at the locations of the marina protective structures. This process will determine what the design incident wave height, Hi, will be for each structure.

Wind Generated Waves

Reproduced below are Tables 3 and 3A, "Percent Frequency of Wind Direction by Speed and Hour," from Summary of Synoptic Meteorological Observations for Great Lakes Areas, Volume 1 - Lake Ontario and Lake Erie, N.O.A.A. Environmental Data Service, National Climatic Center, January 1975.

This is data taken from ships' observations for the western portion of Lake Erie over the period of record - 1960 thru 1973.

TABLE 3

PERCENTAGE FREQUENCY OF WIND DIRECTION BY SPEED AND BY HOUR

WIND DIR	WIND SPEED (KNOTS) 0-3	4-10	11-21	22-33	34-47	48+	TOTAL OBS	PCT FREQ	MEAN SPD	HOUR (GMT) 00	03	06	09	12	15	18	21
N	.4	2.7	4.6	1.6	.1	*		9.5	14.9	8.4	10.8	10.7	9.9	12.3	8.9	6.7	7.1
NE	.3	2.9	4.6	1.3	.2	*		9.3	14.3	8.5	8.5	9.1	7.6	9.8	6.3	10.3	10.5
E	.4	3.4	5.3	1.1	.1	*		10.3	13.6	14.3	11.8	8.8	7.2	7.9	10.9	9.7	13.0
SE	.4	3.9	4.7	.7	.1	*		9.8	12.1	11.6	14.7	9.5	11.1	9.1	8.8	7.8	13.7
S	.4	4.7	8.4	2.5	.1	.0		16.2	14.5	14.7	18.5	19.2	18.1	15.6	16.2	14.9	17.1
SW	.3	4.0	9.9	4.3	.3	*		19.7	16.6	18.5	12.1	18.6	23.7	19.8	19.5	22.9	21.1
W	.4	3.3	5.8	3.5	.7	*		13.8	16.8	13.4	10.2	11.6	11.1	12.6	14.8	17.4	13.3
NW	.4	2.6	4.9	2.7	.4	*		10.9	15.8	10.2	12.6	12.1	11.3	12.3	11.0	9.3	8.7
VAR	.0	.0	.0	.0	.0	.0		.0	.0	.0	.0	.0	.0	.0	.0	.0	.3
CALM	.7							.7	.0	.6	.7	.4	.8	.7	1.5	.9	1.1
TOT OBS							19882		15.1	6123	843	6459	452	6002	988	4429	580
TOT PCT	3.8	28.1	48.1	17.7	2.3	.1		100.0		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 3A

WIND DIR	WIND SPEED (KNOTS) 0-6	7-16	17-27	28-40	41+	TOTAL OBS	PCT FREQ	MEAN SPD	HOUR (GMT) 00 03	06 09	12 15	18 21
N	1.5	4.4	3.1	.6	*		9.5	14.9	8.8	10.6	11.7	6.8
NE	1.3	3.0	2.5	.4	.1		9.3	14.3	8.6	8.9	9.5	10.3
E	1.5	5.7	2.7	.3	.1		10.3	13.6	13.9	8.6	8.5	10.1
SE	1.7	6.2	1.7	.2	*		9.8	12.1	12.2	9.7	9.0	8.5
S	1.8	8.6	5.0	.7	*		16.2	14.5	15.3	19.2	15.6	14.7
SW	1.7	9.2	6.8	1.9	.1		19.7	16.6	17.6	19.1	19.6	22.7
W	1.6	5.4	4.5	1.9	.2		13.6	16.6	12.8	11.5	13.1	16.9
NW	1.3	4.5	4.0	1.0	.1		10.9	15.8	10.6	12.0	12.0	9.2
VAR	.0	.0	.0	.0	.0		.0	.0	.0	.0	.0	.0
CALM	.7						.7	.0	.6	.6	.9	.9
TOT OBS						19882		15.1	4986	4911	4990	5015
TOT PCT	13.2	48.9	30.3	7.0	.6		100.0		100.0	100.0	100.0	100.0

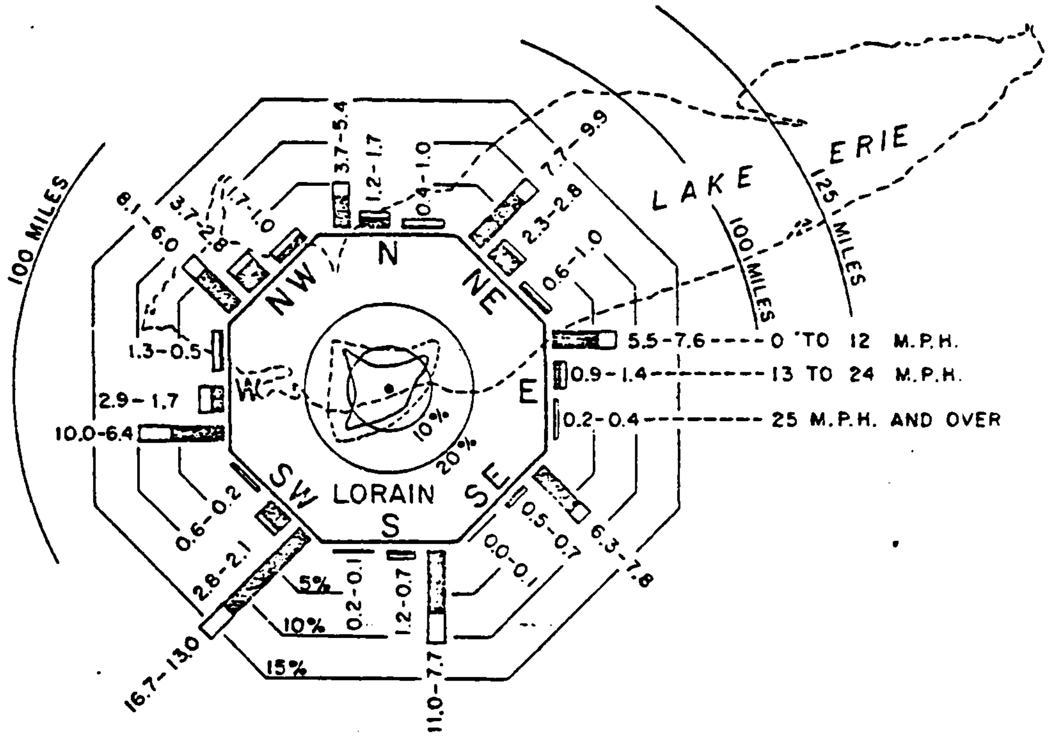
This data provides an indication of maximum observed wind speed (48 knots) for this area which includes Lorain as well as a breakdown of wind speed vs. direction for the 19,882 observatrions made over the period of record. A wind diagram for Lorain Harbor is shown in Figure 5.

Data from SSMO observations for western Lake Erie have been presented in the Design Winds section. This data shows that for the period 1960 thru 1973:

0.6 Percent of the total observations exceeded 41 knots with 0.1% from NE, E, SW & NE; 0.2% from W and fractions between 0 and 0.05% from N, SE & S.

0.1 Percent of the total observations exceeded 48 knots with all directions (except S with 0.0%) showing fractions between 0 and 0.05% to total this 0.1%.

In Stanley's 1970 report on "Recreational Boating and Commercial Docking Facilities Lorain, Ohio", it was stated that records at Cleveland, Ohio for the period 1936 to 1946 show that 11 storms exceeded 18 hours duration at velocities greatr than 29 mph. Peak recorded wind velocities during these storms were 55 mph (48 knots).



WIND DIAGRAM FOR LORAIN HARBOR, OHIO

NOTES

INDICATES DURATION FOR ICE-FREE PERIOD (MAR. TO DEC. INCL.) IN PERCENT OF TOTAL DURATION.

INDICATES DURATION FOR ICE PERIOD (JAN. TO FEB. INCL.) IN PERCENT OF TOTAL DURATION.

INDICATES PERCENT OF TOTAL WIND MOVEMENT OCCURRING DURING ICE-FREE PERIOD.

INDICATES PERCENT OF TOTAL WIND MOVEMENT OCCURRING DURING COMBINED ICE AND ICE-FREE PERIODS.

FIGURES AT ENDS OF BARS INDICATE PERCENT OF TOTAL WIND DURATION FOR ICE-FREE PERIOD AND COMBINED ICE-FREE AND ICE PERIODS, RESPECTIVELY.

WIND DATA BASED ON RECORDS OF THE U.S. COAST GUARD AT LORAIN HARBOR, OHIO FOR PERIOD 1 JAN. 1938-31 DEC. 1971

FIGURE 5

It seems reasonable to assume from these two data sources that a wind speed of 55 mph would be a conservative approximation for use in wind wave generation within Lorain Harbor.

The method used to calculate wind generated waves was taken from "The Shore Protection Manual", 1977 edition, Section 3.6, Wave Forecasting for Shallow Water.

Assumptions used in this analysis were:

1. The fetch length was assumed by measuring the longest over water distances withn the harbor to a marina protective structure (see Figures 6 thru 9).

2. To determine effective fetches, the method of as presented in SPM Section 3.432 was used for rectangular fetches.

3. A bottom friction factor of 0.01 for a smooth sandy bottom was assumed.

4. Wind speed of 55 mph was used regardless of direction (except south).

5. An unlimited duration was assumed for maximum wave approximations.

6. Forecasting curves for shallow water waves from SPM Section 3.6 were used for specific water depths or interpolation was done. Resultingwaveheights were found to be about 20% higher than those predicted by CETN-I-6, March 1981.

ALTERNATIVE 1

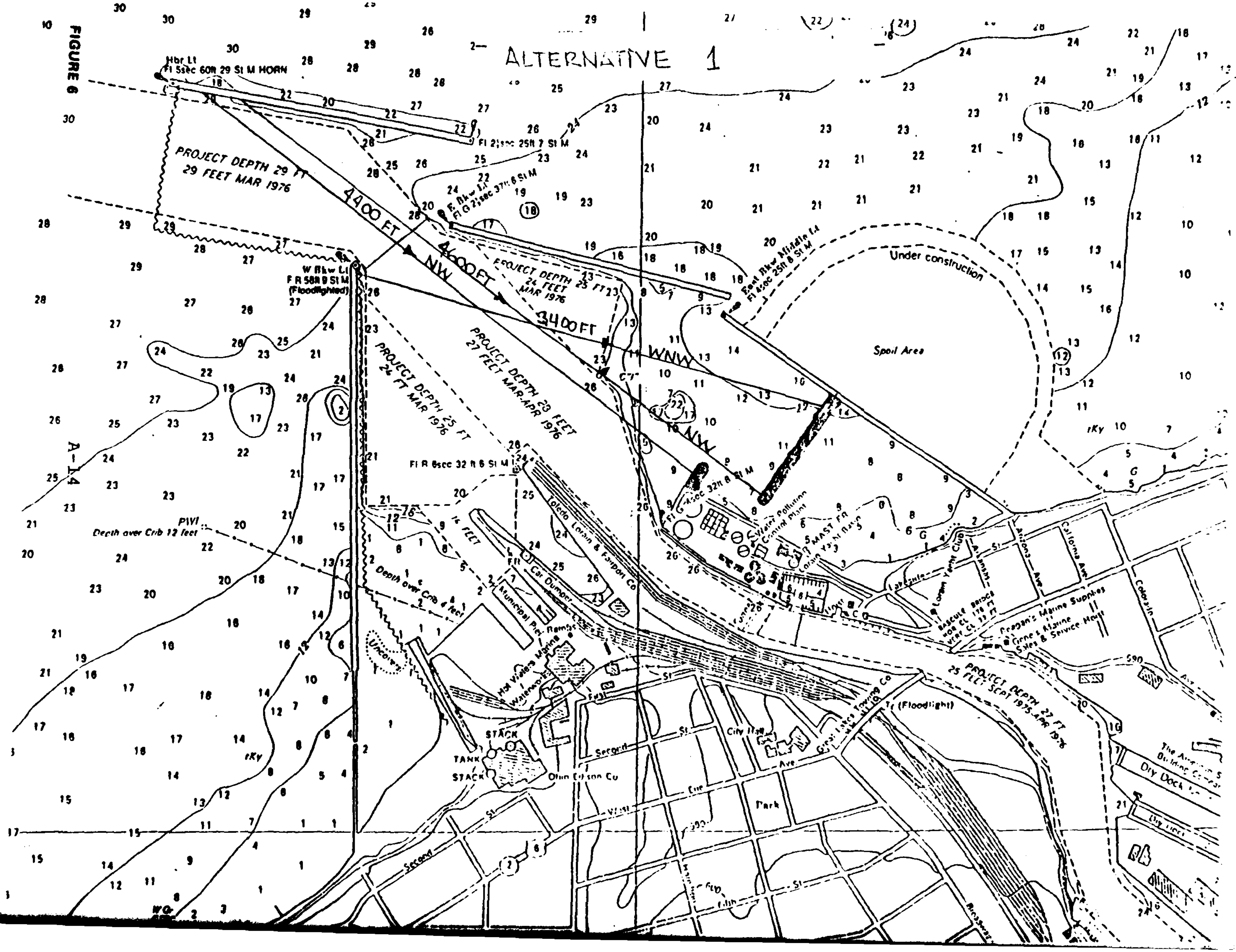


FIGURE 6

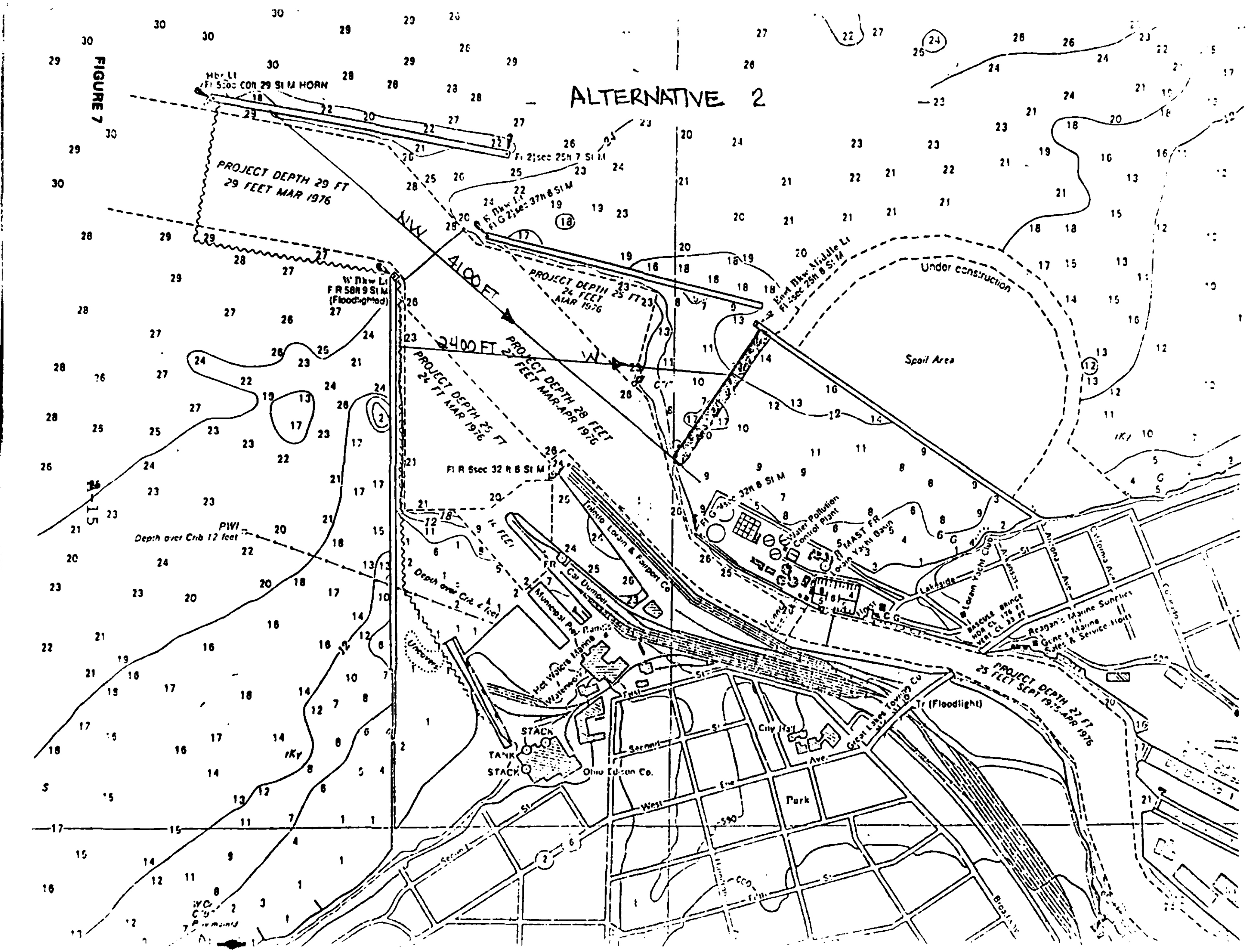

ALTERNATIVE 2
PROJECT DEPTH 29 FT
29 FEET MAR 1976
Hbr Lt
Fl 5sec 60ft 29 St M HORN
Fl 2¼sec 25ft 7 St M
E Bkw Lt
Fl G 2½sec 37ft 8 St M
W Bkw Lt
F R 58ft 9 St M
(Floodlighted)
NW
4100 FT
2400 FT
PROJECT DEPTH 25 FT
24 FEET
MAR 1976
PROJECT DEPTH 28 FEET
27 FEET MAR-APR 1976
PROJECT DEPTH 25 FT
24 FT MAR 1976
East Bkw Middle Lt
Fl 4sec 25ft 8 St M
Under construction
Spoil Area
Fl R 6sec 32 ft 8 St M
Fl G 4sec 32ft 8 St M
Water Pollution
Control Plant
MAST FR
Lorain Yacht Basin
Lorain Yacht Club
Lakeside
Toledo Lorain & Fairport Co
Car Dumper
Municipal Pier
Hot Waters Marina
Uncovers
Depth over Crib 4 feet
Depth over Crib 12 feet
PWI
STACK
TANK
STACK
Ohio Edison Co.
First St
Second St
West Erie Ave.
Park
City Hall
Great Lakes Towing Co
Tr (Floodlight)
BASCULE BRIDGE
HOR CL 176 FT
VERT CL 33 FT
Reagan's Marine Supplies
Gene's Marine
Sales & Service Hoist
PROJECT DEPTH 27 FT
25 FEET SEPT 1975-APR 1976
Arkansas St
Arizona Ave
California Ave
Broadway

FIGURE 7

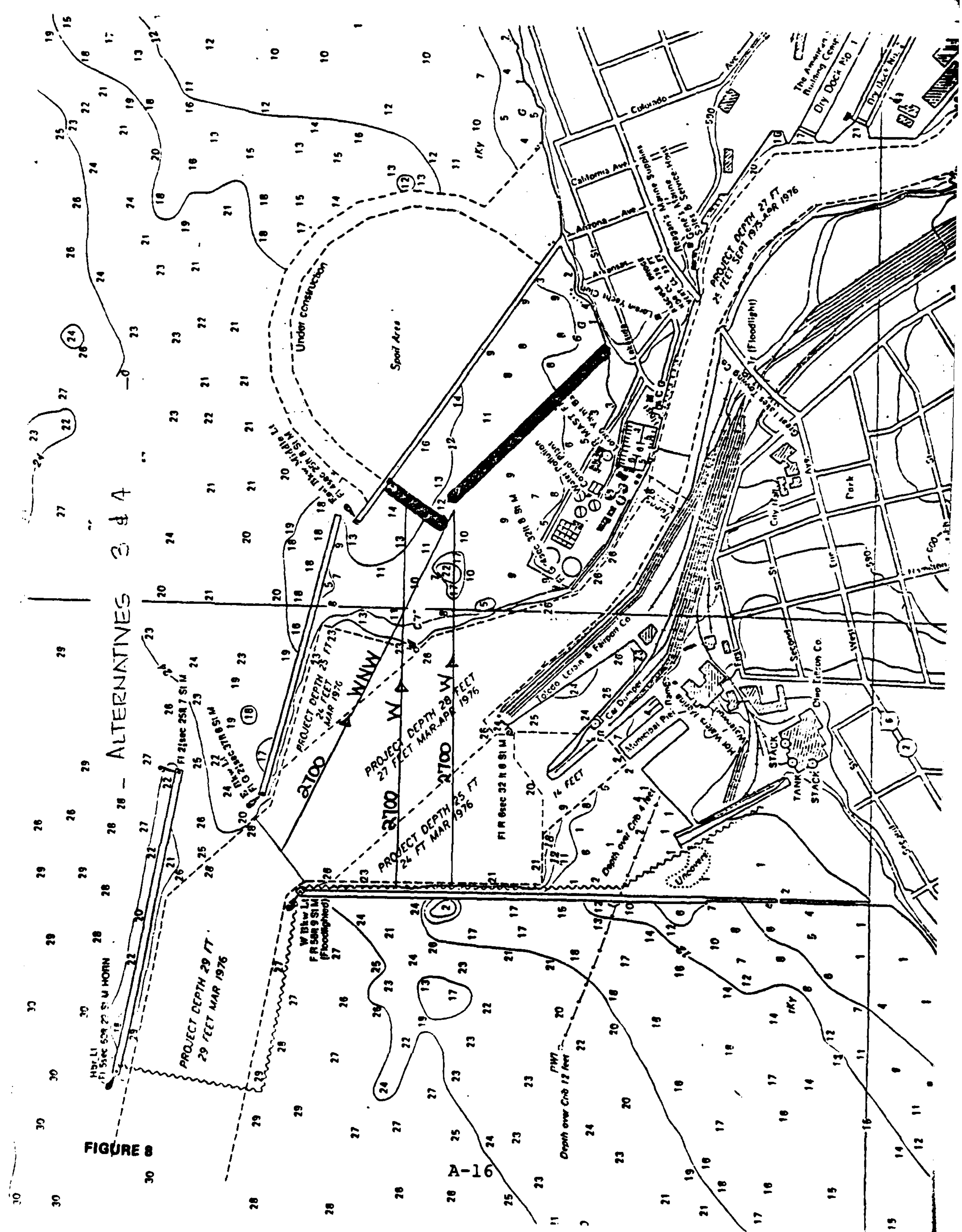

ALTERNATIVES 3 & 4
PROJECT DEPTH 29 FT 29 FEET MAR 1976
PROJECT DEPTH 25 FT 24 FT MAR 1976
PROJECT DEPTH 28 FEET 27 FEET MAR-APR 1976
PROJECT DEPTH 23 FT 24 FEET MAR 1976
PROJECT DEPTH 27 FT FEET SEPT 1975-APR 1976
Spoil Area
Under construction
Toledo Lorain & Fairport Co
Car Dumper
Municipal Pier
Edison Co
STACK
TANK
Park
City Hall
Depth over Crib 12 feet
Depth over Crib 4 feet
Uncovers

FIGURE 8

ALTERNATIVE 5

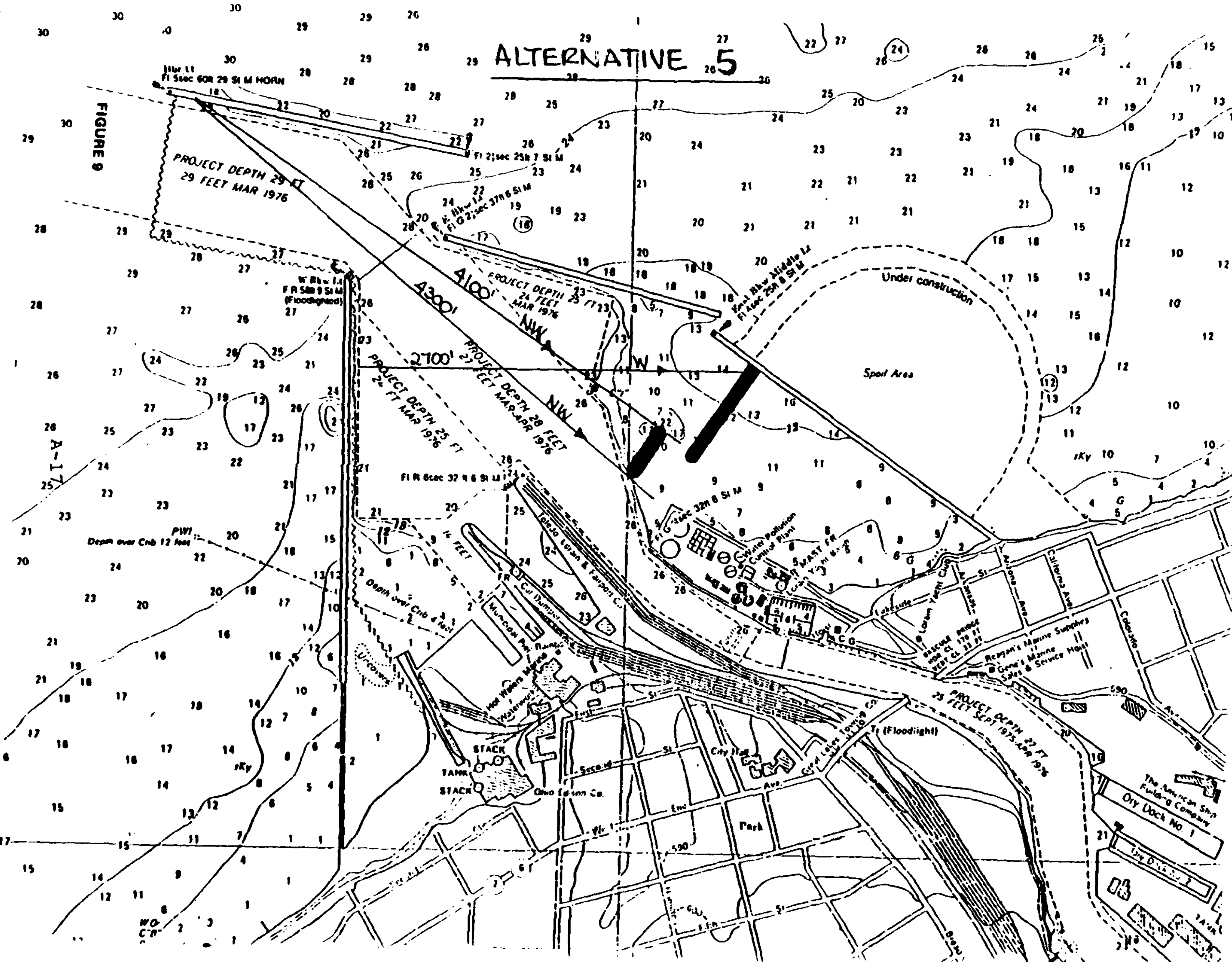


FIGURE 9

ALTERNATIVE NUMBER		STRUCTURE AFFECTED	FETCH LENGTH (FT)	FETCH WIDTH (FT)	FE (FT)	AVERAGE DEPTH (FT)	WAVE HEIGHT (FT)	WAVE PERIOD (FT)
1	NW	Breakwater	4600	600	1450	22	1.6	2.3
1	NW	Entrance	4400	600	1430	22	1.5	2.3
1	NW	Spur	4400	600	1430	26	1.5	2.3
1	WNW	Breakwater	3400	1000	1735	20	1.7	2.4
2	NW	Breakwater	3900	600	1365	29	1.6	2.3
2	NW	Entrance	4100	600	1400	28	1.6	2.3
2	W	Breakwater	2400	1400	1740	23	1.7	2.4
3&4	WNW	Breakwater	2500	600	1125	21	1.4	2.1
3&4	WNW	Entrance	2700	600	1175	21	1.4	2.1
3&4	W	Breakwater	2700	1400	1850	21	1.7	2.4
3&4	W	Entrance	2700	600	1175	21	1.4	2.1
5	NW	East Entrance	4100	600	1400	25	1.5	2.3
5	NW	Main Breakwater	4200	600	1410	25	1.5	2.3
5	NW	Det. Breakwater	4000	600	1370	28	1.6	2.3
5	NW	West Entrance	4300	600	1420	28	1.6	2.3
5	NW	Main Breakwater	2700	1400	1550	21	1.7	2.4
Unlimited Width for Range of Values			4400	N/A	N/A	25	2.5	2.9
			2400	N/A	N/A	25	1.9	2.6

Wave Overtopping Outer Breakwater

References to possible incidence of wave overtopping have been found in the following reports:

TR 2-628 "Detached Breakwater and Improved Navigation Entrance Lorain Harbor, Lorain, Ohio" U.S. Army Engineer Waterways Experiment Station, June 1963.

Plan 5A was adopted as a result of the above investigation per design memorandum No. 6 on the location and orientation of the outer east breakwater. Elements of Plan 5A and 5B appear on the following Figure 10 from TR 2-628. Evidence of overtopping was found during testing of Plans 5A and 5B as shown in Figures 11 and 12. Although these tests were run without the presence of the dike disposal structure (built 1976-1977), they do depict the effects of waves from the directions we wish to study at wave heights and periods similar to our design conditions.

Test waves approaching the east breakwater from N 22-1/2° W (our Class 2) and N 45° E (our Class 1) were shown overtopping the breakwater; however, "...no evidence has been presented indicating that over-topping...causes navigation difficulties. Also,

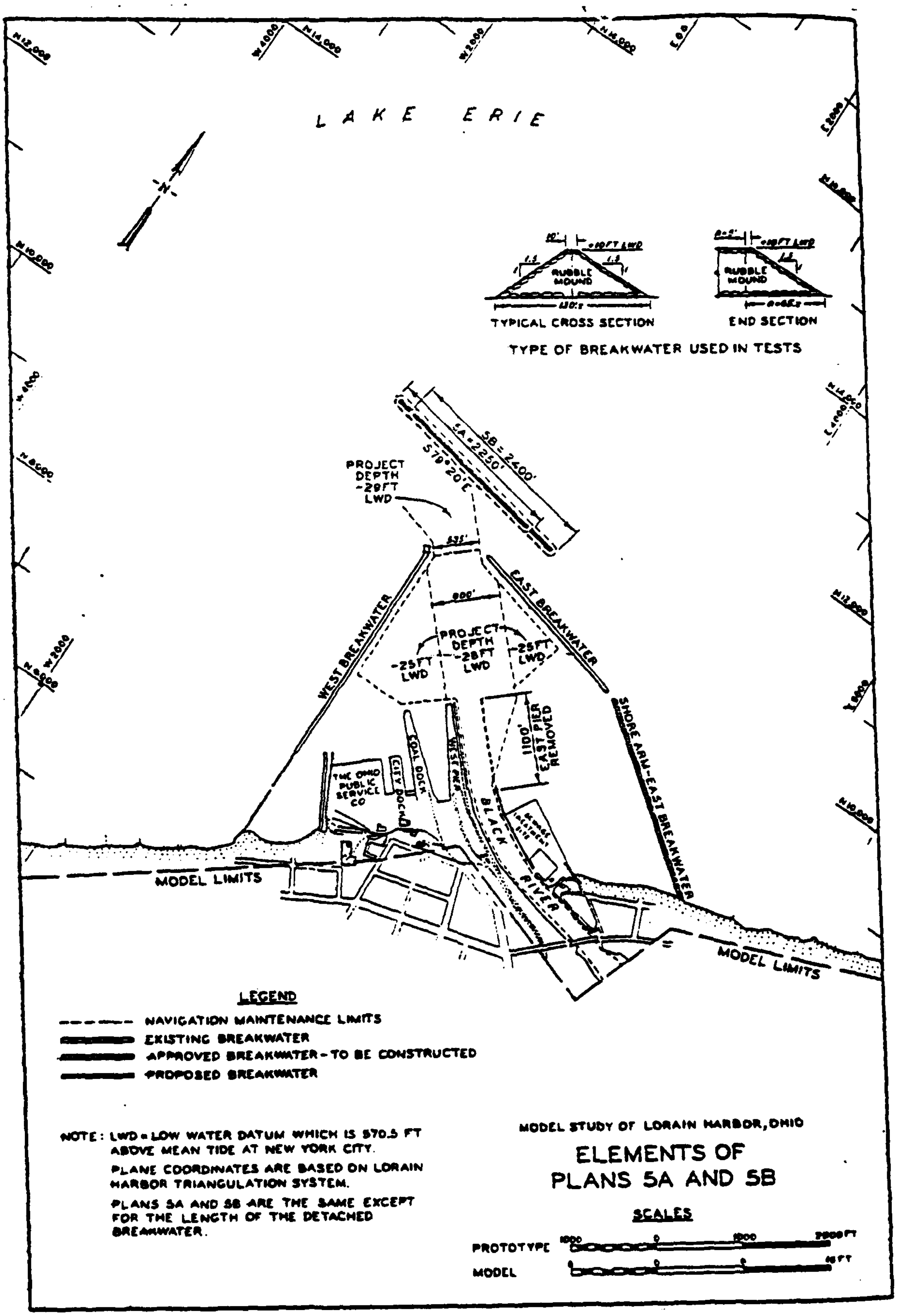
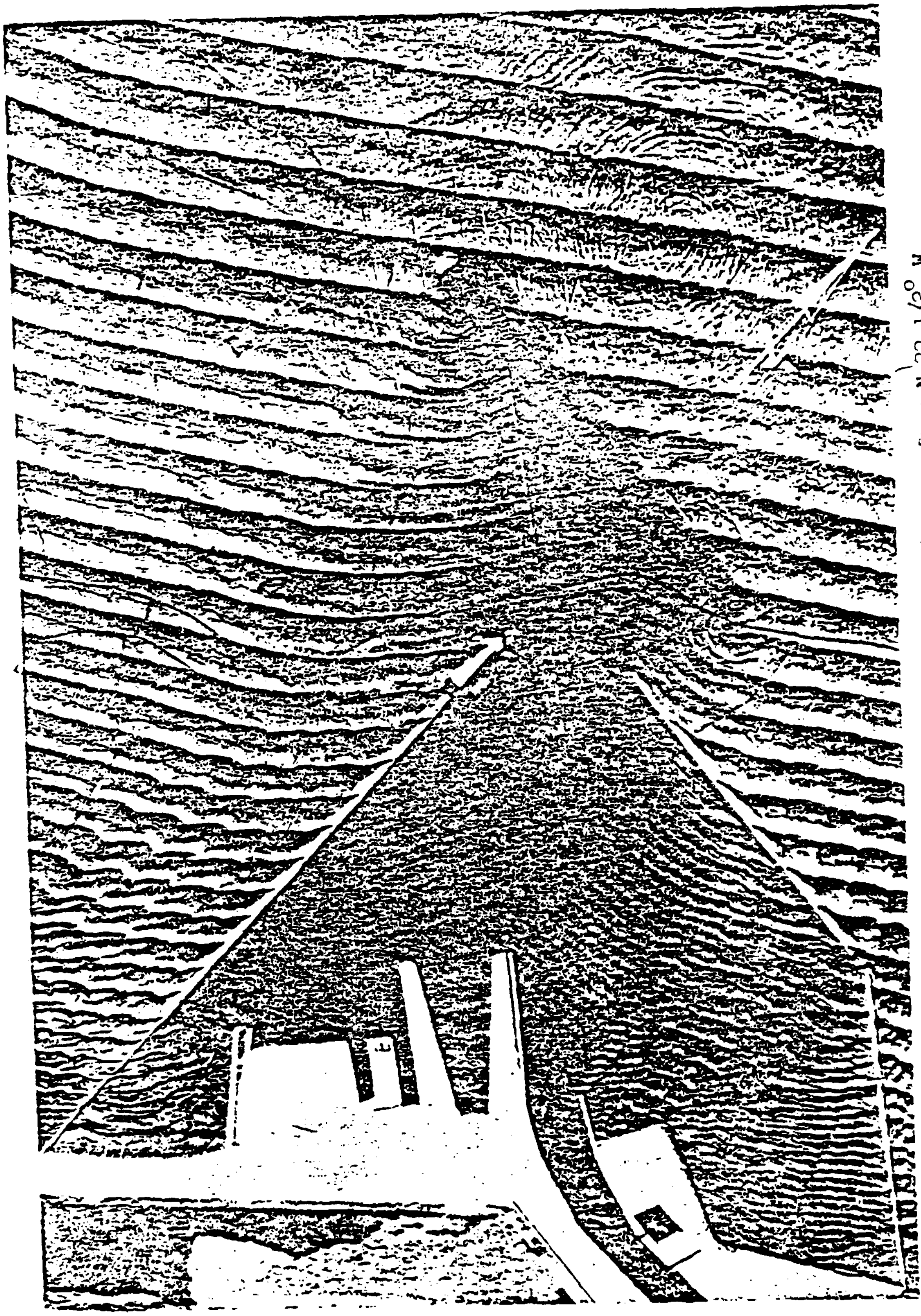


FIGURE 10

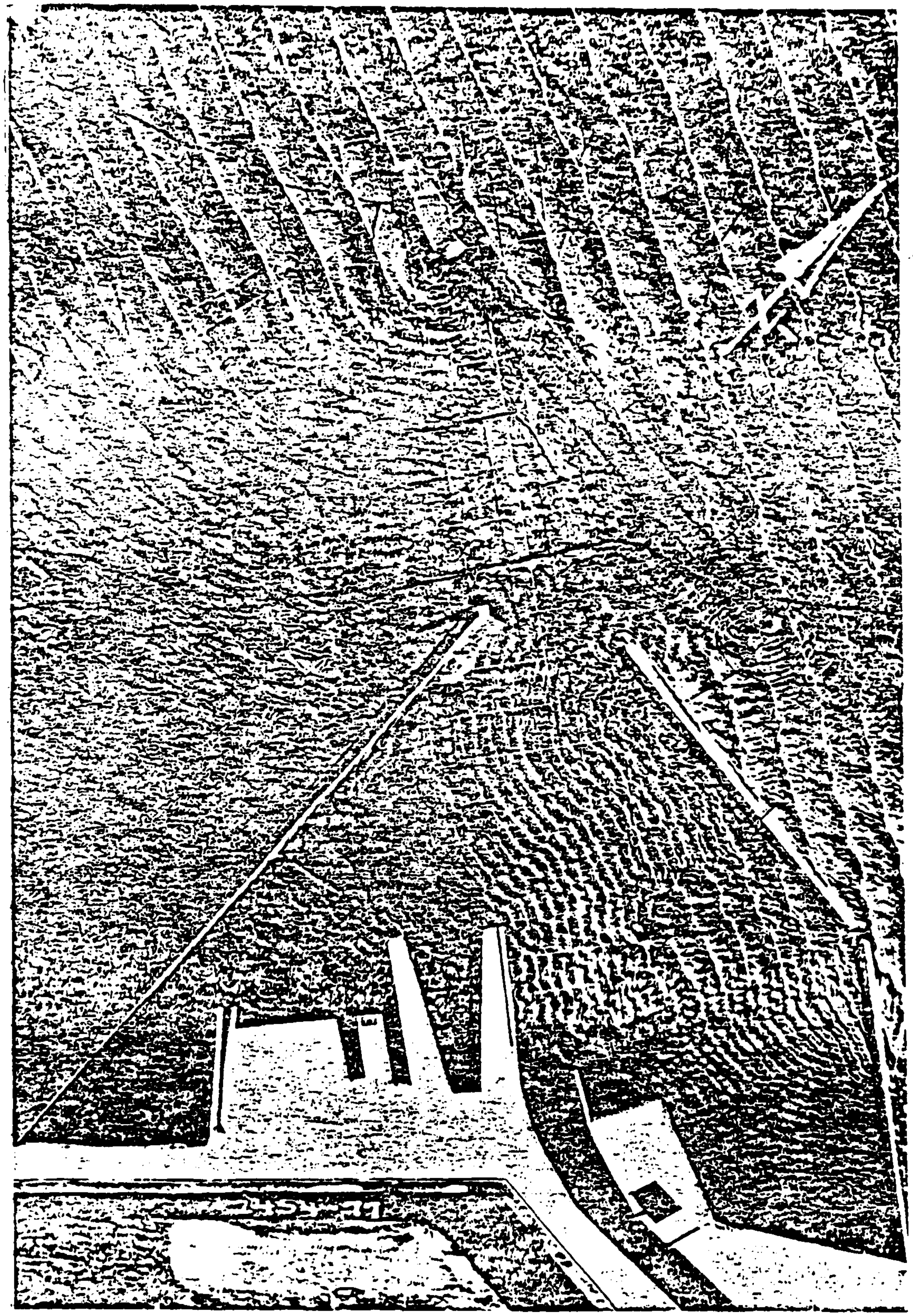
Source: TR2-628



Photograph 11. Plan 5A: 7.5-sec by 11-ft waves from N 22-1/2° W

Source: TRZ-628

FIGURE 11



Photograph A1. Plan 5B: 7.5-sec by 10-ft waves from N 45° E

FIGURE 12

Source: TR2-628

waves of sufficient magnitude to cause serious overtopping of the breakwaters do not occur frequently."

For waves of the magnitude investigated, the overtopping resulted in sufficient residual energy to reform into waves 2 to 3 feet high at Station R-7 along the west pier in the Black River. But, the estimated duration of this occurrence was two hours/year (0.02% of the year).

The "Lorain Marina Feasibility Study", Stanley Consultants, May 1980, treated wave overtopping in the following way:

"Lake waves of 11 to 12 feet height will overtop the existing outer breakwaters wiith sufficient residual energy to reform into waves 1.5 to 2 feet high within the harbor. Reflection and diffraction effects will further reduce their energy. In the proposed basin, wave heights less than 1.5 feet may be anticipated. Waves originating from breakwater overtopping will not cause wave difficulties in the east basin."

On Figures 13 thru 16, each alternative design is shown with an estimate of how reformed waves (after over-topping) might appear in their attack on the marina protective structures. This is a qualitative exercise to determine if navigatin problems will arise in the small-boat harbor entrance due to reformed waves.

These estimates were derived by overlaying the photographs from TR 2-628 onto each alternative layout.

Overtopping waves originating N 45°E:

> The reformed waves will be broadside to vessels entering or exiting the harbor in Alternative 1. The magnitude of the problems will depend upon the wave height but maneuvering will be difficult. Also, these waves in Alternative 1 would tend to push a vessel against the treatment plant bulkhead while at slow speeds in the harbor entrance.
>
> In Alternative 2, reformed waves would be broadside to a vessel approaching the harbor but would pose no problem at the entrance.

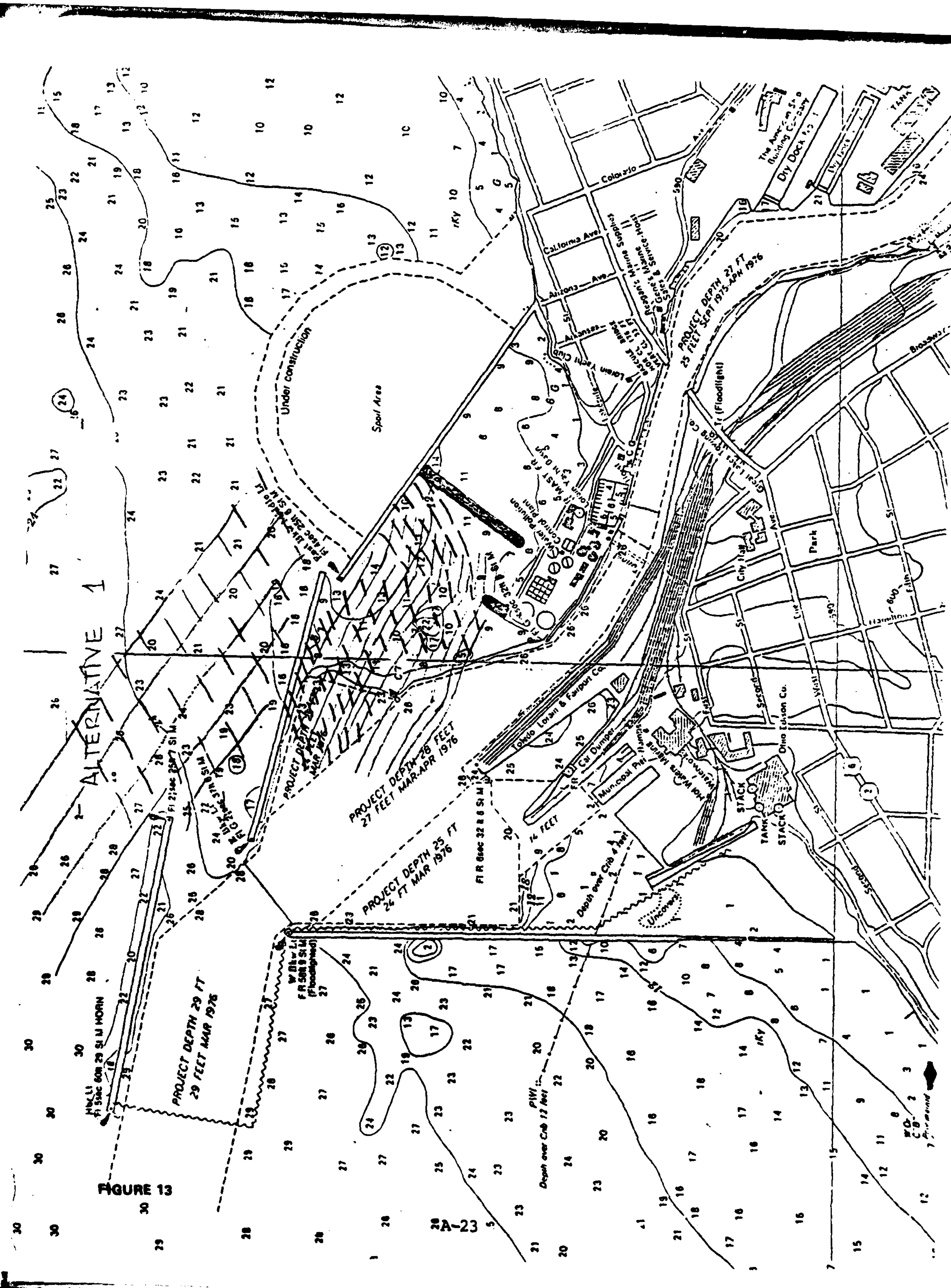

ALTERNATIVE 1
PROJECT DEPTH 29 FT
29 FEET MAR 1976
PROJECT DEPTH 25 FT
24 FT MAR 1976
PROJECT DEPTH 28 FEET
27 FEET MAR-APR 1976
PROJECT DEPTH 27 FT
25 FEET SEPT 1975-APR 1976
Spoil Area
Under construction
Toledo Lorain & Fairport Co
Car Dumper
Municipal Pier
Ohio Edison Co.
City Hall
Park
Dry Dock
Lorain Yacht Club
Colorado
California Ave
Broadway
STACK
TANK
Uncovers

FIGURE 13

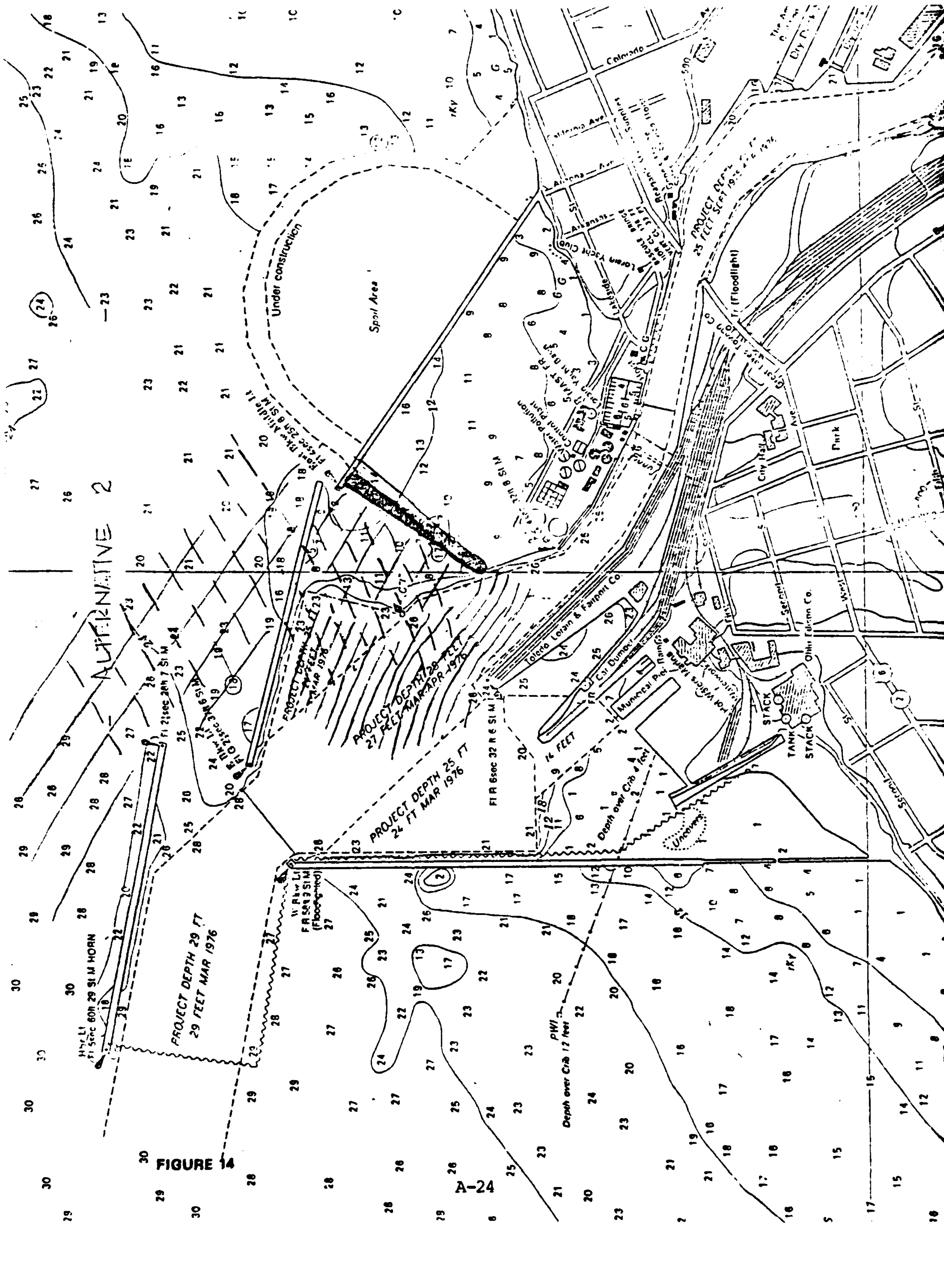

ALTERNATIVE 2
PROJECT DEPTH 29 FT
29 FEET MAR 1976
PROJECT DEPTH 25 FT
24 FT MAR 1976
PROJECT DEPTH 28 FEET
27 FEET MAR-APR 1976
PROJECT DEPTH
25 FEET SEPT
Under construction
Spoil Area
Toledo Lorain & Fairport Co.
Municipal Pier
Ohio Edison Co.
City Hall
Park
Lakeside
Lorain Yacht Club
Water Pollution Control Plant
STACK
TANK
STACK
Tr (Floodlight)
Depth over Crib 12 feet
Depth over Crib 4 feet
Uncovers
16 FEET

FIGURE 14

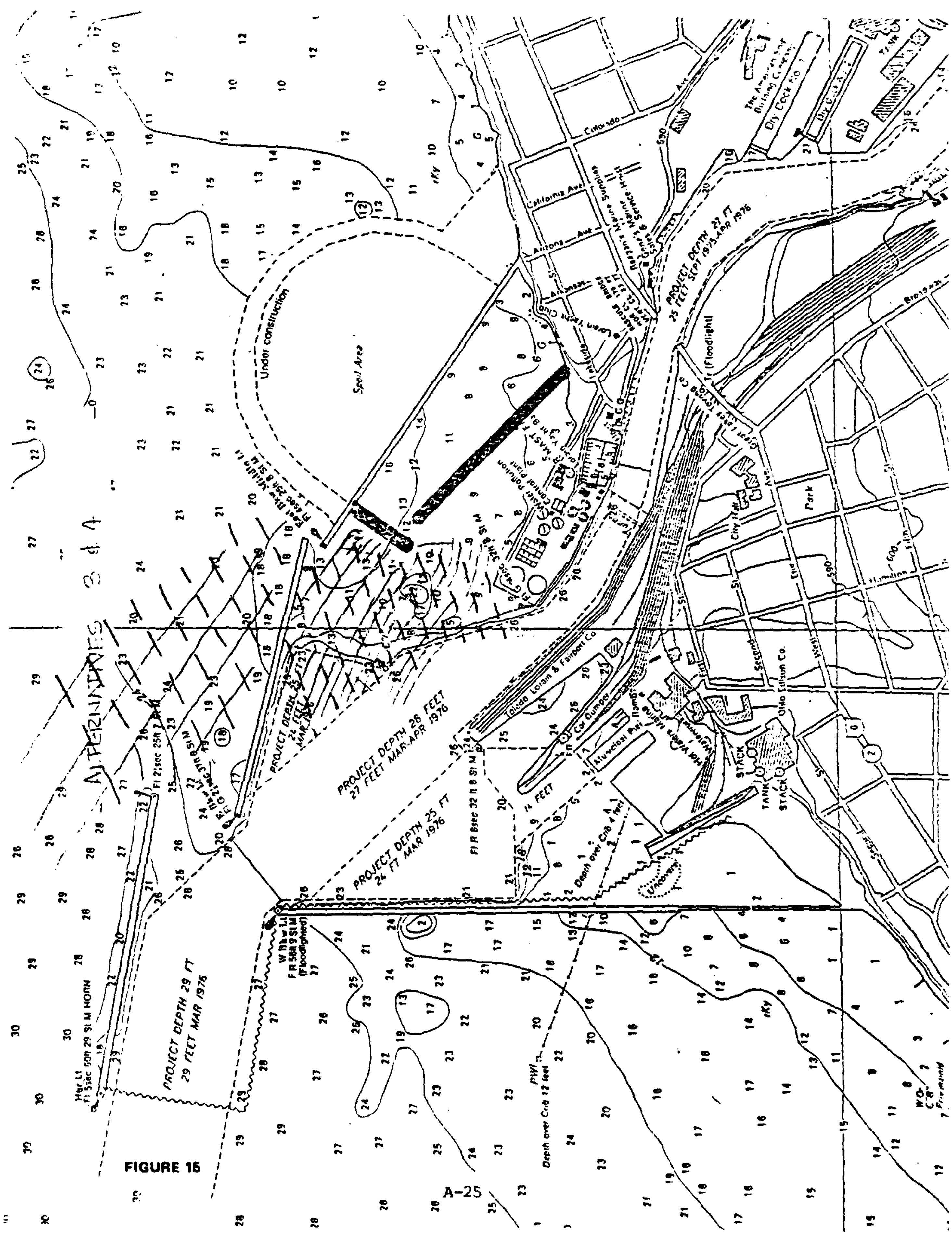

ALTERNATIVES 3 & 4
PROJECT DEPTH 29 FT
29 FEET MAR 1976
PROJECT DEPTH 25 FT
24 FT MAR 1976
PROJECT DEPTH 28 FEET
27 FEET MAR-APR 1976
PROJECT DEPTH 27 FT
25 FEET SEPT 1975-APR 1976
Spoil Area
Under construction
Toledo Lorain & Fairport Co
Ohio Edison Co.
City Hall
Park
STACK
TANK

FIGURE 15

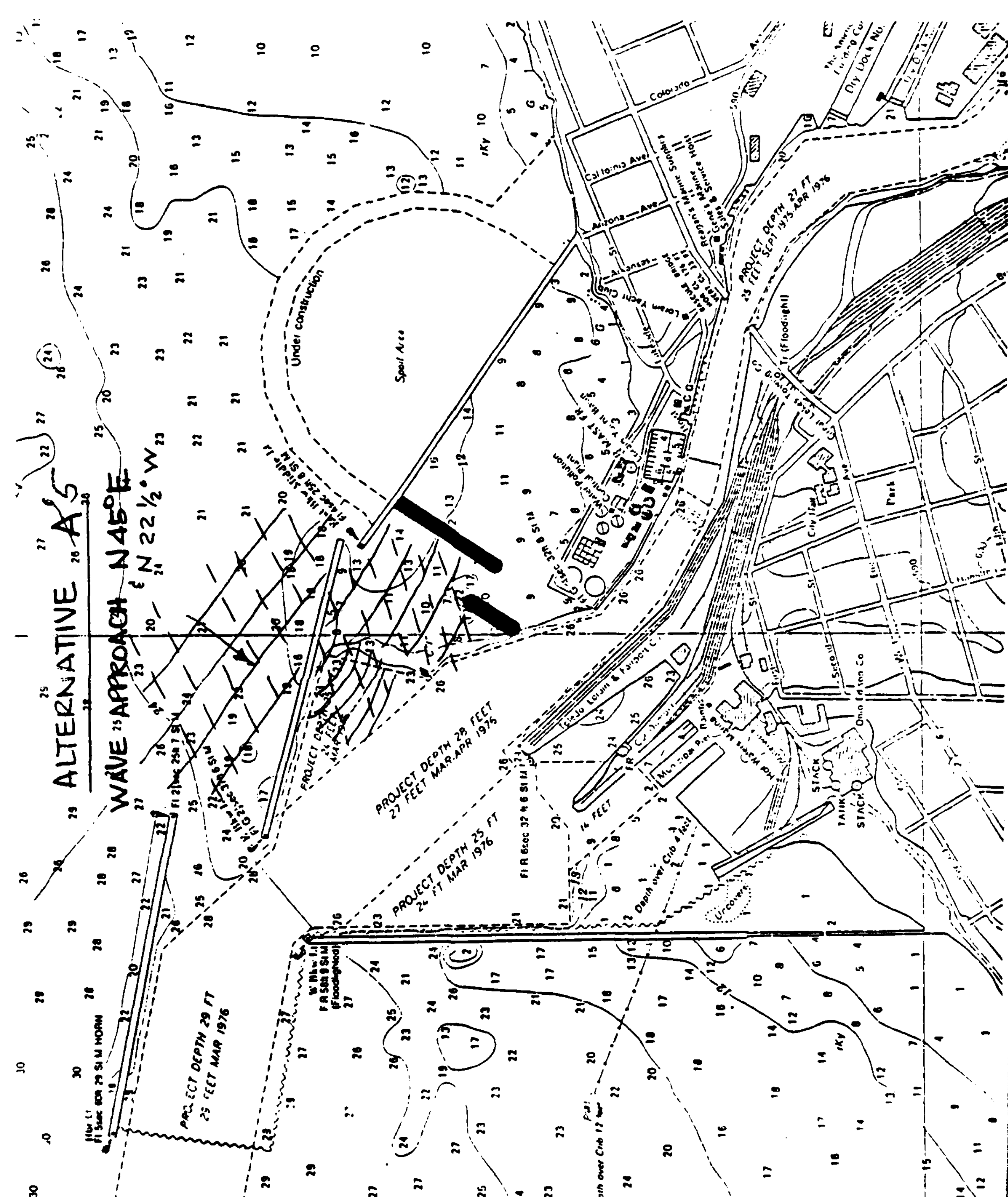

ALTERNATIVE A5
WAVE APPROACH N45°E
N 22½° W
Under construction
Spoil Area
PROJECT DEPTH 28 FEET
27 FEET MAR-APR 1976
PROJECT DEPTH 25 FT
24 FT MAR 1976
PROJECT DEPTH 29 FT
29 FEET MAR 1976
PROJECT DEPTH 27 FT
25 FEET SEPT 1975 APR 1976
Colorado
California Ave
Arizona Ave
City Hall
Park
STACK
TANK
Uncovers

FIGURE 16

Overtopping waves originating N 22-1/2° W:

Reformed waves will be beam on for vessels exiting the Alternative 1 harbor configuration. After diffraction around the spur BW and some decay, these waves should be no problem at the entrance.

For Alternatives 2, 3, 4 and 5, no entrance problems are anticipated although beam seas will be encountered after turning into the main channel while exiting.

The size of the reformed wave is determined inside the harbor by first determining the wave characteristics at the outer breakwater during storm conditions for Class 1 and 2 approaches.

Class 1: Ho = 9.8 ft. To = 7.4 sec.

From NOAA Chart 14841 Lorain Harbor Lake Survey, May 1977.

Depth at toe d = 18 to 19 ft.

From previous lake level calculations, add 5.15 Ft. for 10 year RI level

dswl = 24 ft. for storm conditions.

From irregular wave theory as presented in Seelig and Ahrens "Estimating Nearshore Conditions for Irregular Waves", CERC Draft Report, July 1979.

at dswl = 24 ft. Class 1; Hs = 7.2';

Hmax = 11.6'; Hmean = 4.37'

Class 2: Ho = 10.8 ft. To = 7.5 sec.

at dswl = 24 ft. Class 2; Hs = 9.6';

Hmax = 14.6'; Hmean = 6.0'

The size of a wave transmitted into the harbor due to the above storm conditions is made up of two parts: 1) the wave transmission by overtopping, 2) wave transmission through the structure.

The methods presented in TR 80-1 "Two-Dimensional Tests of Wave Transmission and Reflection Characteristics of Laboratory Breakwaters" by William Seelig, U.S. Army Corps of Engineers, Coastal Engineering Research

Center, June 1980, is used to determine the coefficient of overtopping and the coefficient of transmission for the east breakwater shown in cross-section of Figure 17 on the following page.

From TR 80-1, Pg 49, the overall transmission coefficient is approximately the same for a monochromatic condition as for an equivalent irregular wave.

Of the 17 breakwater cases studied in TR 80-1, the cases which come closest to the existing breakwater conditions are BW3 and BW4.

The following table summarizes the analysis for other approach classes and wave heights. (The coefficient of transmission was determined by averaging BW3 and BW4 cases). This method did not account for non-normal approaches although normal wave incidence has been assumed in each case. Probability of exceedance is calculated for a single storm event (which only occurs once in 20 years).

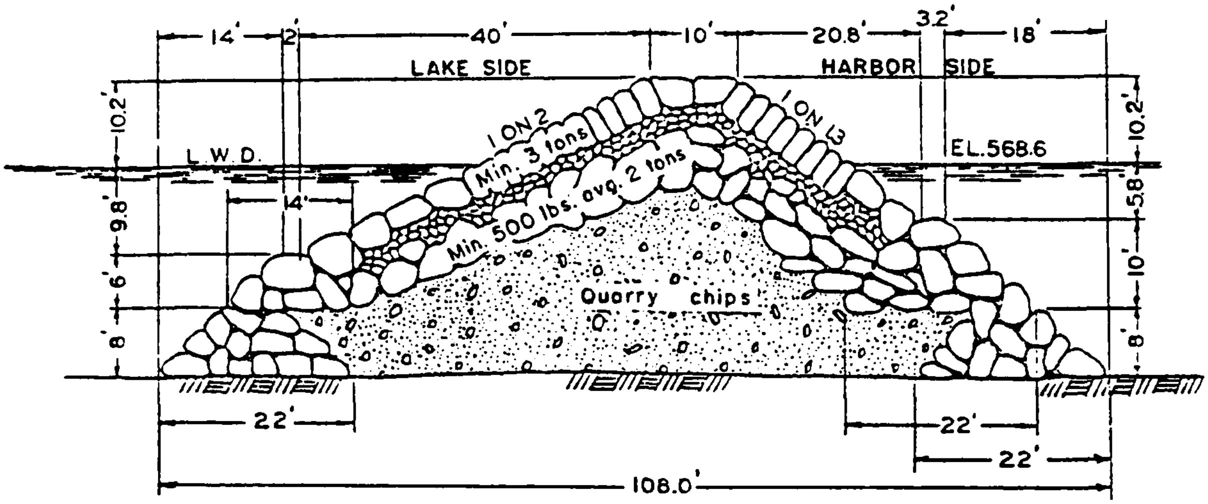
APPROACH CLASS	INCIDENT WAVE HEIGHT (FT)	TRANSMITTED WAVE HEIGHT (FT)	PROBABILITY OF EXCEEDANCE (%)
2	Hmean = 6.0	1.5	48
2	H_{max} = 14.6	4.2	1.0
2	H_s = 9.6	2.5	14
1	Hmean = 4.4	1.1	50
1	H_{max} = 11.6	3.2	0.55

For the purposes of this study, a transmitted wave height (Ht) of 1.5 feet was assumed. Also, assuming no decay within the basin after transmission, waves of this height will not interfere with entry or exit from the marina as falls within the 3 ft. criteria previously established.

The nature of the transmitted waves (from TR 80-1) are:

- o Incident and transmitted wave height distributions have similar shape.

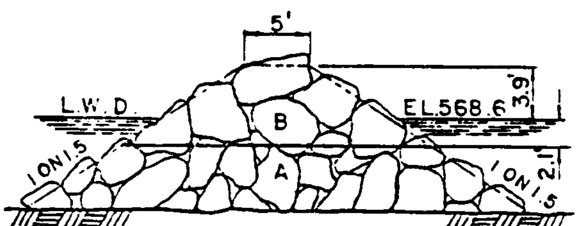
4 A



SECTION OF EAST AND WEST BREAKWATERS "A" AND "B"

BUILT 1901 - 1915

NOTE: OUTER 280' OF EAST BREAKWATER REMOVED IN 1965.

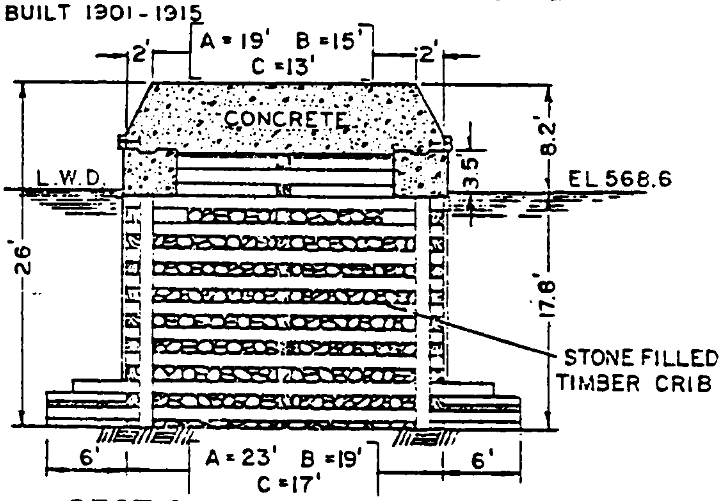


SECTION "E"

WEST BREAKWATER EXTENSION TO SHORE COMPLETED IN 1921

A - MIN. WEIGHT 500LBS NOT LESS THAN 50% 2 TONS OR MORE

B - MIN. WEIGHT 2 TONS



SECTION OF WEST PIER

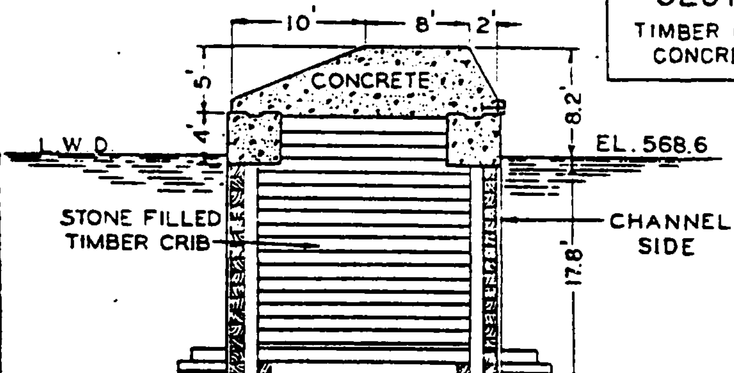
TIMBER CRIB STRUCTURE BUILT, 1828 - 1896
CONCRETE SUPERSTRUCTURE, 1897 - 1908

SECTION A - PIERHEAD TO A POINT 244' SHOREWARD

SECTION B - NEXT 365'

SECTION C - NEXT 395' TO END OF PIER

TOTAL LENGTH 1004'



SECTION OF EAST PIER

TIMBER CRIB:
SUB-AND SUPERSTRUCTURE, 1830 - 1894;
CONCRETE SUPERSTRUCTURE, 1903 - 1905;
112' INNER END STEEL SHEET PILE BULKHEAD, 1921

NOTE: 995' OF OUTER END OF PIER REMOVED IN 1965, TOTAL OVERALL LENGTH AFTER REMOVAL IS 880'.

LORAIN HARBOR

OHIO

PLATE 1A

CORPS OF ENGINEERS BUFFALO, N.Y.

30 JUNE 1965

FIGURE 17

Source: As noted

- o Transmitted and reflected spectra for irregular waves generally have equal or higher spectral peakness than incident spectra.

Wave Diffraction at Entrance

The only way deepwater lake waves can approach the marina protective structures without encountering harbor protective works is through the lake approach channel. As shown in Figure 18, the range of approach covers an arc of approximately 20 from the direction west north west (N 67.5° W). A critical approach direction is also shown which interferes least with the outer breakwater yet projects most into the proposed small-boat harbor area.

Class 3 approach waves should be used in this analysis

Ho = 10.5 ft.   To = 8.1 sec.

from irregular wave theory: Ho Gap = 8.8 ft.

Hmean Gap = 5.4 ft.

The method presented in Shore Protection Manual, Section 2.42, was used for generating wave diffraction patterns for a gap less than 5L at an oblique incidence.

Incoming waves are diffracted by the outer breakwater per Figure 2-28 of SPM, altering the incident wave in the center of the gap an average K* of 0.8. (i.e., Hs = .8 (8.8) = 7.0 ft.; Hmean = .8 (5.4) = 4.3 ft.

Figures 19 thru 22 show the gap diffraction patterns and their influence on the marina protective structures for each altertnative.

The wave heights must be further diffracted at the small-boat harbor entrance structures to determine (the wave height in the entrance) and compare this to the 3 ft. high maximum that design criteria allows. Figures 2-32, 2-33 and 2-34 from SPM are used to perform those corrections.

Angle of approach is estimated between head on and 15 off normal. Therefore, worst case is assumed for these purposes. Using Hs as the incident wave for design and assuming diffraction about the outer breakwater, the design conditions for each alternative are:

ALTERNATIVE	H(entrance)	H(breakwater)
1	1.6'	3.6'
2	1.6'	4.7'
3&4	2.5'	4.3'
5	1.7'West 2.1'East	4.4'

The probability of these heights being exceeded during a 20 year recurrence interval storm is 0.14. The probability of these heights being exceeded during any year is 0.007.

Ship Generated Waves

It is a general consensus of opinion in the literature that the maximum wave height generated is primarily dependent on the ship speed rather than the size and shape. In this particular case (as in those studied in the literature), the largest ships capable of navigating the waterway in question are confined by maneuverability and squat limitations to lower speeds than the much smaller ships using the same waterway.

Whereas the harbor in question may in the near future accommodate the 1000 ft. "Jumbo" ore carriers, these vessels will be limited to speeds of 4 mph (3.5 knots) or less in the river approach channel adjacent to the proposed small-boat harbor and 9 mph (7.8 knots) or less in the main harbor channel.

Conversely, smaller vessels listed below could attain speeds from 10 to 20 knots if conditions warranted.

Vessel	Length	Beam	Draft	Displacement
Coastguard Cutter	40'	10'	3'-6"	10 tons
Tug Boat	45'	13'	6'	29 tons
Fishing Boat	64'	12.83'	3'	35 tons
Fireboat	100'	28'	9-12'	343 tons
Tanker	504'	66'	28'	18,800 tons

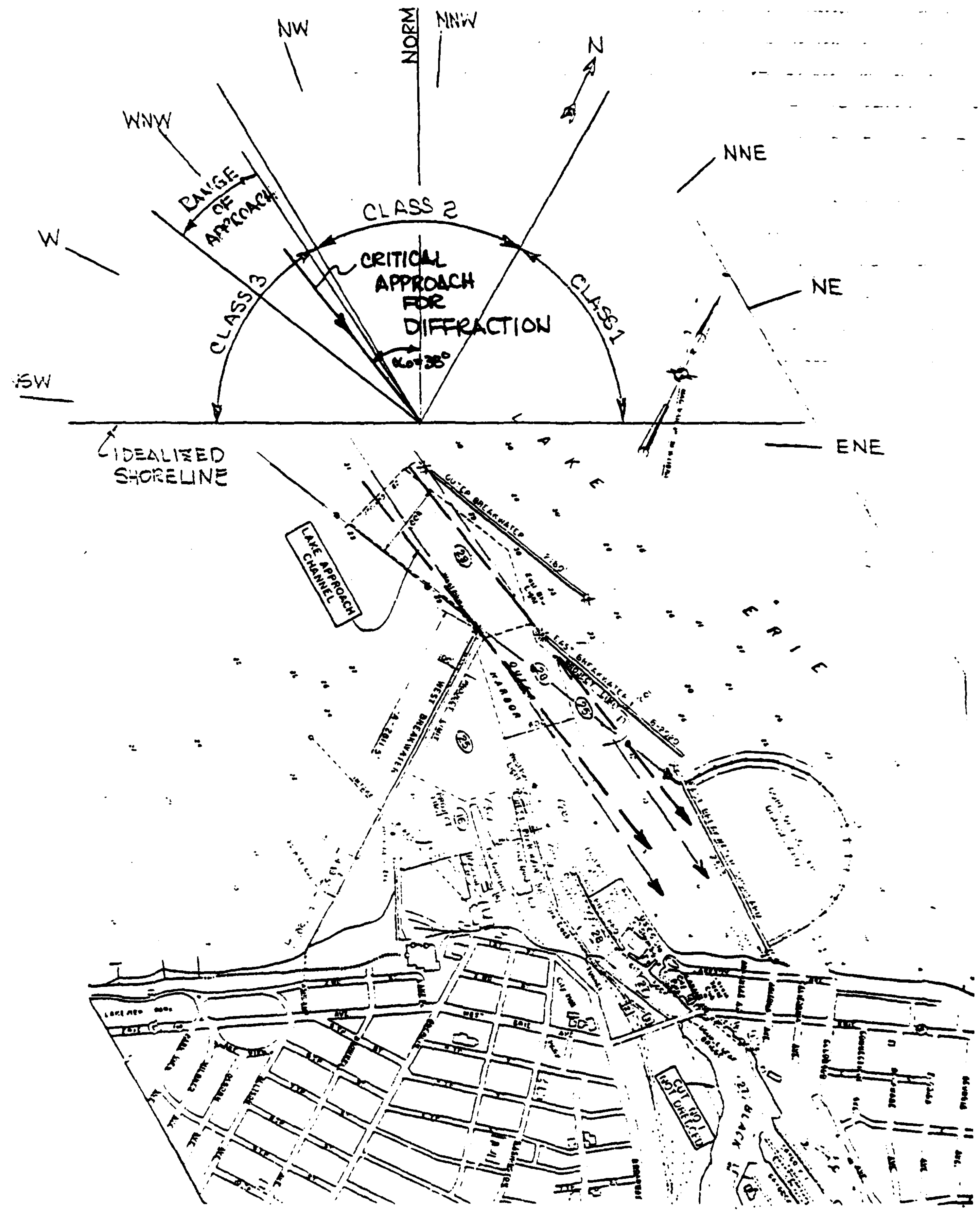


FIGURE 18 DEEPWATER WAVE APPROACH

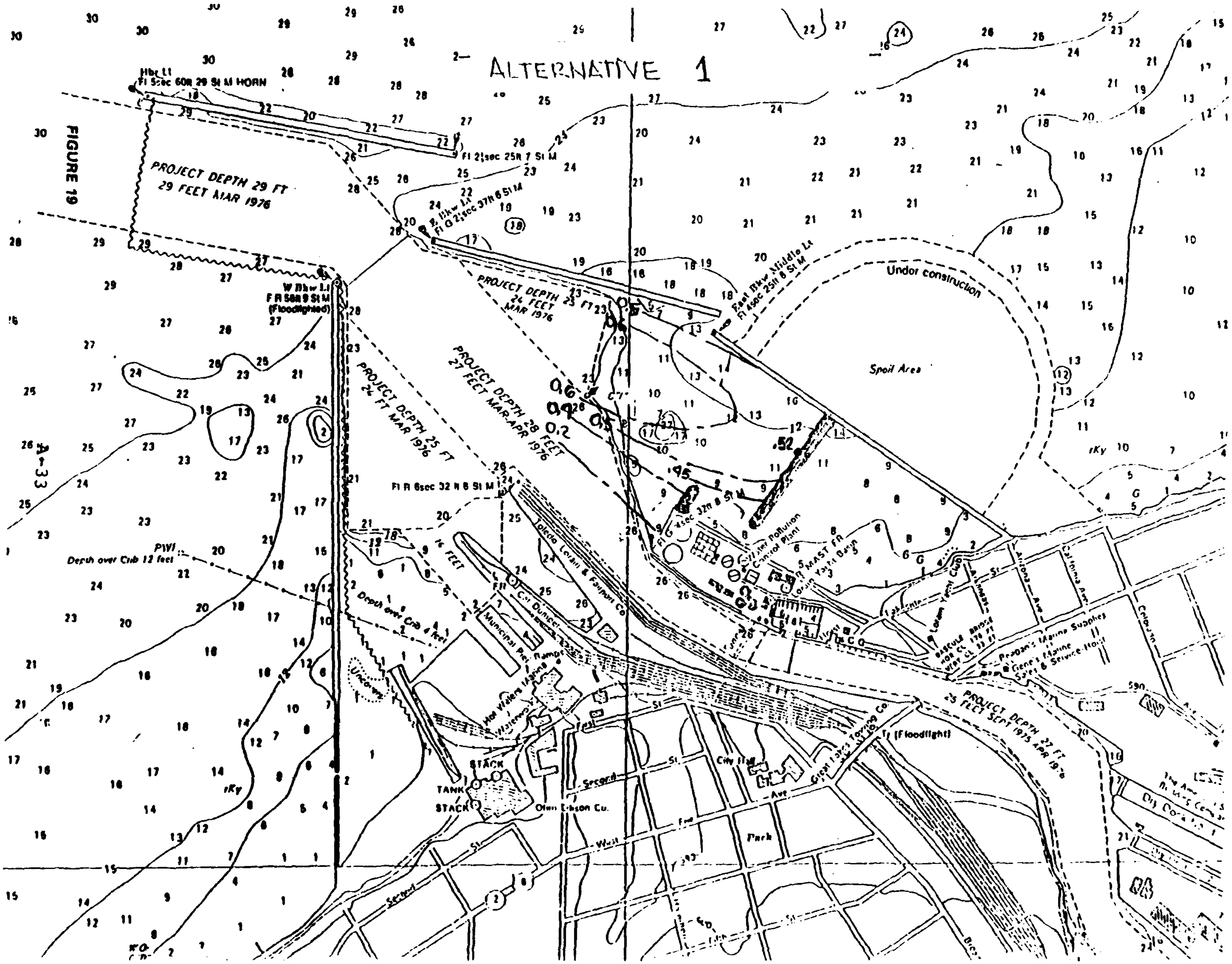

ALTERNATIVE 1
PROJECT DEPTH 29 FT
29 FEET MAR 1976
PROJECT DEPTH 23 FT
24 FEET
MAR 1976
PROJECT DEPTH 28 FEET
27 FEET MAR-APR 1976
PROJECT DEPTH 25 FT
24 FT MAR 1976
PROJECT DEPTH 27 FT
25 FEET SEPT 1975 APR 1976
Undor construction
Spoil Area
Depth over Crib 12 feet
Depth over Crib 4 feet
16 FEET
Toledo Lorain & Fairport Co
Municipal Pier
City Hall
Park
Ohio Edison Co.
STACK
TANK
STACK
Hot Waters Marina
Water Pollution Control Plant
Arizona Ave
California Ave
Colorado

FIGURE 19

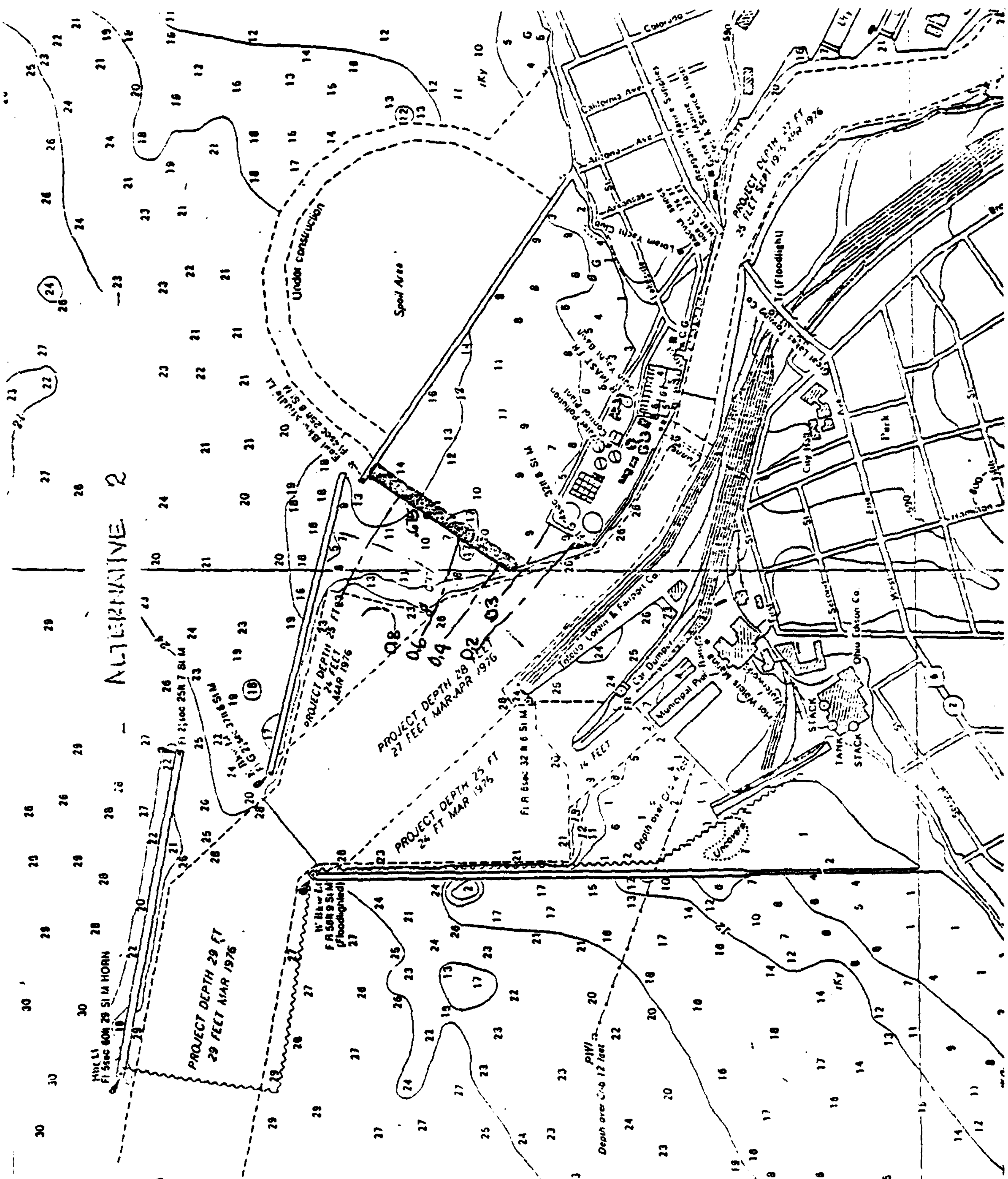

ALTERNATIVE 2
Spoil Area
Under construction
PROJECT DEPTH 29 FT
29 FEET MAR 1976
PROJECT DEPTH 25 FT
24 FT MAR 1976
PROJECT DEPTH 28 FEET
27 FEET MAR-APR 1976
PROJECT DEPTH
24 FEET
MAR 1976
Municipal Pier
Car Dumper
Uncovers
Depth over Crib 12 feet
STACK
TANK
Park
City Hall
Ohio Edison Co.

FIGURE 20

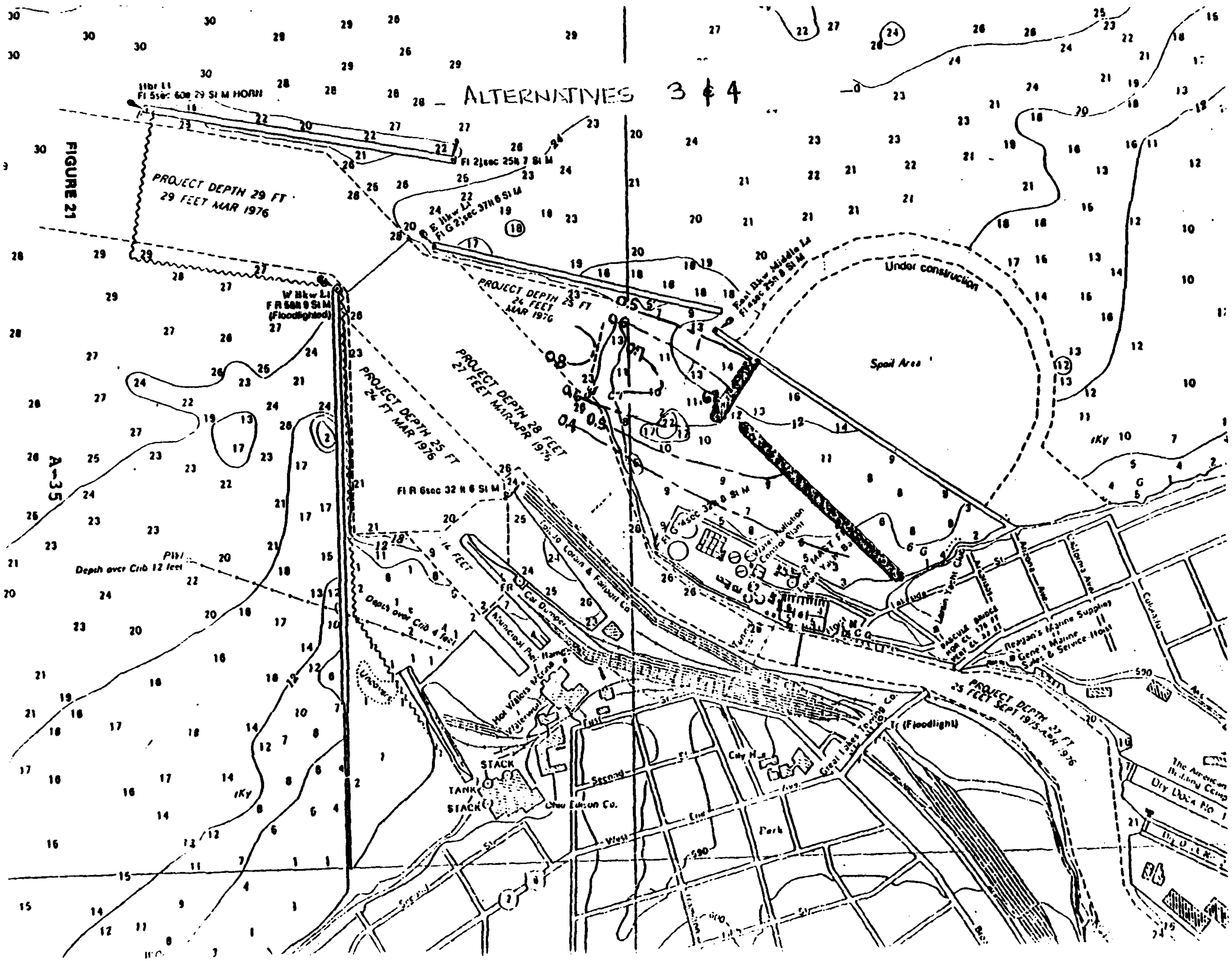
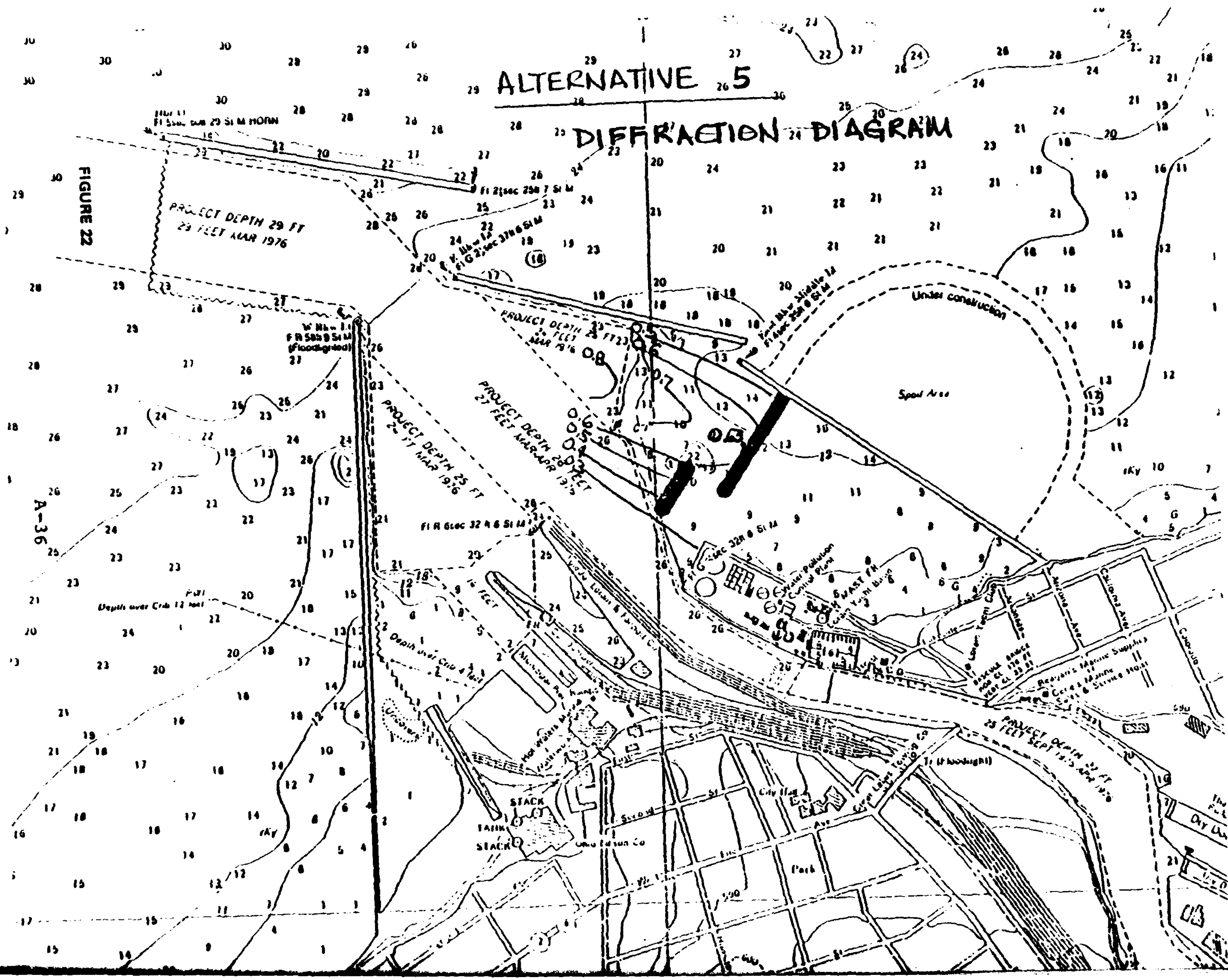

ALTERNATIVES 3 & 4
PROJECT DEPTH 29 FT
29 FEET MAR 1976
PROJECT DEPTH 23 FT
24 FEET
MAR 1976
PROJECT DEPTH 28 FEET
27 FEET MAR-APR 1976
PROJECT DEPTH 25 FT
24 FT MAR 1976
PROJECT DEPTH 27 FT
25 FEET SEPT 1975-APR 1976
Under construction
Spoil Area
W Bkw Lt
F R 58ft 9 St M
(Floodlighted)
Fl R 6sec 32 ft 6 St M
Fl 2)sec 25ft 7 St M
Depth over Crib 12 feet
Depth over Crib 4 feet
16 FEET
Car Dumper
Municipal Pier
STACK
TANK
STACK
Park
Second
West
Tr (Floodlight)
Dry Dock No 1
The American Shipbuilding Comp
Uncovers

FIGURE 21



ALTERNATIVE 5
DIFFRACTION DIAGRAM
PROJECT DEPTH 29 FT
29 FEET MAR 1976
PROJECT DEPTH 25 FT
25 FT MAR 1976
PROJECT DEPTH 28 FEET
27 FEET MAR-APR 1976
PROJECT DEPTH 25 FT
25 FEET SEPT 1975 APR 1976
Under construction
Spoil Area
Depth over Crib 12 feet
Park
STACK

FIGURE 22

Characteristics of these vessels and the maximum waves observed per distance from the sailing line were obtained from "Water Waves Produced By Ships" by Robert M. Sorensen, Journal of Waterways, Harbors and Coastal Engineering Division, A.S.C.E., May 1973

A summary of ship generated waves is presented below:

	Max. Wave Height (Hmax)	
Alternative	Entrance	Breakwater
1	1.8'	1.8'
2&5	1.8'	1.8'
3&4	1.8'	1.8'

Notes:

1. Assuming 10 knots maximum vessel speed.
2. Hmax is highest wave for any vessel assuming:
   a) Cutter, tug & fishing boats can come within 100 feet.
   b) Fireboat & Tanker must remain in ship channel.
3. Worst case is caused by the 64 ft long fishing boat passing within 100 ft of structure or entrance.

Wave Reflection

Regardless of the wave reflection characteristics of structures within the harbor, no waves have been identified in the previous analysis which would cause problems at the small boat harbor entrance even if they were reflected 100%.

Wave Analysis Summary

WAVE HEIGHT (Ft)	ALTERNATIVE 1	2	3 & 4	5
Wind Waves				
H Breakwater	1.7	1.7	1.7	1.7
H Spur/Detach.	1.5	-	-	1.6
H Entrance	1.5	1.6	1.4	1.6 west, 1.5 east
Wave Overtopping				
H all cases Assumes no decay	1.5	1.5	1.5	1.5
Wave Diffraction				
H Breakwater	3.6	4.7	4.3	4.4
H Spur/Detach.	3.2	-	-	4.2
H Entrance	1.6	1.6	2.5	1.7 west, 2.1 east
Ship Waves				
H all cases	1.8	1.8	1.8	1.8
Reflection	-	-	-	-
Worst Case Design: H Breakwater	3.6	4.7	4.3	4.4
Worst Case Design: H Spur/Detach.	3.2	-	-	4.2
Worst Case Design: H Entrance	1.8	1.8	2.5	1.8 west, 2.1 east

SECTION 4

LORAIN SMALL BOAT HARBOR - OTHER DESIGN CONSIDERATIONS

Other phenomena to be considered in the design of the small boat harbor are:

- o Basin oscillation/seiche
- o Sedimentation
- o Exchange rates
- o Currents
- o Diked disposal area filling
- o Potential nuisance odors
- o Subsurface data

Basin Oscillations

Short period basin oscillations may result from waves entering through the harbor opening or caused by vessels within the small-boat harbor, in either case, the irregular geometry of alternative harbor configurations plus the beneficial effects of a sloping beach and a rubble breakwater forming two oposing sides of the basin, preclude these type of basin oscillation problems.

Changes in basin water level due to storm activity (wind and waves) have been estimated at about one foot but these changes occur over a period of several hours posing no hazards to boats or moorings.

Sedimentation

The principle sources of sediment along the Lake Erie shore are littoral transport, stream discharge, and local bluff erosion. Within the basin formed by the small boat harbor littoral transport of material is not possible because of the Lorain Harbor navigation works (east breakwater shorearm and dike disposal structure). Sediment from the Black River which does not deposit in the upper dredged portions of the Federal navigation channel would be discharged through the main harbor channel with small amounts depositing in the outer harbor. Only eddies from the main channel would deposit material within the marina. The evidence of surficial deposits of silt within the basin found by Stanley Consultants in a September 1979 survey support this position. However, if Alternative 3 or 4 is proposed, the proximity of the entrance to the relocated main channel could cause sedimentation problems.

The section of shoreline forming the southeast side of the proposed harbor would be subject to minor wave action therefore bluff erosion is not considered significant. In summary, the lack of sediment supply from the three possible sources mentioned precludes shoaling problems.

Exchange Rates

Essentially the proposed harbor configurations are closed systems with little or no exchange through the narrow entrance due to lack of tides, stream flow or any other mechanism which would initiate volume exchange.

Without exchange the water quality of the basin could degenerate to an objectionable level if policing measures are not enforced. Without being able to quantitatively predict the future water quality of the enclosed basin, no mitigation measures are presented here except to emphasize strict control measures.

Currents

Flood currents due to runoff from the Black River have little or no influence within the marina basin. Eddies from flood currents or wave activity (see Figure 23) would only influence the entrance to the marina basin, not the vessels or moorings. The basin is protected against littoral current activity by the main harbor protective works.

Diked Disposal Area Filling

Currently, estimates by the District show that the Diked Disposal area at Lorain will be completely filled prior to the year 1990, before implementation of a small-boat improvement under this study authority. If future dredge quantities become smaller, and filling takes substantially longer, the area may not be available as a land facilities support site for the marina. However, large errors in estimation would become noticable during later study stages. In this event, some alternatives are available to allow faster filling of specifically required land facility areas. These generally encompass some form of internal diking and selective disposal discharge location.

Internal diking to retain more settling within desired areas can be attained by such means as sheet-piling, placement of commercially available Longard Tubes (5-foot diameter tubes in lengths up to 300 feet which are filled with hydraulic dredging), or creation of a

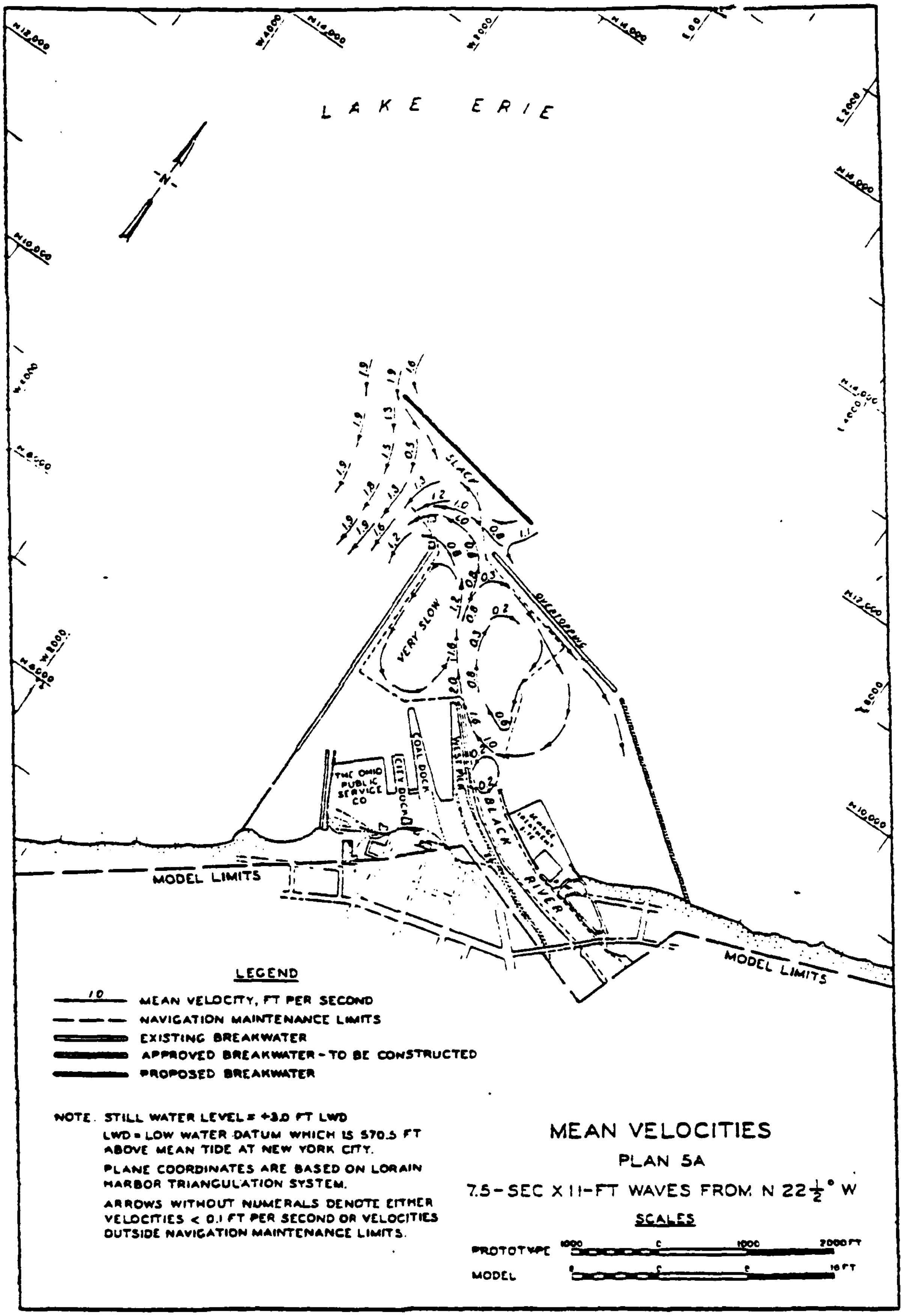


FIGURE 23

Source: TR2-628

mud wave. These are listed in order of decreasing expense. Any measure would be entirely a non-Federal cost.

These items do not require further detailed analysis unless future study stages identify a potential problem with land availability.

Potential Nuisance Odors

City officials describe the Lorain Sewage Treatment Plant as one of the best facilities in Ohio in terms of operation and odor containment. The utilities director stated that the plant has better odor control than 98% of all facilities in the country. However, its location to the west of the selected site prompted more detailed investigation of potential odor problems.

To the maximum extent possible, according to the utilities director, odor control measures are employed throughout the sewage treatment plant operation. In the initial stage of treatment at the detritor, HTH or chlorine in dry form is applied. The HTH applied at this point affects and controls odor in the effluent as it continues on its path through the plant. Additionally, from this point on through the treatment process, the control of odors is handled by a product called "Odor Control" which is actually a deodorizer. Odor Control is dripped into the effluent flow at various points along the treatment route. Drop point locations are just before the effluent enters the pre-aeration tanks, where the effluent enters the aeration tanks, before the effluent enters the final settling tanks, and at the point where the sludge enters into the thickener tank. HTH is also added to sludge in the thickener tank as well. The Odor Control material is of the extra-strength type.

A future measure that soon will aid in controlling odor will be the installation of a new centrifuge pump within the sludge thickener tank. The purpose of the centrifuge will be to remove increased quantities of effluent from the sludge. The impact of this action will be two-fold. First, by using the centrifuge process, the composition of the sludge can be changed from 2 percent solids, 98 per cent liquid as the sludge enters the tank to 8 percent solids, 92 per cent liquid. By changing the solids content of the sludge, plant officials expect to be able to reduce the number of tank truck loads of material hauled out of the plant daily from the curent rate of 12 to 14 per day down to 8 to 10 loads per day. This will consequently cut down the holding time which will decrease the chances of the sludge going septic before being removed from the plant. The second benefit from adding the centrifuge process will be that it will enable the storage of smaller quantities of sludge in the thickener tank between pump-outs, which also will decrease the chance of the material going septic. Since the ability to keep the sludge in the thickener tank from going septic seems to be one of the major keys to controlling objectionable odors, this planned plant improvement will serve as a major benefit to the odor control measures utilized in the plant. The Chief Operator indicated that the centrifuge operation is expected to be on line this year (1981).

Presently, the problem of sludge turning septic is an occassional occurrence during summertime periods of high temperature, high humidity, high water temperature and low wind speed. Only winds from West to South quadrants would affect the marina site. The duration of coincidental periods would be of a short term nature, although not accurately predictable, due to so many variables involved. Changes in the wind direction would cause the odor to go elsewhere. Pump out of the sludge into tank trucks for transport would terminate the septic condition. When the sludge turned septic and the level in the tank was low, the pumping into the tank of additional fresh sludge would cause the septic sludge to turn back to an aerobic condition and thus eliminate the odor. The only possibility for holding septic sludge for an extended period would be when the tank truck would be unable to haul the material away due to breakdown or the inability to spread the material on agricultural land due to wet ground conditions. The likelihood of this occuring does not have a very high probability.

Even with all of the odor control measures currently employed, as well as those to be employed in the near future, the possibility of undesirable odor impact on the proposed small boat harbor site does exist when just the right combination of wind, atmospheric, and weather conditions exist. Within the scope and context of this investigation, the frequency of undesirable odor conditions occurring at the proposed site is considered to be low and not detrimental.

It is the policy of the Utilities Department to stay as updated as possible with new technologies in the odor control area. Regarding any possible expansion of plant operations or possible increases in plant capacities and their impact on odor control, the utilities department indicated that the planning process for the development of a new sewage treatment facility in

Lorain has been ongoing for the last 2 or 3 years. The impact of the development of a new treatment plant would mean that capacities within the present plant would ultimately be reduced, thereby reducing odor problems also. Development of this new facility would be on the far west side of Lorain, thus it would have no impact on the proposed small-boat harbor site.

A total of only six citizen complaints have been made since the sludge hauling process replaced the highly odor producing sludge incineration two years ago. The experiences of operators of the Lorain Yacht Basin adjacent to the treatment plant seem to confirm this low complaint rate related to odor problems by the lack of complaints that they report. By basing a conclusion on the odor problem from the sewage treatment plant strictly upon the amount of complaints received, this would indicate that there really is not a problem.

SECTION 5

LORAIN SMALL BOAT HARBOR - DESIGN OF PROTECTIVE WORKS

Per the summary of wave information the following structures can be grouped together for design purposes:

- o Alternative 1 main breakwater and spur whose design waves were estimated at 3.6 Ft and 3.2 Ft respectively will all be designed for 3.6 Ft wave height.

- o Alternatives 2 thru 5 breakwaters whose design wave varied from 4.2 Ft to 4.7 Ft will be designed for 4.7 Ft wave heights.

Note that in all cases the wave heights in the entrance channel are well within the 3.0 Ft. limit established in the design criteria.

Period of above design waves is 8.1 seconds for diffracted deep water waves.

DESIGN OF PROTECTIVE WORKS - ALTERNATIVE 1

THE DIAGRAM ON THE FOLLOWING PAGE SHOWS THAT THE DEPTH ALONG THE CENTERLINE OF THE MAIN BREAKWATER VARIES FROM 15 FT AT THE TRUNK 10 FT AT THE HEAD. THE SPUR LIES IN WATER DEPTH VARYING FROM 9 FT TO 10 FT (WRT L.W.D.)

FOR THE DESIGN WAVE OF 3.6 FT DETERMINE IF THIS IS BREAKING OR NON BREAKING CONDITION FROM FIGURE 7-4 OF SPM FOR

$$\frac{d_s}{gT^2} = \frac{15 (@LWD)}{32.2 (8.1)^2} = 0.0071 \quad \text{for } m = 0.01 \quad H_b = 12.6$$
$$m = 0.0 \quad H_b = 11.7$$

$$\frac{d_s}{gT^2} = \frac{9 (@LWD)}{32.2 (8.1)^2} = 0.0043 \quad \text{for } m = 0.01 \quad H_b = 7.65$$
$$m = 0.0 \quad H_b = 7.02$$

THEREFORE IN ALL WATER DEPTHS FROM 9 to 15 FT THE DESIGN WAVE IS NON-BREAKING

USING THE METHODS FROM SPM SECT 7.373

$$W = \frac{W_r H^3}{K_D (S_r - 1)^3 \cot\theta}$$

where
W = weight of armor unit in lbs
W_r = Stone density in lbs/ft³ assume 155 pcf
K_D = stability coefficient
K_D = 4.0 non breaking at trunk
K_D = 3.2 nonbreaking at head
S_r = specific gravity of armor = 155/62.4 = 2.48
$\cot\theta$ = side slope = 1.5
H = design wave height
= 3.6 ft at trunk
= (.45)(T) = 3.2 ft at head

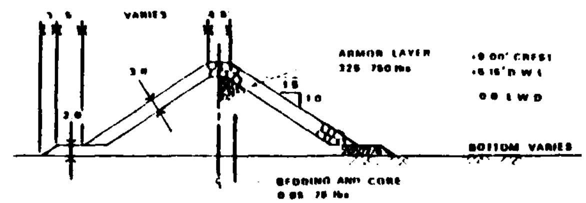
structural head

$$W = \frac{155 (3.2)^3}{(3.2)(1.48)^3 (1.5)} = 326 \text{ lbs}$$

structural trunk

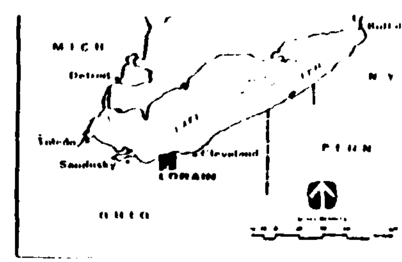
$$W = \frac{155 (3.6)^3}{(4.0)(1.48)^3 (1.5)} = 372 \text{ lbs}$$

DESIGN ENTIRE STRUCTURE FOR TRUNK CONDITIONS!

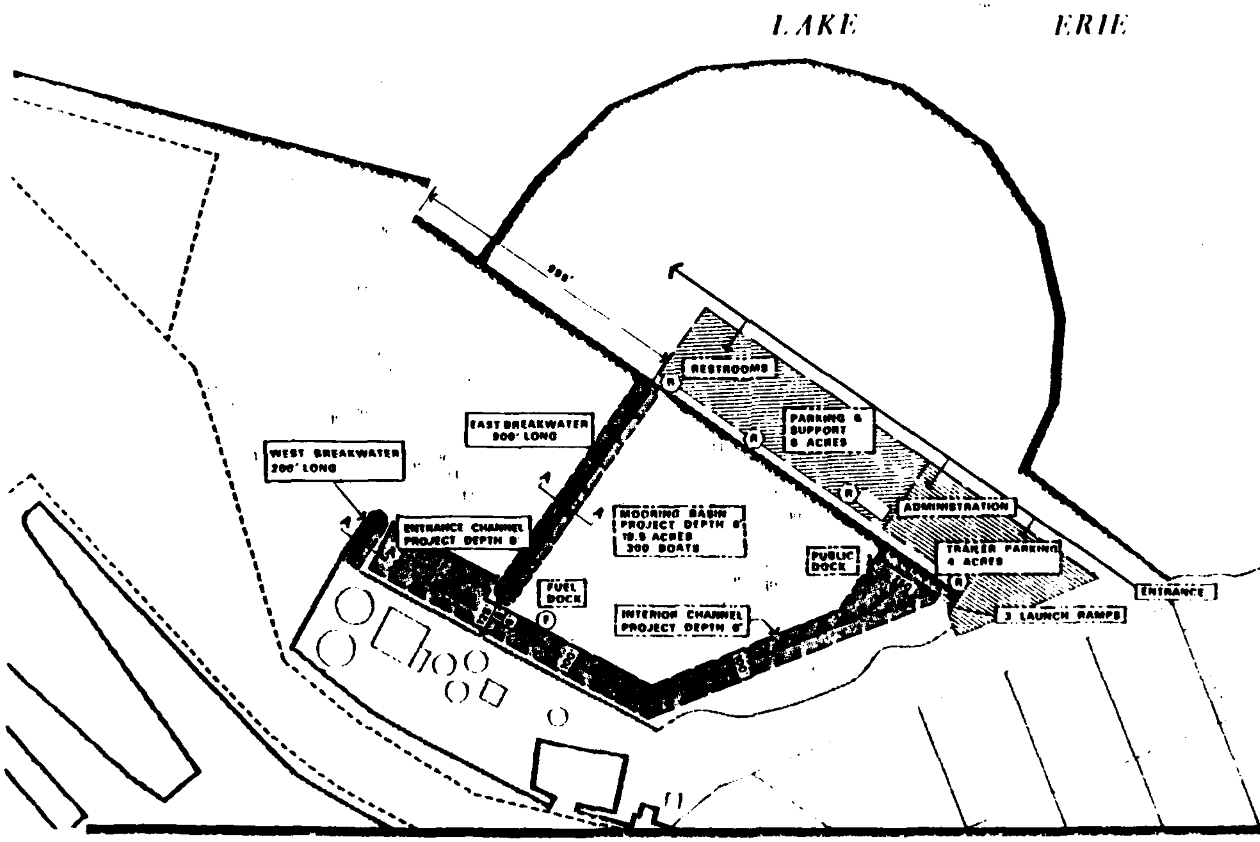


SECTION A - A

300 SLIP CAPACITY WITHOUT RIVERSIDE PARK CUT



VICINITY MAP



NOTES

1. ALL ELEVATIONS REFER TO LOW WATER DATUM (L.W.D.) ELEVATION 568.6 FEET ABOVE MEAN WATER LEVEL AT FATHER POINT, QUEBEC (IGLD) 1955)
2. D.W.L. DESIGN WATER LEVEL

LEGEND

COMPONENTS OF THE GENERAL NAVIGATION PROJECT (COST SHARED ITEMS AT 50% FEDERAL AND 50% NON-FEDERAL)

COMPONENTS OF THE NAVIGATION PROJECT WHICH ARE A NON-FEDERAL RESPONSIBILITY

(F) FUEL DOCKS

(R) RESTROOMS

0 100 200 300 500

SCALE IN FEET

ALTERNATIVE 1

DESIGN OF PROTECTIVE WORKS — ALTERNATE 1

LT STRUCTURAL TRUNK

TRUNK ARMOR ALLOWABLE GRADATION

0.9 W to 2.0 W where W = 372 lbs

335 to 744 lbs or

325 to 750 lbs

TRUNK CREST WIDTH MINIMUM

$$B = 3(1.15)\left(\frac{372}{155}\right)^{1/3} = 4.62 \quad \text{say} \quad 4.6'$$

TRUNK ARMOR THICKNESS

$$r = 2\,(1.15)\left(\frac{372}{155}\right)^{1/3} = 3.08 \quad \text{say} \quad 3.0'$$

TRUNK UNDERLAYER SIZE GRADATION

0.06 W to 0.2 W

22 lbs to 74 lbs

say 25 to 75 lbs

thickness $r = 2(1.15)\left(\frac{37.2}{155}\right)^{1/3} = 1.43$ say 1.45'

BEDDING STONE SIZE GRADATION

0.00015 W to 0.01 W or

0.056 lbs to 3.72 lbs

assume same gradation as at head

0.05 to 5.0 lbs

thickness at bottom assume 2.0 FT. minimum

DESIGN OF PROTECTIVE WORKS - ALTERNATIVE 1

CREST HEIGHT

THE HEIGHT OF THE PROTECTIVE STRUCTURE WILL DEPEND ONLY ON WAVES FROM SPRING, SUMMER OR FALL i.e. the BOATING SEASON. FROM A PREVIOUS ANALYSIS IN THE DESIGN WAVES SECTION $H_o = 9.8$ FT $T_o = 7.8$ sec FOR APPROACH CLASS 3 DEEPWATER WAVES.

THIS WAVE WILL BE REFRACTED AND SHOALED TO THE POINT WHERE IT INTERCEPTS THE TIP OF THE OUTER BREAKWATER WHEREAFTER IT WILL BE DIFFRACTED INTO THE HARBOR USING THE DIAGRAM GENERATED FOR THAT PURPOSE IN SECTION

FROM IRREGULAR WAVE THEORY

$d_s = 29$ FT $\qquad \frac{d_s}{g T_o^2} = 0.0148 \qquad \alpha_o = 38^\circ$

$s^* = 4$ for wind waves

$K_R = 0.86$

$$H_o' = H_o K_R = 9.8\,(0.86) = 8.43$$

$$H_o'/L_o = 8.43/5.12(7.8)^2 = 0.027$$

$m =$ slope seaward $= 0.01$ approx.

$$d/H_o' = 29/8.43 = 3.44$$

for $H_o'/L_o = 0.02 \qquad H_{SIG} = 8.35'$

$H_o'/L_o = 0.04 \qquad H_{SIG} = 7.76'$

$H_o'/L_o = 0.027 \qquad H_{SIG} = 8.14'$ by interpolation

H_s at TIP OF OUTER BREAKWATER $= 8.14'$

H_s at CENTER OF GAP $= 8.14\,(0.8) = 6.51$

H_s at MARINA BREAKWATER $= 6.51\,(0.52) = 3.4$ ft.

USE 3.6 FT (SINCE IT IS SO CLOSE TO 3.4 FT) TO INCLUDE OVERTOPPING FOR WINTER MONTHS

DESIGN OF PROTECTIVE WORKS - ALTERNATIVE I

FROM TR 80-1 RUNUP IS

$$R = \left(\frac{0.692\ \xi}{1+0.504\ \xi}\right) H_i$$

$H_i = 3.6'$ $L_o = 5.12(7.8)^2 = 311.5$

$$\xi = \frac{\tan\theta}{\sqrt{H_i/L_o}} = \frac{1.5}{\sqrt{3.6/5.12(8.1)^2}} = 14.49$$

$$R = \left[\frac{0.692(14.49)}{1+.504(14.49)}\right] 3.6$$

$$R = [1.2]\ 3.6 = 4.33'$$

IF FREEBOARD $F = 4.33'$ NO OVERTOPPING WILL OCCUR BUT TRANSMISSION MAY OCCUR

IF $F = 3.85'$ i.e. h = height of structure is
d @ L.W.D.
+ 5.15 ft storm water level rise
+ 3.85 ft freeboard
or 9.0 ft above L.W.D.

THEN $K_{T_o} = C\left(1 - F/R\right)$ where $C = 0.51 - \frac{0.11B}{h}$

B = crest width = 4.6 ft
F = freeboard = 3.85 ft
R = runup = 4.33 ft
h = breakwater height
= 9+9 = 18 ft shallow spur
= 15+9 = 24 ft deepest bw section
$C_{18} = 0.482$
$C_{24} = 0.489$

$$K_{T_{o_{18}}} = .482\left(1 - 3.85/4.33\right) = 0.053$$

$\therefore H_{T_o} = 0.19$ ft

$$K_{T_{o_{24}}} = .489\left(1 - 3.85/4.33\right) = 0.054$$

$\therefore H_{T_o} = 0.195$ ft

DESIGN OF PROTECTIVE WORKS - ALTERNATE 1

USING CASE BW3 FROM TR 80-1 AS THE CLOSEST CASE TO THE DESIGN CONDITIONS

BW3 SLOPE 1:1.5 PERMEABLE $B/h = 0.61$ ARMOR OVER CORE
THIS SLOPE 1:1.5 PERMEABLE $B/h = 0.28$ to 0.21 3 LAYER

	Shallow Water No Storm	Shallow Water Storm	Deep Water No Storm	Deep Water Storm
Depth @ LWD	9	9	15	15
Storm Level	0	5.15	0	5.15
ds	9	14.15	15	20.15
H/gT^2	0.0017	0.0017	0.0017	0.0017
d/gT^2	0.0043	0.0067	0.0071	0.0095
h	18	18	24	24
d/h	0.5	0.786	0.625	0.840
K_T pg 97 $\frac{d}{h}=0.69$	0.16	0.16	0.165	0.17
K_T pg 100 $\frac{d}{h}=0.92$	0.40	0.39	0.39	0.37
K_T interpolate	0.0 *	0.26	0.12	0.30

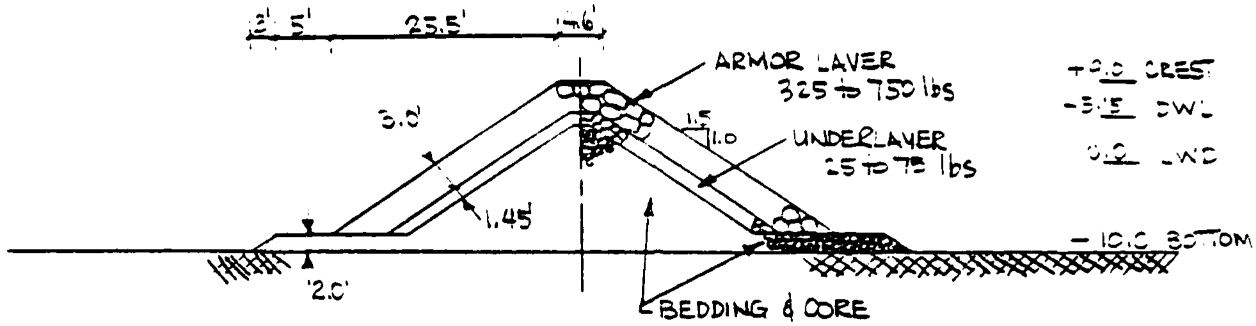
* no overtopping and core extends higher than stillwater level plus wave so no transmission is anticipated.

MAXIMUM TRANSMISSION IS $0.3(3.6) = 1.08$ FT
OR $0.3(3.4) = 1.02$ FT DURING BOATING SEASON

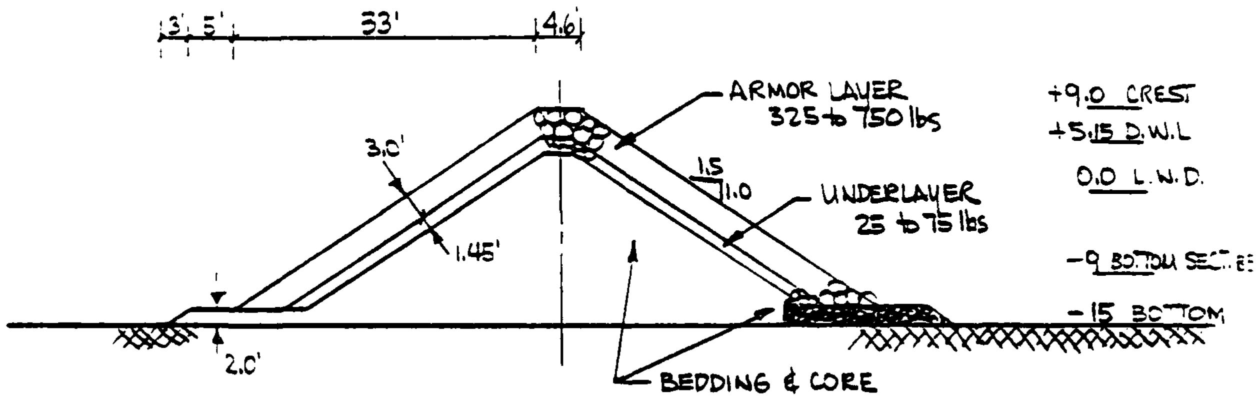
A CREST HEIGHT OF 9 FT ABOVE L.W.D IS OK

THIS SAME BREAKWATER CROSS SECTION SHOULD BE CONSERVATIVE FOR TRANSMISSION OF WIND GENERATED WAVES SINCE PERMEABLE BREAKWATERS ARE MORE TRANSPARENT TO LONGER PERIOD WAVES
$T_{\text{WIND WAVES}} = 2.4$ sec $<<$ $T_{\text{DIFFRACTED WAVES}} = 8.1$ SEC

CROSS SECTIONS OF PROTECTIVE WORKS - ALTERNATE 1



SECTION A-A HEAD OF MAIN & SPUR BREAKWATERS

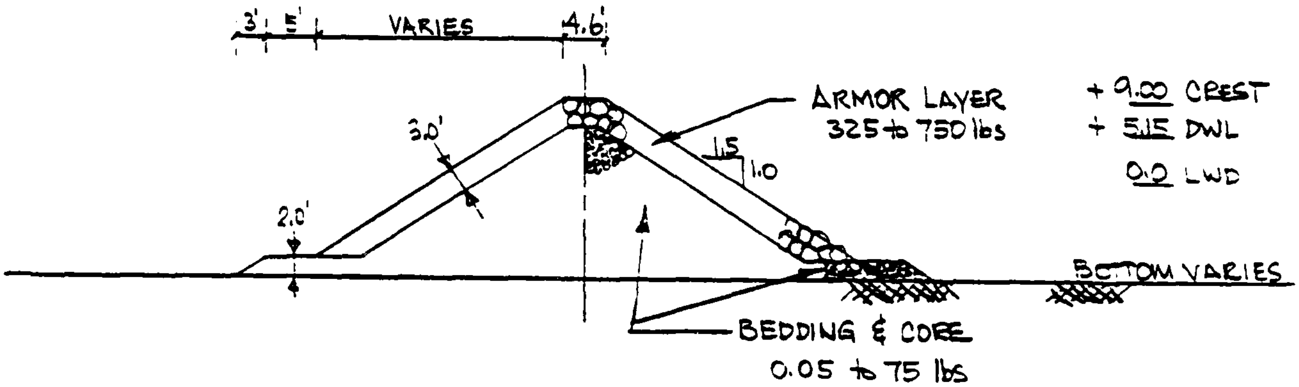


SECTION C-C TRUNK OF MAIN BREAKWATER

RECOMMENDED SECTION FOR DESIGN OF ALTERNATIVE 1

THE CROSS-SECTIONS ON THE PREVIOUS PAGE REPRESENT THE STANDARD 3-LAYER DESIGNS FOR RUBBLE MOUND BREAKWATERS.

CONSIDERING THE SMALL DESIGN WAVE AND THE LIMITS OF STONE GRADATION AND TO FACILITATE EASE OF CONSTRUCTION, A SIMPLIFIED 2 LAYER DESIGN IS RECOMMENDED FOR PROTECTION OF THE SMALL BOAT HARBOR. THIS 2 LAYER SECTION IS THE EXACT DUPLICATE OF CASE BW3 FROM TR 80-1.



RECOMMENDED SECTION ALTERNATIVE 1

LORAIN SMALL BOAT HARBOR - PROTECTIVE WORKS
ALTERNATE 2

THE DIAGRAM ON THE FOLLOWING PAGE SHOWS THE DEPTH VARIATION OVER THE LENGTH OF THIS BREAKWATER AS 9 FT AT THE HEAD TO 16 FT AT THE BASE OF THE TRUNK (W.R.T. L.W.D.)
THE DESIGN WAVE OF 4.7 FT IS NON-BREAKING IN THESE WATER DEPTHS. USING SPM SECTION 7.373;
(AT HEAD $H = .4(7) = 2.8'$ & $W = 281$ lbs ∴ TRUNK DESIGN GOVERNS)

DESIGN OF STRUCTURAL TRUNK
WEIGHT OF ARMOR UNITS

$$W = \frac{155\,(4.7)^3}{4.0\,(1.48)^3\,(1.15)} = 827 \text{ lbs} \qquad K_D = 4.0 \text{ at trunk}$$

ALLOWABLE GRADATION
0.9 W to 2.0 W = 745 to 1654 say 750 to 1600 lbs

MINIMUM CREST WIDTH

$$B = 3\,(1.15)\left(\frac{827}{155}\right)^{1/3} = 6.03' \qquad \text{say } 6.0'$$

LAYER THICKNESS

$$r = 2\,(1.15)\left(\frac{827}{155}\right)^{1/3} = 4.02' \qquad \text{say } 4.0'$$

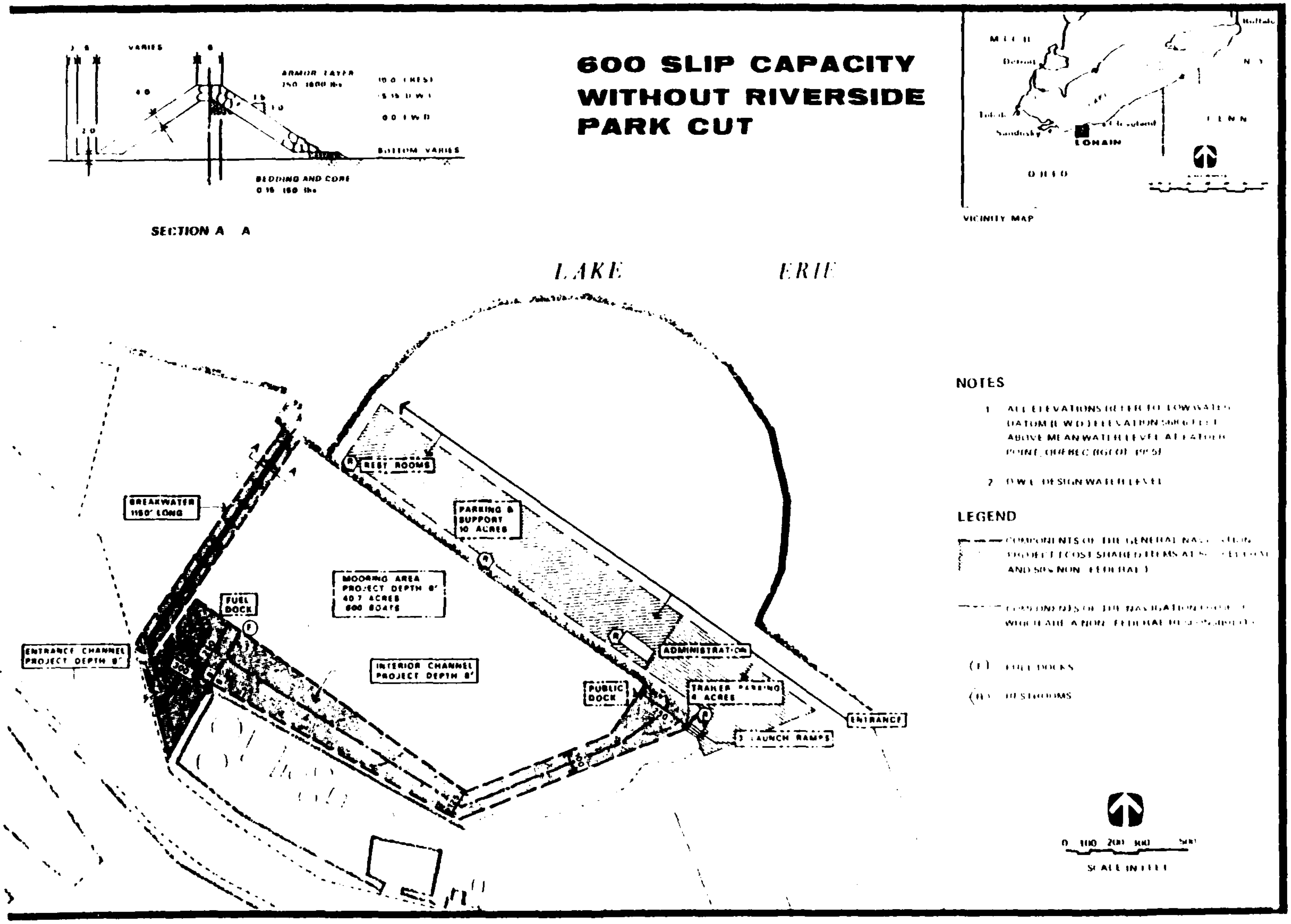
UNDERLAYER STONE SIZE
0.06 W to 0.2 W = 49.6 to 165 lbs
say 50 to 150 lbs

LAYER THICKNESS $r = 2(1.15)\left(\frac{82.7}{155}\right)^{1/3} = 1.87'$ say 1.9'

BEDDING STONE GRADATION
0.00015W to 0.01 W = 0.124 to 8.3 lbs
say 0.15 to 10 lbs

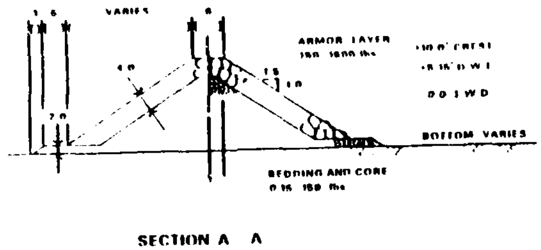
MINIMUM THICKNESS ASSUMED AS 2.0 FT

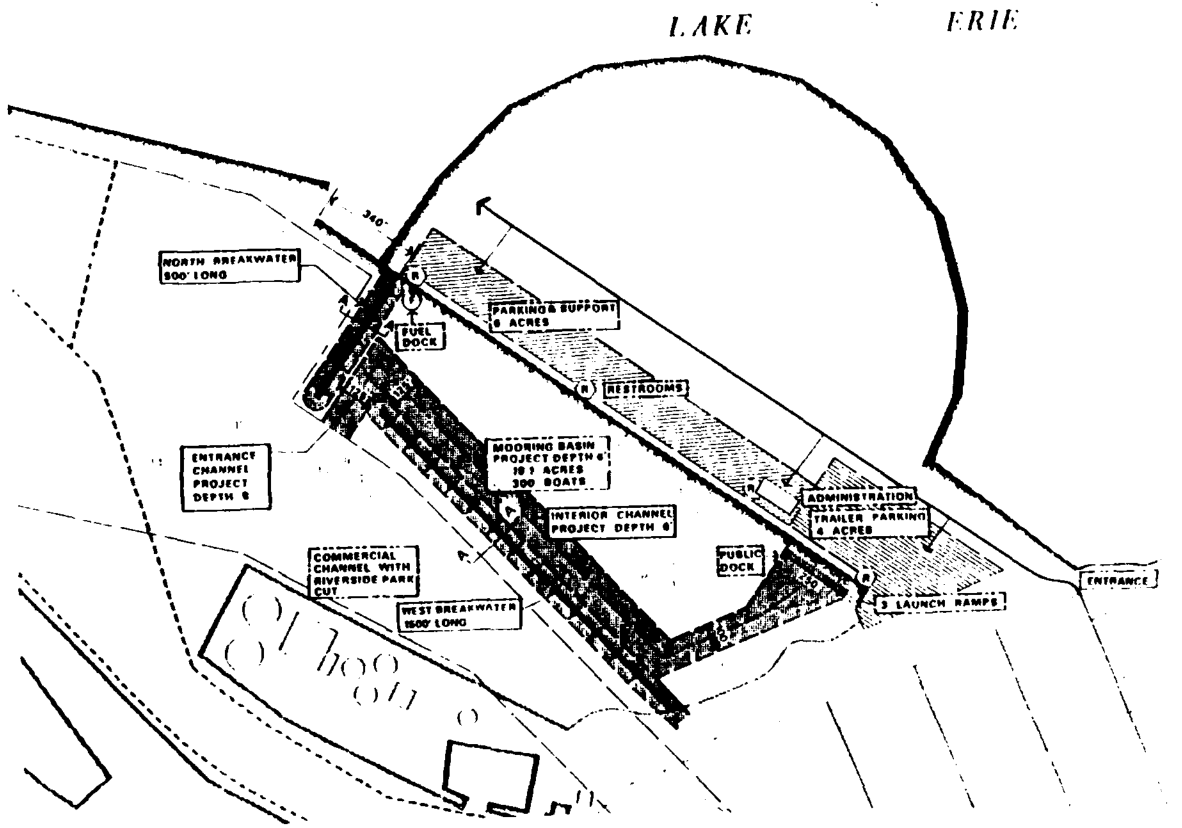
ALTERNATIVE PLAN 2



ALTERNATIVE PLAN 3

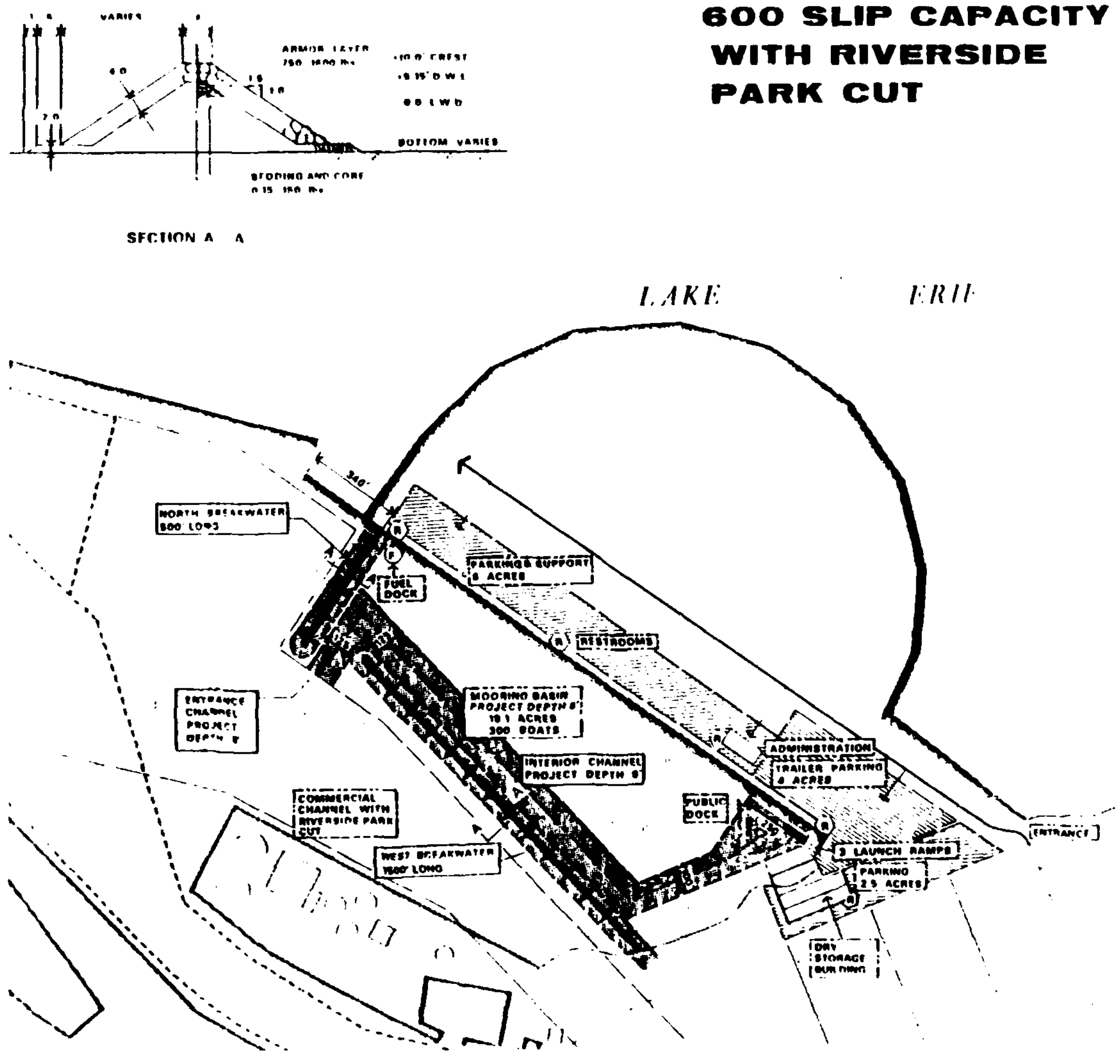
300 SLIP CAPACITY WITH RIVERSIDE PARK CUT



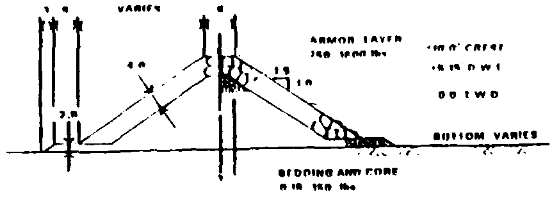


ALTERNATIVE PLAN 4

600 SLIP CAPACITY WITH RIVERSIDE PARK CUT

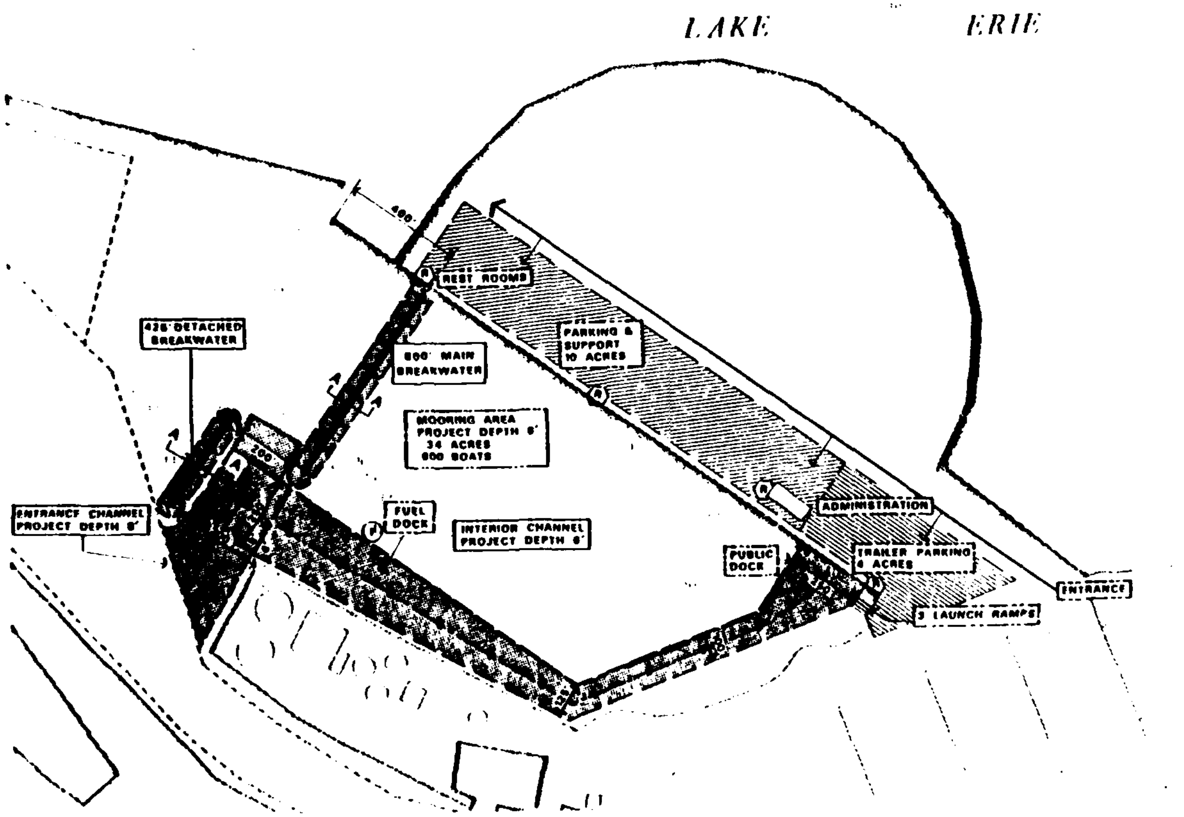


ALTERNATIVE PLAN 5



SECTION A A

600 SLIP CAPACITY WITH DETACHED BREAKWATER



DESIGN OF PROTECTIVE WORKS - ALTERNATE 2

CREST HEIGHT
BY AN ANALYSIS SIMILAR TO THAT PRESENTED FOR ALTERNATE 1

BOATING SEASON DESIGN WAVE $H_o = 9.8'$ $T_o = 7.8$ sec
AFTER REFRACTION & SHOALING TO THE TIP OF THE OUTER BREAKWATER $H_s = 8.14'$ $T_p = 7.8$ sec
AFTER DIFFRACTION AROUND OUTER BREAKWATER TO GAP AT HARBOR ENTRANCE $H_s = 6.51'$ $T_p = 7.8$ sec
AFTER DIFFRACTION THRU GAP MAXIMUM HEIGHT ALONG PROTECTIVE BREAKWATER IS
$H_s = 6.51\,(.675) = 4.4$ FT $T_p = 7.8$ sec

FROM TR 80-1 RUNUP IS

$$R = \left[\frac{0.692\,\xi}{1+.504\,\xi}\right] H_i$$

$H_i = 4.7$ for maximum effect

$$\xi = \frac{\tan\theta}{\sqrt{H_i/L_o}} = \frac{1.5}{\sqrt{4.7/5.12(8.1)^2}} = 12.68$$

$$R = \left[\frac{0.692\,(12.68)}{1+.504\,(12.68)}\right] 4.7$$

$$R = 1.187\,(4.7) = 5.58'$$

THEREFORE
IF FREEBOARD $F = 5.58'$ NO OVERTOPPING WILL OCCUR

IF $F = 4.85'$ $h = 4.85 + 5.15 = 10'$ ABOVE L.W.D.
height of structure

$$K_{T_O} = C\,(1 - F/R)$$

$F =$ freeboard $= 4.85$ ft
$R =$ runup $= 5.58$ ft
$h =$ height $= 16 + 10 = 26$ ft max
$9 + 10 = 19$ ft min
$C = 0.51 - \frac{0.11\,B}{h}$ $B = 6$ ft

$$K_{T_{O26}} = .485\,(1 - 4.85/5.58) = .063$$

$H_{TO26} = 0.30$ FT

$$K_{T_{O19}} = .475\left(1 - \frac{4.85}{5.58}\right) = 0.062$$

$H_{TO19} = 0.29$ FT

$C_{26} = .485$
$C_{19} = .475$

DESIGN OF PROTECTIVE WORKS - ALTERNATE 2

USING CASE BW3 FROM TR 80-1 TO THESE DESIGN CONDITIONS

$d_s = 16 + 5.15 = 21.15'$
$h = 16 + 10 = 26.0'$
$d_s/h = 0.813$
$H = 4.7'$ $T = 8.1$ sec
$H/gT^2 = 0.0022$
$d/gT^2 = 0.0100$

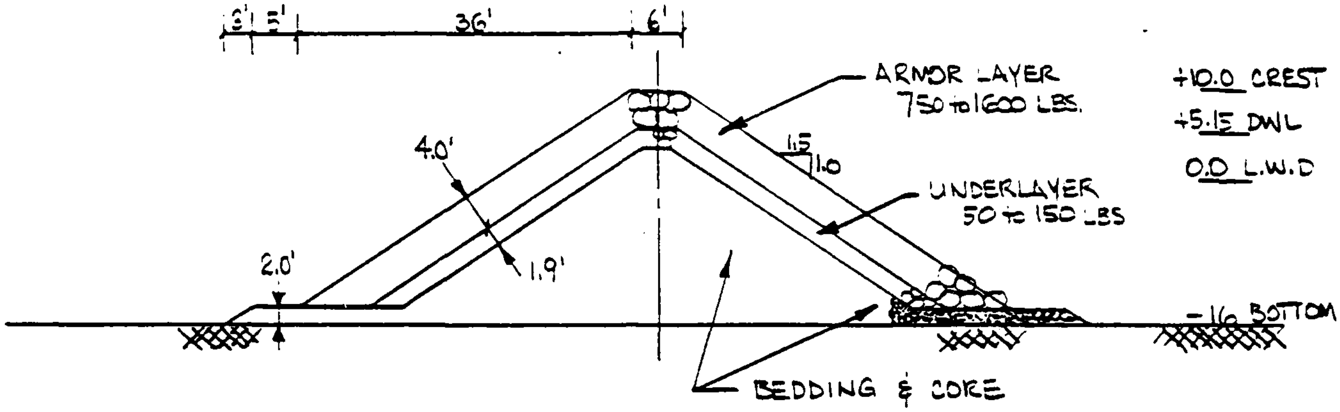
from pg 97 $d/h = 0.69$ $K_T = .13$
100 $d/h = 0.92$ $K_T = .32$
for $d/h = 0.813$ $K_T = .23$

$H_T = 0.23\,(4.7) = 1.08$
$H_T = 0.23\,(4.4) = 1.01$ DURING BOATING SEASON

A CREST HEIGHT OF 10 FT ABOVE L.W.D. IS OK

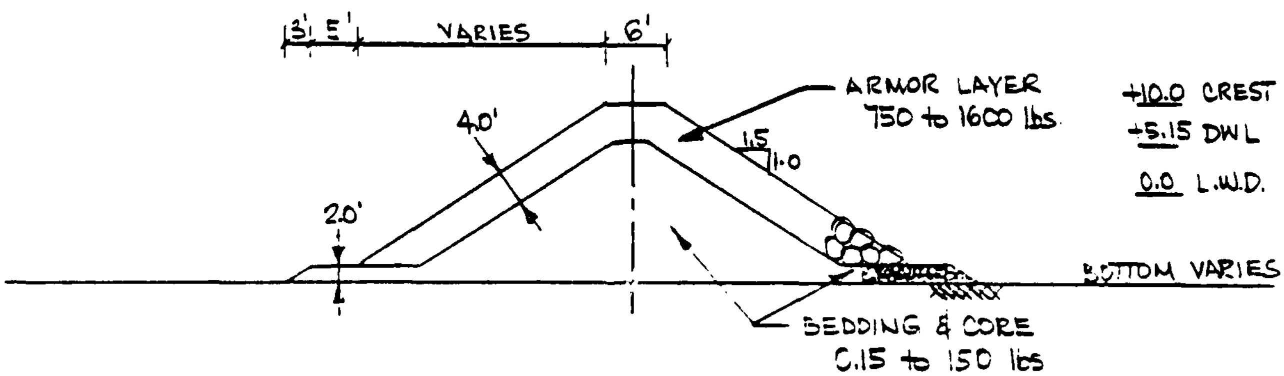
AND BREAKWATER SHOULD BE CONSERVATIVE AGAINST TRANSMISSION OF WIND WAVES.

ASSUMING A STANDARD 3-LAYER DESIGN A CROSS SECTION THROUGH THE TRUNK IS PRESENTED BELOW



SECTION B-B THROUGH TRUNK

CONSIDERING THE SMALL RANGE OF SIZE IN THE STONE LAYERS COMPRISING THE BREAKWATER AND EASE OF CONSTRUCTION A 2 LAYER DESIGN IS RECOMMENDED AS SHOWN BELOW



RECOMMENDED SECTION - ALTERNATIVES 2 THRU 5

SECTION 6

QUANTITIES AND COSTS

PRELIMINARY MATERIALS SURVEY

A preliminary materials survey was performed in March 1981 to determine possible sources for the Lorain Small Boat Harbor breakwaters.

Material Types and Gradations

Design

Two possible design alternatives will be considered for the Lorain Small Boat Harbor Breakwaters. They are type 1 and type 2 breakwaters differing in their height and stone size requirements.

The material required for each alternative design include:

Type 1

ITEM	SIZE
Armor Stone	325 to 750 lbs.
Bedding & Core Stone	0.05 to 75 lbs.

Type 2

ITEM	SIZE
Armor Stone	750 to 1600 lbs.
Bedding & Core Stone	0.15 to 150 lbs.

Specific Gravity of Stone Materials

A specific gravity of 2.48(155pcf) was used to compute the stone sizes for the two stone types. A variation is specific gravity equal to ± 5 percent (2.36 to 2.60) is acceptable. It will be necessary to redesign stone sizes for any source used having a stone material whose specific gravity is not 2.48 ± 5 percent.

Material Quality

Quality requirements for each material type are discussed below. The bedding, core, and armor stone should be subjected to the tests established by the Ohio River Division laboratories, Cincinnati, Ohio. Test No. P-9, "Riprap and Breakwater Stone Evaluation," including a suite of tests to determine stone durability. All stone to be used for this purpose will be free from significant cracks, seams, and overburden spoil. The sources which are suitable for this must not show significant breakdown in the freeze-thaw or wet-dry tests.

Material Sources

General

Armor, bedding, and core can be produced from the indicated sources listed below. It is possible that all the material from these sources is not suitable. The right will be reserved in the specifications to reject materials from certain localized areas, zones, strata, channels, or stockpiles when such materials are deemed unsuitable.

Selected quarrying will be required for the production of armor, bedding, and core. The specifications will require that shale and other undesirable materials will be excluded by adequate processing.

Sources

Seven convenient sources shown on the list below are capable of producing the required material for breakwater construction in Lorain Harbor. They all are located within a 60 mile radius of the project and materials can be transported by either barge or truck.

Source	Quarry or Pit Location	Radius Distance
Quality Quarries	Kelley's Island, OH	35
Cleveland Quarries	South Amherst, OH	5
Boyas Excavating Co.	Valley View, OH	35
Standard Slag Co.	Marblehead, OH	28
E. Kraemer & Sons, Inc.	Clay Center, OH	60
Sandusky Crushed Stone	Sandusky, OH	26
Woodville Lime & Chemical Co.	Woodville, OH	60

A brief description of materials available from each quarry is as follows:

Quality Quarries, Kelley's Island, OH

Rock type - Amherstburg and Lucas Dolomite
Proposed Use - Armor, bedding & core stone
Service Record - Last used 1976 for dike disposal site 14
Description - Sample specific gravity range from 2.39 to 2.41

Cleveland Quarries, South Amherst, OH

Rock type - Berea Sand Stone
Proposed Use - Same as above
Service Record - Unknown

Description - Specific gravity varies from 2.28 to 2.33. This stone has been used on several outer breakwaters in Buffalo District. However, it will fail durability tests.

Boyas Excavating, Valley View, OH

Rock type - Euclid Sand Stone/Lentil and Bedford Shale
Proposed Use - Armor, Bedding & Core Stone
Service Record - Last used in 1977 Operation Foresight Project repair at Eastlake, Ohio
Description - Specific gravity ranges from 2.34 to 2.42. Materials appear to be suitable for intended use.

Standard Slag Co., Marblehead, OH

Rock type - Dolomite/Lucas Formation
Proposed Use - Same as above
Service Record - Last used 1974-77 to construct the Lorain dike disposal area, Lorain, Ohio
Description - Specific gravity varies from 2.52 to 2.75 depending upon lift. Self unloading vessels and barge facilities available.

E. Kraemer & Sons, Inc., Clay Center, OH

Rock type - Niagaran Dolomite
Proposed Use - Same as above
Service Record - Unknown
Description - Specific gravity varies from 2.67 to 2.71. Rail facilities available

Sandusky Crushed Stone, Sandusky, OH

Rock type - Delaware & Columbus Dolomite
Proposed Use - same as above
Service Record - Used in 1973-74 on Sandusky local river protection project. Freemont, Ohio
Description - Specific gravity varies from 2.60 to 2.72. Rail facilities available

Woodville Lime & Chemical Co., Woodville, OH

Rock type - Niagaran Dolomite
Proposed Use - same as above
Service Record - Used in 1971 as Riprap for Freemont, Oh local flood protection
Description - Average specific gravity 2.64. Rail facilities available.

COST ESTIMATES

The cost estimates for major navigation items and recreational fishing items are combined and displayed for each alternative plan. Following all these tabulations are the cost estimates for each plan's self-liquidating items. The detailing of cost estimates into features and subfeatures is as complete as possible and includes quantities and unit costs for all main construction items. All costs are expressed at March 1981 price levels.

CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. ALTERNATIVE #1

LOCATION INSIDE OUTER HARBOR AT LORAIN, OHIO

JOB NAME

JOB NUMBER

PRELIMINARY ☐ FINAL ☐

BY DATE

CHECK DATE

LINE	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	BREAKWATERS				
	Mob. & Demob.		LS		58,500
	Armor stone 750-1600 lbs.	10,400	TN	41.00	426,400
	Underlayer/Bedding .05 to 150 lbs.	33,050	TN	19.00	627,950
	Contingency				277,000
	Total (Breakwaters)				1,390,000
	RECREATIONAL FACILITIES				
	Armor stone 325 to 750 lbs.	133	TN	41.00	5,453
	Underlayer/Bedding .05 to 150 lbs.	3,250	TN	19.00	61,750
	Handrail	1,028	LF	12.00	12,336
	Walkway (concrete)	268	CY	300.00	80,400
	Contingency				40,000
	Total (Recreation)				200,000
	Engineering & Design				190,918
	Supervision and Administration				206,828
	Subtotal (all preceeding)				1,989,000
	AIDS TO NAVIGATION				
	U.S. Coast Guard	2	EA	35,000	70,000
	TOTAL (all preceeding)				2,059,000

CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. ALTERNATIVE #1

LOCATION INSIDE OUTER HARBOR AT LORAIN, OHIO

JOB NAME

JOB NUMBER

PRELIMINARY ☐ FINAL ☐

BY DATE

CHECK DATE

LINE	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	LANDS AND DAMAGES	10	ACRE	22,000	220,000
	ANNUAL MAINTENANCE				
	Breakwaters				27,830
	Aids to Navigation				800
	Recreation				5,400
	Total (Maintenance)				34,000
	NON-FEDERAL COSTS				1,214,000
	50% of Project Costs Less				
	Aids to Navigation				
	Cash contribution for Nav.				(869,000)
	Cash contribution for Rec. Fish				(125,000)
	Lands and Damages				(220,000)
	FEDERAL COSTS				1,064,000
	50% of Project Costs				(994,000)
	Aids to Navigation				(70,000)

CONSTRUCTION COST ESTIMATE - SHEET NO. 2 OF 2

CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. ALTERNATIVE #2

LOCATION INSIDE OUTER HARBOR AT LORAIN, OHIO

JOB NAME

JOB NUMBER

PRELIMINARY ☐ FINAL ☐

BY DATE

CHECK DATE

LINE	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	BREAKWATERS				
	Mob. & Demob.		LS		58,500
	Armor stone 750-1600 lbs.	15,250	TN	32.00	488,000
	Underlayer/Bedding .15 to 150 lbs.	37,600	TN	25.00	940,000
	Contingency				372,000
	Total (Breakwaters)				1,859,000
	RECREATIONAL FACILITIES				
	Underlayer/Bedding .15 to 150 lbs.	2,250	TN	25.00	56,250
	Handrail	1,100	LF	12.00	13,200
	Walkway (concrete)	330	CY	300.00	99,000
	Contingency				42,000
	Total (Recreation)				210,000
	Engineering & Design				248,300
	Supervision and Administration				268,900
	Subtotal (all preceeding)				2,586,000
	AIDS TO NAVIGATION				
	U.S. Coast Guard	1	EA	35,000	35,000
	TOTAL (all preceeding)				2,621,000

CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. ALTERNATIVE #2

LOCATION INSIDE OUTER HARBOR AT LORAIN, OHIO

JOB NAME

JOB NUMBER

PRELIMINARY ☐ FINAL ☐

BY DATE

CHECK DATE

LINE	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	LANDS AND DAMAGES	14	ACRE	22,000	308,000
	ANNUAL MAINTENANCE				
	Breakwaters				37,180
	Aids to Navigation				400
	Recreation				6,500
	Total (Maintenance)				44,000
	NON-FEDERAL COSTS				1,601,000
	50% of Project Costs Less				
	Aids to Navigation				
	Cash contribution for Nav.				(1,162,000)
	Cash contribution for Rec. Fish				(131,000)
	Lands and Damages				(308,000)
	FEDERAL COSTS				1,328,000
	50% of Project Costs				(1,293,000)
	Aids to Navigation				(35,000)

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CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. ALTERNATIVE #3

LOCATION INSIDE OUTER HARBOR AT LORAIN, OHIO

JOB NAME

JOB NUMBER

PRELIMINARY ☐ FINAL ☐

BY ____ DATE ____

CHECK ____ DATE ____

LINE	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	BREAKWATERS				
	Mob. & Demob.		LS		58,500
	Armor stone 750-1600 lbs.	24,800	TN	32.00	793,600
	Underlayer/Bedding .15 to 150 lbs.	59,100	TN	25.00	1,477,500
	Contingency				582,000
	Total (Breakwaters)				2,912,000
	RECREATIONAL FACILITIES				
	Underlayer/Bedding .15 to 150 lbs.	1,075	TN	25.00	26,900
	Handrail	459	LF	12.00	5,500
	Walkway (concrete)	138	CY	300.00	41,400
	Contingency				18,000
	Total (Recreation)				92,000
	Engineering & Design				361,000
	Supervision and Administration				391,000
	Subtotal (all preceeding)				3,756,000
	AIDS TO NAVIGATION				
	U.S. Coast Guard				70,000
	TOTAL (all preceeding)				3,826,000

CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. ALTERNATIVE #3

LOCATION INSIDE OUTER HARBOR AT LORAIN, OHIO

JOB NAME

JOB NUMBER

PRELIMINARY ☐ FINAL ☐

BY DATE

CHECK DATE

LINE	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	LANDS AND DAMAGES	10	ACRE	22,000	220,000
	ANNUAL MAINTENANCE				
	Breakwaters				58,300
	Aids to Navigation				800
	Recreation				2,700
	Total (Maintenance)				61,800
	NON-FEDERAL COSTS				2,098,000
	50% of Project Costs Less				
	Aids to Navigation				
	Cash contribution for Nav.				(1,820,000)
	Cash contribution for Rec. Fish				(58,000)
	Lands and Damages				(220,000)
	FEDERAL COSTS				1,948,000
	50% of Project Costs				(1,878,000)
	Aids to Navigation				(70,000)

CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. ALTERNATIVE #4

LOCATION INSIDE OUTER HARBOR AT LORAIN, OHIO

JOB NAME

JOB NUMBER

PRELIMINARY ☐ FINAL ☐

BY DATE

CHECK DATE

LINE	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	BREAKWATERS				
	Mob. & Demob.		LS		58,500
	Armor stone 750-1600 lbs.	24,800	TN	32.00	793,600
	Underlayer/Bedding .15 to 150 lbs.	59,100	TN	25.00	1,477,500
	Contingency				582,000
	Total (Breakwaters)				2,912,000
	RECREATIONAL FACILITIES				
	Underlayer/Bedding .15 to 150 lbs.	1,075	TN	25.00	26,900
	Handrail	459	LF	12.00	5,500
	Walkway (concrete)	138	CY	300.00	41,400
	Contingency				18,000
	Total (Recreation)				92,000
	Engineering & Design				361,000
	Supervision and Administration				391,000
	Subtotal (all preceeding)				3,756,000
	AIDS TO NAVIGATION				
	U.S. Coast Guard				70,000
	TOTAL (all preceeding)				3,826,000

CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. ALTERNATIVE #4
LOCATION INSIDE OUTER HARBOR AT LORAIN, OHIO

JOB NAME
JOB NUMBER
PRELIMINARY ☐ FINAL ☐
BY DATE
CHECK DATE

LINE	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	LANDS AND DAMAGES	12.5	ACRE	22,000	275,000
	ANNUAL MAINTENANCE				
	Breakwaters				58,300
	Aids to Navigation				800
	Recreation				2,700
	Total (Maintenance)				61,800
	NON-FEDERAL COSTS				2,153,000
	50% of Project Costs Less				
	Aids to Navigation				
	Cash contribution for Nav.				(1,820,000)
	Cash contribution for Rec. Fish				(58,000)
	Lands and Damages				(275,000)
	FEDERAL COSTS				1,948,000
	50% of Project Costs				(1,878,000)
	Aids to Navigation				(70,000)

CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. ALTERNATIVE #5

LOCATION INSIDE OUTER HARBOR AT LORAIN, OHIO

JOB NAME

JOB NUMBER

PRELIMINARY ☐ FINAL ☐

BY DATE

CHECK DATE

LINE	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	BREAKWATERS				
	Dredge Fill	6,700	CY	6.00	40,200
	Mob. & Demob.		LS		58,500
	Armor stone 750-1600 lbs.	18,300	TN	32.00	585,600
	Underlayer/Bedding .15 to 150 lbs.	49,850	TN	25.00	1,246,250
	Contingency				483,000
	Total (Breakwaters)				2,414,000
	RECREATIONAL FACILITIES				
	Underlayer/Bedding .15 to 150 lbs.	1,965	TN	25.00	49,100
	Handrail	765	LF	12.00	9,100
	Walkway (concrete)	227	CY	300.00	68,100
	Contingency				32,000
	Total (Recreation)				158,000
	Engineering & Design				308,550
	Supervision and Administration				334,263
	Subtotal (all preceeding)				3,214,000
	AIDS TO NAVIGATION				
	U.S. Coast Guard	3	EA	35,000	105,000
	TOTAL (all preceeding)				3,319,000

CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. ALTERNATIVE #5

LOCATION INSIDE OUTERHARBOR AT LORAIN, OHIO

JOB NAME

JOB NUMBER

PRELIMINARY ☐ FINAL ☐

BY DATE

CHECK DATE

LINE	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	LANDS AND DAMAGES	14	ACRE	22,000	308,000
	ANNUAL MAINTENANCE				
	Breakwaters				48,300
	Aids to Navigation				1,200
	Recreation				4,500
	Total (Maintenance)				54,000
	NON-FEDERAL COSTS				1,915,000
	50% of Project Costs Less				
	Aids to Navigation				
	Cash contribution for Nav.				(1,508,600)
	Cash contribution for Rec. Fish				(98,400)
	Lands and Damages				(308,000)
	FEDERAL COSTS				1,712,000
	50% of Project Costs				(1,607,000)
	Aids to Navigation				(105,000)

CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. 300 Boats ALTERNATIVE 1 - SELF LIQUIDATING

LOCATION LORAIN, OHIO

JOB NAME ____

JOB NUMBER ____

PRELIMINARY ☐ FINAL ☐

BY ____ DATE ____

CHECK ____ DATE ____

LINE	DESCRIPTION		QUANTITY	UNIT	UNIT PRICE	AMOUNT
	ROADWAY:	PAVING 2000' x 40'	80,000	SQ. FT.	1.30	104,000
		CURBS	4,100	L. FT.	9.25	38,000
		SUBTOTAL				142,000
	PARKING:	BERTHING AREA	96,000	SQ. FT.	.90	86,500
		LAUNCH RAMP AREA	170,000	SQ. FT.	.90	153,000
		DRY STORAGE AREA (D.S.)				
		SUBTOTAL				239,500
	LAUNCHING FACILITIES:					
		RAMP 15' x 125'	3	L. S.	13,000	39,000
		BULKHEAD (D.S.)				
		SUBTOTAL				39,000
	BUILDINGS:	ADMINISTRATION BLDG.	1,500	S. F.	46	69,000
		REST ROOMS	20	TOILETS	3,700	74,000
		DRY STORAGE				
		SUBTOTAL				143,000
	DOCKS:	BERTHING AREA	300	SLIPS	2,750	825,000
	5' x 60'	PUBLIC DOCK	300	S. F.	16	4,800
	150' x 5'	LAUNCHING RAMP DOCK	750	S. F.	16	12,000
		DRY STORAGE DOCK (D.S.)				
		SUBTOTAL				841,800
	EQUIPMENT:	DRY STORAGE LAUNCH (D.S.)				
		DRY STORAGE RACKS (D.S.)				
		SUBTOTAL				
	UTILITIES:	DOCKS	300	SLIPS	480	144,000
		SUBTOTAL				144,000
		TOTAL OF PAGE				1,550,000

CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. 300 Boats (CONT.) ALTERNATIVE 1- SELF LIQUIDATING

LOCATION LORAIN, OHIO

JOB NAME

JOB NUMBER

PRELIMINARY ☐ FINAL ☐

BY DATE

CHECK DATE

LINE	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	TOTAL FROM PREVIOUS PAGE				1,550,000
	CONTINGENCY 25%				387,500
	TOTAL				1,938,000

CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. 600 BOATS ALTERNATIVE 2 - SELF LIQUIDATING

LOCATION LORAIN, OHIO

JOB NAME

JOB NUMBER

PRELIMINARY ☐ FINAL ☐

BY DATE

CHECK DATE

LINE	DESCRIPTION		QUANTITY	UNIT	UNIT PRICE	AMOUNT
	ROADWAY:	PAVING 2600' x 60'	156,000	S. F.	1.30	203,000
		CURBS 2600	5,500	L. F.	9.25	51,000
		SUBTOTAL				254,000
	PARKING:	BERTHING AREA	192,000	S. F.	.90	173,000
		LAUNCH RAMP AREA	170,000	S. F.	.90	153,000
		DRY STORAGE AREA (D.S.)				
		SUBTOTAL				326,000
	LAUNCHING FACILITIES:					
		RAMP	3	L. S.	13,000	39,000
		BULKHEAD (D.S.)				
		SUBTOTAL				39,000
	BUILDINGS:	ADMINISTRATION BLDG.	2,000	S. F.	44	88,000
		REST ROOMS	40	TOILETS	3,700	148,000
		DRY STORAGE				
		SUBTOTAL				236,000
	DOCKS:	BERTHING AREA	600	SLIPS	2,750	1,650,000
	100' x 5'	PUBLIC DOCK	500	S. F.	16	8,000
	150' x 5'	LAUNCHING RAMP DOCK	750	S.F.	16	12,000
		DRY STORAGE DOCK (D.S.)				
		SUBTOTAL				1,670,000
	EQUIPMENT:	DRY STORAGE LAUNCH (D.S.)				
		DRY STORAGE RACKS (D.S.)				
		SUBTOTAL				
	UTILITIES:	DOCKS	600	SLIPS	480	288,000
		SUBTOTAL				288,000
		TOTAL OF PAGE				2,800,000

CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. 600 BOATS (CONT.) ALTERNATIVE 2 - SELF LIQUIDATING

LOCATION LORAIN, OHIO

JOB NAME

JOB NUMBER

PRELIMINARY ☐ FINAL ☐

BY DATE

CHECK DATE

LINE	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	TOTAL FROM PREVIOUS PAGE				2,800,000
	CONTINGENCY 25%				700,000
	TOTAL				3,500,000

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CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. 300 BOATS ALTERNATIVE 3 - SELF LIQUIDATING

LOCATION LORAIN, OHIO

JOB NAME

JOB NUMBER

PRELIMINARY ☐ FINAL ☐

BY DATE

CHECK DATE

LINE	DESCRIPTION		QUANTITY	UNIT	UNIT PRICE	AMOUNT
	ROADWAY:	PAVING 2400' x 40'	96,000	S. F.	1.30	124,000
		CURBS 2400'	5,000	L. F.	9.25	46,200
		SUBTOTAL				171,000
	PARKING:	BERTHING AREA	96,000	S. F.	.90	86,500
		LAUNCH RAMP AREA	170,000	S. F.	.90	153,000
		DRY STORAGE AREA (D.S.)				
		SUBTOTAL				239,500
	LAUNCHING FACILITIES:					
		RAMP	3	L. S.	13,000	39,000
		BULKHEAD (D.S.)				
		SUBTOTAL				39,000
	BUILDINGS:	ADMINISTRATION BLDG.	1,500	S. F.	46	69,000
		REST ROOMS	20	TOILETS	3,700	74,000
		DRY STORAGE				
		SUBTOTAL				143,000
	DOCKS:	BERTHING AREA	300	SLIPS	2,750	825,000
	5 'x 60'	PUBLIC DOCK	300	S. F.	16	4,800
		LAUNCHING RAMP DOCK	750	S. F.	16	12,000
		DRY STORAGE DOCK (D.S.)				
		SUBTOTAL				841,000
	EQUIPMENT:	DRY STORAGE LAUNCH (D.S.)				
		DRY STORAGE RACKS (D.S.)				
		SUBTOTAL				
	UTILITIES:	DOCKS	300	SLIPS	480	144,000
		SUBTOTAL				144,000
		TOTAL OF PAGE				1,580,000

CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. 300 BOATS (CONT. ALTERNATIVE 3 - SELF LIQUIDATING

LOCATION LORAIN, OHIO

JOB NAME

JOB NUMBER

PRELIMINARY ☐ FINAL ☐

BY DATE

CHECK DATE

LINE	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	TOTAL FROM PREVIOUS PAGE				1,580,000
	CONTINGENCY 25%				395,000
	TOTAL				1,975,000

CONSTRUCTION COST ESTIMATE - SHEET NO. 2 OF 2

CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. 600 BOATS ALTERNATIVE 4 - SELF LIQUIDATING

LOCATION LORAIN, OHIO

JOB NAME

JOB NUMBER

PRELIMINARY ☐ FINAL ☐

BY ______ DATE ______

CHECK ______ DATE ______

LINE	DESCRIPTION		QUANTITY	UNIT	UNIT PRICE	AMOUNT
	ROADWAY:	PAVING 2400' x 40'	96,000	S.F.	1.30	125,000
		CURBS 2400'	5,000	L.F.	9.25	46,200
		SUBTOTAL				171,000
	PARKING:	BERTHING AREA	96,000	S.F.	.90	86,500
		LAUNCH RAMP AREA	170,000	S.F.	.90	153,000
		DRY STORAGE AREA (D.S.)	96,000	S.F.	.90	86,500
		SUBTOTAL				326,000
	LAUNCHING FACILITIES:					
		RAMP	3	EA	1,300	39,000
		BULKHEAD (D.S.)	72	L.F.	661	48,000
		PAVING (D.S.) 40' x 100'	4,000	S.F.	3.85	15,000
		SUBTOTAL				102,000
	BUILDINGS:	ADMINISTRATION BLDG.	2,000	S.F.	44	88,000
		REST ROOMS	40	TOILETS	3,700	148,000
		DRY STORAGE	24,000	S.F.	18	432,000
		SUBTOTAL				668,000
	DOCKS:	BERTHING AREA	300	SLIPS	2,750	825,000
	5' x 100'	PUBLIC DOCK	500	S.F.	16	8,000
	5' x 150'	LAUNCHING RAMP DOCK	750	S.F.	16	12,000
	5'x100'x3'x100'	DRY STORAGE DOCK (D.S.)	800	S.F.	16	12,800
		SUBTOTAL				857,800
	EQUIPMENT:	DRY STORAGE LAUNCH (D.S.)	2	EA	60,000	120,000
		DRY STORAGE RACKS (D.S.)	300	EA	500	150,000
		SUBTOTAL				270,000
	UTILITIES:	DOCKS	300	SLIPS	480	144,000
		SUBTOTAL				144,000
		TOTAL OF PAGE				2,500,000

CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. 600 BOATS ALTERNATIVE4 - SELF LIQUIDATING

LOCATION LORAIN, OHIO

JOB NAME

JOB NUMBER

PRELIMINARY ☐ FINAL ☐

BY DATE

CHECK DATE

LINE	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	TOTAL FROM PREVIOUS PAGE				2,500,000
	CONTINGENCY 25%				625,000
	TOTAL				3,125,000

CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. 600 BOATS ALTERNATIVE 5 - SELF LIQUIDATING

LOCATION LORAIN, OHIO

JOB NAME

JOB NUMBER

PRELIMINARY ☐ FINAL ☐

BY DATE

CHECK DATE

LINE	DESCRIPTION		QUANTITY	UNIT	UNIT PRICE	AMOUNT
	ROADWAY:	PAVING 2600' x 60'	156,000	S.F.	1.30	203,000
		CURBS 2600'	5,500	L.F.	9.25	51,000
		SUBTOTAL				254,000
	PARKING:	BERTHING AREA	192,000	S.F.	.90	173,000
		LAUNCH RAMP AREA	170,000	S.F.	.90	153,000
		DRY STORAGE AREA (D.S.)				
		SUBTOTAL				326,000
	LAUNCHING FACILITIES:					
		RAMP	3	L.S.	13,000	39,000
		BULKHEAD (D.S.)				
		SUBTOTAL				39,000
	BUILDINGS:	ADMINISTRATION BLDG.	2,000	S.F.	44	88,000
		REST ROOMS	40	TOILETS	3,700	148,000
		DRY STORAGE				
		SUBTOTAL				236,000
	DOCKS:	BERTHING AREA	600	SLIPS	2,750	1,650,000
		PUBLIC DOCK	500	S.F.	16	8,000
		LAUNCHING RAMP DOCK	750	S.F.	16	12,000
		DRY STORAGE DOCK (D.S.)				
		SUBTOTAL				1,670,000
	EQUIPMENT:	DRY STORAGE LAUNCH (D.S.)				
		DRY STORAGE RACKS (D.S.)				
		SUBTOTAL				
	UTILITIES:	DOCKS	600	SLIPS	480	288,000
		SUBTOTAL				288,000
		TOTAL OF PAGE				2,800,000

CONSTRUCTION COST ESTIMATE

REFERENCE/PLAN NO. 600 BOATS ALTERNATIVE 5 - SELF LIQUIDATING

LOCATION LORAIN, OHIO

JOB NAME

JOB NUMBER

PRELIMINARY ☐ FINAL ☐

BY DATE

CHECK DATE

LINE	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	TOTAL FROM PREVIOUS PAGE				2,800,000
	CONTINGENCY 25%				700,000
	TOTAL				3,500,000

APPENDIX B

NAVIGATION ECONOMIC ANALYSIS

APPENDIX B
NAVIGATION ECONOMIC ANALYSIS
TABLE OF CONTENTS

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APPENDIX B

ECONOMIC ANALYSIS OF RECREATIONAL BOATING

1.0 INTRODUCTION

Lorain County is ranked ninth in population among Ohio's 88 Counties. Located along the coast of Lake Erie, it is served by a major port facility and handles significant amounts of iron ore, limestone, and other dry and liquid bulk freight moving within the Great Lakes region. Unlike other major metropolitan county coastal areas, Lorain presently has limited small craft harbor facilities and restricted opportunities for recreational boating in local waters.

The need for small boat harbor facilities along all of the Great Lakes has been examined several times in the past 37 years, beginning with the report "The Coasts of the Great Lakes--Harbors of Refuge for Light-Draft Vessel" (December 11, 1944). This report has been revised to specifically address recreation boating needs on Lake Erie (July, 1946). Recently a regional survey was completed regarding potential recreation boating facility needs for the entire American shoreline of Lake Erie, Lake Ontario and St. Lawrence River (MRI, 1980).

Along with these regional surveys, the Chief of Army Corps of Engineers initiated survey-scope studies of 35 harbors on Lake Erie, including Lorain. The Buffalo District initiated a study of small-boat needs at Lorain in the mid-1960. The resulting report, Coast- of Lake Erie Interim Report on Lorain Harbor, Ohio, was not completed after it was determined at a 1968 Public Meeting that some local interests strongly opposed a selected site in the West Basin.

Since the early 1970's, local interests have undertaken preliminary small boat studies at Lorain, including the most recent, Lorain Harbor Recreational Area Study (Stanley Consultants, 1978). That report and a 1979 revised Reconnaissance Report on Lorain Harbor have concluded that small-craft user-demand exceeds supply capacity at Lorain. However, these conclusions are based more on qualitative analysis than on quantitative data.

As part of the Preliminary Feasibility Study of providing additional Small-Boat Harbor facilities at Lorain Harbor, Ohio, a computer analysis techniques was implemented to project user-demand for existing and future recreational boat facilities. This analysis provides sufficient detail for assuring accurate prediction of derived benefits, commensurate with Stage 2 study goals.

1.1 Objectives and Scope

The demand for boating facilities on Lake Erie, particularly in Lorain County, is thought to exceed the capacity of existing facilities. The purpose of the present study is to predict the future user-demand for regional, permanent based boats in Lorain Harbor to evaluate the potential expansion of existing small-boat facilities at Lorain. The objectives of the small-craft user-demand study are:

- Review and update existing inventory of recreation boating facilities;
- Determine existing small boat fleet mix and use patterns;
- Project user-demand for recreation boating facilities; and
- Evaluate potential boating needs at Lorain.

Potential recreation boat user-demand was estimated in ten year intervals for the period 1990 to 2040. The methods described below were designed to derive fleet mix demand levels, and establish potential federal interest in the development of additional boating facilities at Lorain. In this analysis, Lake Erie boat market origin zones were established to project small-craft user-demand at the specific supply source location of Lorain Harbor. Projected small-craft user-demand is evaluated in the following terms.

- Boat fleet market origin;
- Boat fleet projection;
- Boat fleet mix by type and size;
- Boat facility user-demand;
- Trailerable and non-trailerable boat user-demand; and
- Transient boat user-demand.

1.2 Study Area

The study area for this analysis was based on average recreational boater travel data and Lake Erie boat user registrations by County. The potential Lake Erie boat market origin area was identified from 1970 and 1980 Ohio boat registration data tapes provided by the Ohio Department of Natural Resources (ODNR) on the basis of registered Lake Erie boats by county.

The study area is comprised of 46 Ohio counties. Based on a recent survey (MRI, 1980) of regional market origin distance, the study area counties were grouped into five origin zones. The demand market origin zone areas were established according to the percent of total Ohio registered Lake Erie boats by distance in reach 3003 (identified in Figure 1-1). Because 98 percent of current Lake Erie boat market was determined to be generated within a 100-mile radius of Lorain, all counties falling with this area were included in the study. The regional demand market origin zones by county are identified in Figure 1-2. The project study area counties are summarized by zone in Table 1-1.

According to the market survey more than 90 percent of Lake Erie boaters in reach 3003 which includes the Lorain area, live within 50 miles of the marina where they keep their boats; slightly more than 75 percent live within 25 miles; and slightly more than half live within 10 miles. The average distance from a slip renter's residence to his marina is 19.7 miles (MRI, 1980).

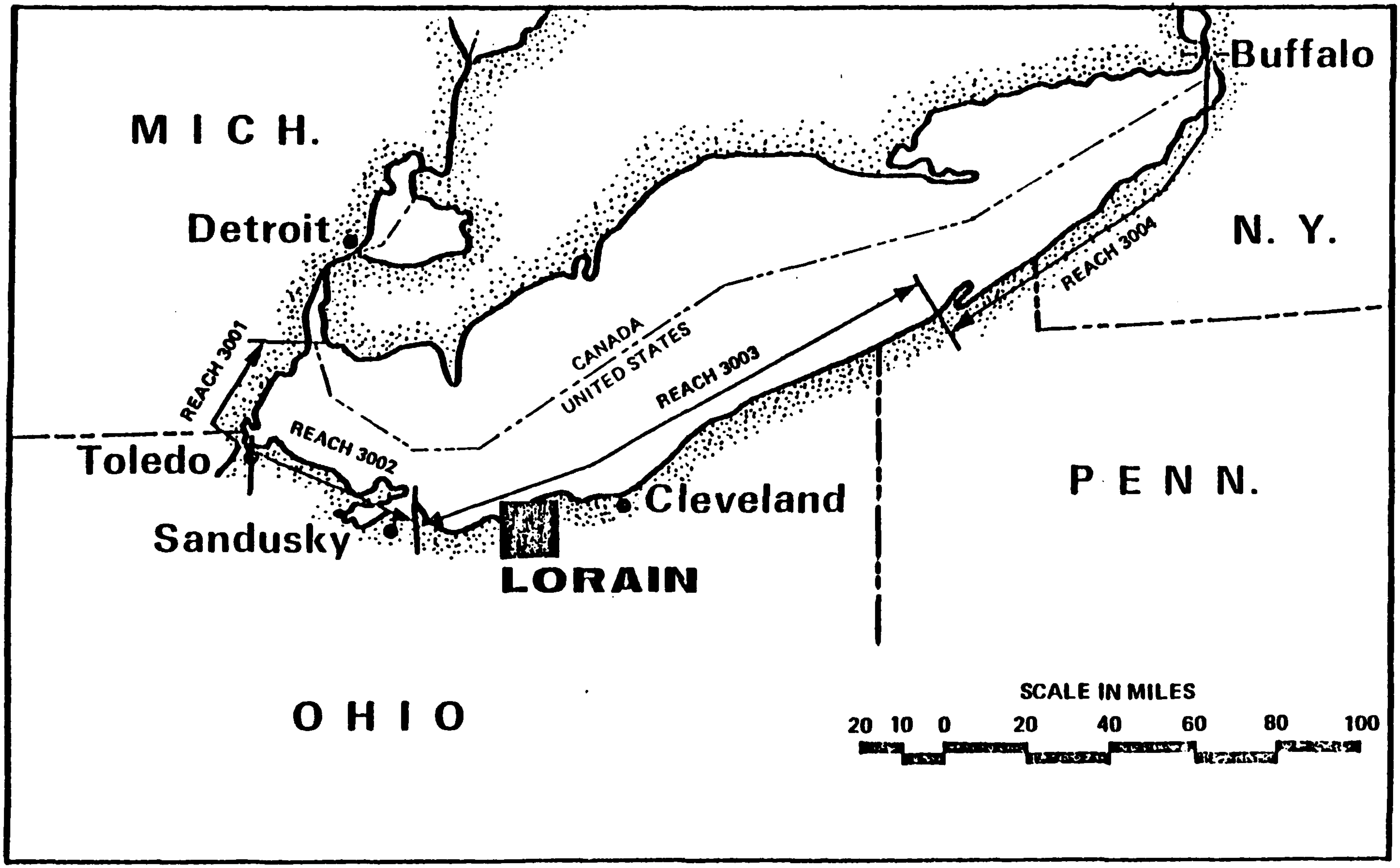

FIGURE 1 –1 BOATING SURVEY REACHES

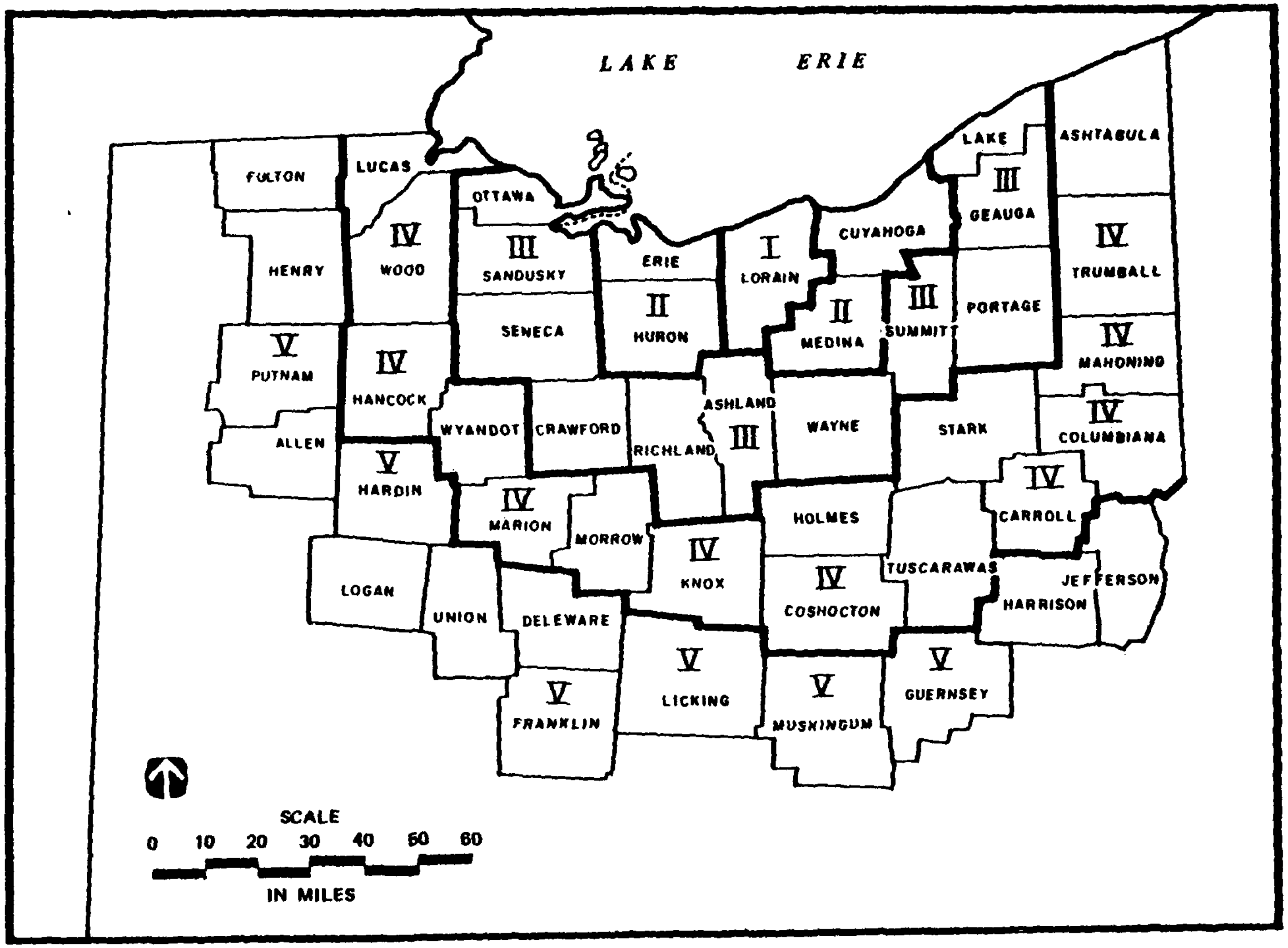

FIGURE 1-2 PROJECT STUDY AREA

TABLE 1-1
PROJECT STUDY AREA COUNTIES BY DEMAND MARKET ORIGIN ZONE(1)

ZONE I	ZONE II	ZONE III	ZONE IV	ZONE V
Lorain	Cuyahoga	Lake	Ashtabula	Jefferson
	Medina	Geauga	Trumball	Harrison
	Erie	Portage	Mahoning	Guernsey
	Huron	Summitt	Stark	Muskingum
		Wayne	Columbiana	Licking
		Ashland	Carroll	Delaware
		Richland	Tuscarwas	Union
		Crawford	Holmes	Logan
		Seneca	Coshocton	Hardin
		Sandusky	Knox	Allen
		Ottawa	Morrow	Putnam
			Marion	Henry
			Wyandot	Fulton
			Handcock	Franklin
			Wood	
			Lucas	

Note:

1. Zone distance based on MRI market origin data (October, 1980).

2.0 TECHNICAL APPROACH

2.1 Overview

In projecting recreational boat user-demand, the analysis included an initial literature review; an inventory of the existing Lake Erie fleet mix in the study area counties; an inventory of existing boating facilities and user patterns in Lorain County; an analysis of socioeconomic characteristics of boat ownership; the development of projected socioeconomic characteristics for the counties in the study area; a projection of boat fleet user-demand by zone of origin; an allocation of projected user-demand for the proposed Lorain marina; and an evaluation of potential boating facility needs in Lorain. This information is used to estimate appropriate facility size and to evaluate the benefits of providing facility improvements at Lorain. The major work elements involved in the user demand analysis are presented in a flow diagram in Figure 2-1.

User-demand for recreational boating facilities in this analysis is defined in terms of per capita boat ownership by Lake Erie water use area. Various economic methods are used to project future demand based on current boat ownership characteristics and user patterns. Boat facility demand is estimated on the basis of the following factors:

- Current demand;
- Expected future demand; and
- Induced latent demand.

The total future user-demand is assumed to equal the sum of the expected future demand and the potential latent demand induced by additional or improved facilities, and by subsidized operational costs including reduced access and user-demand costs.

The percent of boats by type and size which use Lake Erie were determined for each county in the study area from 1970, 1980 ODNR boat registration data types. The projected fleet mix by type and size by decade was derived by applying these percentages to the total number of estimated boats. The fleet mix percentages by county are assumed constant throughout the projection period.

An inventory of existing boating facilities in Lorain County was compiled from a recent survey of regional Lake Erie recreational boating facilities (MRI, 1980) and augmented by field investigations in August 1981. The inventory included data on the number, location,

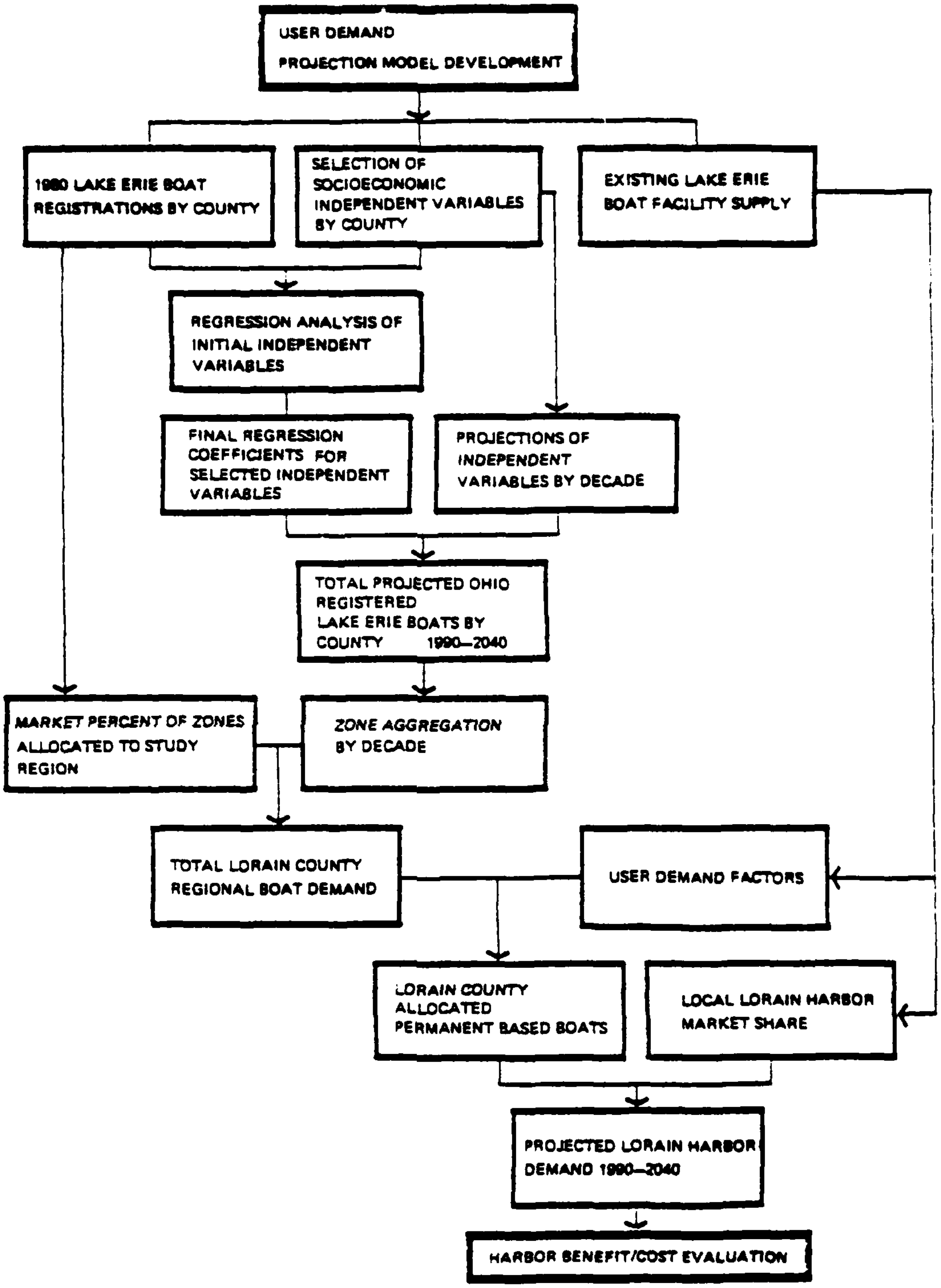

TABLE 2.1: USER DEMAND PROGRAM FLOW

and capacity of recreational boating facilities. All boating facilities in the Lorain region displayed full use during field investigations, thus capacity of the existing facilities was assumed to be an accurate estimate of current use patterns. The estimated facility use patterns were assumed constant for all types and sizes of boats throughout the projection period.

Potential recreational boating facility needs in the City of Lorain were determined by summing the capacities of existing marinas in the city and county based on local usage patterns. The total city/county capacity was then subtracted from the regional projections and locally allocated demand to determine potential future city facility needs. It was assumed that no competing facilities are being built or improved that would significantly attract boaters from the Lorain market origin zones.

2.2 Data Sources

The analysis relies almost exclusively on secondary data sources. Socioeconomic and recreational boat user-demand data were compiled from available sources, including the U.S. Department of Commerce, the U.S. Army Corps of Engineers, the Ohio State Department of Economic and Community Development Data User Center, and the Ohio Department of Natural Resources (ODNR). Summaries of state boat registration data by boat type and size were compiled directly from 1970 and 1980 computer registration data tapes obtained from ODNR. The data was then sorted by county code to yield county data on Lake Erie registered boat types and sizes.

A computerized literature search was also conducted to identify appropriate recreation boating user-demand related technical materials. The reference research effort included use of the Lockheed/DIALOG on-line information service which provides access to technical literature in the areas of Science, Technology, Business/ Economics, and the Social Sciences. The DIALOG data base references included U.S. Department of Commerce, National Technical Information Service, SciSearch and Social SciSearch, Sociological Abstracts, and Comprehensive Dis-sertation Abstracts. The materials reviewed were utilized in development of the user-demand projection and allocation models.

3.0 EXISTING BOATING CONDITIONS

3.1 Current Boating Demand

Summaries of existing boat user-demand for the study area and the state were developed from 1970 and 1980 Ohio State boat registration computer tape data. The State boat registration files provided data which included the county of registration, the principal lake user area, and the type and size of the craft. The study area as defined, included approximately 96 percent of all Ohio boats registered for use on Lake Erie.

There were an estimated 58,662 registered Lake Erie boats in Ohio in 1970, or approximately 28 percent of the total registered boats in the State. The number of registered Lake Erie boats increased to an estimated 72,191, (again, percent 28 percent of the total) in 1980. This represents an annual increase in Lake Erie registered boats of approximately 2.1 percent from 1970 to 1980.

In contrast, there were an estimated 3,530 Lake Erie registered boats in Lorain County in 1970, or approximately 78 percent of the total registered in the County. These increased to an estimated 5,332 in 1980, or approximately 84 percent of the total. The average annual rate of increase in Lorain County registered Lake Erie boats from 1970 to 1980 was approximately 4.2 percent, or almost double that of the state for the same time period. The total number of Lake Erie registered boats for Lorain County and the State for 1970 and 1980 are presented in Table 3-1.

The historical data indicate that the per capita boating ratio of Lake Erie boats registered in Lorain County is increasing over time. This is due in part to rapid increases in disposable income and to significant increases in average boat ownership age group numbers. In Lorain County the number of registered Lake Erie boats per 1000 population increased from approximately 13.7 boats in 1970 to 19.4 boats in 1980, or an estimated boat per population ratio annual increase of 3.5 percent. The increase in the boat ownership ratio reflects the effects of income and demographic time trend effects from 1970 to 1980.

TABLE 3-1
OHIO REGISTERED BOAT SUMMARY 1970/1980*

AREA	Total Registered Boats		Total Lake Erie Registered Boats		Annual Percent Change Lake Erie Registered
	1970	1980	1970	1980	1970/1980
Lorain County	4,530	6,316	3,530	5,332	4.2
State Total	208,954	270,092	58,662	72,191	2.1

Source: State of Ohio Department of Natural Resources 1970/1980 Computer Boat Registration Files.

3.2 Regional Supply

According to a recent survey, reach 3003 which includes the Lorain Area, contains approximately 73 boating facilities. Sixty of these facilities are privately owned, 4 are owned by municipalities, 3 are state owned, and 1 facility is in quasi-public ownership. Administration of these facilities is largely private with state management of two facilities, municipal management of two facilities, and quasi-public management of one facility (MRI, 1980).

An estimated total of 8,171 slips and moorings is available for use in this reach, or approximately 29 percent of the total 27,765 Lake Erie slips and moorings in the State. The current reach utilization is estimated at 7,560 slips and moorings, or an approximate average occupancy rate of 92.5 percent. However, an estimated 27 percent of existing slip/mooring capacity is of either fair or poor quality. Thus, many of the available slips are not of an acceptable quality to attract either new boaters or those desiring to upgrade their equipment. In addition, many of these available slips and moorings are located in shallow parts of marinas or have restricted access to Lake Erie and therefore cannot accommodate average size or larger crafts (MRI, 1980).

The fleet mix for boats utilizing slips in reach 3003 is made up primarily of 16 to 25-foot craft at 53 percent of the total and 26 to 39-foot craft at 40 percent. Almost half of the boats utilizing slips are classified as cruisers, with the next largest class, inboards/outboards at 18.1 percent of the total, and auxiliary sailboats at 15.3 percent (MRI, 1980).

The percentage of cruisers in this reach is consistently high for all of the harbors/bays, with the possible exception of Fairport Harbor, which only has 26.5 percent of its fleet in cruisers. The percentage of cruisers for the other harbors in this reach range from 36.8 percent at Cleveland Harbor to 68 percent at Vermilion Harbor. However, Fairport Harbor and Lorain Harbor have a relatively high percentage of inboard and outboard boats, at 30.6 percent and 33.3 percent of the totals, respectively. Within reach 3003, Lorain Harbor also has the second highest percentage of sailboats at 16.7 percent of the total. Cleveland Harbor has the second highest percentage of auxiliary sailboats of all harbors. Finally, reach 3003 has a considerably lower percentage of outboard boats than any of the other Lake Erie reaches at 8.8 percent of the total (MRI, 1980).

The types of docks and construction materials used in reach 3003 vary considerably. About one-half of the docks are wood and one-forth are metal. Approximately half of the docks are in excellent condition and 39 percent are in good condition (MRI, 1980).

3.3 Local Supply

Harbors and marinas in the Lorain area which berth substantial numbers of Lorain County registered boats are identified by location for the following townships and cities in Figure 3-1.

- Avon Lake
- Lorain
- Black River
- Vermillion

To determine the need for additional boating facilities in the city of Lorain, it was first necessary to identify the existing local supply. A field reconnaissance of public and commercial marinas and boating clubs in Lorain County and the City of Vermillion was conducted in August, 1981. All the sites identified were within the average travel distance for slip renters in reach 3003, approximately 20 miles.

Table 3-2 provides an inventory of the capacity at each marina, including slips and dry storage facilities. All of the available wet slip marinas, except Copper Kettle are operating at capacity; therefore the information in Table 3-2 provides a good estimate of that portion of current user-demand being served by existing

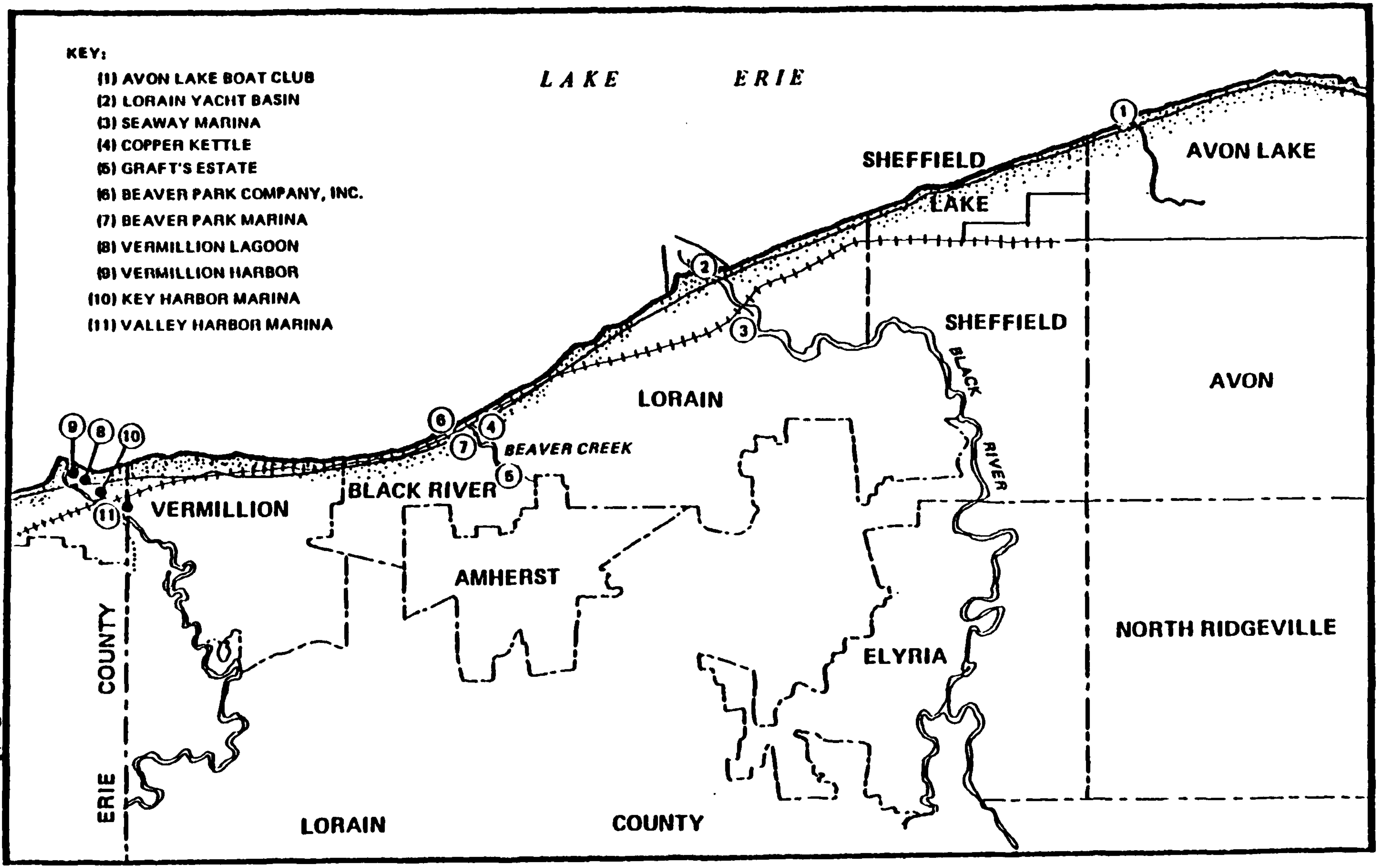

FIGURE 3.1 LORAIN COUNTY MARINA'S BY LOCATION

TABLE 3-2
LORAIN COUNTY MARINAS AND SELECTED CHARACTERISTICS

Facility Name and Location	Management Type	Type of Boating	No. of Wet Slips	% Current Occupancy	No. of Dry Berths	% Current Occupancy
Avon Lake						
Avon Lake Boat Club	2	1,2	0	-	102	100%
City of Lorain						
Lorain Yacht Basin	1	1,2	68	100%	0	-
Seaway-Marina	1	1,2	23	100%	100	85%
Black River						
Copper Kettle Marina	1	1	228	85%	150	85%
Grafts Estate	2	1	43	100%	0	-
Beaver Park Marina	1	1	300	100%	0	-
Beaver Park Company, Inc.	1	1,2	170	100%	0	-
Vermillion						
Vermillion Harbor	1	1,2	113	100%	0	-
Vermillion Lagoon	2	1,2	350	100%	0	-
Valley Harbor Marina	1	1	300	100%	0	-
Key Harbor Marina	1	1	250	100%	0	-
TOTALS	N/A	N/A	1,845	98%	352	87%

KEY:

NA = No Data Available

Management:

1 = Privately owned, open to public.
2 = Privately owned, members only.

Type of Boating

1 = Power
2 = Sail

facilities. The data summarized were obtained from a survey of marinas compiled by the Ohio Department of Natural Resources, Watercraft Division; from an Boating Facility Needs Report (MRI,1980) a boating facilities guide by The Ohio State University; and from field reconnaissance conducted in August, 1981.

In summary, of the estimated 2,197 berths in Lorain County, 1,845 (84 percent) are wet slips and 350 (16 percent) are enclosed dry storage berths. The current occupancy rates are estimated at 98 percent and 87 percent for wet and dry storage berths, respectively. There are also approximately 18 boat ramps in Lorain County.

According, the estimated 1980 Lorain County boat facility user-demand factor based on total number of county berths is 0.41; this is 8 percent larger than the estimated state-wide user-demand factor of 0.34 for 1980.

3.4 Characteristics of Present Boating Activities

Characteristics of existing boating activity can be inferred from 1980 ODNR boat registration data and facility use by the present average fleet mix. The fleet mix registered in Lorain County in 1980 indicates that approximately 59 percent of the total boats are outboard, 27 percent are inboard, 6 percent are sail boats, and the remaining 8 percent are hand-powered. The Lorain County Lake Erie fleet mix is composed of 44 percent of craft 16 foot and under, 50 percent of 16 to 26 foot craft, and 6 percent of 26 to 40 foot craft.

The presence of different craft types indicate different types of uses. For example, large inboard and cruiser types are frequently used for overnight and long-term lake excursions, often to the Sandusky and Pelee Islands: smaller inboard and outboard craft are more frequently used for short term lake fishing close to shore and near breakwaters.

The composition of the fleet mix has changed in the last five years according to interviews with marina operators. The fleet mix in Lorain County is becoming increasingly characterized by 16 to 25 foot outboards and auxillary powered sail boats. The larger outboard craft used in walleye fishing are now locating outside of Lorain County, in marinas closer to preferred fishing sites in Western Lake Erie. One explanation for this shift is the higher cost of large power boat propulsion as compared to land travel.

Concurrently, there is increased sailing and small fishing craft activity in Lorain County, particularly in the Lorain Yacht Basin area. Although most of the local fishing involves small inboard and outboard craft that are frequently trailered, increasing numbers of auxillary powered sailboats and smaller, non-auxillary powered sailboats are creating excess demand for facilities.

4.0 FACILITY DEMAND

4.1 Projection Model

In order to derive projections of recreational boat user-demand for the study area counties (i.e, market demand origin zones), a statistical model was developed. The statistical model was based on boat ownership registration correlated with various socioeconomic characteristics. A series of two-stage multiple regression equations was utilized in estimating expected demand for the counties within the study area zones. The 1970/1980/time-series/cross-sectional boat registration data were used as the dependent variable to derive coefficients for significant independent socioeconomic variables. The demand model relating boat ownership to relevant socioeconomic characteristics was transformed into the following functional relationship:

$$U = f(x_1, x_2 \ldots x_n, D)$$

where:

U = Recreational Boat Demand
x = Relevant Socioeconomic Characteristics
D = Dummy Control Variable

The key criterion in any statistical prediction model is the percent explanation indicated by the solution equation as a whole. The following socioeconomic characteristics for each county within the study were utilized as the independent variables for the initial fitting of the equation.

- Population Size
- Number of Household
- Per Capita Income
- Professional Employment
- Population Age 45 - 64
- Ethnicity, (i.e., Blacks and other minority races)
- Centroid Distance to Lake Erie

The model requires multi-variate methods of analysis; in this case, multi-variate regression was applied to provide the solution to a number of statistics. Regression analysis is a statistical procedure which attempts to account for the variation found in the dependent variable by the variation found in independent or predictor variables. Two variables which covary are said to be correlated. Thus, regression analysis has the explanatory and predictive powers that correlation analysis lacks.

Multiple regression is based on the following mathematical expression:

$$Y = a + b_1 X_1 + b_2 X_2 + \ldots + b_K X_K;$$

Where: Y = the dependent (or predicted) variable,
a = a constant,
$X_1, X_2, \ldots, X_K$ = the first, the second, and and Kth independent (or predictor) variable, respectively, and
$b_1, b_2, \ldots, b_K$ = the coefficients for X_1, X_2, y..., and X_K, respectively.

This equation is solved using actual data and results in estimates of Y. The stronger the relationships between the dependent and independent variables, the more closely the estimated values approximate the actual values of Y.

Clearly, as any one of the independent variables changes so must the dependent variable. The coefficient indicates how much of a change in the independent variable is required for a unit change in the value of the dependent variable. Standardized coefficients (Beta's) are important in determining the relative importance of the independent variables in accounting for variations in Y. Standardization removes the unique units of measurement usually associated with each of the independent variables. The constant, a, is simply the value of Y when all X's are zero.

Aside from standardized regression coefficients, a number of related regression statistics are useful in analyzing user-demand, some of which include:

- Simple r -- the correlation coefficient between two variables. It measures the association between variation in the two variables and ranges from +1.0 to -1.0, where a positive value means that as one variable increases in value so does the other; a negative value means that as one decreases the other increases; and 0.0 value means that there is no pattern between variations in the two variables.

- R^2 -- the squared multiple correlation coefficient, or explained variance. It provides the proportion of variation in the dependent variable which is accounted for by the variations in the set of independent variables in the regression equation. It is computed as the ratio of the variation in Y explained by the independent variables to the total variation in Y.

- F-ratio -- the ratio of variation within the estimated values of Y (from the regression equation) to the variation between actual and estimated values of Y. This ratio is modified by the size of the sample (number of observations or units of analysis), since a large sample size is less likely to be uniquely biased for one reason or another. A significantly large F-ratio indicates that there is relatively less difference between estimated and actual values of Y than there is variation in the expected values of Y. F-ratios are useful in determining if the addition of an independent variable to a regression equation adds significantly more explanation of Y. This is one method of determining the "significance" of the variable. The overall F-ratio for the regression equation indicates the overall significance of the set of independent variables in the regression equation.

- residuals -- the differences between actual and estimated values of Y. The residuals are useful in developing new hypotheses to explain the dependent variable. When the cbservations are geographic units such as census tracts, the residuals can be mapped. The resulting patterns of residuals may stimulate further analysis by revealing subtle associations.

- partial r -- the correlation coefficient between two sets of residuals, one resulting from a regression between the dependent variable and a set of independent variables and another resulting from a regression between a criterion variable and the same set of independent variables employed in the first regression. This statistic indicates the degree of association between the dependent and the independent variables, above and beyond any indirect associations they have as a result of their associations with other variables. The square of the partial r provides the proportion of the variance in Y which is explained by the criterion variable independent of the effects of the other independent variables on either the dependent or the criterion variable. This explained variance is in addition to the explained variance provided by the R^2 value (Kerlinger, 1973).

The independent variables initially chosen for inclusion in the demand model were those identified in previous recreational demand studies from the literature search as being highly correlated to boat ownership and user patterns. A dummy variable was included in the regression function as a control variable for equation fit. In calibration of the model, a correlation matrix composed of Pearson Coefficients was derived to assess the significance and interrelationships between the set of independent variables and the dependent variable. A number of the initial independent variables were excluded from the final model specification due to the presence of high multicolinearity or interaction among specific independent variables. From this analysis, a final set of independent variables was selected on a basis providing the best equation fit which include the following:

- Population Size
- Per Capita Income
- Ethnicity (i.e., blacks and other minority races)
- Centroid Distance to Lake Erie

Regression equations were determined for both total registered boats and Lake Erie registered boats by origin zone. Analytical results were evaluated on a statistical basis of R^2 and F values. Solutions for the equations function were calculated by use of the Statistical Package for Social Sciences (SPSS), multiple regression computer program. The statistical results were comparable and for the most part confirmed initial expectations. The partial coefficients were derived for Lake Erie per capita boat ownership as a function of socioeconomic characteristics, and the R^2 and F values for each equation are summarized in Table 4-1.

Analysis of equation fit was evaluated on the basis of R^2 statistics. Both R^2 and F values indicate that the equations are significant at the .01 level. Thus, the equations were accepted as suitable for projection purposes. The Lake Erie per capita boat ownership data base is summarized in Table 4-2 (included at the end of Appendix B).

4.2 Regional Demand Projection

Table 4-1 presents the correlation coefficients for Ohio State registered boats that use Lake Erie for the zones of origin. When the coefficients are applied to the projected values of the corresponding independent variables by county, the equation results in projections of Lake Erie registered boats. A Projection matrix algorithm was developed for this purpose and applied to each origin zone coefficient set. Solutions to the equations were obtained through the use of a computer.

The independent variables utilized in the projection matrix included total county population, per capita income by county, ethnicity (percent) by county and county centroid distance to Lake Erie. The variables were estimated from 1990 to 2040 by decade. The estimates were based on the best available socioeconomic data projections obtained from the Ohio State Data User Center (ODC) and adjusted for the duration of the study period as follows:

- Population - Baseline projections to the year 2005 were obtained from ODC's 1981 Interim Population Projection by County summary. The extrapolations derived were based on a log linear regression curve fit. The population projections were considered conservative with an annual rate of increase of less than 1 percent;

- Per Capita Income - Baseline data from 1970/1978 was obtained from ODC's per capita income by county summary. The projections derived were based on a non-linear logrithmic curve fit. The projections are also considered conservative with an annual rate of increase of approximately 2 percent.

- Ethnicity (percent of total population) - Baseline data (percent of total) were obtained using 1977 county estimates of race prepared for the National Cancer Institute by the census bureau. The projections were derived from individual county racial factors which were applied to the population projections as a constant; the estimates are considered conservative, and assume no significant changes during the study period; and

TABLE 4-1
PARTIAL COEFFICIENTS OF REGRESSION EQUATIONS
LAKE ERIE REGISTERED BOAT OWNERSHIP 1970/1980*

Zone	Population	Income	Ethnicity	Centroid	Constant	R^2	F
I	0.0066	0.1878	38,824.0	-4.5	1,305.1	0.99	447
II	0.0066	0.18781	38,824.0	-4.5	1,305.1	0.99	447
III	0.0032	0.00382	-9,505.9	-73.5	2,903.2	0.74	12
IV	0.0095	0.00381	-3,117.6	-40.0	1,726.5	0.76	96
V	0.0015	0.0024	-1,567.3	-1.6	111.7	0.99	229

* Rounded to second significant digit.

- County Centroid Distance - The constant baseline factors were derived by a centroid mapping algorithm. A centroid mileage distance to Lake Erie was determined for each county in the study area. This variable is a proxy for travel decay and variable location weight with respect to per capita boat ownership.

The socioeconomic data projection base is summarized in Table 4-3 (included at the end of Appendix B).

The resulting demand origin zone equation solutions were summed for each of the projection time periods. The total projected Ohio registered Lake Erie boats and annual percent change from 1990 to 2040 are summarized by zone in Table 4-4. The total number of projected Ohio state registered Lake Erie boats demonstrated an annual increase of less than 1 percent. The model's projection for 1980 was approximately 97 percent of the 1980 ODNR computer boat registration data tape files indicating that the model fit well.

The Ohio total Lake Erie registered boat projections were then adjusted by zone to determine the potential Lorain regional market share of the estimated total demand. Regional market share percentages utilized were based on average marina travel distance (MRI, 1980). From the Lorain regional market share Zone I was assumed to be 53 percent of the total demand, Zone II at 24 percent, Zone III at 16 percent, Zone IV at 5 percent, and Zone V at 2 percent. The total Lorain County regional market demand share estimates by projection period are presented in Table 4-5.

4.3 Allocation Model

The allocation of regional boat market demand with respect to Lorain Harbor facility needs were estimated by adjusting for local potential marina market share and current local user-demand factor. Although the demand allocation does not use a gravity model, it is based on the gravity concept that facilities generate an "attraction" (i.e., demand) to potential boaters that is directly proportional to the attraction force of the facilities and inversly proportional to the trip distance (i.e., travel cost) between the facilities and the location of boat owners (Bartholomew, 1973).

The model typically yields high correlation between distance to facility centers and the capacity-use in relation to total use in the region. Trip distance was

TABLE 4-4
TOTAL PROJECTED OHIO REGISTERED LAKE ERIE BOATS
1990 - 2040

ZONE	1990	2000	2010	2020	2030	2040	Annual Percent Change
I	6,368	7,380	8,275	9,117	9,902	10,641	1.03
II	28,917	31,541	33,942	36,880	39,603	42,142	0.76
III	17,563	19,484	21,193	22,805	24,299	25,703	0.76
IV	21,274	24,219	26,881	29,474	31,912	34,224	0.96
V	2,073	2,372	2,611	2,867	3,113	3,350	0.96
TOTAL	76,195	84,996	92,902	101,143	108,829	116,060	0.85

TABLE 4-5
LORAIN COUNTY REGIONAL MARKET DEMAND ESTIMATES
1990 - 2040

ZONE	1980	1990	2000	2010	2020	2030	2040
I Projected Lorain Market Share @53%	2,826	3,375	3,911	4,386	4,832	5,248	5,640
II Projected Lorain Market Share @24%	6,282	6,940	7,570	8,146	8,851	9,505	10,114
III Projected Lorain Market Share @ 16%	2,488	2,810	3,117	3,391	3,649	3,877	4,112
IV Projected Lorain Market Share @ 5%	914	1,064	1,211	1,344	1,474	1,596	1,711
V Projected Lorain Market Share @ 2%	36	42	47	52	57	62	67
Lorain County Region Market Demand TOTAL	12,546	14,231	15,856	17,319	18,863	20,288	21,644

accounted for in the model by use of county centroid distance and estimates of local potential market demand shares by distance. Potential user-demand factors which account for the proportional attraction force of local facilities were derived on a basis of total wet and dry slips to the regional total ratio.

The current city of Lorain user-demand factor was estimated at approximately 0.17, based on total wet and dry slip supply and the estimated regional market demand share in 1980. In contrast, the State of Ohio's average user-demand factor was estimated at approximately 0.34 in 1980. However, both use estimates are below that for Lorain County facility and locally registered boat ratio of 0.41 for 1980.

The difference in local and regional or state user-demand factors is assumed to reflect a supply constraint and to represent local latent facility demand. However, uncon-strained by supply, the current local user-demand is assumed to increase incrementally and approach that for the county or state. The latent demand factor projections were based on current Lorain County user-demand factor adjusted for marina market assumptions used in this analysis. The latent demand factor is estimated to be 0.07 in the year 1990, then increasing to 0.14 by the year 2000, and remaining constant through the remaining projection period.

Estimates of potential local Lorain area boat market demand were derived by applying both current and latent user-demand factors to the projections of regional boat market demand. The model's allocation is highly sensitive to the user-demand factors. Although a significant proportion of the total projected demand is due to latent demand considerations, the projections are considered conservative as a result of the user-demand factors utilized in the model.

Projected Lorain area recreation boat user-demand market is summarized in Table 4-6. Latent demand accounts for approximately 29 percent of the total estimated demand in 1990 and approximately 45 percent of the total estimated for the remaining projections.

Lorain area boat market user-demand estimates were allocated to the proposed Lorain marina project the on a basis of local market share assumptions. A range of local market share values were considered, including a low market share value or current local market share factor of approximately 0.11;a median market share value or equal local facility area share factor of 0.25; and a high market share or a larger than equal

TABLE 4-6
PROJECTED LORAIN COUNTY RECREATION BOAT USER DEMAND
1990 - 2040

ZONE	1980	1990	2000	2010	2020	2030	2040
Lorain County Regional Lake Erie Boat Market	12,546	14,231	15,856	17,319	18,863	20,288	21,644
Current User-Demand Factor [1]	2,133	2,419	2,695	2,944	3,207	3,449	3,680
Latent User-Demand Factor [4]	-	996 [2]	2,220 [3]	2,425 [3]	2,641 [3]	2,840 [3]	3,030
Total Lorain County Permanent Based Lake Erie Boat Demand	2,133	3,415	4,915	5,369	5,848	6,289	6,710

Notes:

1. User-Demand Factor Based on 1980 Lorain Regional Slip/Boat Ratio @ .17
2. Latent User-Demand Factor @ 0.07
3. Latent User-Demand Factor @ 0.14
4. Latent User-Demand as defined, is entirely related to changes in existing supply, and not expected until 1990.

local market share factor value of 0.33. Lorain Harbor is one of four existing facility sites which could meet the anticipated future demand. Accordingly, median values were utilized in the projections and are considered conservative. The total Lorain Harbor area median value facility demand for years 1990-2040 are summarized in Table 4-7.

The estimated total facility demand was then adjusted for projected facility need. The existing local facility capacity of approximately 215 slips was subtracted from projected total demand to estimate local facility need. Based on median value facility demand projections, the total facility need at Lorain is projected to exceed 600 slips by the the year 1990. The Lorain Harbor area facility need estimates for 1990 to 2040 are presented in Table 4-7.

4.4 Projected Fleet Mix

The projection of future fleet mix by type and size of craft was based on current facility use percentages derived by MRI, adjusted for field observations (August 1981). The fleet mix type and size percentages were applied to the projected facility needs. The fleet mix type and size proportions were assumed constant during the study period.

The future fleet mix by type and size of craft are summarized in Table 4-8 and 4-9; respectively. In summary, the fleet mix by type is assumed constant throughout the projection period and estimated at approximately 6 percent outboards, 22 percent in/outboards, 8 percent inboards, 16 percent sailboats, 8 percent auxillary sailboats, and 40 percent cruisers. The projected fleet mix by size is estimated for 16 foot and under at approximately 6 percent of the total, 16-25 foot at 61 percent, 26-39 foot at 31 percent, and 40-64 foot at 2 percent.

The transient fleet activity will probably increase if the proposed marina is developed. Currently more than one percent of Lorain facilities is used for daily transient demand. However, it is assumed that one percent of total facility capacity will be used for transients (U.S. Army Corps of Engineers, July 1979). Transient facility projected daily need is approximately 6 slips in the year 1990, and 10 slips in the year 2000. The projected transient facility need for 1990-2040 is summarized in Table 4-10.

TABLE 4-7
ESTIMATED LORAIN HARBOR AREA FACILITY NEEDS - PERMANENT BASED
1990-2040

ZONE	1990	2000	2010	2020	2030	2040
Lorain County Market Demand[1]	3,415	4,915	5,369	5,848	6,289	6,710
Lorain Harbor Area Demand Allocation						
Median @ .25	854	1,229	1,342	1,462	1,572	1,678
Estimated Facility Need[2]	639	1,014	1,127	1,247	1,351	1,463

Note:

1. Estimates include Latent Demand Consideration
2. Estimated Facility Need Based on Adjustment for Current Lorain Harbor Supply of 215 Wet/Dry Slips.

TABLE 4-8
PROJECTED LORAIN HARBOR FLEET MIX BY TYPE[1]
1990-2040

TYPE[2]	1990	2000	2010	2020	2030	2040
Outboard	38	61	68	75	81	88
In/Outboard	141	223	248	274	298	322
Inboard	51	81	90	100	108	117
Sail	102	162	180	200	216	234
Auxillary Sail	51	81	90	100	108	117
Cruiser	256	406	451	489	540	585
TOTAL	639	1,014	1,127	1,247	1,351	1,463

NOTE:

1. Based on Projected Current and Latent Demand Median Values.
2. Fleet Mix Percentages Derived from MRI Data, adjusted for field observations, (October, 1080).

TABLE 4-9
PROJECTED LORAIN HARBOR FLEET MIX BY SIZE[2]
1990-2040

Year	Under 16 ft.	16/26 ft.	26/40 ft.	40/65 ft.	65/over	Total
1990	38	390	198	13	0	639
2000	61	619	314	20	0	1,014
2010	68	687	349	23	0	1,127
2020	75	760	387	25	0	1,247
2030	81	824	419	27	0	1,351
2040	88	892	454	29	0	1,463

Note:

1. Based on Projected Current and Latent Demand Median Values.
2. Fleet Mix Percentages Derived from MRI Data, adjusted for field observations (October, 1981).

TABLE 4-10
PROJECTED FLEET USER DEMAND SUMMARY
1990-2040

	1990	2000	2010	2020	2030	2040
Trailered Boats[1]	5,635	6,279	6,858	7,470	8,034	8,571
Transient Boat Slips[2]	6	10	11	12	14	15
Permanent Boat Slips	639	1,014	1,127	1,247	1,351	1,463

NOTE:

1. Based on 90% of Lorain Market Demand Area of Lake Erie Registered Boats under 16 Ft.

2. Based on 1% of Total Demand for Slip Space.

Estimates of the number of trailered boats was developed by associating trailerings to small-boat sizes. Based on discussions with ODNR, it was assumed that approximately 90 percent of all boats under sixteen feet are trailered, and that 44 percent of registered boats are under 16 feet. The projected number of trailered boats for years 1990 to 2040 are presented in Table 4-10.

The results of the user-demand study indicate a definite and substantial need for a recreation boat marina facility at Lorain, Ohio. Further substantiation and updating of small-boat demands can appropriately occur during subsequent study stages. These future efforts may encompass the following items:

- The user-demand model can utilize final 1980 census data and official socioeconomic projections when they become available as the demand model is highly sensitive to population and economic factors.
- A detailed locational analysis can provide a more accurate regional analysis of facility transfer demand. Cartographic mapping of changes in per capita boat ownership registration by type can indicate trends in boating use characteristics and associated fleet mix facility demand.
- A more detailed facility mix analysis can determine an optimal mix of wet and dry slip storage. A regional price/supply analysis compared to current construction costs can indicate an appropriate facility design for a combination wet and dry storage facility, if planned.

5.0 BENEFIT ANALYSIS

5.1 Analysis Background

Introduction. Potential recreational navigation benefits calculated below were based on principals established in a Corps of Engineers Regulation (ER 1120-2-113).

Fleet Mix. The expected future fleet mix at Lorain, derived from boating demand forecast Tables 4-8 and 4-9, is as follows:

Type of Boat	Size of Boat (Ft. of Length) Under 16	16-25	26-39	40-64	TOTAL
Outboard	4%	2%	-	-	6%
Inboard/ Outdrive	1%	16%	5%	-	22%
Inboard	-	6%	1%	1%	8%
Cruiser	-	24%	15%	1%	40%
Sailboat	1%	8%	7%	-	16%
Auxiliary Sailboat	-	5%	3%	-	8%
Total	6%	61%	31%	2%	100%

Assumptions. In allocating permanent berths in the proposed facility it was assumed that one percent of berths would be assigned for use by transient boats. Furthermore, because existing marina facilities in the regional area are being utilized to the capacity, it was assumed that transfers to the proposed Lorain facility from other existing marinas would be replaced by boats of equal type and value. Therefore, the benefits accruing as a result of the project could be expressed totally in terms of "new boats" and consideration of "transferred boats" as a separate category would be unnecessary.

Due to the proximity of the Lorain harbor to Geneva-on-the-Lake (situated approximately 70 miles east northeast of Lorain on Lake Erie), rates of return used in the benefit calculations for the proposed facility were assumed to equal those utilized in the economic evaluation of the Geneva-onthe-Lake small boat harbor.

Depreciated Boat Values. Average depreciated boat values used in the benefit calculations were based upon the "Average Fleet Depreciation Matrix" developed by the Corps of Engineers, which reflects 1977 values. These figures were updated to July, 1981 values by applying the average of the gains in the following indices as furnished by the U.S. Department of Labor, Bureau of Labor Statistics.

- Entertainment Component of the Consumer Price Index for:

  a) Cincinnati SMSA - Gain from Sept., 1977 to July, 1981 of 24.27%.

  b) Cleveland SMSA - Gain from Aug., 1977 to June, 1981 of 25.46%.

- Sport-vehicles sub-component of the entertainment component of the Consumer Price Index for U.S. Cities - Gain from Dec., 1977 to June, 1981 of 28.7%.

- Average gain - 26.1%.

Demand vs. Capacity. Present boat capacity in the Lorain Harbor area is approximately 215 permanent berths or moorings. Upon completion of the added capacity of either 300 or 600 permanent berths in about 1990, available berths would still be less than the expected demand at that time. Figure 5-1 displays this comparison. In calculating expected economic benefits, full absorption of the added capacity is expected to occur by the second year of operation; a straight line growth was assumed. At 7 5/8 percent interest and a 50 year project life, the applicable annual average equivalent factor is .96365.

5.2 Benefits-Permanent Boats

Benefit calculations for boats permanently based in the new harbor are displayed in Tables 5-1 and 5-2 Benefits shown in Table 5-2 for the 600-boat configuration are applicable to both the 600 wet slip alternative and the 300 wet/300 dry slip alternative.

New boats by class were estimated by applying the fleet mix percentages to the permanent berth count for each alternative.

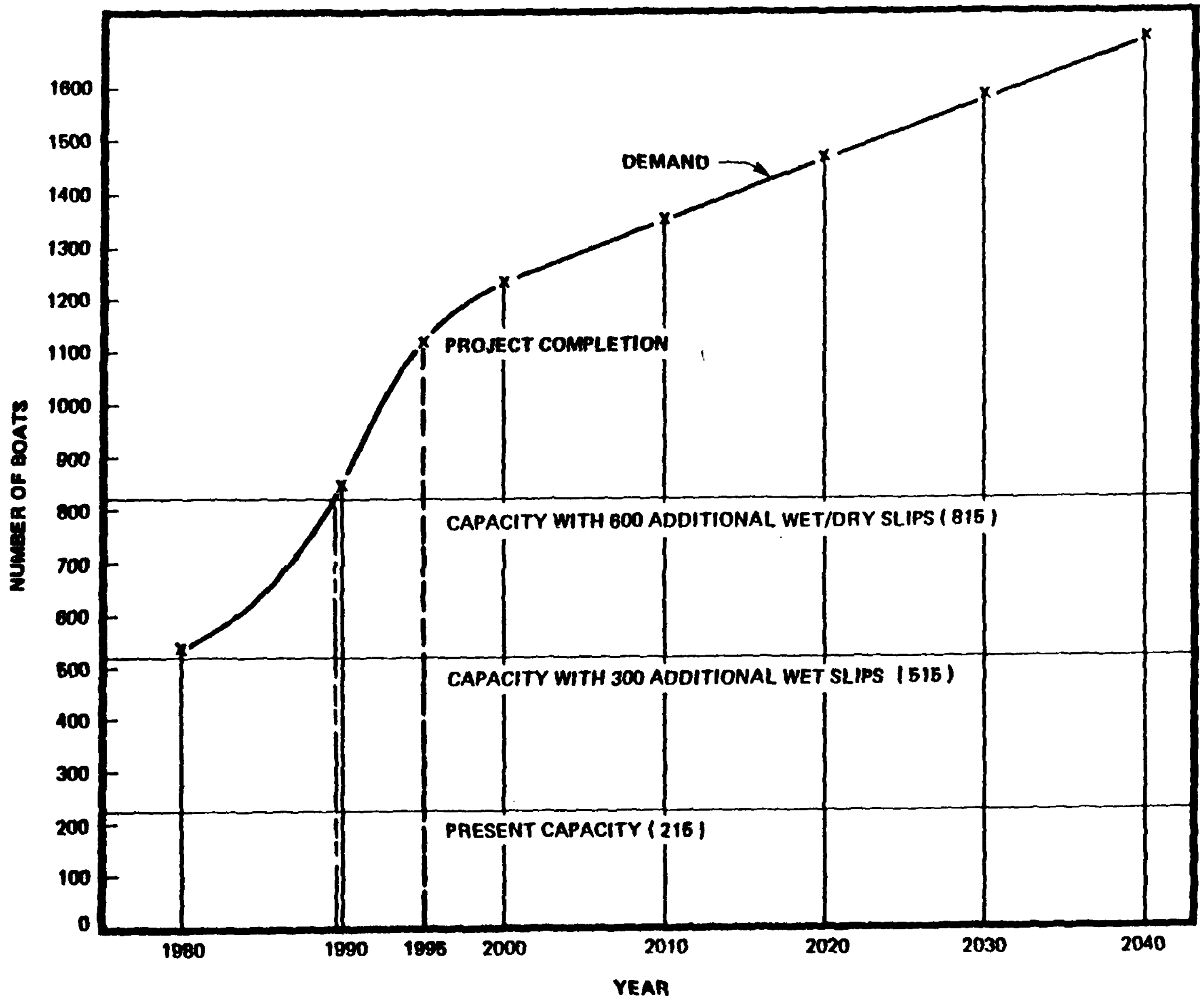

FIGURE 6–1 COMPARISON OF DEMAND AND CAPACITY OF BOATING AT LORAIN HARBOR

TABLE 5-1
NEW BOATS NET BENEFITS AT 300-BOAT FACILITY AT LORAIN

Type	Size(Ft)	No.of Boats	Average Depreciated Value($)	RATES OF RETURN ($) Max[1]	Ideal[2]	Pres.	Future	Gain	Value ($)	ON CRUISE Average Days Use	Average Days on Cruise	Percent Use	Value ($)
Outboard	Less Than 16	12	$ 1,460	15	13	-	13	13	2,278				
Outboard	16-15	6	4,010	15	13	-	13	13	3,128				
Inboard/ Outdrive	Less Than 16	3	4,790	12	10.5	-	10.5	10.5	1,509				
	16-25	47	7,790	12	10.5	-	10.5	10.5	38,444				
	26-39	15	13,280	12	10.5	-	10.5	10.5	20,916				
Inboard	16-25	18	10,470	12	10.5	-	10.5	10.5	19,788				
	26-39	3	17,060	12	10.5	-	10.5	10.5	5,374				
	40-64	3	48,720	12	10.5	-	10.5	10.5	15,347				
Cruiser	16-25	71	9,800	9	8	-	8	8	55,664				
	26-39	44	30,690	9	8	-	8	8	108,029	42	3	7.1	7,670
	40-64	3	87,640	9	8	-	8	8	21,034	42	7	16.7	3,513
Sailboat	Less Than 16	3	1,110	12	10.5	-	10.5	10.5	350				
	16-15	24	4,910	12	10.5	-	10.5	10.5	12,373				
	26-39	21	9,950	12	10.5	-	10.5	10.5	21,940				
Aux. Sail	16-25	15	11,980	9	8	-	8	8	14,376				
	26-39	9	25,330	9	8	-	8	8	18,238	42	3	7.1	1,295
TOTAL		297							358,788				12,478

1. Maximum as stated in EM 1120-2-113
2. Return expected at ideal Lorain Harbor

Net benefits: $358,788 - $12,478 = $346,310

TABLE 5-2

NEW BOATS NET BENEFITS AT 600-BOAT FACILITY AT LORAIN

Type	Size(Ft)	No.of Boats	Average Depreciated Value($)	RATES OF RETURN ($) Max[1]	Ideal[2]	Pres.	Future	Gain	Value ($)	ON CRUISE Average Days Use	Average Days on Cruise	Percent Use	Value ($)
Outboard	Less Than 16	24	$ 1,460	15	13	-	13	13	4,555				
Outboard	16-25	12	4,010	15	13	-	13	13	6,256				
Inboard/	Less Than 16	6	4,790	12	10.5	-	10.5	10.5	3,018				
Outdrive	16-25	94	7,790	12	10.5	-	10.5	10.5	76,887				
	26-39	30	13,280	12	10.5	-	10.5	10.5	41,832				
Inboard	16-25	36	10,470	12	10.5	-	10.5	10.5	39,577				
	26-39	6	17,060	12	10.5	-	10.5	10.5	10,748				
	40-64	6	48,720	12	10.5	-	10.5	10.5	30,694				
Cruiser	16-25	142	9,800	9	8	-	8	8	111,328				
	26-39	88	30,690	9	8	-	8	8	216,058	42	3	7.1	15,340
	40-64	6	87,640	9	8	-	8	8	42,067	42	7	16.7	7,025
Sailboat	Less Than 16	6	1,110	12	10.5	-	10.5	10.5	699				
	16-25	48	4,910	12	10.5	-	10.5	10.5	24,746				
	26-39	42	9,950	12	10.5	-	10.5	10.5	43,880				
Aux. Sail	16-25	30	11,980	9	8	-	8	8	28,752				
	26-39	18	25,330	9	8	-	8	8	36,475	42	3	7.1	2,590
TOTAL		594							717,572				24,955

1. Maximum as stated in EM 1120-2-113
2. Return expected at ideal Lorain Harbor

Net benefits: $717,572 - $24,955 = $692,617

5.3 Benefits-Trailered Boats

According to the future fleet mix, one-sixth of all boats under 16 feet in length will be sailboats, while five-sixths will be powered boats. Since trailered boats are expected to be predominantly under 16 feet in length, it is this ratio that has been used in calculating launching ramp capacities and benefits.

According to the economic evaluation performed in connection with the Geneva-on-the-Lake project, annual launch capacities are 2,868 per ramp for power boats and 2,754 per ramp for sailboats. The weighted average capacity is, therefore, 2,849 launches per ramp per year.

The proposed improvements include three launching ramps for area boaters. This would add an additional 8,547 launches per year to the capacity of the Lorain Harbor area. Based upon an estimated 50 use-days per boat per year for small boats utilizing Lake Erie, this new launch capacity amounts to the equivalent of 171 new permanent boats. One-sixth, or 29, would be sailboats of under 16 feet in length, and five-sixths, or 142, would be power boats of under 16 feet in length.

Benefit calculations related to the 171 equivalent boats are shown in Table 5-3.

5.4 Benefits - Transient Boats

One percent of the permanent slips would be set aside for transient boats in all alternatives. In the case where three slips will be set aside, it is assumed that all of these will be utilized on the 24 peak days (i.e, holidays and weekends during the boating season) during the boating season. On non-peak days, average usage is assumed to be 50 percent. In those alternatives where six slips are set aside for transient use, it is again assumed that all six will be in use on peak days. On the non-peak days, usage is assumed to be 50 percent.

Therefore, with a season which permits 130 days of boating, the total use-days would amount to 231 for 3 transient slips and 462 for 6 transient slips. At a ratio of 42 average use-days per boat, this amounts to the equivalent of 5.5 and 11.0 permanent boats, respectively. The mix of these boats among cruisers and auxiliary sailboats is assumed to be consistent with the fleet mix for boats over 26 feet in length in those categories. Table ~~5-4~~ displays the mix and the resulting benefits for both cases.

TABLE 5-3
Trailered Boats at 300-and 600-Boat Facility at Lorain

Type	Size(Ft)	No.of Boats	Average Depreciated Value($)	RATES OF RETURN (%)					Value ($)
				Max[1]	Ideal[2]	Pres.	Future	Gain	
Outboard	Less Than 16	142	$ 1,460	15	13	-	13	13	27,028
Sailboat	Less Than 16	28	1,110	12	10.5	-	10.5	10.5	3,322
TOTAL		171							30,350

1. Maximum as stated in EM 1120-2-113
2. Return expected at ideal Lorain Harbor

TABLE 5-4

TRANSIENT BOATS BENEFITS AT 300 BOAT FACILITY AT LORAIN

Type	Size(Ft)	No.of Boats	Average Depreciated Value($)	RATES OF RETURN (%) Max[1]	Ideal[2]	Pres.	Future	Gain	Value ($)
Cruiser	26-39	4.3	30,690	9	8	-	8	8	10,557
Cruiser	40-64	0.3	87,640	9	8	-	8	8	2,103
Auxiliary Sailboat	26-39	0.9	25,330	9	8	-	8	8	1,824
TOTAL		5.5							14,484

TRANSIENT BOATS BENEFITS AT 600 BOAT FACILITY AT LORAIN

Type	Size(Ft)	No.of Boats	Average Depreciated Value($)	RATES OF RETURN (%) Max[1]	Ideal[2]	Pres.	Future	Gain	Value ($)
Cruiser	26-39	8.7	30,690	9	8	-	8	8	21,360
Cruiser	40-64	0.6	87,640	9	8	-	8	8	4,207
Auxiliary Sailboat	26-39	1.7	25,330	9	8	-	8	8	3,445
TOTAL		11.0							29,012

1. Maximum as stated in EM 1120-2-113
2. Return expected at ideal Lorain Harbor

5.5 Summary of Benefits

A summary of expected benefits resulting from both a 300-boat and a 600-boat configuration is displayed in Table 5-5. The average annual benefits for new and transient boats have been reduced to reflect a brief 1 year absorption period as discussed earlier. Because of the large demand for launching ramps, full benefits are expected to acrue to the new facility within a short time after opening and no reduction in benefits due to absorption is included.

Tabular comparisons of each alternative's naviagtion costs, benefits, and B/C ratio is displayed in Section E of the main report.

TABLE 5-5

SUMMARY OF BENEFITS

	300 BOAT FACILITY[3]		600 BOAT FACILITY[3]	
	TOTAL	Average Annual Benefits	TOTAL	Average Annual Benefits
New Boats	$ 346,310	$ 333,723[1]	$ 692,617	$ 666,443[1]
Trailered Boats	30,350	30,350[2]	30,350	30,350[2]
Transient Boats	14,484	13,958[1]	29,012	27,958[1]
TOTAL	$ 391,144	$ 378,031	$ 751,979	$ 725,751

1. Average Annual Equivalent Factor = .9636539; based upon 50 yr. life; 7 5/8 percent interest; straight line growth; full absorption in second year.

2. Average Annual Equivalent Factor = 1.0

3. Completed in 1995

TABLE 4-2

LAKE ERIE REGISTERED BOAT OWNERSHIP DATA BASE

COUNTY	Year	Lake Erie Registered Boats	County Population	Number of Household	Income Per Capita	Professional Employment	Group Age 45-64	Ethnicity	Centroid[2]
Zone I									
1. Lorain	1970	3,530	256,843	79,518	3,759	21,673	51,369	19,520	10.9
	1980	5,332	274,979	93,530	9,452	32,388	68,745	20,816	
Zone II									
1. Cuyahoga	1970	19,470	1,720,835	532,766	4,682	152,248	344,167	397,513	5.7
	1980	20,173	1,449,167	509,921	11,343	178,420	344,808	346,308	
2. Medina	1970	455	82,717	25,609	4,007	6,909	16,543	728	24.8
	1980	926	113,419	38,578	9,317	14,508	28,355	998	
3. Erie	1970	2,988	75,909	23,501	4,069	6,801	15,182	5,693	4.1
	1980	3,716	79,741	27,123	9,942	10,050	18,340	5,989	
4. Huron	1970	755	49,587	15,352	3,715	4,461	9,917	645	16.7
	1980	1,091	54,688	18,601	8,683	6,681	11,484	711	
Zone III									
1. Lake	1970	3,891	197,200	61,053	4,211	17,132	39,440	3,155	4.7
	1980	5,332	212,916	72,420	9,592	25,667	51,100	3,407	
2. Geauga	1970	831	62,977	19,498	4,215	5,198	12,595	1,008	18.8
	1980	812	74,549	25,357	9,460	9,034	17,892	1,778	

Continued on Next Page

TABLE 4-2 (Cont'd)

LAKE ERIE REGISTERED BOAT OWNERSHIP DATA BASE

COUNTY	Year	Lake Erie Registered Boats	County Population	Number of Household	Income Per Capita	Professional Employment	Group Age 45-64	Ethnicity	Centroid[2]
3. Portage	1970	373	125,863	38,967	3,307	10,750	25,173	3,021	34.1
	1980	458	136,261	46,347	7,852	15,461	32,703	3,270	
4. Summitt	1970	11,243	553,371	171,322	4,084	47,258	110,674	60,207	26.9
	1980	1,395	526,115	178,951	9,537	59,121	126,268	57,241	
5. Wayne	1970	164	87,123	26,973	3,594	7,966	17,425	1,620	43.9
	1980	189	97,643	33,212	8,348	11,984	23,434	1,816	
6. Ashland	1970	189	43,303	13,407	3,498	3,995	8,661	346	37.8
	1980	187	46,249	15,731	8,651	5,561	11,100	370	
7. Richland	1970	740	129,997	40,247	3,864	11,754	25,999	9,737	40.8
	1980	720	131,787	44,826	8,752	14,736	31,629	9,871	
8. Crawford	1970	464	50,364	15,593	3,786	5,103	10,073	352	40.3
	1980	614	51,191	17,412	9,091	5,224	12,286	358	
9. Seneca	1970	1,265	60,696	18,791	3,725	5,073	12,139	1,414	27.5
	1980	1,094	62,096	21,121	9,252	7,153	14,903	1,447	
10. Sandusky	1970	1,828	60,983	18,880	3,602	5,362	12,197	1,354	14.3
	1980	1,422	63,552	21,616	8,912	7,610	15,252	1,411	
11. Ottawa	1970	2,507	37,099	11,486	3,959	3,049	7,420	352	4.9
	1980	2,945	40,179	13,666	9,459	4,698	9,643	385	

Continued on Next Page

TABLE 4-2 (Cont'd)

LAKE ERIE REGISTERED BOAT OWNERSHIP DATA BASE

COUNTY	Year	Lake Erie Registered Boats	County Population	Number of Household	Income Per Capita	Professional Employment	Group Age 45-64	Ethnicity	Centroid[2]
Zone IV									
1. Ashtabula	1970	1,544	98,237	30,414	3,715	8,350	19,647	2,800	13.4
	1980	1,876	104,370	35,500	8,163	11,212	25,049	2,982	
2. Trumbull	1970	237	232,579	72,006	3,878	20,240	46,516	13,815	38.2
	1980	279	238,970	81,282	9,866	31,678	57,353	14,195	
3. Mahoning	1970	237	304,545	94,286	3,731	25,639	60,909	45,377	56.1
	1980	524	290,682	98,871	8,819	26,286	69,764	43,312	
4. Stark	1970	395	372,210	115,235	3,860	32,386	74,442	24,640	49.2
	1980	449	378,878	128,870	9,105	42,531	90,931	25,006	
5. Columbiana	1970	4	108,310	33,533	3,309	9,061	21,662	1,592	68.9
	1980	56	113,796	38,706	7,808	11,854	27,311	1,673	
6. Carroll	1970	5	21,579	6,681	2,942	1,764	4,316	72	68.7
	1980	15	25,566	8,696	6,455	3,121	6,136	84	
7. Tuscarwas	1970	8	77,211	23,904	3,432	6,424	15,442	734	71.1
	1980	27	84,694	28,807	8,316	9,054	20,327	805	
8. Holmes	1970	18	23,024	7,128	2,489	1,770	4,605	28	60.9
	1980	39	29,576	10,060	6,431	3,118	7,098	37	
9. Coshocton	1970	15	33,486	10,367	3,418	2,980	6,697	469	77.4
	1980	13	36,158	12,299	9,252	4,139	8,678	506	

Continued on Next Page

TABLE 4-2 (Cont'd)

LAKE ERIE REGISTERED BOAT OWNERSHIP DATA BASE

COUNTY	Year	Lake Erie Registered Boats	County Population	Number of Household	Income Per Capita	Professional Employment	Group Age 45-64	Ethnicity	Centroid
10. Knox	1970	60	41,795	12,940	3,419	3,754	8,359	418	65.4
	1980	90	46,435	15,794	7,279	4,550	11,144	464	
11. Morrow	1970	34	21,348	6,092	3,023	1,734	4,270	17	58.9
	1980	95	26,572	9,038	6,881	2,790	6,377	21	
12. Marion	1970	277	64,724	20,038	3,673	5,585	12,945	2,006	60.8
	1980	149	68,309	23,234	9,213	7,656	16,394	2,118	
13. Wyandot	1970	471	21,826	6,757	3,486	1,941	4,365	52	47.9
	1980	345	22,748	7,737	9,145	3,558	5,460	57	
14. Handcock	1970	894	61,217	18,953	3,870	5,481	12,243	490	47.6
	1980	863	64,391	21,902	9,738	8,075	15,454	522	
15. Wood	1970	1,169	89,722	27,777	3,697	7,868	17,944	655	24.2
	1980	1,626	107,670	36,622	8,808	12,517	25,841	786	
16. Lucas	1970	10,009	483,551	149,706	4,125	42,931	96,710	65,666	11.3
	1980	11,766	472,993	160,882	10,011	53,966	113,518	64,270	
Zone V									
1. Jefferson	1970	7	96,193	29,781	3,527	7,455	12,239	5,464	89.0
	1980	16	90,803	30,885	9,188	9,465	21,793	5,163	
2. Harrison	1970	2	17,013	5,267	3,187	1,315	3,403	577	85.9
	1980	3	18,227	6,200	8,449	1,873	4,374	619	

Continued on Next Page

TABLE 4-2 (Cont'd)

LAKE ERIE REGISTERED BOAT OWNERSHIP DATA BASE

COUNTY	Year	Lake Erie Registered Boats	County Population	Number of Household	Income Per Capita	Professional Employment	Group Age 45-64	Ethnicity	Centroid [2]
3. Guernsey	1970	5	37,665	11,661	3,092	3,025	7,533	881	95.3
	1980	9	41,988	14,282	7,895	4,542	10,077	984	
4. Muskingum	1970	7	77,826	24,095	3,223	6,570	15,565	2,895	100.7
	1980	15	83,641	28,449	7,960	9,382	20,074	3,111	
5. Licking	1970	64	107,799	33,374	3,381	8,964	21,560	1,962	85.5
	1980	83	121,296	41,257	8,425	12,821	29,111	2,208	
6. Delaware	1970	61	42,908	13,284	3,615	3,814	8,582	1,450	77.0
	1980	105	53,701	18,266	8,579	6,833	12,888	1,815	
7. Union	1970	35	23,786	7,364	3,554	2,060	4,757	559	81.6
	1980	79	29,647	10,084	8,020	3,315	7,115	697	
8. Logan	1970	8	35,072	10,858	3,607	3,103	7,014	645	85.5
	1980	26	39,193	13,331	9,176	5,337	9,406	721	
9. Hardin	1970	51	30,813	9,540	3,211	2,602	6,163	247	67.3
	1980	38	32,803	11,157	7,750	3,867	7,873	262	
10. Allen	1970	-0-	111,144	34,410	3,811	9,816	22,229	10,859	69.6
	1980	35	112,425	38,240	9,652	13,283	26,982	10,990	
11. Putnam	1970	68	31,134	9,640	3,393	2,389	6,227	47	56.6
	1980	88	33,058	11,244	8,821	3,974	7,934	50	

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TABLE 4-2 (Cont'd)

LAKE ERIE REGISTERED BOAT OWNERSHIP DATA BASE

COUNTY	Year	Lake Erie Registered Boats	County Population	Number of Household	Income Per Capita	Professional Employment	Group Age 45-64	Ethnicity	Centroid[2]
12. Henry	1970	9	27,058	8,377	3,942	2,406	5,412	298	39.6
	1980	34	28,474	9,685	9,215	3,459	6,834	313	
13. Fulton	1970	142	33,071	10,239	3,917	2,879	6,614	83	35.2
	1980	219	37,887	12,887	9,263	4,335	9,093	95	
14. Franklin	1970	1,047	833,249	257,972	3,910	75,673	166,650	118,321	95.8
	1980	1,062	864,249	293,962	9,176	108,448	207,420	122,974	
State	1970	58,662	10,657,423	3,229,512	3,949	921,270	2,131,485	1,001,798	
	1980	68,293	10,797,418	3,672,591	9,332	1,251,120	2,591,380	1,176,919	

Notes:

1. Ethnicity variable is the percent of blacks and other minority races of total population as defined by U.S. Department of Commerce, Bureau of Census, NCI Estimates, July 1, 1977.
2. County Centroid distance variable is based on miles from Lake Erie.

TABLE 4-3
SOCIOECONOMIC PROJECTION DATA BASE

COUNTY	Year	Total Population	Per Capital Income	Ethnicity	(%)
Zone I					
1. Lorain	1990	296,718	14,063	22,462	(0.076)
	2000	321,910	18,407	24,369	(0.076)
	2010	341,848	22,337	25,878	(0.076)
	2020	363,542	25,924	27,520	(0.076)
	2030	385,236	29,224	29,162	(0.076)
	2040	406,930	32,279	30,805	(0.076)
Zone II					
1. Cuyahoga	1990	1,351,678	16,755	312,238	(0.231)
	2000	1,220,516	21,844	281,939	(0.231)
	2010	1,103,813	26,448	253,876	(0.231)
	2020	1,103,813	30,650	253,876	(0.231)
	2030	1,103,813	34,516	253,876	(0.231)
	2040	1,103,813	38,095	253,876	(0.231)
2. Medina	1990	139,432	13,648	1,227	(0.009)
	2000	163,682	17,710	1,440	(0.009)
	2010	192,040	21,385	1,690	(0.009)
	2020	218,930	24,740	1,927	(0.009)
	2030	245,821	27,826	2,163	(0.009)
	2040	272,712	30,684	2,400	(0.009)
3. Erie	1990	85,016	14,710	6,376	(0.075)
	2000	89,816	19,196	6,736	(0.075)
	2010	94,370	23,253	7,078	(0.075)
	2020	99,070	26,958	7,430	(0.075)
	2030	103,769	30,365	7,783	(0.075)
	2040	108,468	33,520	8,135	(0.075)
4. Huron	1990	58,385	12,733	759	(0.013)
	2000	61,753	16,533	803	(0.013)
	2010	66,152	19,971	860	(0.013)
	2020	70,172	23,108	912	(0.013)
	2030	74,191	25,996	964	(0.013)
	2040	78,211	28,669	1,017	(0.013)
Zone III					
1. Lake	1990	231,703	13,989	3,707	(0.016)
	2000	259,949	18,108	4,159	(0.016)
	2010	277,201	21,835	4,435	(0.016)
	2020	297,904	25,237	4,766	(0.016)
	2030	318,607	28,367	5,098	(0.016)
	2040	339,311	31,265	5,429	(0.016)

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TABLE 4-3 (Cont'd)
SOCIOECONOMIC PROJECTION DATA BASE

COUNTY	Year	Total Population	Per Capital Income	Ethnicity	(%)
2. Geauga	1990	87,392	13,751	1,381	(0.016)
	2000	100,266	17,769	1,584	(0.016)
	2010	112,474	21,403	1,777	(0.016)
	2020	124,945	24,721	1,974	(0.016)
	2030	137,416	27,774	2,171	(0.016)
	2040	149,887	30,600	2,368	(0.016)
3. Portage	1990	151,472	11,552	3,635	(0.024)
	2000	172,512	15,027	4,140	(0.024)
	2010	185,317	18,170	4,448	(0.024)
	2020	200,832	21,039	4,820	(0.024)
	2030	216,348	23,679	5,192	(0.024)
	2040	231,864	26,123	5,565	(0.024)
4. Summitt	1990	511,541	13,983	56,270	(0.110)
	2000	503,075	18,154	55,338	(0.110)
	2010	495,084	21,927	53,469	(0.110)
	2020	495,084	25,372	53,469	(0.110)
	2030	495,084	28,541	53,469	(0.110)
	2040	495,084	31,475	53,469	(0.110)
5. Wayne	1990	106,070	12,225	1,973	(0.019)
	2000	116,662	15,863	2,170	(0.019)
	2010	126,136	19,153	2,346	(0.019)
	2020	135,840	22,157	2,527	(0.019)
	2030	145,544	24,920	2,707	(0.019)
	2040	155,249	27,478	2,888	(0.019)
6. Ashland	1990	49,789	12,830	398	(0.001)
	2000	53,387	16,765	427	(0.001)
	2010	56,630	20,323	453	(0.001)
	2020	60,583	23,572	470	(0.001)
	2030	63,388	26,560	507	(0.001)
	2040	66,768	29,327	534	(0.001)
7. Richland	1990	135,272	12,748	10,132	(0.075)
	2000	140,104	16,491	10,494	(0.075)
	2010	142,742	19,877	10,691	(0.075)
	2020	146,122	22,968	10,945	(0.075)
	2030	149,503	25,812	11,198	(0.075)
	2040	152,883	28,444	11,451	(0.075)
8. Crawford	1990	51,626	13,405	361	(0.007)
	2000	52,496	17,459	367	(0.007)
	2010	53,127	21,127	372	(0.007)
	2020	53,810	24,475	377	(0.007)
	2030	54,493	27,555	381	(0.007)
	2040	55,176	30,407	386	(0.007)

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TABLE 4-3 (Cont'd)
SOCIOECONOMIC PROJECTION DATA BASE

COUNTY		Year	Total Population	Per Capital Income	Ethnicity	(%)
9.	Seneca	1990	63,916	13,733	1,489	(0.023)
		2000	64,724	17,952	1,508	(0.023)
		2010	66,334	21,768	1,546	(0.023)
		2020	67,724	25,253	1,578	(0.023)
		2030	69,115	28,457	1,610	(0.023)
		1040	70,505	31,425	1,643	(0.023)
10.	Sandusky	1990	65,894	13,218	1,463	(0.022)
		2000	68,964	17,272	1,531	(0.022)
		2010	71,420	20,939	1,586	(0.022)
		2020	74,048	24,287	1,644	(0.022)
		2030	76,677	27,366	1,702	(0.022)
		2040	79,305	30,218	1,761	(0.022)
11.	Ottawa	1990	42,240	13,934	401	(0.009)
		2000	44,212	18,138	420	(0.009)
		2010	46,783	21,941	444	(0.009)
		2020	49,123	25,412	467	(0.009)
		2030	51,463	28,606	489	(0.009)
		2040	53,803	31,563	511	(0.009)
	Zone IV					
1.	Ashtabula	1990	110,375	11,809	3,146	(0.029)
		2000	115,071	15,219	3,280	(0.029)
		2010	121,140	18,303	3,452	(0.029)
		2020	126,791	21,119	3,614	(0.029)
		2030	132,441	23,709	3,775	(0.029)
		2040	138,092	26,107	3,936	(0.029)
2.	Trumbull	1990	240,414	14,710	14,281	(0.059)
		2000	251,414	19,277	14,934	(0.059)
		2010	255,332	23,408	15,167	(0.059)
		2020	261,126	27,179	15,511	(0.059)
		2030	266,692	30,649	15,842	(0.059)
		2040	272,716	33,861	16,199	(0.059)
3.	Mahoning	1900	284,522	12,962	42,394	(0.149)
		2000	274,424	16,853	40,899	(0.149)
		2010	264,438	20,372	39,401	(0.149)
		2020	264,438	23,585	39,401	(0.149)
		2030	264,438	26,540	39,401	(0.149)
		2040	264,438	29,277	39,401	(0.149)

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TABLE 4-3 (Cont'd)
SOCIOECONOMIC PROJECTION DATA BASE

C O U N T Y		Year	Total Population	Per Capital Income	Ethnicity	(%)
4.	Stark	1990	386,756	13,377	25,603	(0.066)
		2000	399,920	17,388	26,475	(0.066)
		2010	407,193	21,016	26,956	(0.066)
		2020	416,294	24,328	27,559	(0.066)
		2030	425,294	27,375	28,161	(0.066)
		2040	434,495	30,196	28,764	(0.066)
5.	Columbiana	1990	117,425	11,472	1,726	(0.015)
		2000	119,787	14,913	1,761	(0.015)
		2010	124,345	18,025	1,828	(0.015)
		2020	128,151	20,866	1,884	(0.015)
		2030	131,957	23,479	1,940	(0.015)
		2040	135,763	25,899	1,996	(0.015)
6.	Carroll	1990	27,783	9,335	92	(0.003)
		2000	30,277	12,028	100	(0.003)
		2010	33,379	14,464	110	(0.003)
		2020	36,210	16,688	119	(0.003)
		2030	39,041	18,733	129	(0.003)
		2040	41,872	20,627	138	(0.003)
7.	Tuscarawas	1990	90,483	12,285	860	(0.010)
		2000	93,909	16,016	892	(0.010)
		2010	100,545	19,391	955	(0.010)
		2020	106,133	22,473	1,008	(0.010)
		2030	111,722	25,307	1,061	(0.010)
		2040	117,310	27,932	1,114	(0.010)
8.	Holmes	1990	35,979	9,616	43	(0.001)
		2000	40,229	12,620	48	(0.001)
		2010	44,479	15,339	53	(0.001)
		2020	48,729	17,820	58	(0.001)
		2030	52,979	20,103	64	(0.001)
		2040	56,229	22,217	67	(0.001)
9.	Coshocton	1990	37,984	13,944	531	(0.014)
		2000	39,622	18,385	555	(0.014)
		2010	41,871	22,401	587	(0.014)
		2020	43,894	26,067	615	(0.014)
		2030	45,918	29,440	642	(0.014)
		2040	47,941	32,563	671	(0.014
10.	Knox	1990	51,107	10,452	511	(0.010)
		2000	54,269	13,414	543	(0.010)
		2010	58,925	16,093	589	(0.010)
		2020	63,134	18,540	631	(0.010)
		2030	67,344	20,790	673	(0.010)
		2040	71,553	23,073	715	(0.010)

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TABLE 4-3 (Cont'd)
SOCIOECONOMIC PROJECTION DATA BASE

	C O U N T Y	Year	Total Population	Per Capital Income	Ethnicity	(%)
11.	Morrow	1990	30,447	10,033	24	(0.001)
		2000	34,207	12,987	27	(0.001)
		2010	38,772	15,659	31	(0.001)
		2020	43,020	18,098	34	(0.001)
		2030	47,268	20,342	38	(0.001)
		2040	51,516	22,419	41	(0.001)
12.	Marion	1990	70,807	13,700	2,195	(0.031)
		2000	74,349	17,928	2,305	(0.031)
		2010	77,391	21,753	2,399	(0.031)
		2020	80,528	25,243	2,496	(0.031)
		2030	83,665	28,454	2,593	(0.031)
		2040	86,802	31,427	2,691	(0.031)
13.	Wyandot	1990	23,065	13,711	55	(0.002)
		2000	23,715	18,022	57	(0.002)
		2010	24,335	21,922	58	(0.002)
		2020	24,933	25,483	60	(0.002)
		2030	25,531	28,758	61	(0.002)
		2040	26,130	31,791	63	(0.002)
14.	Handcock	1990	69,868	14,490	907	(0.013)
		2000	74,610	18,967	1,033	(0.013)
		2010	78,936	23,017	1,159	(0.013)
		2020	83,501	26,715	1,284	(0.013)
		2030	88,067	30,116	1,410	(0.013)
		2040	92,632	33,265	1,535	(0.013)
15.	Wood	1990	124,190	12,967	869	(0.007)
		2000	141,504	16,874	991	(0.007)
		2010	158,738	20,408	1,111	(0.007)
		2020	175,925	23,635	1,231	(0.007)
		2030	193,111	26,603	1,352	(0.007)
		2040	210,298	29,351	1,472	(0.007)
16.	Lucas	1990	469,304	14,793	63,356	(0.135)
		2000	470,904	19,289	63,572	(0.135)
		2010	469,493	23,357	63,382	(0.135)
		2020	469,493	27,070	63,382	(0.135)
		2030	469,493	30,486	63,382	(0.135)
		2040	469,493	33,648	63,382	(0.135)
	Zone V					
1.	Jefferson	1990	83,812	13,758	4,760	(0.057)
		2000	77,706	18,072	4,413	(0.057)
		2010	71,781	21,975	4,077	(0.057)
		2020	71,781	25,537	4,077	(0.057)
		2030	71,781	28,815	4,077	(0.057)
		2040	71,781	31,849	4,077	(0.057)

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TABLE 4-3 (Cont'd)
SOCIOECONOMIC PROJECTION DATA BASE

COUNTY	Year	Total Population	Per Capital Income	Ethnicity	(%)
2. Harrison	1990	18,715	12,690	617	(0.033)
	2000	18,603	16,697	613	(0.033)
	2010	18,492	20,322	610	(0.033)
	2020	18,492	23,622	610	(0.033)
	2030	18,492	26,676	610	(0.033)
	2040	18,492	29,495	610	(0.033)
3. Guernsey	1990	45,018	11,779	1,053	(0.023)
	2000	46,262	15,442	1,083	(0.023)
	2010	49,393	18,755	1,169	(0.023)
	2020	52,821	21,780	1,223	(0.023)
	2030	55,703	24,562	1,303	(0.023)
	2040	58,585	27,138	1,371	(0.023)
4. Muskingum	1990	86,781	11,802	3,228	(0.037)
	2000	87,643	15,419	3,260	(0.037)
	2010	92,121	18,690	3,427	(0.037)
	2020	95,380	21,677	3,548	(0.037)
	2030	98,639	24,424	3,669	(0.037)
	2040	101,898	26,968	3,791	(0.037)
5. Licking	1990	135,111	12,513	2,459	(0.018)
	2000	148,987	16,363	2,712	(0.018)
	2010	162,643	19,846	2,960	(0.018)
	2020	176,381	23,025	3,210	(0.018)
	2030	190,119	25,950	3,460	(0.018)
	2040	203,857	28,657	3,710	(0.018)
6. Delaware	1990	61,852	12,620	2,091	(0.034)
	2000	70,852	16,415	2,395	(0.034)
	2010	80,324	19,848	2,715	(0.034)
	2020	89,522	22,982	3,026	(0.034)
	2030	98,721	25,865	3,337	(0.034)
	2040	107,919	28,534	3,648	(0.034)
7. Union	1990	34,118	11,672	802	(0.024)
	2000	37,674	15,092	885	(0.024)
	2010	42,840	18,186	1,006	(0.024)
	2020	47,454	21,010	1,117	(0.024)
	2030	52,067	23,609	1,224	(0.024)
	2040	56,681	26,014	1,332	(0.024)
8. Logan	1990	42,025	13,681	773	(0.018)
	2000	44,119	17,929	812	(0.018)
	2010	47,596	21,771	876	(0.018)
	2020	50,593	25,279	931	(0.018)
	2030	53,590	28,505	986	(0.018)
	2040	56,587	31,493	1,041	(0.018)

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TABLE 4-3 (Cont'd)

SOCIOECONOMIC PROJECTION DATA BASE

C O U N T Y	Year	Total Population	Per Capital Income	Ethnicity	(%)
9. Hardin	1990	34,657	11,440	277	(0.008)
	2000	36,005	14,908	288	(0.008)
	2010	37,927	18,045	303	(0.008)
	2020	39,670	20,909	317	(0.008)
	2030	41,413	23,544	331	(0.008)
	2040	43,156	25,983	345	(0.008)
10. Allen	1990	116,930	14,379	11,342	(0.097)
	2000	119,600	18,835	11,601	(0.097)
	2010	122,493	22,865	11,881	(0.097)
	2020	125,480	26,545	12,172	(0.097)
	2030	128,468	29,930	12,416	(0.097)
	2040	131,455	33,063	12,751	(0.097)
11. Putnam	1990	34,922	13,204	52	(0.001)
	2000	36,860	17,341	55	(0.001)
	2010	38,754	21,083	58	(0.001)
	2020	40,658	24,499	61	(0.001)
	2030	42,562	27,642	64	(0.001)
	2040	44,467	30,551	67	(0.001)
12. Henry	1990	30,073	13,514	331	(0.011)
	2000	31,311	17,547	341	(0.011)
	2010	32,819	21,196	361	(0.011)
	2020	34,254	24,563	377	(0.011)
	2030	35,690	27,591	392	(0.011)
	2040	37,126	30,428	408	(0.011)
13. Fulton	1990	42,417	13,616	106	(0.002)
	2000	46,517	17,704	116	(0.002)
	2010	51,244	21,402	128	(0.002)
	2020	55,747	24,777	139	(0.002)
	2030	60,250	27,883	151	(0.002)
	2040	64,753	30,758	162	(0.002)
14. Franklin	1990	901,508	13,467	128,014	(0.142)
	2000	978,832	17,495	138,994	(0.142)
	2010	1,012,962	21,138	143,841	(0.142)
	2020	1,060,362	24,464	150,571	(0.142)
	2030	1,107,763	27,524	157,302	(0.142)
	2040	1,155,164	30,357	164,033	(0.142)
State	1990	11,078,982	13,716	1,207,609	(0.109)
	2000	11,428,072	17,831	1,245,660	(0.109)
	2010	11,638,852	21,555	1,268,635	(0.109)
	2020	11,898,203	24,954	1,296,904	(0.109)
	2030	12,157,554	28,081	1,325,173	(0.109)
	2040	12,416,905	30,976	1,353,443	(0.109)

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1.4.1 "General Characteristics of the Population, 1970, 1976, 1978."

1.4.3 "Work Force Characteristics of the Population, 1970, 1976, 1978."

2.1 "Personal Income Per Capita & Average Annual Rate of Change, U.S., and by SMSA & Nonmetropolitan County, Ohio, 1970 - 1978."

2.8 "Median Family Income, by County, Ohio, 1977."

APPENDIX C

RECREATIONAL FISHING BENEFITS

APPENDIX C

RECREATIONAL FISHING BENEFITS

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APPENDIX C

RECREATIONAL FISHING BENEFITS

INTRODUCTION

The analysis of land-based fishing benefits for the alternative plans of improvement is presented in this technical appendix. The methodology, demand levels, and accrued benefits result directly from facility accommodations constructed as part of the small-boat harbor project. This includes concrete walkways and handrails on selected breakwaters as itemized in the cost detail sheets of Appendix A.

METHODOLOGY

The "capacity method" was employed to determine usage levels of newly provided fishing facilities. This method was chosen because 1) a regional model is not available, and, 2) sufficient excess demand exists in the area. The study area is adjacent to a large population area (Cleveland) and presently is experiencing capacity usage.

The "unit day value" method was used to evaluate the dollar benefits attributable to facility usage by fishermen. This method was determined to be most applicable for the following reasons:

- lack of a regional model,
- no specialized recreation activity is involved,
- annual fishermen visits expected to be less than 500,000,
- recreation-specific costs are less than 25% of total projects costs.

STUDY AREA

A large expanse of Lake Erie shoreline encompassing the Lorain, Ohio location was initially investigated to select those land-based fishing sites which relate to the small boat harbor study. Following paragraphs describe those sites which were included in the recreational fishing analysis and those which were excluded.

With the "capacity method," no transfers are assumed to occur between sites. However, site selection is performed to identify those specific locations where observed usage patterns provide a basis for estimating future usage patterns on project facilities.

Sites Included In Analysis

The following specific sites within Lorain Harbor are considered significant in the prediction of shore based fishing usage at project facilities:

- o Municipal Pier,
- o Water Quality Control Peninsula
- o Diked Disposal Area

These three areas are close to east and west boundaries of the small-boat harbor (see Figure 1). Of those listed, the Municipal Pier and the Water Quality Control Peninsula are currently in full use. The diked disposal area is in the process of being filled, with an estimated year of completion around 1990. At the present time the rubble mound breakwater surrounding the disposal area is accessible; however access is difficult.

Fishing usage patterns have been observed at the sites by the Ohio Department of Natural Resources (ODNR), the Polish Fisherman's Club, and Lorain Harbor personnel. From these observations, the numbers and densities of fishermen on an average day, average weekend day, and run day can be estimated for each site.

Sites Not Included in Analysis

The following fishing sites within the region surrounding the study area were not considered to be relevant:

Liberty and Lakeview Parks-Amount of shore fishing from these locations is insignificant per interview with Polish Fisherman's Club president. Parking is limited and catch is small.

Beaver Creek-4 miles west of Lorain Harbor, shore fishing is insignificant per interview with Polish Fisherman's Club President. Parking is limited.

Cleveland Electric-20 minutes drive east of Lorain Harbor. Site does not aid in characterizing average day and weekend usage patterns at Lorain. ODNR reports demand exceeds supply here. Any possible transfers would be excess demand.

Rocky River-35 to 40 minutes drive east of Lorain Harbor. Too great of a distance for local use.

Cleveland, Sandusky, Huron-Each in excess of 45 minutes from Lorain Harbor. Transfer is not anticipated because of excessive travel time.

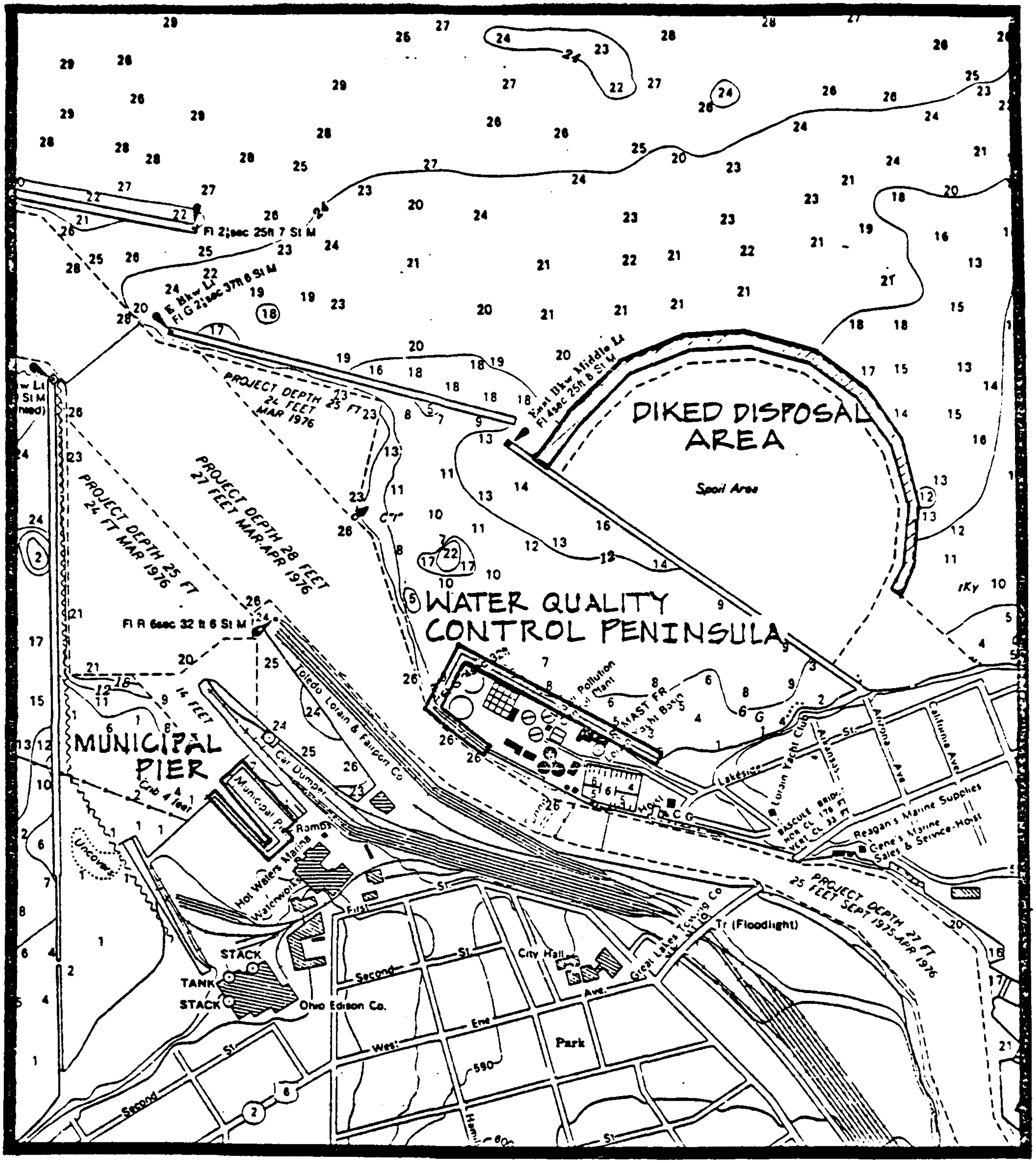

FIGURE 1 EXISTING LAND-BASED FISHING AT LORAIN HARBOR

The locations and travel times of these locations from Lorain Harbor are shown in Figure 2, which also shows Shore Angler Counts at various Lake Erie locations.

Transfers from these sites to project facilities is assumed not to occur. The local demand in Lorain exceeds the capacity of any additional facilities, reducing the attractiveness of these facilities to regional fishermen. Therefore, existing regional usage patterns are not significantly affected by project facilities.

POTENTIAL RECREATIONAL FISHING DEMAND

As a check on the applicability of "capacity method" for predicting land-based fisherman use in the area, a forecast of total potential demand was made. This total potential demand was based upon the assumption of unlimited opportunity for land-based fishing.

The total potential fishing demand is estimated from population growth forecasts and the percentage of that population expected to purchase fishing licenses in Lorain County. Then, the number of fishing licenses is related to the demonstrated annual shore fisher days expended at Lorain Harbor.

Past Lorain County population and fishing license data was reviewed during years when fisherman crowding was less pronounced at shoreline locations (prior to 1965). From this data, 10.6 percent of the population purchased fishing licenses.

The factor relating Lorain County fishing licenses to annual shore days at Lorain Harbor is based on 1975 data and ODNR Creel Census report. Annual fisher days exceeded number of fishing licenses by a factor of 3.2.

From the use of these above factors, Table 1 was produced on Page C-6. Population predictions were provided by Lorain County. This data can be compared to subsequent capacity summaries (Table 7) to demonstrate the validity of using the "capacity method."

Shore angler counts

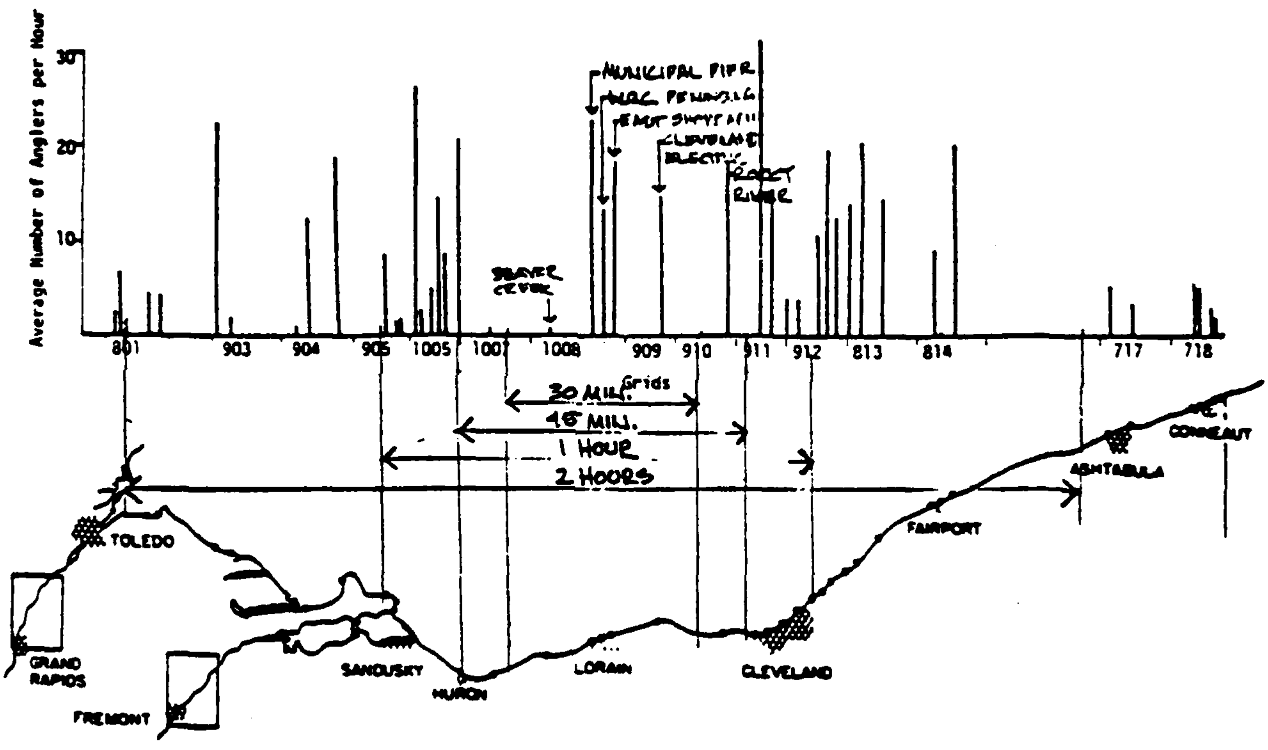

FIGURE 2

Source: ODNR Creel Census, 1975

TABLE 1

POTENTIAL ANNUAL FISHER DAYS IN LORAIN HARBOR

Year	Population	Fishing Licenses	Annual Fisher Days
1990	296,700	31,500	100,600
2000	321,900	34,100	109,200
2010	347,800	36,200	115,800
2020	363,500	38,500	123,200
2030	385,200	40,800	130,600
3040	406,900	43,100	137,900

RECREATION RESOURCE CONDITIONS (1980 and 1990)

Table 2 displays the estimated instantaneous fishing capacity of existing facilities at Lorain Harbor for years 1981 and 1990. "Instantaneous Fishing Capacity" is the number of fishermen which can occupy facilities at any one time. "Length" is the lineal footage of lakeside, dock or pier edge available to fishermen. "Density" is the estimated distance between fishermen at the locations based on observations and the factors of: accessibility, quality of fishing, and quality of environment. The sum of the calculated capacity of all elements within a site equals the total number of fishermen observed on a fish run day.

Information sources include the Ohio Department of Natural Resources (ODNR), Polish Fisherman's Club in Lorain, and the Lorain Harbor Master. Summary results of the 1979 creel census by ODNR are depicted on a previous page (Figure 2).

When the diked disposal area is filled, the Lorain area fishing capacity is expected to increase since the dike will become more accessible. A park is planned on the disposal area which may further increase future fishing usage there due to improved parking and other potential support facilities.

TABLE 2

ESTIMATED FISHING CONDITIONS

AT

EXISTING STUDY SITES

FACILITIES	Length	Density	Instantaneous Fishing Capacity[1]
Municipal Pier			
Warm Water Discharge	1000	8'	125
End of Pier	130	12'	11
Boat Launch Slip	360	48'	7
Sub Total (1981 & 1990 Conditions)			143
Peninsula			
Water Quality			
Southwest Side	370	12'	31
Northwest End	330	8'	41
Northeast Side	1000	24'	42
Sub Total (1981 & 1990 Conditions)			114
Diked Disposal Area[2]			
Open Lake (1981 Conditions)	3400	80'	42
Open Lake (1990 Conditions)	3400	16'[3]	213
TOTAL INSTANTANEOUS FACILITY CAPACITY (1981 Conditions)			299
TOTAL INSTANTANEOUS FACILITY CAPACITY (1990 Conditions)			

[1] Instantaneous count of fishermen on a run day as observed by ODNR, Lorain Port Authority, and Polish Fishermen's Club. This reflects quality of experience, desirability of fish species caught, availability of parking or other support facilities, and protection from inclement weather or lake conditions.

[2] Fishing into the outer harbor does not occur along the sheetpile breakwater due to poor catches and safety concerns.

[3] When the Diked Disposal Area is filled and the surface area graded, compacted, and landscaped, the extent of future use may increase due to improved accessibility and possible public facilities (parking, etc.) tentatively proposed by Lorain County, OH."

The sheetpile breakwater which forms the westerly limit of the Diked Disposal Area is not used by fishermen. Based upon information supplied by the Polish Fisherman's Club and Lorain Port Authority, catch sizes there are too low to attract fishermen, and the vertical sheetpiles create safety fears since no handrail exists and there is no means to climb out of the water. Conversely, the open lake perimeter consists of rock, which attracts fish and provides a means to recover from a fall into the lake. Fishing conditions are good along the rock perimeter except during storms.

The annual fisher days occurring at Lorain Harbor are estimated for the year 1981 in Table 3, and for the year 1990 in Table 4. The instantaneous fisherman count for each type of "use day" is factored with daily turnover, and number of "use days" per year to estimate the total number of fisher days per year. For the year 1990, the proportional relationship between run day counts and average weekday and weekend counts is assumed to be the same as occurs in 1981.

TABLE 3

ESTIMATED ANNUAL FISHER DAYS (1981)

Type of Use Day	Instantaneous Fisherman Counts[1/]	Daily Turn-over	No. of Fisher-man per Day	No. of Days/ Year	No. of Fisher Days Per Yr
Avg. Weekday	32	3	96	127	12,192
Avg. Weekend	84	3	252	48	12,096
Run Day	299[2/]	3	897	8	7,176
	Total Annual Fisherdays			=	31,464
	Total Instantaneous Capacity			=	299

[1/]Based on 1981 estimates by Polish Fisherman's Club and by Lorain Harbor Master, and on 1975 Creel Census by ODNR.

[2/]From Table 2.

TABLE 4

ESTIMATED ANNUAL FISHER DAYS (1990)

Type of Use Day	Instantaneous Fisherman Counts[1/]	Daily Turn-over	No. of Fisher-man per Day	No. of Days/ Year	No. of Fisher Days Per Yr
Avg. Weekday	50	3	150	127	19,050
Avg. Weekend	132	3	396	48	19,008
Run Day	470[2/]	3	1410	8	11,280
	Total Annual Fisherdays				= 49,338
	Total Instantaneous Run-day Capacity				= 470

[1/]Facilities in year 1990 are assumed to be used similarly to year 1981.

[2/]From Table 2.

RECREATIONAL FISHING USE WITH PROJECT

With the "capacity method", no net transfer of fisher days is assumed from other facilities. Therefore, fisher days expected at project breakwaters is increased usage over levels expected without breakwater fishing.

The density predictions at project breakwaters are based on an analysis of existing use patterns as described in the Creel Census and by local fishermen. These patterns are affected by conditions relative to the quality of fishing (catch rate and kind), accessibility, and environmental aesthetics.

The predicted densities are divided into breakwater lengths to attain instantaneous breakwater capacity on a run day. Results are shown in Table 5. The instantaneous run day capacities at the project breakwaters are converted into annual fisher days as shown in Table 6. As noted in the footnotes of this table, the proportional relationship between run day capacity and average weekday and weekend capacity for project facilities is assumed to be the same as occurs at existing facilities.

The implementation of a small-boat harbor alternative in Lorain is not expected to affect existing fishing sites. The existing land-based fishing site which would be adjacent to the small-boat harbor basin (i.e. Water Quality Control Peninsula) has sufficient depths to avoid dredging impacts, and contiguous channels are designed with widths that minimize near shore boat traffic. This analysis is consistent with observed fishing activity at the Municipal Pier, which has heavy, nearby launching activity for trailered boats.

Table 7 presents a summary of total estimated fisher-days at Lorain Harbor throughout the project life of each alternative small-boat harbor plan.

TABLE 5

INSTANTANEOUS RUN DAY CAPACITY OF SHORE FISHING FACILITIES
AT THE PROJECT BREAKWATER

FACILITIES	ALTERNATIVE 1			ALTERNATIVE 2			ALTERNATIVES 3 & 4			ALTERNATIVE 5		
	Length	Density	Capacity	Length	Density	Capacity	Length	Density	Capacity	Length	Density	Capacity
Project Breakwater												
Main Breakwater N.W.	900	16	56	1150	12	96	500	12	42	800	14	57
Main Breakwater S.E.	900	32	28	1150	24	48	500	32	16	800	24	33
Second Breakwater N.W.	200	16	13									
Second Breakwater S.E.	200	32	6									
TOTAL			103			144			58			90

Length: is the length of the available fishing area.

Density: is the typical "Run" day distance between fishermen.

TABLE 6

ESTIMATED FISHER DAYS PER YEAR
AT LORAIN SMALL-BOAT HARBOR FACILITIES

ALTERNATIVE NO. 1	INSTANT CAPACITY 1/	TURNOVER RATIO	DAILY CAPACITY	NUMBER OF DAYS EACH YEAR	FISHER DAYS PER YEAR
Average Weekday	11	3.0	33	127	4191
Average Weekend	29	3.0	87	48	4176
Runday	103 2/	3.0	309	8	2472
Total					10,839
ALTERNATIVE NO. 2					
Average Weekday	15	3.0	45	127	5715
Average Weekend	40	3.0	120	48	5760
Runday	144	3.0	432	8	3456
Total					14,931
ALTERNATIVES NO. 3 & 4					
Average Weekday	6	3.0	18	127	2286
Average Weekend	16	3.0	48	48	2304
Runday	58 2/	3.0	174	8	1392
Total					5,982
ALTERNATIVE NO. 5					
Average Weekday	10	3.0	30	127	3810
Average Weekend	25	3.0	75	48	3600
Runday	90 2/	3.0	270	8	2160
Total					9,570

1/ Instant capacity of facility additions assumed to be used in a similar manner as existing recreational fishing facilities.

2/ From Table 5.

TABLE 7

ESTIMATED FISHER DAYS AT LORAIN HARBOR

Alternative Number	Annual Fisher Days Without Project[1]	Annual Fisher Days At Project[2]	Total Fisher Days W/ Project
1	49,300	10,800	60,100
2	49,300	14,900	64,200
3	49,300	6,000	55,300
4	49,300	6,000	55,300
5	49,300	9,600	58,900
No Action	N/A	N/A	N/A

[1] From Table 4.

[2] From Table 6.

BENEFIT VALUATION

The value of land-based fisher days on the project breakwaters is determined by subjective means. Tables K-3-1 and K-3-2 (reproduced from Federal Register, Vol. 44, No. 242, December 14, 1979) on the last two pages of this Appendix provide basis for this valuation method. The points assigned to breakwater fishing for the various categories of Table K-3-2 are described in Table 8. The resulting valuation of land-based fishing benefits is $3.50 per fisher day.

By applying the benefits value of $3.50 per fisher day to the number of fisher days expected for each alternative, the net recreational benefits are derived as shown in Table 9. Comparative tables of fishing facility costs and benefits for all alternatives are contained in Section E of the main report.

TABLE 8—ASSESSMENT OF BREAKWATER FISHING AT LORAIN SMALL BOAT HARBOR

Criteria	Point Range		Project Site Characteristics	Points Credit
	Minimum	Maximum		
A. Number of activities at the site	0	30	Adjacent to a planned regional park offering picnic, cycling, softball, and fishing facilities. The small-boat harbor offers high quality boating experience.	20
B. Availability of alternative shore fishing location	0	18	Nearby shore fishing facilities exist at Lorain Harbor and more exist within one hour. All of these facilities are crowded and capacities do not meet demands.	3
C. Carrying capacity	0	14	Adequate parking and fish support facilities are provided. The available fish catch is large enough to attract fisherman.	10
D. Accessibility to the project site	0	18	Access to the site is provided by a wide, 2-lane, paved street. Adjacent to the site, a paved parking facility and entry roads provide high-standard traffic circulation.	18
E. Aesthetic nature of the project site	0	20	Breakwater fishing site is adjacent to aesthetically pleasing marina, open harbor area, and regional park. A waste water facility located on opposite shore will occasionally cause nuisance odors.	10
Total	0	100		61

TABLE 9

LORAIN SMALL-BOAT HARBOR

NET RECREATIONAL FISHING BENEFITS

Alternative	Expected Fisher Days	Fisher Day Valuation	Net Benefits
1	10,839	$3.50	$37,937
2	14,931	3.50	52,258
3	5,982	3.50	20,937
4	5,982	3.50	20,937
5	9,570	3.50	33,495

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PRELIMINARY FEASIBILITY REPORT STAGE II, LORAIN SMALL-BOAT HARB--ETC(U)
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Revised Table K-3-1 (FY 1981) - Conversion of Points to Dollar Values

Activity Categories	POINT VALUES										
	0	10	20	30	40	50	60	70	80	90	100
General Recreation (Points from Table K-3 2)	1.40	1.60	1.80	2.10	2.50	2.90	3.20	3.40	3.60	3.90	4.10
General Fishing & Hunting (Points from Table K-3 2)	2.00	2.20	2.40	2.60	2.90	3.20	3.50	3.70	3.90	4.00	4.10
Specialized Fishing & Hunting (Points from Table K-3 3)	9.50	9.80	10.00	10.30	10.50	11.50	12.50	13.40	14.40	15.40	16.30
Specialized Recreation Other than Fishing & Hunting (Points from Table K-3 3)	5.50	5.90	6.40	6.80	7.30	8.20	9.10	10.90	12.70	14.50	16.30

Note: See 44 FR 72963-64 (published December 14, 1979) for Table K-3-2 and K-3-3.

Table K-3 2 - Guidelines for Assigning Points for General Recreation

Criteria	Judgment Factors				
a) Recreation Experience	Two general activities 3/	Several general activities	Several general activities; one high quality value activity 4/	Several general activities; more than one high quality high activity	Numerous high quality value activities; some general activities
Total Points: 30					
Point Value:	0-4	5-10	11-16	17-23	24-30
b) Availability of Opportunity 7/	Several within 1 hr. travel time; a few within 30 min. travel time	Several within 1 hr. travel time; none within 30 min. travel time	One or two within 1 hr. travel time; none within 45 min. travel time	None within 1 hr. travel time	None within 2 hr. travel time
Total Points: 18					
Point Value:	0-3	4-6	7-10	11-14	15-18
c) Carrying Capacity 1/	Minimum facility development for public health and safety	Basic facilities to conduct activity(ies)	Adequate facilities to conduct without deterioration of the resource or activity experience	Optimum facilities to conduct activity at site potential	Ultimate facilities to achieve intent of selected alternative
Total Points: 14					
Point Value:	0-2	3-5	6-8	9-11	12-14
d) Accessibility	Limited access by any means to site or within site	Fair access poor quality roads to site; limited access within site	Fair access, fair road to site; fair access, good roads within site	Good access, good roads to site; fair access, good roads within site	Good access, high standard road to site; good access within site
Total Points: 18					
Point Value:	0-3	4-6	7-10	11-14	15-18
e) Environmental Quality	Low esthetic factors 5/ exist that significantly lower quality 6/	Average esthetic quality; factors exist that lower quality to minor degree	Above average esthetic quality; any limiting factors can be reasonably rectified	High esthetic quality; no factors exist that lower quality	Outstanding esthetic quality; no factors exist that lower quality
Total Points: 20					
Point Value:	0-2	3-6	7-10	11-15	16-20

1/ Value should be adjusted for overuse.

2/ Value for water-oriented activities should be adjusted if significant seasonal water level changes occur.

3/ General activities include those that are common to the region and that are usually of normal quality. This includes picnicking, camping, hiking, riding, cycling, and fishing and hunting of normal quality.

4/ High quality value activities include those that are not common to the region and/or Nation and that are usually of high quality.

5/ Major esthetic qualities to be considered include geology and topography, water, and vegetation.

6/ Factors to be considered in lowering quality include air and water pollution, pests, poor climate, and unsightly adjacent areas.

7/ Likelihood of success at fishing and hunting.

8/ Intensity of use for activity.

APPENDIX D

PUBLIC INVOLVEMENT

APPENDIX D

PUBLIC INVOLVEMENT

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APPENDIX D

PUBLIC INVOLVEMENT

Data Collection

Numerous informal interviews, letters, and telephone conversations occurred during data collection and study analyses phases. The comments and opinions received by these methods were not indicative of definite or official positions. Their primary use was for data as reflected in the main report.

Cultural Resource Coordination

A letter dated 7 January 1981 was sent to the Regional Preservation Archaeologist, Ohio Historic Preservation Office, Cleveland, Ohio seeking information about archaeological resources in the proposed boat harbor project area. A reply was received 15 January 1981 from the Ohio Historic Preservation Office in Cleveland stating that no archaeological sites are presently known in the study area. It was suggested that an additional field investigation be done in a location to the south of the Diked Disposal Area prior to construction of new facilities.

Telephone contacts with the Western Reserve Historical Society in Cleveland and the Lorain County Regional Planning Commission during November of 1981 revealed that no buildings listed on the Ohio or National Registry of Historic Buildings exist in the proposed project area.

U.S. Coast Guard

The U.S. Coast Guard was asked to estimate the cost of installation and maintenance for aids-to-navigation. A copy of their letter is included on the following page.

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Address reply to:
COMMANDER (oan)
Ninth Coast Guard District
1240 East 9th St.
Cleveland, Ohio 44199
Phone: (216) 522-3991

16500
Ser 227
21 April 1981

Mr. Mark W. Hornibrook
Tetra Tech, Inc.
630 North Rosemead Blvd.
Pasadena, California 91107

Dear Mr. Hornibrook:

This responds to your letter of 6 April 1981 concerning the proposed small boat harbor at Lorain, Ohio.

Alternatives 1, 3, and 5 will each require the installation of two battery operated lights. Alternative 2 will require only one such light. Our current estimate for installation of a standard 20 foot navigational aid pole with battery operated light on a rubble mound breakwater is $35,000. Annual maintenance cost per light is approximately $400.

Sincerely,

D. T. JONES
LCDR, U. S. Coast Guard
Acting Chief, Aids to Navigation Branch
By direction of the Commander
Ninth Coast Guard District

U. S. Fish and Wildlife Service

Coordination of the alternatives considered in the Stage 2 Report was conducted with the U.S. Fish and Wildlife Service, East Lansing Area Office. The Intermediate Fish and Wildlife Coordination Act Report for the Small-Boat Harbor at Lorain, Ohio, dated 19 February 1982 is presented below. The Draft Coordination Act Report will be requested in the summer of 1982 for inclusion in the DEIS.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

IN REPLY REFER TO:

East Lansing Area Office
Manly Miles Building, Room 202
1405 South Harrison Road
East Lansing, Michigan 48823

FEB 19 1982

Colonel George P. Johnson
District Engineer
U. S. Army Engineer District
Buffalo
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Johnson:

Enclosed is our Intermediate Fish and Wildlife Coordination Act (FWCA) Report for the Small-Boat Harbor Project at the City of Lorain, Lorain County, Ohio. These comments have been prepared under the authority of and in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and in compliance with the intent of the National Environmental Policy Act of 1969. The Ohio Division of Wildlife has reviewed this report and their letter of concurrence is enclosed. A detailed chemical, physical, and biological characterization of the Black River and Lorain Harbor area is contained in our Intermediate FWCA Report on the Commercial Navigation Improvements Project submitted to your office on January 22, 1981.

PROJECT DESCRIPTION

In response to a resolution of the U. S. House of Representatives that navigational and other needs at Lorain Harbor be reviewed, a reconnaissance report was completed in January 1979 by the U. S. Army Corps of Engineers, Buffalo District. Needs that were identified included:

a. Improvement of commercial navigation features.

b. Expansion of small-boat (recreational) facilities.

c. Improvement of water quality in Lorain Harbor, particularly as it relates to sedimentation.

d. Protection of waterfowl habitat.

e. Mitigation of shoreline damages due to Corps activities.

The Draft Preliminary Feasibility Report (Stage 2) on the Lorain Small-Boat Harbor, dated October 1981, was prepared by Tetra Tech for the Buffalo District in order to more precisely define excess recreational boating and fishing demands and to identify and analyze a wide range of alternatives for providing increased small-boat harbor capacity and concomitant recreational fishing opportunities at or near Lorain Harbor to meet these demands. Demand for small-boat slips is indicated to have exceeded capacity at Lorain Harbor by about 300 slips in 1980 and is projected to exceed capacity by about 600 in 1990 and by about 900 in 1995 (the anticipated date of completion of the project). Potential site locations in the Lorain area were evaluated in terms of economics, environmental impact, socio-economics, and the ability of the site to meet design criteria for moorage and refuge. The following six sites were initially selected for evaluation:

No. 1. 600 wet slips inside east breakwater.

No. 2. 600 wet slips east of diked disposal area.

No. 3. 425 wet slips inside west breakwater.

No. 4. 400 wet slips in 21st Street wetland.

No. 5. 600 wet slips at mouth of Beaver Creek.

No. 6. 400 boat dry-storage facility at Municipal Pier.

Site No. 1 was determined by the consultants to provide the best combination of capacity, access to land facilities, and benefit/cost ratio; with potentially minimal environmental impact. Subsequent to the selection of Site No. 1 as the site best suited to meet project planning objectives, the following five preliminary harbor plans were developed for the site:

Plan No. 1. 300 slips w/o Riverside Park cut

Plan No. 2. 600 slips w/o Riverside Park cut

Plan No. 3. 300 slips with Riverside Park cut

Plan No. 4. 600 slips (300 wet and 300 dry) with Riverside Park cut

Plan No. 5. 600 slips (detached breakwater) w/o Riverside Park cut.

Plans No. 3 and No. 4 were included as the commercial channel cut through Riverside Park is still being considered in the analysis of Lorain Harbor modifications for commercial navigation.

DESCRIPTION OF RESOURCE

Much of the following is a summary of the resource description provided in our Intermediate FWCA Report on the Commercial Navigation Improvements Project for Lorain Harbor. Please consult that report where necessary for more detail.

Physical Environment

Three of the six sites initially selected for evaluation by the consultant (Nos. 1, 3, and 6) are located in the Lorain Outer Harbor. Site No. 1, located in the east side of the outer harbor, presently contains approximately 70 acres of undredged bottom habitat. The area is bounded on the southeast side by the 2,323-foot east breakwater shorearm which is constructed of steel sheet pile cells filled with granular material and capped with concrete. The nearshore end of the east breakwater shorearm is connected to the shoreline by a 134-foot concrete block shore connection. The area is bounded on the northeast side by a 2,020-foot armor stone breakwater with side slopes of 2H:1V on the lake side and 1.3H:1V on the harbor side. Between the lakeward end of the east breakwater shorearm and the landward end of the east breakwater is a 100-foot wide water circulation gap. The 1,100-foot shoreline parallel to Lakeside Avenue is a moderately sloping area of gravel and cobble. Extending northwest from this shoreline and separating the southeast area of the outer harbor from the Black River is a sheet steel pile bulkheaded peninsula containing the Lorain Water Pollution Control Plant and the U. S. Coast Guard Station. The northeast portion of this peninsula also has some large riprap protection along the shoreline. The west side of the 70-acre shallow water area is bounded by portions of the outer harbor maintained to depths of 25 to 28 feet for commercial navigation purposes.

Site No. 3, located in the west corner of the Outer Harbor, presently contains approximately 30 acres of undredged bottom habitat. The area is bounded on the west side by a short shore return of rubble mound construction. Waterward of the shore return is the 1,004-foot long west pier constructed of stone filled timber cribs. A 25-foot wide water circulation gap breaks the west pier 750 feet from its landward end. Waterward of the west pier is the west breakwater constructed of armor stone. The area is bounded on the north by a 25-foot deep turning basin and on the west by a 16-foot deep dredged area. The west half of the south shoreline of the area is a shallow sloping sand beach. On the east half of the south shoreline is the Edgewater Generating Station. The cooling water intake for the power plant is in approximately the center of the south shoreline of Site No. 3. Much of Site No. 3 is a shallow water area with a sand substrate.

Site No. 6, located at the Municipal Pier, would be a dry-storage facility. The Municipal Pier is flanked by two slips. The east slip is presently utilized as a boat launching area. The west slip contains the cooling water discharge from the Edgewater Steam Electric Generating Station. The pier and the slips are protected by steel sheet pile bulkheads. The slips are already of such depth that little or no dredging would be required.

Site No. 4 is located in the 21st Street wetland in the Lorain Inner Harbor. A detailed description of the wetland is provided in the Physical Environment section of our Intermediate FWCA Report on the Commercial Navigation Improvements.

The other two sites (Nos. 2 and 5) initially selected for evaluation are outside Lorain Harbor. Site No. 2 is located immediately east of the confined disposal facility. The existing shoreline is a narrow beach strewn with cobbles and boulders. The west side of the area is bounded by the armor stone dike of the confined disposal facility. The area is open to the lake on the northeast side.

Site No. 5 is located at the mouth of Beaver Creek, west of Lorain Harbor. The mouth of Beaver Creek has been modified to facilitate boating access and to accomodate a large marina. The shoreline on either side of the mouth is sand and gravel beach habitat.

Water and Sediment Quality

Both water and sediment quality are seriously degraded in Lorain Harbor and limit the fish community in terms of species diversity and population size for the majority of those species that are still present. U. S. Environmental Protection Agency (EPA) tests (February 25, 1975) have indicated that Outer Harbor sediments are moderately or heavily polluted for the following parameters:

Volatile solids	(moderately)
Chemical oxygen demand	(heavily)
Total kjeldahl nitrogen	(heavily)
Oil and grease	(heavily)
Lead	(heavily)
Zinc	(heavily)
Total phosphorous	(heavily)
Ammonia nitrogen	(heavily)
Cyanide	(heavily)
Manganese	(heavily)
Nickel	(heavily)
Arsenic	(heavily)
Barium	(heavily)
Cadmium	(heavily)
Chromium	(moderately)
Copper	(heavily)
Iron	(heavily)

Water quality problems noted during a U. S. EPA survey (July 16-19, 1979) in Lorain Harbor included elevated temperatures, seasonally low dissolved oxygen readings, and high levels of cyanide, ammonia, phenolics, and metals. Both water and sediment quality are generally more degraded in the Inner Harbor than in the Outer Harbor.

The water and sediment quality that might be expected in the area of Site No. 2 was briefly characterized in the Final EIS for the Diked Disposal Facility, Site No. 7, Lorain Harbor (U. S. Army Corps of Engineers, Buffalo District 1975). While the benthic community was typical of that found in moderately polluted sediments, we would expect the overall water and sediment quality to be substantially better than that found inside Lorain Harbor.

No specific data on the water and sediment quality at the mouth of Beaver Creek was located. Beaver Creek is classified by the Ohio Environmental Protection Agency (1978) as Warmwater Habitat/Primary Contact Recreation. As such, the water quality in Beaver Creek can be expected to be substantially better than that of the lower Black River, which is classified as Limited Warmwater Habitat.

Fishery Resource

The fish community of the Lorain Inner and Outer Harbor is described in our Intermediate FWCA Report on the Commercial Navigation Improvements. Table 2 of that report lists 43 species of fish found as juveniles or adults in Lorain Outer Harbor within the last 10 years. Four additional species have been found only in larval stages during this same time period. At least 39 of these 47 species, plus two additional species, have also been collected in the lower six miles of the Black River during this ten-year period.

A general survey of the fish community in and around the Lorain Outer Harbor was conducted in 1981 by personnel from the Sandusky Office of the Ohio Division of Wildlife (Ohio Department of Natural Resources 1982). Sampling was conducted from June 1 thru November 3, utilizing gill nets, shore seines, and trawls. The locations of the survey stations are shown in Figure 1. The results of the survey are presented in Table 1. Twenty-nine species of fish were collected in one or more life stages (young-of-year, juvenile, and/or adult). The catch rates for most of the 29 species collected in the survey agree quite well with the relative abundance classifications given for the species in Table

2 of our previous FWCA Report. The most abundant species in both the survey and in Table 2 are gizzard shad, emerald shiner, spottail shiner, rainbow smelt, yellow perch, freshwater drum, and white bass. Note that the number of white perch collected in the survey is almost as great as the number of white bass. First reported from the central and eastern basin of Lake Erie in 1953 (Trautman 1957), the white perch population remained very low until only the last few years. It is now undergoing a dramatic explosion that may have serious repercussions upon the white bass population and perhaps upon other sport and commercial species. Of the 18 species listed in Table 2 that were not collected in the survey, 16 are classified as rare or uncommon. The other two species, bluegill and mottled sculpin, are classified as common. No smallmouth bass, largemouth bass, or sunfish were collected during the survey, in spite of the relatively high level of effort. The creel census data for 1980 and 1981 at Lorain Harbor shows an estimated 45 smallmouth bass were caught in 1980 by shore fishermen and none in 1981 (see Table 2). However, the expansion factors used to estimate total harvest from a limited number of actual bag checks means that the actual catch of smallmouth bass may have only been a small fraction of the estimated catch of 45 in 1980. Four species (bluntnose minnow, brook silverside, sauger, and shorthead redhorse) collected in the survey had not previously been collected in the Outer Harbor area within the last ten years as juveniles or adults. The first three species had previously been collected in larval stages.

Very little specific information could be found on the fish community in the vicinity of the mouth of Beaver Creek. Table 3 lists 19 species of fish collected at four sampling sites in the middle and upper portions of the Beaver Creek drainage basin on October 10, 1977 (White 1978). Many of these species, including bullheads, sunfishes, largemouth bass, and white crappie would be expected to be found in the lower portion of Beaver Creek. Species such as walleye and northern pike would be expected to move in and out of Beaver Creek at certain times of the year (Dr. White, personal communication, 1981).

Table 4 presents the results of surveys of fish communities in the vicinity of the Erie Nuclear Power Plant (approximately 17 miles west of Lorain Harbor) and the Avon Lake Power Plant (approximately 8 miles east of Lorain Harbor). The fish communities characterized in these surveys differ very little from that previously described for Lorain Harbor. Only eight species were found in these surveys that had not also been collected in Lorain Harbor within the last ten years. Three of the species are stream species that occasionally stray into Lake Erie, three of the species are listed as endangered in the State of Ohio and are seldom encountered, and two are species historically recorded for Lorain Harbor but not collected in the last ten years. Thus it appears that the nearshore fish community along the south-central portion of Lake Erie is fairly uniform in its species composition and their relative abundance. The juxtaposition of open lake habitat, base-gradient stream habitat, and wetland habitat found in the vicinity of the mouth of Beaver Creek is similar to that found in Lorain Harbor and at the Erie Nuclear Power Plant area and we would therefore expect the respective fish communities to be quite similar.

A portion of the offshore fish community can be characterized by the commercial gill net catch shown in Table 5. The fishery is limited to use of gill nets with a stretch mesh of not less than 2 1/2 inches nor greater than 2 7/8 inches. While this introduces an obvious bias in the use of the data to characterize the offshore fish community, the amount of effort (41 million feet of net fished in 1980) cannot be duplicated in scientific surveys. Approximately 78 percent of the estimated catch for the Huron to Fairport reach is based on survey data from an area from Vermilion to Avon. The increase in the white perch population that was previously discussed, can also be seen in the commercial gill net catch. For 1980 the catch of white perch was 54, 746 and for 1981 it was 374,000. Other catch data from 1981 was provided to us by the Ohio Division of Wildlife but was not utilized as it has not been officially published by the Division.

The relative abundance of fish species found as larvae in the Lorain Outer Harbor was provided in Table 3 of the previous FWCA Report. These abundance classifications were based upon entrainment data for the Edgewater Generating Station in 1977 and upon standard ichthyoplankton net surveys in the Outer Harbor done in 1977. In 1978 these collections were continued both in-plant and at one station in the immediate vicinity of the cooling water intake. Entrainment at both the Edgewater and Avon Lake Power Plants as estimated from in-plant sampling and field sampling for 1978 is presented in Table 6 (Mazera 1981). A comparison of the relative abundance of species in 1977 to that in 1978 reveals that several species, such as rainbow smelt, carp/goldfish, and yellow perch were far less abundant as larvae in 1978 than in 1977. The results of fall trawling for young-of-the-year (YOY) fish conducted by the Ohio Division of Wildlife indicated that the 1978 index for YOY yellow perch in District II was the lowest of any year between 1975 and 1980 and was only twenty percent as great as the next lowest index in that time period (Davies, et al. 1981). The data for the Avon Lake Power Plant reveals higher estimated entrainment than at Edgewater for all species except white bass/white perch, Lepomis spp., and sauger. As the average daily flows at the two plants are very similar, this higher entrainment may reflect higher larval densities in the open lake or concentrated spawning on the riprap dike along the intake channel.

A general characterization of larval abundance in the Ohio portion of the central basin of Lake Erie is provided by Mazera (1981). Figure 2 shows the locations of the ten transects that were surveyed. Note that transects 3 and 4 flank Lorain Harbor. Depths at the three stations along each transect were 1m, 5m, and 10m. Table 6 indicates the relative abundance of the 28 taxa of larval fish captured along the Ohio shoreline of the central basin in 1978. Individual species lists for each transect are unavailable at this time. Nine species were collected in large enough numbers and occurred in a sufficient number of samples to be considered abundant. These species are gizzard shad, rainbow smelt, carp, emerald shiner, spottail shiner, trout-perch, yellow perch, logperch, and freshwater drum. Mean density at each station for each of these nine species is presented in Figures 3 thru 11. The mean larval densities of gizzard shad, rainbow smelt, and freshwater drum are higher for transects 3 and 4 than for any other transects. The mean larval density of emerald shiners at transect 3 far exceeds the densities at other transects, but the density at transect 4 is much lower and is only the fourth highest of the 10 transects. Conversely, the larval densities of trout-perch, spottail shiner, yellow perch, carp, and logperch were much lower at transects 3 and 4 relative to the other transects, particularly those on the east end of Ohio's central basin shoreline. Of course, it should be remembered that larval densities will vary considerably from year to year depending upon environmental conditions during the spawning season. Whether these changes in density will also result in changes in the relative ranking of transects could only be determined with several year's data.

Avian Resource

Southcentral Lake Erie, including Lorain Harbor, is located at the intersection of major north-south and east-west migration corridors for the following species: lesser scaup, American wigeon, mallard, red-breasted merganser, canvasback, blue-winged teal, redhead, greater scaup, common pintail, whistling swan, ruddy duck, bufflehead, common goldeneye, green-winged teal, Canada goose, northern shoveler, wood duck, gadwall, common merganser, black duck, ring-necked duck, and hooded merganser (presented in approximate decreasing order of number of migrants). The habitat offered by Lorain Harbor is much more attractive to diving ducks than to marsh ducks. Of the seven species of diving ducks listed above, six are common to abundant in Lorain Harbor during migration. Of the seven species of marsh ducks listed above, only the mallard is common in Lorain Harbor during migration. Table 7 of the Intermediate FWCA Report shows comparative seasonal use of the west and east halves of the Lorain Outer Harbor by waterbirds. Note that for almost all species, utilization of the West Outer Harbor is equal to or greater than utilization of the East Outer Harbor. This is most notable in severe winters when the only open water is provided by the cooling water discharge from the Edgewater Power Station in the West Outer Harbor.

The data on comparative seasonal use was provided by Mr. John Pogacnik, a member of the Black River Audubon Society. A recent conversation with Mr. Pogacnik revealed that waterbirds including horned grebes, mallards, black ducks, and gadwalls have been using the area immediately east of the diked disposal facility shore connection in numbers roughly equal to use in Lorain Outer Harbor. Some of this use may be a function of the fact that waterfowl hunting has been banned on the diked disposal facility. Another area reported to be receiving very high use is the new floating tire breakwater in the southeast section of the Outer Harbor. Very large numbers of gulls, particularly Bonaparte's gulls, have been using the breakwater as a resting area. The 1981 Christmas bird count in Lorain produced a conservative estimate of 94,000 gulls in the harbor area. The floating breakwater has even attracted ruddy turnstones and sanderlings.

Mr. Pogacnik also indicated that the area around the mouth of Beaver Creek receives very little waterbird use relative to that found in and around the Lorain Outer Harbor. The limited number of waterbirds generally seen in the area consist primarily of mergansers.

Potential Impacts of Marina Construction at Six Proposed Sites

The major work proposed at Sites No. 1 and 2 would involve the construction of large rubble breakwaters and the conversion of relatively unprotected aquatic habitat into protected basins. Fishery investigations in the Cleveland area indicated that protected marina basins and breakwaters provided the major breeding and nursery areas (White, et al. 1975). The construction of rubble breakwaters and the forming of protected basins would, in almost all cases, be considered beneficial to the fish community. Little dredging would be involved at Sites No. 1 and 2, and the land-based facilities would be constructed on the diked disposal facility; thus minimizing impacts. Some reduction in waterbird use of the areas could occur as a result of increased human disturbance associated with a marina.

Site No. 5 also involves the construction of a large rubble breakwater and the forming of a protected basin. However, the work would be performed in a shallow sand beach area with possible wetland involvement. Dredging of the shallow areas would be involved, along with the filling of productive terrestrial habitat for land-based facilities. Thus, the benefits associated with the rubble breakwater and protected basin would be somewhat offset by losses to the terrestrial community and the need to dredge existing bottom habitat. Further losses would result from the need to riprap 1,200 feet of existing sand beach.

Site No. 3 would also involve the dredging of existing shallow water/sand substrate habitat and the filling of the sand beach area for land-based facilities. No protective rubble breakwater is proposed. Some fishery benefits could be realized depending on the types of material used to construct the bulkhead along the shoreline and to increase the elevation of the west breakwater. However, these potential benefits would probably not offset the loss of the only large area within Lorain Harbor having protected shallow water/sand substrate habitat.

Site No. 4 involved the dredging of the entire 21st Street wetland and the construction of a 1,500-foot breakwater. While the breakwater might provide substantial benefits to the fishery if water quality problems in the Black River are alleviated, the loss of the wetland habitat would not be acceptable. The U. S. Fish and Wildlife Service has consistently opposed navigation improvement alternatives in the Lorain Inner Harbor that would result in the loss of this wetland. As productive wetland habitat is very scarce along the lower Black River, and as feasible alternative sites exist for the recreational marina, we request that Site No. 4 be dropped from further consideration.

Site No. 6 involves a dry-storage facility in an area having minimal terrestrial habitat value. The proposed plan for the site would also involve little or no direct impact on the fish community. However, the major shoreline sport fishery in the Lorain area is centered on the Edgewater Generating Station cooling water discharge slip. Inherent in any plans for a dry-storage facility in this area should be the maintenance or enhancement of this shoreline fishery.

In summary, Sites No. 1, 2, and 6 provide feasible alternative sites for marina development involving minimal environmental impact. As such, they are preferred over Sites No. 3, 4, and 5, where development would result in far more serious impacts.

As the consultant has selected Site No. 1 as the preferred site and has developed five alternative harbor plans for the site, a more detailed analysis of impacts associated with Site No. 1 follows.

The major environmental impacts of the proposed alternative plans for Site No. 1 will involve: 1) conversion of a relatively unprotected portion of the harbor into a protected basin with reduced water circulation, 2) replacement of between 2.1 and 3.9 acres of existing bottom substrate with between 0.9 and 1.6 acres of rock rubble habitat, and 3) increased human disturbance of the area.

The five alternative plans being considered for the small-boat harbor involve protecting between 18.1 and 40.7 acres of shallow water area with rubble mound breakwaters according to the consultant's Stage 2 Preliminary Feasibility Report. However, the basins for Plans No. 2 and No. 5 will be significantly smaller than shown in the report due to the fact that the breakwaters for these plans are proposed to be built in an area that will be dredged to a depth of 28 feet for a turning basin under the Commercial Navigation Improvements Project. Thus, Plans No. 2 and No. 5 must be revised to move the breakwaters east of the expanded turning basin. The maximum mooring basin size would thereby be limited to about 33 acres.

Breakwaters and channels will be designed to limit wave heights to three feet in the entrance channel and one foot in the mooring area. Such a design will result in a significant reduction of water circulation in the area relative to existing conditions. If nutrient and waste loadings to Lorain Harbor from upstream industrial, municipal, and agricultural sources continue at approximately existing levels, significant water quality problems may develop in the small-boat harbor during calm periods. Depressed dissolved oxygen levels would be one of the most serious potential water quality problems that could limit fish use of the small-boat harbor during these periods. Loss of some existing gravel, cobble, and rubble habitat may occur as a result of reduced water circulation, permitting sediment build up at shallower harbor depths than presently occurs. The creation of a protected basin, with possible increased siltation and decreased oxygen levels may lead to an increased use of the area by emerald shiners, trout-perch, channel catfish, bullheads, crappies, sunfishes, and freshwater drum but a decreased use by longnose dace, mottled sculpin, logperch, and walleye. The combination of improvements proposed under the commercial navigation project and the corresponding plans for the small-boat harbor (with the exception of Plan No. 1) will result in the modification of essentially all of the 70-acre undredged habitat presently existing in the East Outer Harbor.

The construction of the protective breakwater system will result in the loss of between 2.1 and 3.9 acres of existing bottom substrate. The breakwaters will provide between 0.9 and 1.6 acres of rock rubble habitat (as measured in a flat plane). However, the total surface area of the breakwaters actually available for colonization by benthic organisms will probably be greater than the area of substrate covered by the breakwaters. The breakwaters will also provide for spawning, nursery, and feeding habitat for a number of fish species in Lorain Harbor. Overall, the breakwaters should benefit the fishery, particularly if water and sediment quality problems in Lorain Harbor can be ameliorated.

The increased human activity associated with the small-boat harbor will result in some disturbance to waterbirds that presently utilize the East Outer Harbor. However, an examination of Table 7 from our Intermediate FWCA Report for the Commercial Navigation Improvements indicates that the majority of this utilization occurs during the spring and fall, when boating activity is at a low level. The only waterbirds that regularly use the East Outer Harbor in the summer that could be adversely affected are: mallards, killdeer, spotted sandpipers, gulls, terns, and belted kingfishers.

Federally Endangered and Threatened Species

The proposed project lies within the range of the following Federally endangered (E), threatened (T), or proposed (P) species:

Common Name	Scientific Name	Habitat
Indiana bat (E)	*Myotis sodalis*	Caves and riparian

This area was inspected by a biologist of the U. S. Fish and Wildlife Service and it was determined that no suitable habitat for endangered species existed. Therefore, it is my opinion that the project, as currently proposed, will not jeopardize the continued existence of any Federally listed species.

Mitigation Discussion

Due to the existing depths at Site No. 1, dredging and other work which would directly destroy habitat will not be required. As previously mentioned, the habitat provided by the rock rubble breakwaters should more than compensate for the existing substrate that will be covered. However, the indirect effects of the breakwaters on water quality due to impaired circulation, may be significant. If a review of potential water quality problems by your staff finds our concern to be justified, culverts or other flow-through systems should be installed in the breakwaters to reduce circulation problems. Some water quality problems might also be avoided if boat pump-out facilities and other sanitary facilities associated with the recreation/small-boat harbor area are designed to handle the maximum capacity expected during peak use periods. Some disturbance of waterbird use in the area appears to be unavoidable and presently occurs to a limited degree due to the existing boat ramp and a small-craft mooring area recently constructed by the Lorain Port Authority.

Sincerely yours,

Raymond G. Oberst

Area Manager

References

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Table 1. Species composition of fish community at Lorain Harbor as revealed by gill netting (GN), shore seining (SS), and trawling (Tr) conducted from 6/1/81 thru 10/3/81 (Ohio DNR 1982)

(see Figure 1 for locations of survey stations)

		Gill Netting Stations						Shore Seining Stations					Trawling Stations		
		GN2	GN4	GN5	GN6	GN1	GN3	SS2	SS1	SS3	SS4	SS6	Tr1	Tr2	Tr3
Alewife	YOY	11	3	7			1		17	3	3	4		1	
Gizzard shad	YOY	323	212	117	50	6	113	12	113	105	198	14	46	24	20
	JUV	30	1	3	22	33	9								
	AD		1			7	3								
Rainbow smelt	YOY							40	29	5		2	26	174	5
	AD		6	1											
Northern pike	AD						1								
Goldfish	AD						1								
Common carp	AD	1	2	2		14	5							1	
Emerald shiner	YOY							25	103	197	41	69	12	328	1
	AD							37	52	155	56	19	29	9	2
Spottail shiner	YOY							48	167	4	34	184	14	4	11
	AD	49	91	65	72	109	500	2	4	315	1	13	20	7	
Spotfin shiner	AD								3	1		7			
Bluntnose minnow	YOY									7					
	AD								10	3	3				
Longnose dace	AD								1		19				
White sucker	AD	4		3	1										
Golden redhorse	AD			3	1	8									
Shorthead redhorse	AD	1					1								
Brown bullhead	AD				3	1	9								
Channel catfish	AD	3	1	3		1	3								
Stonecat	AD	4	17	13		4								2	

Table 1. (continued) Species composition of fish community at Lorain Harbor as revealed by gill netting (GN), shore seining (SS), and trawling (Tr) conducted from 6/1/81 thru 10/3/81 (Ohio DNR 1982)

(see Figure 1 for locations of survey stations)

		Gill Netting Stations						Shore Seining Stations					Trawling Stations		
		GN2	GN4	GN5	GN6	GN1	GN3	SS2	SS1	SS3	SS4	SS6	Tr1	Tr2	Tr3
Trout-perch	YOY														5
	JUV													2	
	AD		1			4							1		
Brook silverside	YOY									2	1	1			
	AD									1	2				
White perch	YOY		28	11	3		2	3		1	1	5	7	43	12
	JUV	2	2	1		8	6	14	3		1		2		1
	AD	14	40	17	3	2	3								
White bass	YOY	20	1	10	8	2	29	17		11	9	13	11	40	1
	JUV	40	40	25	3		21	2					11	3	
	AD			1		2			4						
Rock bass	AD	13	4	5		1	1								
White crappie	YOY												1	3	
	AD				2		2								
Black crappie	AD						2								
Yellow perch	YOY					1			55		1	7	7	43	
	JUV	3	13	65	3	12	1						1	2	
	AD	3	17	37	6	9	2								
Logperch	AD									1					
Sauger	JUV			1											
Walleye	YOY	1													
	JUV	3		1									1		
	AD	1		2											
Freshwater drum	YOY		27	1		30					2			2	38
	JUV		1			22	12								
	AD	11	17	13		51	7	1							

Table 2. Sport fish harvest data for shore fishermen in Lorain Harbor*

	1975	1976	1977	1980	1981
Channel catfish	3,612	653	895	2,770	257
White bass	144,890	36,571	118,395	37,286	41,931
Smallmouth bass	157	69	366	45	0
Yellow perch	84,402	29,836	54,354	17,190	2,498
Walleye	494	0	83	0	233
Freshwater drum	24,457	8,397	6,296	11,405	1,840
Other species	20,199	10,122	7,709	8,418	2,990
Total Catch	278,611	85,648	188,098	77,114	49,749
Angler Hours	214,151	120,315	130,666	102,606	63,755

* Baker, C.T, M. Rawson and D.L. Johnson. 1976. Ohio's annual Lake Erie creek census. D.-J. Perf. Rep. F-35-R, Study 3, Final Report. Ohio Dept. Natural Resources, Division of Wildlife. 25p. (and personal communication with personnel of the Ohio DNR)

Table 3. Fish species collected at each of four sites in the middle and upper portion of the Beaver Creek drainage basin on October 10, 1977*

	Site 1302	Site 1303	Site 1304	Site 1305
Central mudminnow				x
Grass pickerel		x	x	x
Stoneroller	x	x		
Silverjaw minnow		x		
Golden shiner		x		x
Striped/common shiner		x	x	x
Bluntnose minnow	x	x		
Fathead minnow	x			
Creek chub	x	x	x	
White sucker	x	x	x	x
Black bullhead	x	x		x
Yellow bullhead				x
Green sunfish	x	x	x	x
Pumpkinseed				x
Bluegill	x	x	x	x
Largemouth bass		x		x
White crappie		x		
Rainbow darter		x		
Johnny darter		x		

* White, A.M. 1978. Analysis of Stream Habitats, Vols. 1 and 2, Technical Appendix A21 of Final Report for the Northeast Ohio Areawide Coordinating Agency.

Table 4. Species composition of fish communities in vicinity of Erie Nuclear Power Plant* and Avon Lake Power Plant**

	Erie Nuclear Power Plant			Avon Lake Power Plant	
	Gill Nets	Shore Seines	Trawls	Field Data	Impingement
Sea lamprey	1				18
Lake sturgeon	1				
Bowfin	1				
Alewife	1,846	3,165	3,759	324	295
Gizzard shad	1,599	997	37,376	887	532,423
Coho salmon	39			10	24
Chinook salmon	2			4	
Rainbow smelt	418	1	1,175	2	72,928
Northern pike	2			1	
Muskellunge			1		
Goldfish	33		113	3	186
Carp	554	2	104	102	32
Silverjaw minnow		1			
Silver chub			1		
Golden shiner					42
Emerald shiner	182	307	19,022	361	47,816
Spottail shiner	3,472	318	8,552	271	8,217
Spotfin shiner		5			
Sand shiner		11			
Fathead minnow					10
Creek chub					1
Quillback	36	1		4	
White sucker	79	2	1	3	20
Northern hog sucker	1				
Golden redhorse	2			4	
Shorthead redhorse	20			1	
Yellow bullhead				1	1
Brown bullhead	1		8		25
Channel catfish	120		89	4	38
Stonecat	71	1	9	22	275
Trout-perch	16		4,815	7	5,114
Brook silverside		1			
White perch	1				
White bass	298	21	2,084	31	15,957

Table 4. (continued) Species composition of fish communities in vicinity of Erie Nuclear Power Plant* and Avon Lake Power Plant**

	Erie Nuclear Power Plant			Avon Lake Power Plant	
	Gill Nets	Shore Seines	Trawls	Field Data	Impingement
Rock bass	4			2	5
Green sunfish					25
Pumpkinseed					6
Bluegill		4	1		32
Smallmouth bass	3	2			7
White crappie	45		104	2	99
Black crappie	1	1	8		46
Yellow perch	973		2,658	51	2,165
Logperch	2		11		66
Sauger	5				
Walleye	82		110	40	24
Freshwater drum	1,041		3,565	32	9,008
Mottled sculpin					22

* U. S. Nuclear Regulatory Commission. 1977. Draft Environmental statement related to construction of Erie Nuclear Plant, Units 1 and 2. Ohio Edison Company, et al.
and Wolfert, D.R., W.D.N. Busch, and H.D. Van Meter. 1978. Seasonal abundance of fish in an inshore area of southcentral Lake Erie, 1974-75. Admin. Report. U. S. Fish and Wildlife Service, Sandusky Biological Station. 16pp.

** Aquatic Ecology Associates. 1976. An aquatic ecological study of the inshore area of Lake Erie in the vicinity of the Avon Lake Stream Electric Generating Station, Avon Lake, Ohio. Cleveland Electric Illuminating Company, Cleveland, Ohio. 380pp.
and Applied Biology, Inc. 1979. Section 316(b) intake monitoring program. Cleveland Electric Illuminating Company Avon Lake Plant. Final Report.

Table 5. Estimated number of fish caught by species in Ohio's commercial gill net fishery for 1980 (Rawson 1981)

	Huron to Fairport	Fairport to Pennsylvania Border	Total Estimated Catch
Lake sturgeon	19	0	19
Alewife	19,363	402	19,765
Gizzard shad	101,414	10,062	111,476
Lake whitefish	150	0	150
Coho salmon	3,935	744	4,679
Rainbow trout	0	127	127
Lake trout	113	1,160	1,273
Rainbow smelt	579,069	46,309	625,378
Common carp	424	27	451
Silver chub	3,798	0	3,798
Emerald shiner	2,001	0	2,001
Spottail shiner	1,526	525	2,051
Quillback	248	0	248
White sucker	38,288	18,170	56,458
Northern hog sucker	1,003	0	1,003
Shorthead redhorse	14,858	4,259	19,117
Brown bullhead	2,863	0	2,863
Channel catfish	45,255	3,492	48,747
Stonecat	41,564	2,032	43,596
Trout-perch	120	542	662
Burbot	95	0	95
White perch	52,389	2,357	54,746
White bass	33,940	9,967	43,907
Rock bass	622	326	948
Smallmouth bass	48	704	752
White crappie	12	0	12
Yellow perch	8,635,049	1,731,055	10,366,104
Sauger	791	27	818
Walleye	111,088	31,247	142,335
Freshwater drum	3,777,477	483,505	4,260,982
Ft. of net fished	34,263,800	6,801,700	41,065,500
Ft. of net surveyed	1,053,700	257,000	1,310,700

Table 6. Entrainment[1] at Edgewater and Avon Lake Power Plants estimated from in-plant sampling and field sampling for 1978 (Mazera 1981)

	Edgewater P.P.		Avon Lake P.P.	
	In-plant	Field	In-plant	Field
Gizzard shad/alewife	5.87	7.91	25.2	23.80
Rainbow smelt		0.29	25.80	1.27
Carp/goldfish	0.28	0.48	9.13	
Emerald shiner		0.97		0.74
Spottail shiner		0.25		0.11
Notropis sp.	40.80		130.00	
Bluntnose minnow			0.72	
Minnow	2.57		7.66	
Cyprinidae		0.04		
White sucker	0.08		0.84	
Trout-perch	0.42		3.22	
Burbot			0.24	
White bass/white perch		0.94		
Lepomis spp.	0.20		0.03	
Yellow perch		0.05	1.35	0.10
Logperch	0.38	0.27	3.33	0.25
Sauger	0.02			
Percidae				0.14
Freshwater drum	0.20	0.43	0.41	10.30
Mottled sculpin			0.22	

[1] Estimated entrainment expressed as millions of fish annually.

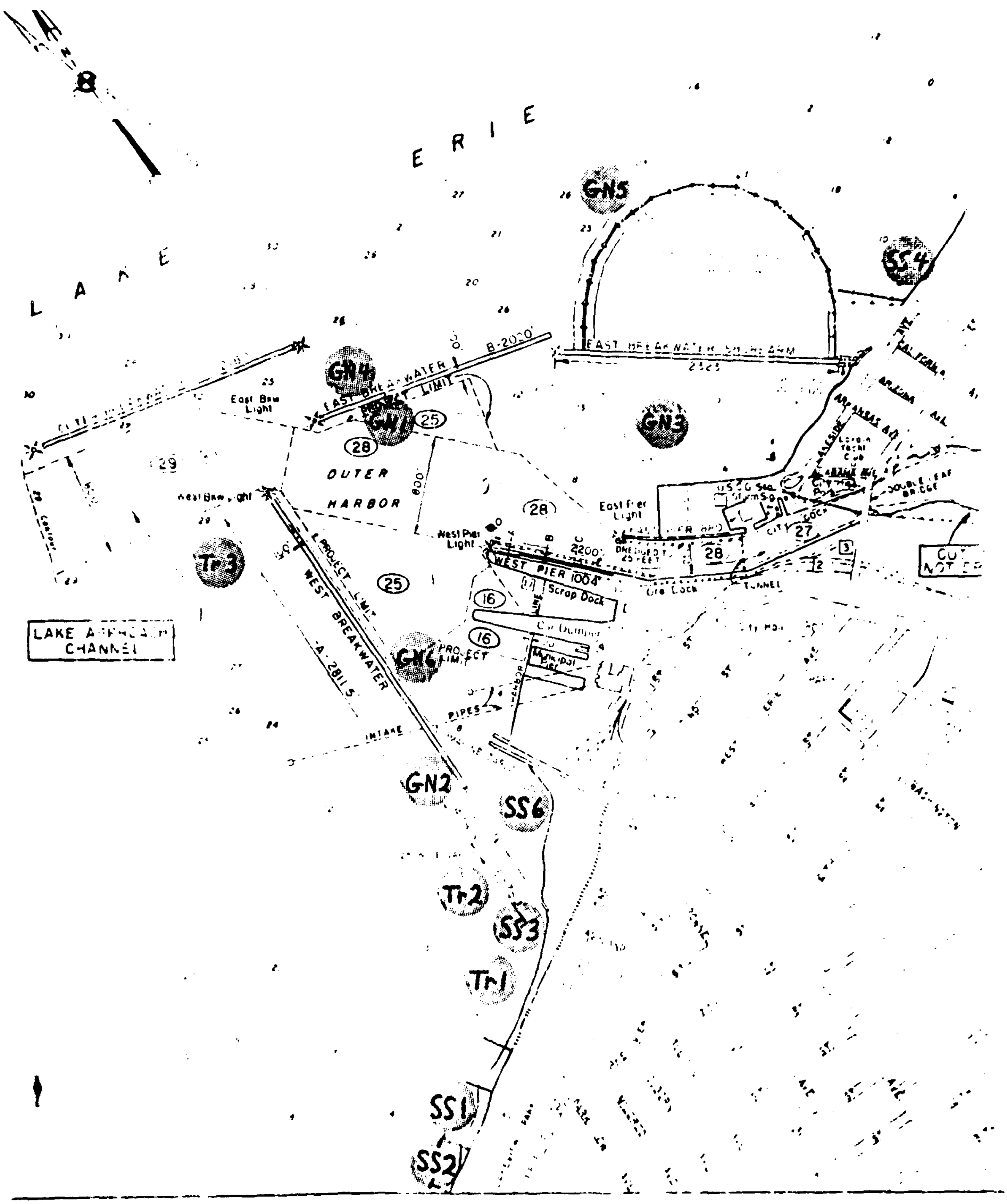


Figure 1. Locations of survey stations for 1981 Ohio DNR survey of fish community at Lorain Harbor (Ohio DNR 1982).

(see Table 1 for results of survey)

Table 7. Relative abundance of larval fishes captured along the Ohio shoreline of the central basin 1978 (Mazera 1981)

	Average Density*	Percentage of Total Catch**
Emerald shiner	32.30	34.28
Gizzard shad	28.42	30.53
Spottail shiner	16.37	17.58
Freshwater drum	3.92	4.21
Rainbow smelt	3.40	3.66
Carp	2.85	3.06
Yellow perch	1.25	1.34
Trout-perch	1.00	1.01
Johnny darter	0.80	0.84
Logperch	0.74	0.79
Mottled sculpin	0.47	0.50
Cyprinidae	0.46	0.48
Notropis sp.	0.25	0.26
Percidae	0.20	0.21
Unidentified larvae	0.07	0.08
Lepomis sp.	0.07	0.06
Striped shiner	0.06	0.06
White sucker	0.05	0.04
Walleye	0.04	0.04
White bass	0.03	0.03
Rock bass	0.02	0.03
Burbot	0.02	0.03
Golden shiner	0.02	0.02
Pomoxis sp.	0.01	0.02
Sauger	0.01	0.02
Quillback carpsucker	0.01	0.01
Black crappie	0.01	0.01
Smallmouth bass	0.01	0.01

* Average density found by dividing the sum of the calculated densities by the number of samples collected during the period of larval occurrence.

** Species ranked in descending order of average density.

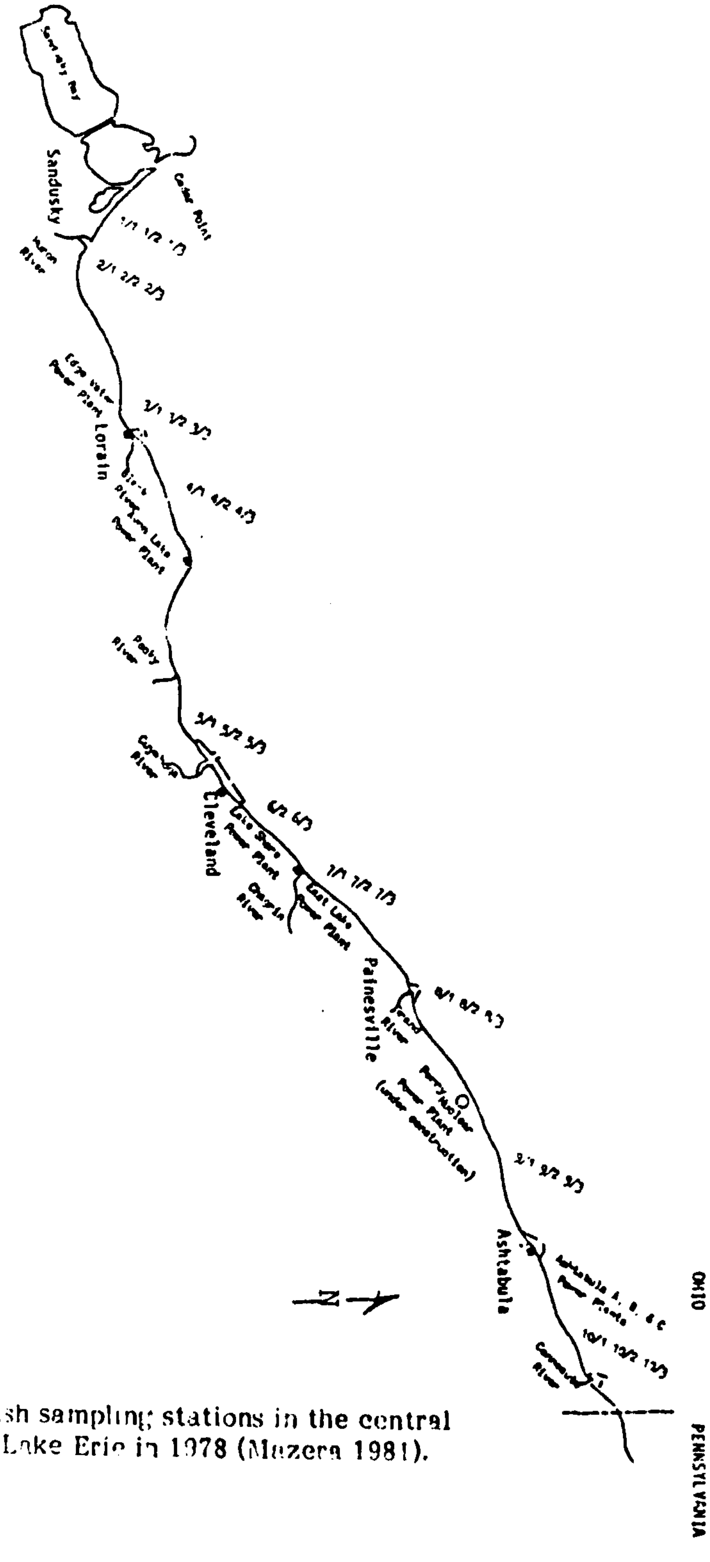


Figure 2. Larval fish sampling stations in the central basin of Lake Erie in 1978 (Muzera 1981).

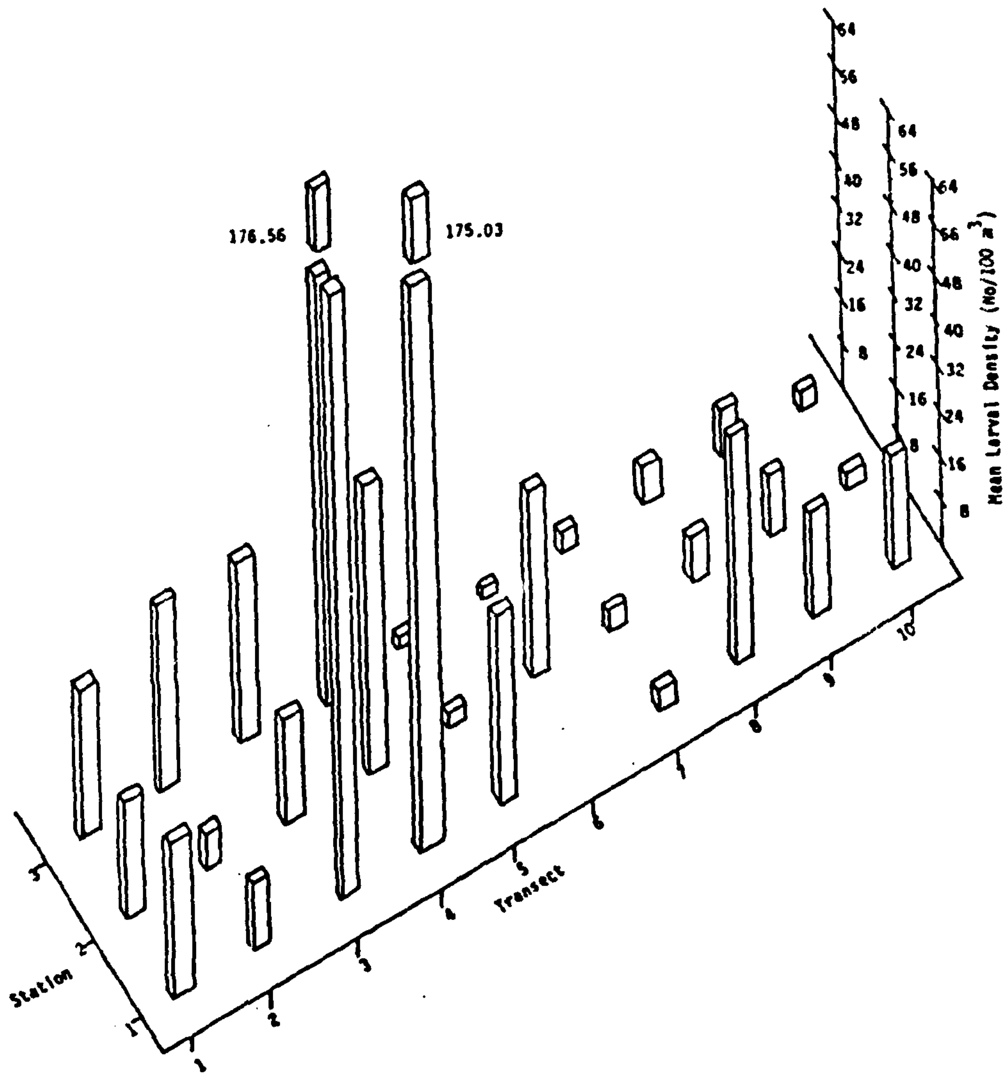


Figure 3 Central Basin - 1978.
Mean Density of Gizzard Shad Larvae at Each Station.

(Mazera 1981)

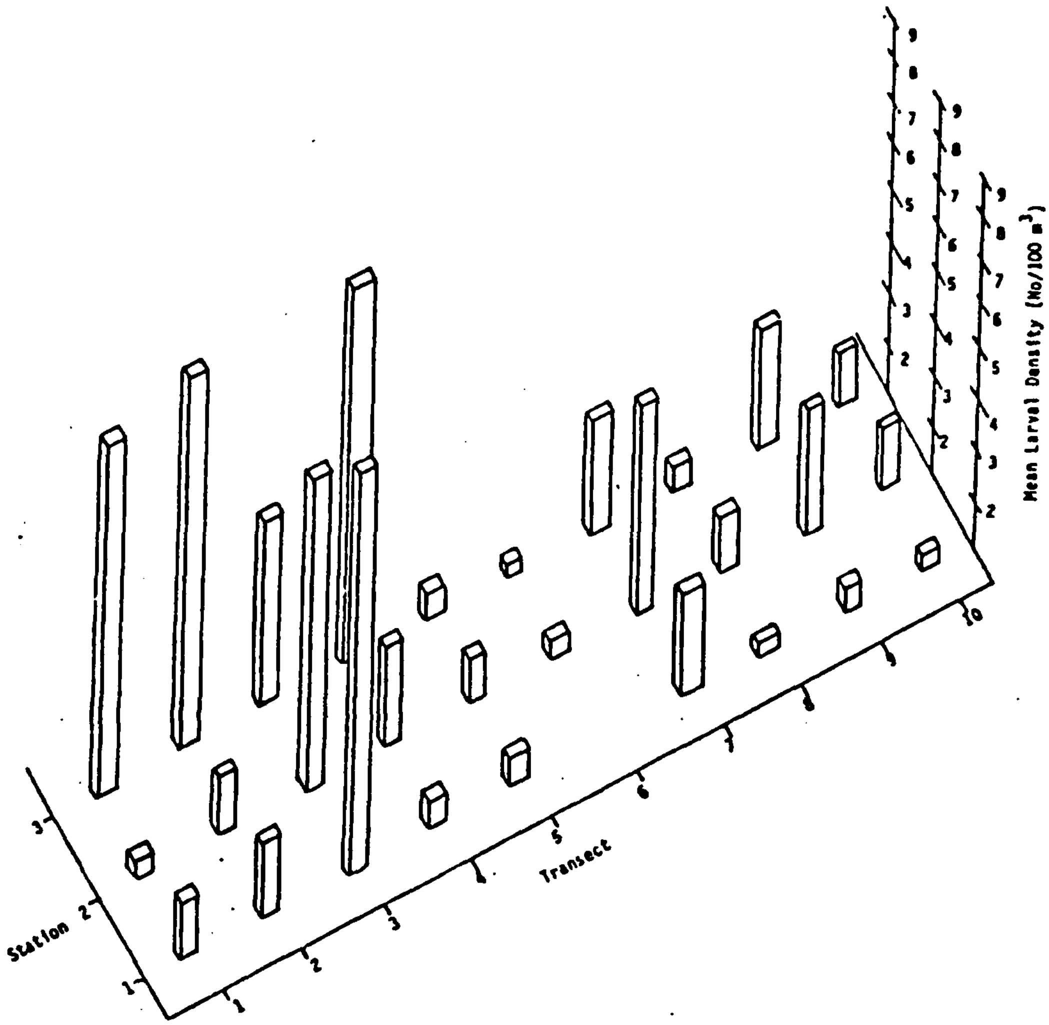


Figure 4 Central Basin - 1978.
Mean Density of Rainbow Smelt Larvae at Each Station.

(Mazera 1981)

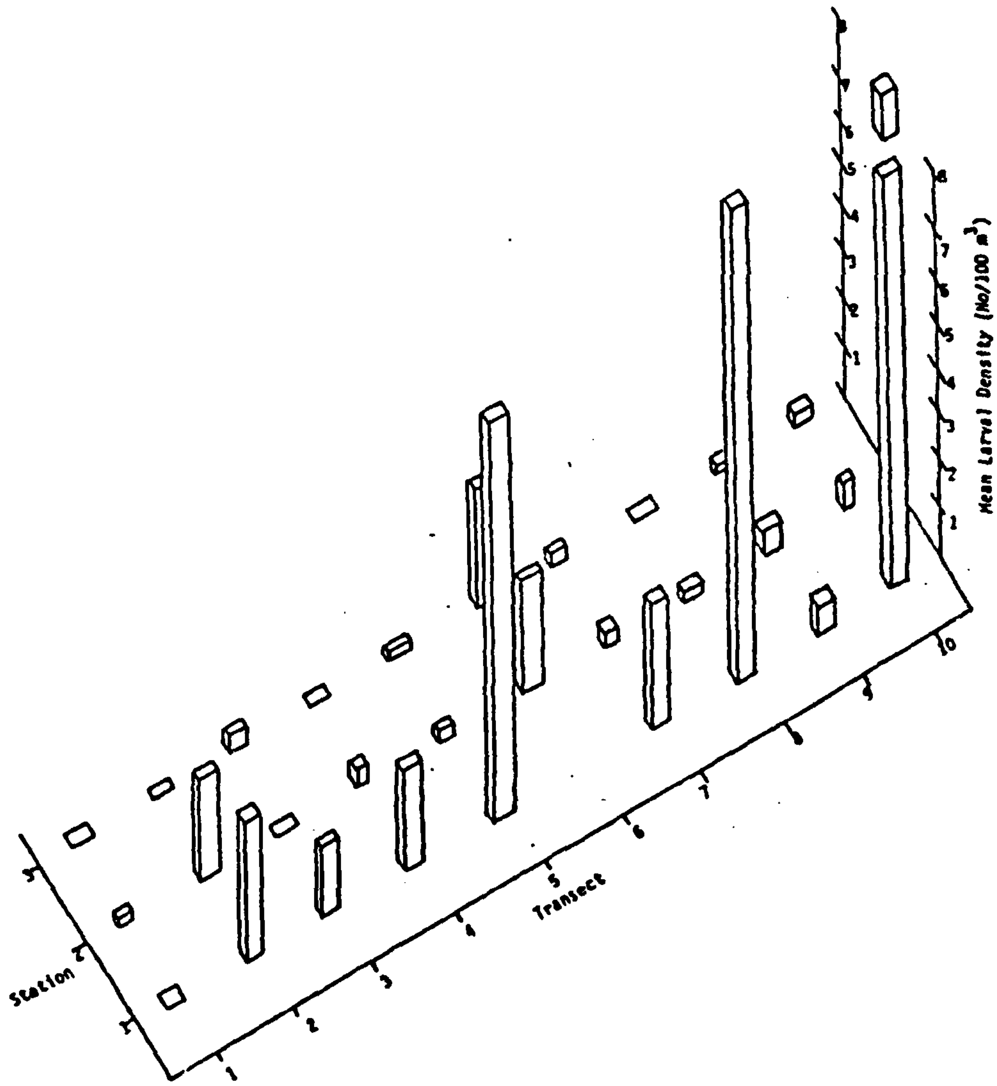


Figure 5 . Central Basin - 1978.
Mean Density of Carp Larvae at Each Station.

(Mazera 1981)

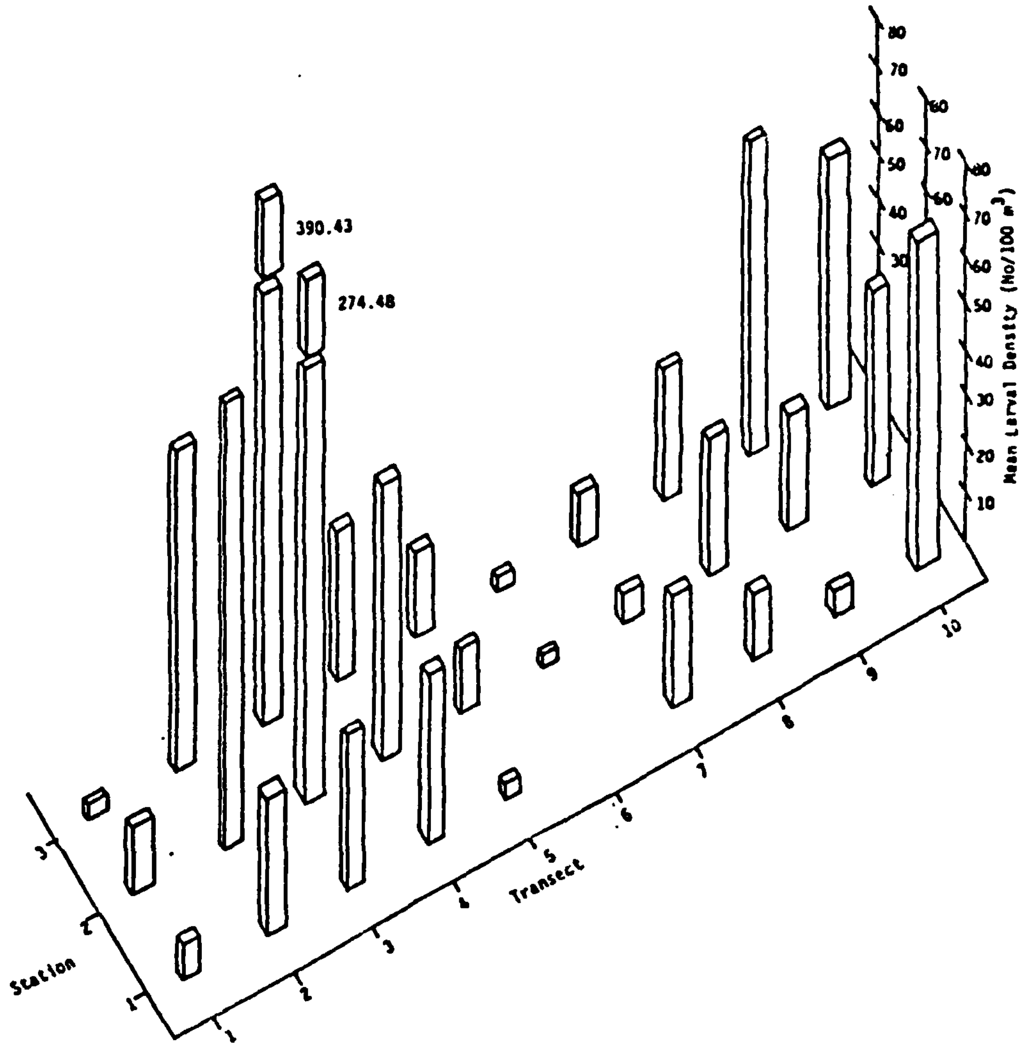


Figure 6. Central Basin - 1978.
Mean Density of Emerald Shiner Larvae at Each Station.

(Mazera 1981)

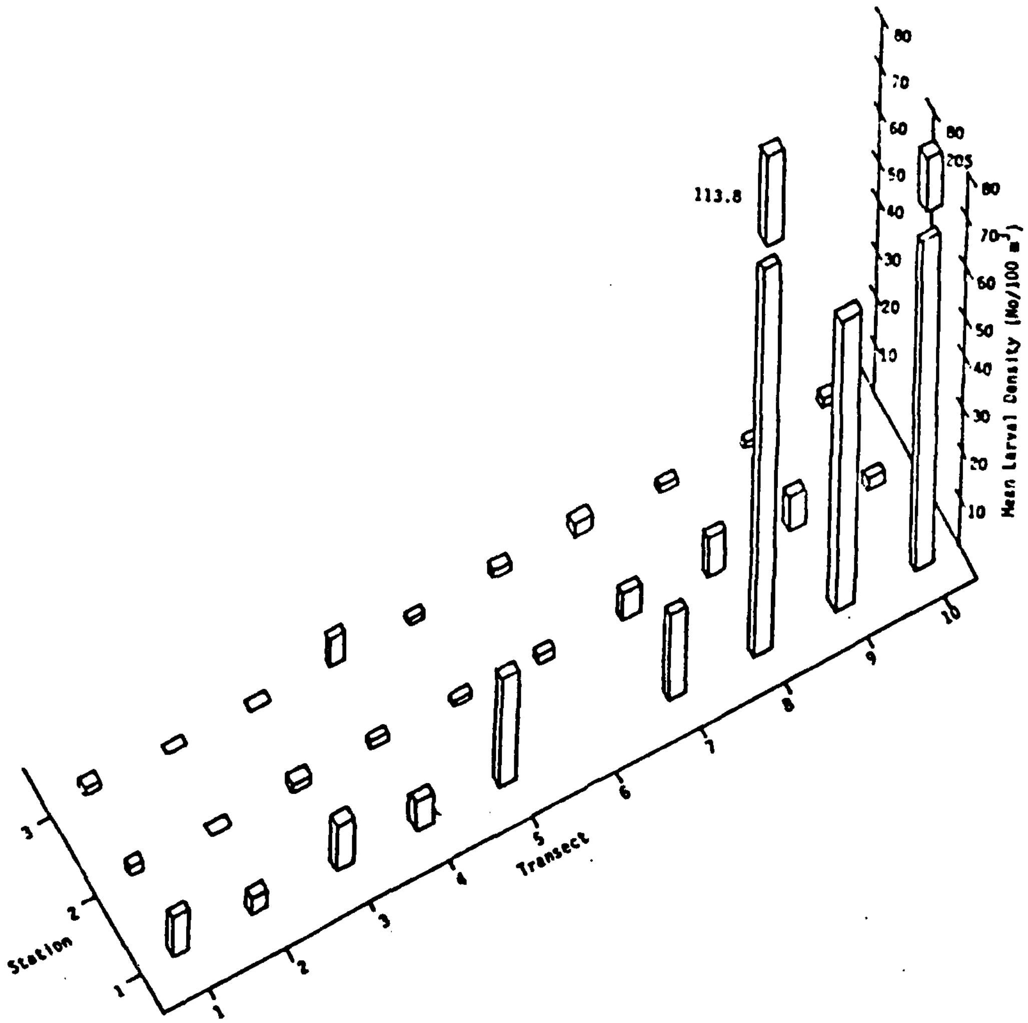


Figure 7 Central Basin - 1978.
Mean Density of Spottail Shiner Larvae at Each Station.

(Mazera 1981)

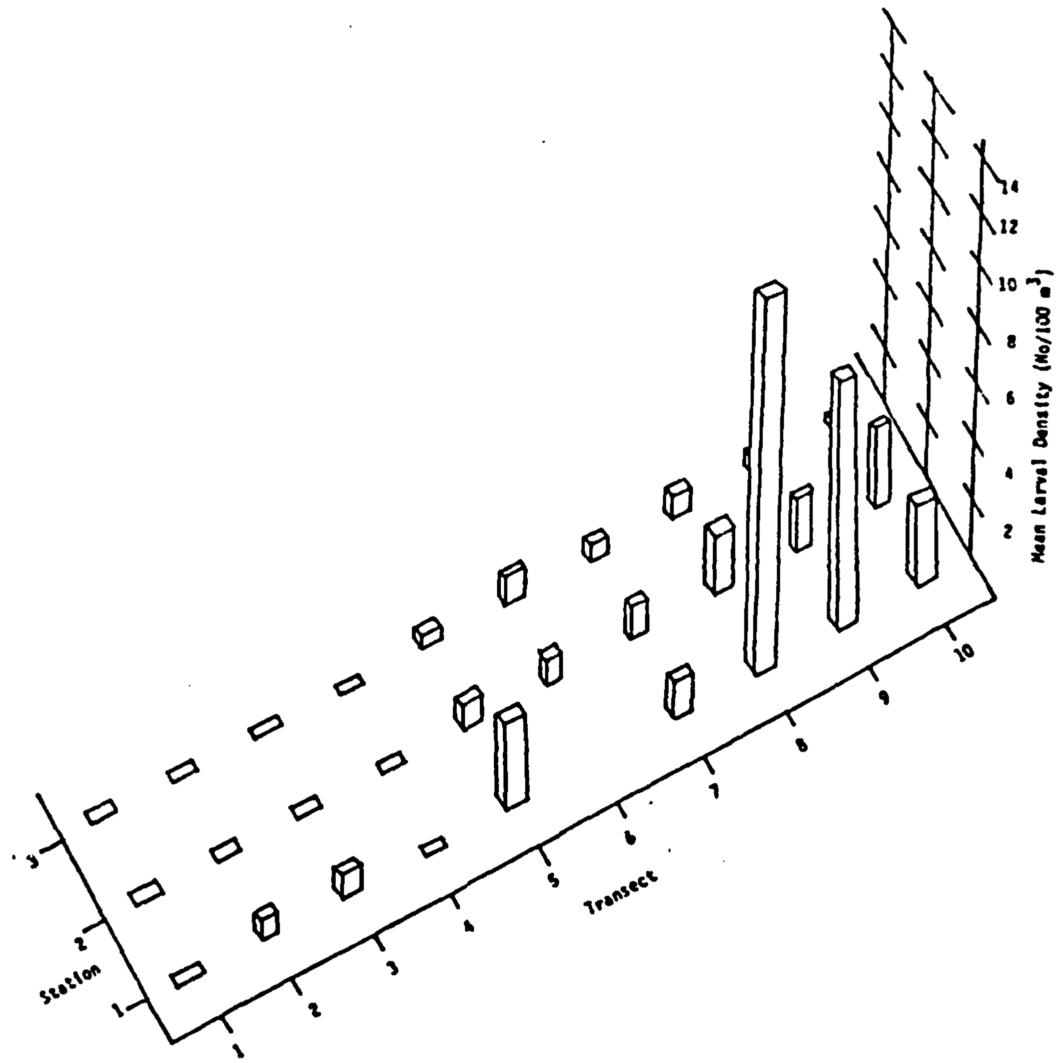


Figure 8 Central Basin - 1978.
Mean Density of Trout Perch Larvae at Each Station.

(Mazera 1981)

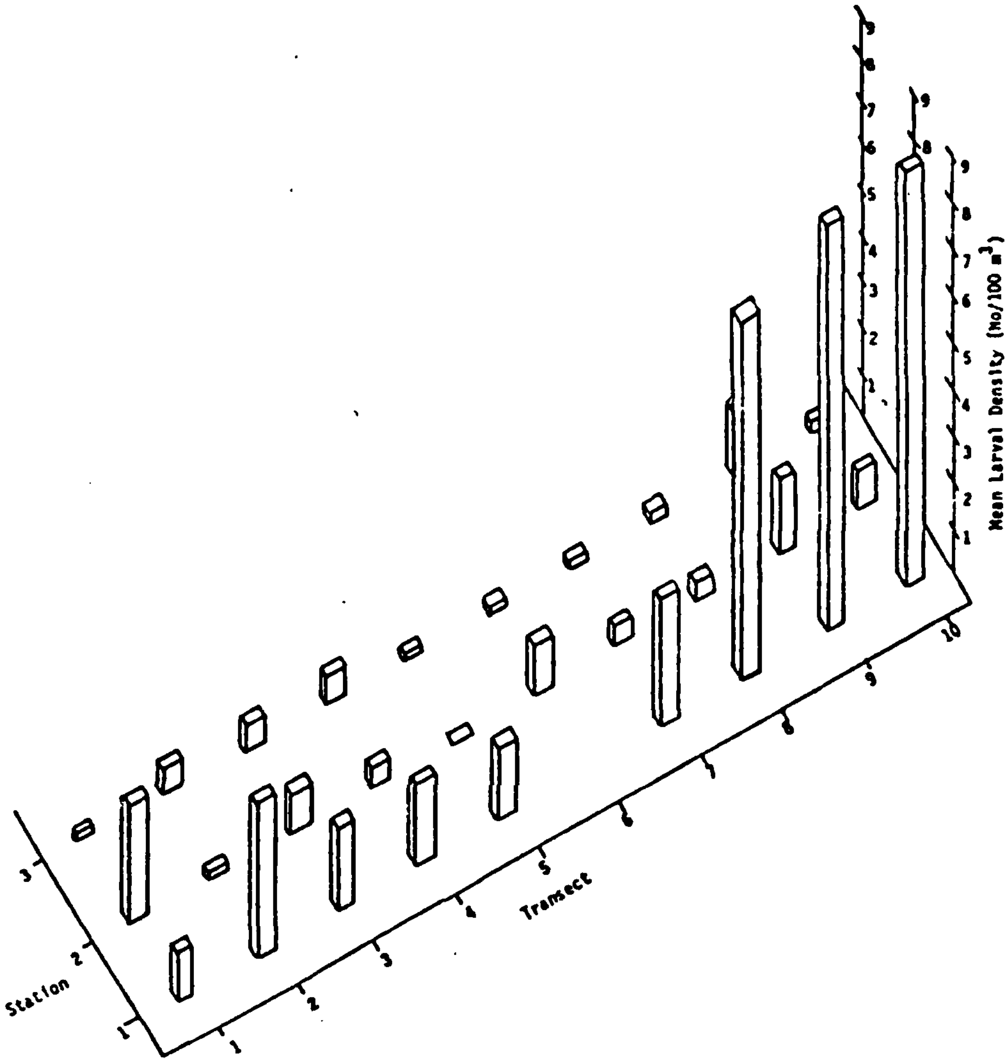


Figure 9 Central Basin - 1978.
Mean Density of Yellow Perch Larvae at Each Station.

(Mazera 1981)

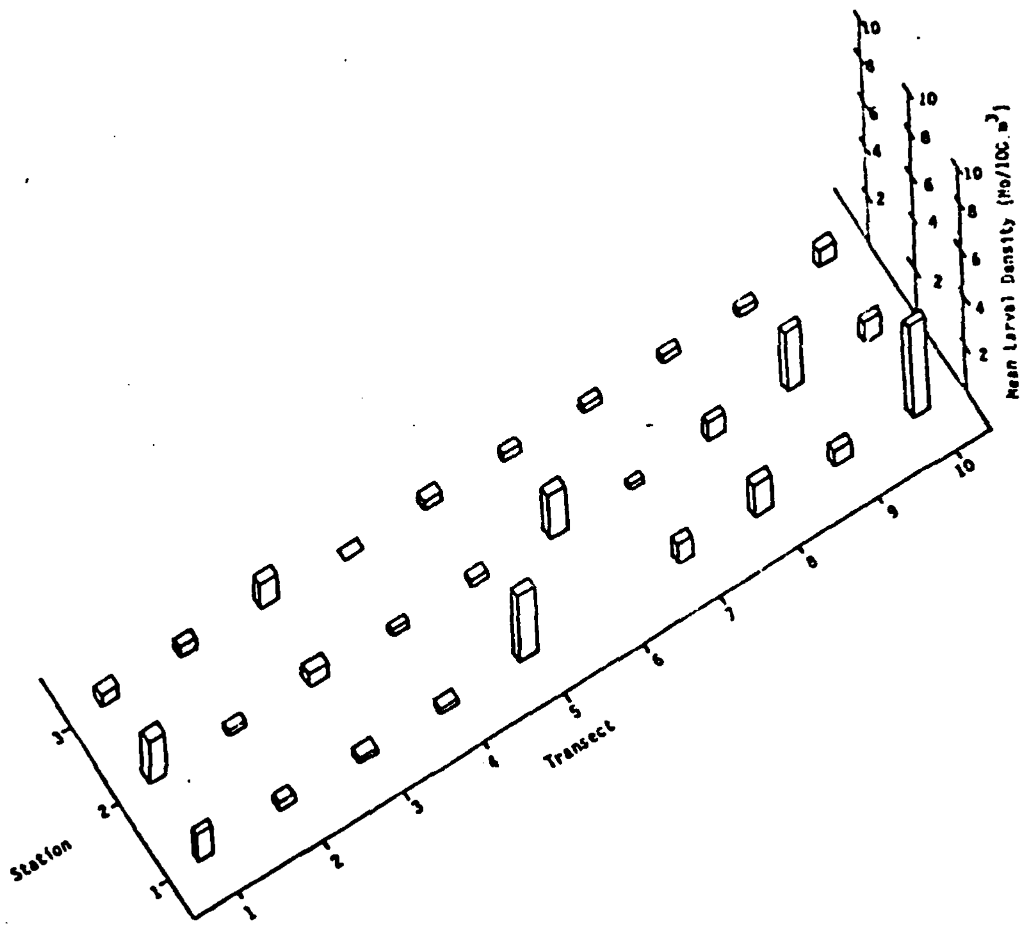


Figure 10 Central Basin - 1978.
Mean Density of Log Perch Larvae at Each Station.

(Mazera 1981)

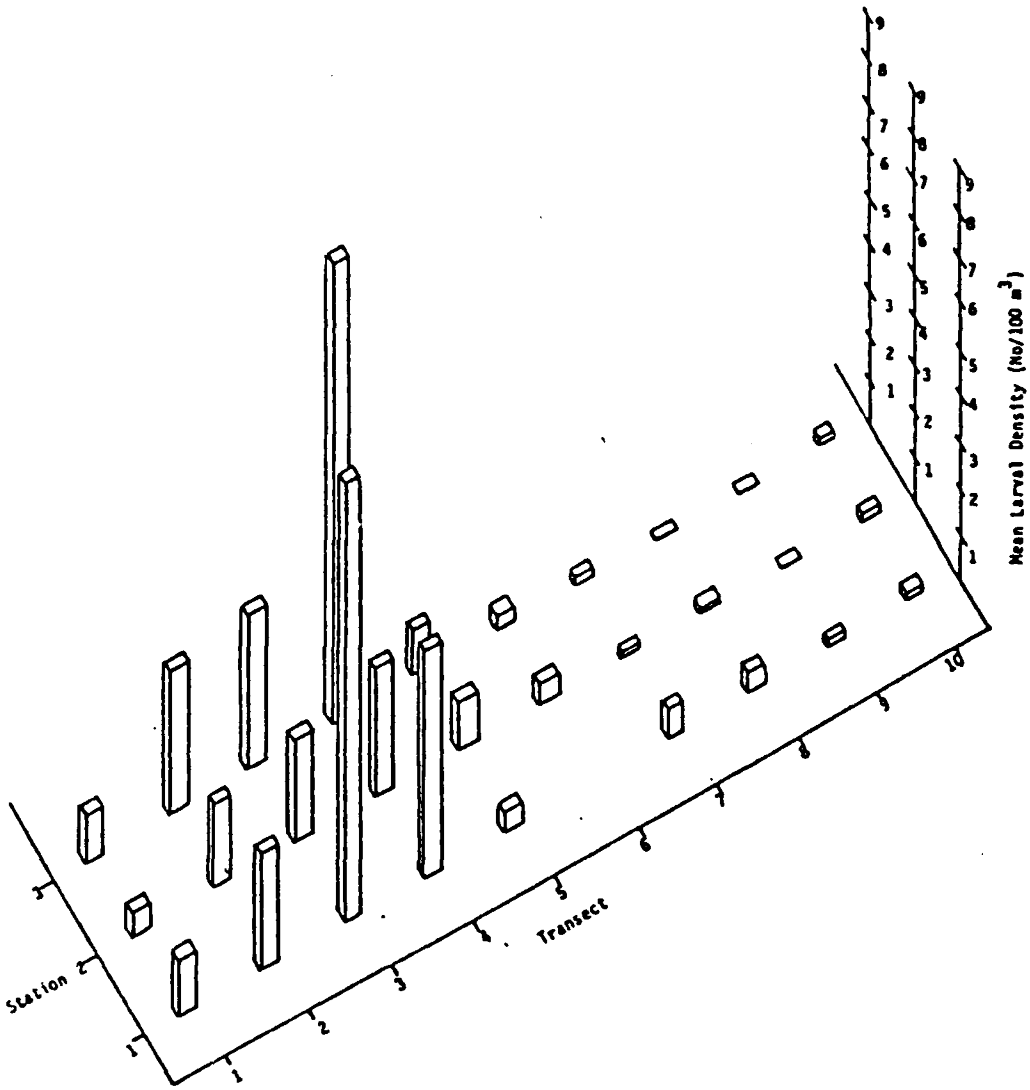


Figure 11 Central Basin - 1978.
Mean Density of Freshwater Drum Larvae at Each Station.

(Mazera 1981)

ODNR

Ohio Department of Natural Resources
DIVISION OF WILDLIFE
Fountain Square · Columbus, Ohio 43224

February 9, 1982

Mr. John Popowski, Area Manager
U.S. Fish and Wildlife Service
East Lansing Area Office
1405 South Harrison Road
East Lansing, MI 48823

Dear Mr. Popowski:

This responds to the request of Mr. Kent Kroonemeyer, Columbus Field Office Supervisor, for a review of the Intermediate Fish and Wildlife Coordination Act Report for the Small Boat Harbor Project at the City of Lorain, Lorain County, Ohio.

The Division of Wildlife concurs with the views expressed in the report relative to resource assessment and potential impacts of marina construction. Additionally, we support the recommended investigation of potential water quality degradation which may result from breakwater construction. If impaired water circulation proves to be problematic, we feel installation of flow-through systems would be warranted.

We appreciate the opportunity to review this document, and look forward to continued cooperation with your staff on this important project.

Sincerely,

STEVEN H. COLE
Chief

SHC:bb

cc: Kent Kroonemeyer
USFWS, Columbus Field Office

Workshops

The principal public involvement efforts for this preliminary feasibility study include three public workshops: 1) orientation, 2) initial iteration, and 3) alternatives. The invitation list, workshop summaries, and attendance records follow in this appendix.

INVITATION LIST FOR ALL WORKSHOPS

Environmental Protection Agency
Ohio District Office
21929 Lorain Avenue
Cleveland, OH 44126

National Marine Fisheries Service
NOAA, Department of Commerce
7 Pleasant Street
Gloucester, MA 01930

Bureau of Outdoor Recreation
Lake Central Region
U.S. Department of the Interior
Federal Building
Ann Arbor, MI 48107

U.S. Fish and Wildlife Service
P.O. Box 650
Sandusky, OH 44870

Mr. Kenneth Multerer
U.S. Fish and Wildlife Service
3990 East Broad Street
Columbus, OH 43215

Harvey Swack, Sr. Planner
N.E. Ohio Areawide Coordinating Agency
1501 Euclid Avenue
Cleveland, OH 44115

Parry Johnson, Chief Naturalist
Lorain County Metro. Parks Department
Elyria, OH 44035

Richard McGinnis, Director
Lorain County Regional Planning Commission
21 Turner Block
Court Street
Elyria, OH 44035

Dr. Charles Carter
Chief, Lake Erie Section
Division of Geological Survey
Ohio DNR
P.O. Box 650
Sandusky, OH 44870

Director
Ohio Environmental Protection Agency
Box 1049
450 E. Town Street
Columbus, OH 43216

Ralph Bernhagen, Coordinator
Ohio Department of Natural Resources
Fountain Square, Building E
Columbus, OH 43224

Roger Hubbell, Chief
Office of Outdoor Recreation Services
Ohio Department of Natural Resources
Fountain Square
Columbus, OH 43215

Mr. Bruce McPherson
Coastal Zone Management
Ohio Department of Natural Resources
Fountain Square
Columbus, OH 43215

William Parker, Mayor
City of Loran
City Hall
West Erie Avenue
Lorain, OH 44052

Frank Mason, Director
Lorain Community Development Department
500 City Hall
Lorain, OH 44052

Gerald Amato, Chairman,
Rivers/Harbors
Lorain City Council
1029 W. 45th Street
Lorain, OH 44053

Mr. E. Jacobozzi
Director of Public Service
City Hall
200 W. Erie Street
Lorain, OH 44052

City Council of Lorain, OH
City Hall
200 W. Erie Street
Lorain, OH 44052

City Engineer
City of Lorain
West Erie Avenue
Lorain, OH 44052

Mr. W. Mills
Director of Public Safety
City Hall
200 West Erie Street
Lorain, OH 44052

Mr. Joe Trifiletti
Parks and Recreation Department
City Hall
Lorain, OH 44052

Mr. S. Prudoff
Director of Community Development
City Hall
200 West Erie Street
Lorain, OH 44052

John Sulpizio, Executive Director
Lorain Port Authority
511 City Hall
Lorain, OH 44052

Mr. Robert Jaycox
Lorain Harbormaster
1125 W. Erie Avenue
Lorain, OH 44052

Citizens Advisory Committee
For Community Development
c/o Mr. C. Cicerella, Co-Chairman
3319 Oberlin Avenue
Lorain, OH 44052

Russell Bateson, Executive Director
Greater Lorain Chamber of Commerce
204 Fifth Street
Lorain, OH 44052

Matthew Pribanic, President
Polish Fishermens Club
1229 W. 33rd Street
Lorain, OH 44052

Mr. Tom Lee
Lorain Sailing Club
P.O. Box 697
Lorain, OH 44052

Mr. Tom Lee
Lorain Yacht Club
2200 W. Erie Avenue
Lorain, OH 44052

Beaver Park Marina
6101 W. Erie Avenue
Lorain, OH 44052

Copper Kettle Marina & Gas Dock
5823 W. Erie Avenue
Lorain, OH 44052

Parson's Inc.
636 Sandusky Street
Vermilion, OH 44089

Seaway Marine
108 E. 9th Street
Lorain, OH 44052

Valley Harbor Marina, Inc.
1295 W. River Road
Vermilion, OH 44089

Gene Marine Sales and Service
220 E. Erie Avenue
Lorain, OH 44052

Lorain Marine
401 Broadway
Lorain, OH 44052

Parsons Marine and
Industrial Serice, Inc.
5260 Liberty Avenue
Lorain, OH 44052

SUMMARY

OF

ORIENTATION WORKSHOP

LORAIN SMALL-BOAT HARBOR

A workshop meeting was held at Lorain City Council Chambers on Wednesday, 5 November 1980, at 7:30 P.M. to initiate a preliminary feasibility study for a small-boat harbor at Lorain, Ohio. The meeting was attended by 48 people. A list of attendees is attached to this summary.

The meeting was opened by Chuck Gilbert, Chief of Planning Division, Buffalo District. Mr. Gilbert requested that the meeting remain informal and asked everyone to introduce themselves. He expressed pleasure at the size of turnout and variety of interests represented at the workshop. Tetra Tech's role as consultants for the Corps' small-boat harbor study was explained prior to acquainting the public with the meeting's purpose and with background information on the harbor project.

Mr. Gilbert related that the workshop's purpose was to exchange information on Corps study procedures, review findings of past harbor studies, determine study objectives, and locate possible sites for a small-boat harbor. The planning process was reviewed, with explanations that a reconnaissance report had been completed by the Corps which recommended a preliminary feasibility study for the Lorain Small-Boat Harbor. Plan formulation was described as the current stage of study progress, which involves development of preliminary plans. Mr. Gilbert explained that this encompasses problem identification, formulation of alternatives, impact assessment, and evaluation.

The findings of previous studies were presented in summary fashion. These included a determination that: 1) an unmet demand for recreational boating exists at Lorain; 2) a harbor of refuge is needed; 3) commercial fishing may benefit from a small-boat harbor; 4) a previous Corps study for a small-boat harbor at the west breakwater site had been discontinued due to public opposition; and 5) recent city interest has been focused upon a potential marina at the east breakwater location.

The geographical limits of the study area were defined for the public. These limits extended two miles along the Lake Erie coast in either direction from the Black River's mouth, and also up the Black River for a distance of about three miles.

A schedule for accomplishing the preliminary feasibility study was presented, including a site selection workshop in early December, design of alternatives during the winter and early spring of 1981, an alternatives workshop in May, and report completion in September of 1981.

General concern was expressed by many people that study scheduling should be compressed. Similar criticisms were expressed upon learning that project construction probably could not occur before the year 1990. Mr. Gilbert explained the governmental procedures which require these time spans for project study and completion.

Craig Holland, Tetra Tech's principal engineer for this study, was introduced as the next speaker. He indicated that initial study tasks, of which this meeting was a component, included gathering updated information on recreational boating conditions and concerns at Lorain. This information would be used in problem indentification and, ultimately, in determining harbor planning objectives and constraints.

Planning objectives were explained to be important for evaluating alternatives. A presentation of factors likely to be used in evaluating various harbor sites was made. Engineering factors included all-weather design, convenient access from land and water, ease of operation, and main-tenance. Economic factors involved Federal costs, local costs, and project benefits. Environmental factors encompassed impacts upon wetlands, water quality, and wildlife. Potential social factors included land-use compatibility, recreational enhancement, employment opportunity, business enhancement, and archaeological/historical protection.

Mr. Holland indicated that efforts would be made to choose at least one potential harbor site in each of four categorical areas: 1) outside existing harbor area; 2) in the outer harbor area; 3) on the Black River; and 4) in an area suitable for a non-structural alternative.

This concluded the Corps presentations for the public workshop. Questions or comments then were encouraged from attendees, with Mr. Gilbert generally responding to policy subjects and Mr. Holland largely responding to planning and engineering matters.

John Sulpizio of the Lorain Port Authority made many substantive remarks regarding city plans for a floating- breakwater marina near the east breakwater, scheduled for completion in 1981. He and others were interested in possible marina sites to the east of the Diked Disposal Area.

Other siting recommendations included Beaver Creek, berthing within the Diked Disposal Area, and restudying the west breakwater site. All, except the altered use of the Diked Disposal Area, were accepted into the study. The extreme improbability of Federal approval for altered use of the Diked Disposal site prevented its acceptance as an alternate site. The Beaver Creek site, which lies outside the original study area, was included because the site is within the jurisdiction boundaries of the City of Lorain. Some approval of all sites was received, although the Black River generally was considered undesirable due to commercial navigation conflicts.

Boating demands were the topic of prolonged discussions, with most people agreeing that a significant shortage of available berthing capacity exists at Lorain. Sailboat owners were particularly displeased with the lack of convenient launching facilities as well as berthing space. Some described the local boating demand as being virtually unlimited. Attendees were invited to submit their data and opinions regarding boating demands to the Corps and Tetra Tech. Tetra Tech agreed to follow-up on any contacts or information.

As summarized earlier, many continued to express disappointment at the project schedule. Another topic included U.S. Coast Guard concern for more staffing as boating activity increases.

In conclusion, there appeared to be a very positive local response toward the need for a small-boat harbor at Lorain. However, opinions varied as to proper site and size of harbor. Continued interest and involvement by the public is expected to contribute greatly to project planning efforts.

SIGN UP LIST

NAME & ORGANIZATION

1. Don Weaver
   Lorain Yacht Club

2. Lynn Greene
   Lorain Yacht Club

3. Bill Gow
   Lorain Port Authority

4. Capt. R.A. Jaycox
   Harbormaster Lorain

5. Matthew Pribanic
   Polish Fishermen's Club

6. Bruce McPherson
   ODNR-CZM

7. John Zorich
   Buffalo District-COE

8. Bob Webster
   Buffalo District-COE

9. Chuck Gilbert
   Buffalo District-COE

10. F. Gasper
    Boat Owner

11. Susan Fisher
    City of Sheffield Lake

12. Dennis M. O'Toole
    Lorain Yacht Club

NAME & ORGANIZATION

13. B.H. Donofrio

14. Joe Barry

15. Richard W. Beka
    Lorain Yacht Club

16. Ronald F. Twinning
    Lorain Co. Regional Planning Commission

17. L. Gene Van Sickle
    Lorain Yacht Club

18. Ray Henry
    City Engineer for Lorain

19. Karl Kalister
    Lorain Sailing Club

20. Charles Shuster
    Lorain Harbor Patrol

21. D. Thomas Lee
    Lorain Sailing Club

22. Bob Kaatz
    Copper Kettle Marina

23. J.M. Machkoff
    Copper Kettle Marina

24. Paul Alexy
    Lorain Yacht Club

SIGN UP LIST (CONT'D)

NAME & ORGANIZATION

25. Stanley A. Orlowski
    Polish Fishermen's Club
    Lorain Port Authority

26. Robert Van Hagnew
    Vermilion Boat Club

27. Thomas Pincura
    Lorain Sailing Club

28. P.G. Pincura
    Lorain Sailing Club

29. Jack Pincura

30. R.T. Kromer

31. Joseph F. Brove

32. Ralph W. Miller
    Lorain Port Authority

33. Richard Greszler
    Lorain Port Authority

34. Dan B. Canalos
    Lorain Port Authority

35. Jim Tomazic
    Small Sailboat Owner

36. Mike Kobylka
    Small Boat Owner

NAME & ORGANIZATION

37. Bob Lucas
    ODNR

38. Frank Garper
    Boat Owner

39. S. Sandy Satullo
    Copper Kettle Marina

40. John Sulpizio
    Lorain Port Authority

41. Norv Hall
    ODNR

42. Ken Alvey
    ODNR Division of Watercraft

43. Daniel A. Cook
    Lorain Sailing Club

44. Roger E. Doane
    L.P.A.

45. Jim Zagorsky
    Marine International

46. Harvey R. Swack
    NOACA

47. Craig Holland
    Tetra Tech, Inc.

48. Ted Turk
    Tetra Tech, Inc.

SUMMARY

OF

INITIAL ITERATION WORKSHOP

LORAIN SMALL-BOAT HARBOR

As part of a preliminary feasibility study for a small-boat harbor at Lorain, Ohio, the U.S. Army Corps of Engineers, Buffalo District, held a public workshop meeting at Lorain City Council Chambers on Wednesday, 10 December 1980, at 7:30 P.M. This was the second workshop scheduled in connection with the preliminary feasibility study. Approximately 25 people attended the meeting, although not all signed the roster.

The Iteration Workshop was opened by John Zorich of the Buffalo District. Bob Webster was introduced as the Corps' project manager, and Tetra Tech's Craig Holland and Mark Hornibrook were introduced as the District's harbor planning consultants. All others in attendance were asked to introduce themselves. Mr. Zorich indicated that the meeting would be informal and made a brief presentation of overall project scheduling and purpose. He also encouraged use of a workshop handout as a means of submitting written comments.

Craig Holland, Tetra Tech's principal engineer for the Lorain small-boat harbor study, then presented a narrative and slide show of current project results and findings. This presentation was informal, with many questions and comments voiced by attendees.

Mr. Holland explained that public input from the initial workshop had yielded important boating demand information and pertinent opinions regarding the study effort. Inclusion of the Beaver Creek location into the geographical study area was presented as one example of substantive results from the initial workshop.

The Iteration Workshop was defined as having two purposes: 1) evaluation of alternative sites for a small-boat harbor, and 2) acquisition of information and opinion relative to selecting the best site. A total of five sites were listed as potential locations for constructing the harbor. These were presented as being:

Site No.	Location
1	Inside East Breakwater
2	East of Diked Disposal Area
3	Inside West Breakwater
4	Black River at 21st Street
5	Beaver Creek

Additionally, a non-structural alternative was described as being Alternative No. 6. Each of these alternative sites was depicted by a schematic layout and an explanation of harbor size, costs, advantages, and disadvantages.

The "Inside the East Breakwater" site was noted as having very low cost, convenient land and water access, and visual attractiveness relative to recreational usage of the Diked Disposal Area. The site's conflict with possible relocation of the commercial navigation channel was described as a disadvantage. A local boat owner added that the site's close proximity to the sewage treatment plant should be included as a disadvantage.

The second alternative site, "East of Diked Disposal Area, was described as having advantages relative to shore erosion mitigation, avoidance of commercial conflicts, and attractive usefulness of the Diked Disposal Area. The disadvantages of this site were listed as high costs associated with lengthy breakwaters, extensive bulkheading, and basin dredging.

The "Inside West Breakwater" site was highlighted as having low Federal costs. However, local costs were shown to be very high. Other disadvantages presented as the workshop included residential displacement, limited slip capacity, conflict with operations at the power plant, and inefficient land/water configuration. Public concern was voiced relative to adverse effects upon fishing and beach usage in the area if this site was selected.

The "Black River at 21st Street" site was defined as having multiple disadvantages, including wetland destruction, conflict with commercial shipping channels, limited slip capacity, and costliness. No person presented any arguments in defense of this site, however, some attendees regarded the wetland to be of very limited value. Others expressed an opinion that the low-lying land should not be classified as a wetland at all.

The alternative site at "Beaver Creek" was described as possessing convenient access to major highways and as avoiding commercial navigation conflicts. However, this site's costliness and potential sedimentation problems were listed as disadvantages. The need for road access across a railroad was described as being dangerous. Some people at the meeting felt that acquisition of required private lands would be very costly.

The non-structural alternative was depicted as a dry-storage facility at the Municipal Pier along with continued usage of the Lorain Yacht Basin. This plan's limited all-weather functions, inconvenient land/water access, and limited recreational enhancements were described as offsetting cost advantages. There was much public opposition to this plan, based on its general unattractiveness and its conflict with existing fishing opportunities at the pier.

Comparative evaluations of each site's response to major engineering, economic, environmental, and social factors were presented. The engineering comparison demonstrated the inferiority of the "Black River at 21 Street" site, "Beaver Creek" site, and the non-structural plan. The economic comparison revealed the favorability of selecting the "Inside East Breakwater" site, the "Inside West Breakwater" site, or the non-structural plan. The environmental comparison showed the "Black River at 21 Street" site and the "Beaver Creek" site to be measurably less acceptable than other sites. The social comparison favored the two sites adjacent to the Diked Disposal Area ("Inside East Breakwater" and "East of Diked Disposal Area").

A composite of all these evaluations was presented to demonstrate the overall ranking of the alternative sites. The "Inside East Breakwater" site was rated highest. A tentative conclusion was made that this site be selected for further study because of its overall superiority and its potential for implementation.

There were no adverse comments relative to tentative selection of the "Inside East Breakwater" site, and no recommendations to select any other site. In general, attendees seemed pleased with the progress of the preliminary feasibility study.

LORAIN SMALL-BOAT HARBOR
ITERATION WORKSHOP - DECEMBER 10, 1980

SIGN UP LIST

Frank N. Gasper

Stanley A. Orlowski, Polish Fishermen's Club and Lorain Port Authority

Capt. R.A. Jaycox, Harbor Master, City of Lorain

Kenneth J. Alvey, ODNR Division of Watercraft

David Kramer

R.T. Kromer, Retired Member of Lorain Yacht Club, Marina Owner

Ned Skimin, City Council

Ronald Twining, Lorain County Regional Planning Comm.

Cynthia Billman

Ralph W. Miller, Lorain Port Authority

Susan E. Fisher, Planner Coordinator, City of Sheffield Lake

Joe Karnes, Mechanical Reef Control Systems, Inc.

Ralph Bernhagen, Ohio DNR-CZM

Richard Greszler, Lorain Port Authority

Steve Bailey, Lorain Parks and Recreation

Jerry Amato, Lorain City Council

Jack LaVriha, Lorain Journal

Bill Gow, Lorain Port Authority

Joseph F. Brove

J. Sulpizio, Lorain Port Authority

John Zorich, Buffalo District

Bob Webster, Buffalo District

Craig Holland, Tetra Tech, Inc.

Mark Hornibrook, Tetra Tech, Inc.

SUMMARY
OF
ALTERNATIVES WORKSHOP
LORAIN SMALL-BOAT HARBOR

As part of the preliminary feasibility study for a small-boat harbor at Lorain, Ohio, the U.S. Army Corps of Engineers, Buffalo District, held a public workshop meeting at Lorain City Council Chambers on Thursday, 10 September 1981, at 1:30 P.M. This was the third and final workshop scheduled in connection with the preliminary feasibility study. Approximately 20 people (see attached list) attended the meeting.

The Alternatives Workshop was opened by John Zorich of the Buffalo District. Ed Gustek was introduced as the Corps' project manager, and Tetra Tech's Craig Holland was introduced as the Corps' harbor planning consultant. Other attendees were asked to introduce themselves. Mr. Zorich made a brief presentation of the workshop's intended purpose and explained the history of project planning, including past public input and site selection analyses.

Mr. Holland then presented a slide show and talked about current project status and tentative conclusions. This presentation was informal, with many questions and comments from attendees.

Mr. Holland began by depicting project scheduling for this study phase and showing District completion in December 1981. He presented a summary of the site selection process and results, including selection of the Inside East Breakwater location.

The Alternatives Workshop was defined as having two purposes: 1) evaluation of alternative harbor plans at the Inside East Breakwater site, and 2) selection of alternative plans for further study. A total of five harbor plans were presented and a "no-action" plan was added for comparative evaluation purposes. The evaluation process and its specific engineering, economic, environmental, and social elements were explained. Each small-boat harbor plan was depicted by a schematic layout slide.

Alternative Plan #1 was shown as having capacity for 300 slips and three launch ramps. A 900-foot east breakwater and a 200-foot west breakwater were featured as the major structural elements. Total Federal costs were presented as $1.1 million, and total non-Federal costs were presented as $2.9 million (including $1.1 million for local share of major navigation expenses plus $1.8 million for self-liquidating items). This plan's non-conformance to a possible commercial channel realignment through Riverside Park was explained. Advantages of this alternative were described as being low total cost and avoidance of conflict with existing commercial traffic. This alternative's limited slip capacity and resultant high cost-per-slip were described as disadvantages. The benefit/cost ratios for recreational navigation and fishing were shown to exceed 2.0.

Alternative Plan #2 was highlighted as having capacity for 600 slips at only slightly higher costs than Plan #1. Total Federal and non-Federal costs were shown as $1.3 million and $4.8 million, respectively. A single breakwater, 1150 feet long, was depicted for wave protection. The possible commercial channel through Riverside Park was demonstrated to be incompatible with Plan #2. This plan was shown to have the lowest cost-per-slip of any of the other structural alternatives. The benefit/cost ratios for recreational navigation and fishing were demonstrated to well exceed 3.0. Possible commercial navigation conflicts were described in the entrance area.

Alternative Plans #2 and #4 were shown to be compatible with the Riverside Park commercial channel possibility. A 1500-foot west breakwater and a 500-foot north breakwater were featured on both plans. The water basin on each plan was designed for 300 slips, but Plan #4 includes an additional 300 boat dry-storage facility. As with all other plans, three launch ramps were depicted. Total Federal costs for Plans #3 or #4 were estimated to be $1.2 million. Non-Federal costs were estimated to be $3.1 million for Plan #3, and $4.2 million for Plan #4. Plan #3 has demonstrated the highest cost-per-slip of any alternative. Both Plans #3 and #4 were shown to create some conflicts with commercial traffic at the entrance to the small-boat harbor. The benefit/cost ratios were described as lower than Plan #1 (for Plan #3) and similar to Plan #2 (for Plan #4).

Alternative Plan #5 with capacity of 600 slips was depicted as being in all ways similar to Plan #2, except a detached break-water segment is used to allow separation of commercial and recreational traffic at the entrance area. This was explained to be a feature of increased safety which caused moderate cost increases over Plan #2. Total Federal costs for Plan #5 were estimated to be $1.7 million, and non-Federal costs to be $5.1 million. The benefit/cost ratios were shown to be slightly reduced in comparison to Plan #2.

Plan comparisons were made within two separate categories: those plans which do not allow the Riverside Park channel cut (Plans #1, #2, and #5) and those which do (Plans #3 and #4). Selection of at least one plan from each category was advised since the decision on the Riverside Park cut is undetermined. None of the plans were shown to have benefit/cost ratios which indicate economic infeasibility.

Within the initial category, Plan #1 was not favored by anyone present. General reaction was recorded that the capacity limitation of Plan #1 made it less preferable than the somewhat more costly Plans #2 and #5. Plan #2 was selected by attendees as being preferable to Plan #5. The additional cost for increased entrance safety in Plan #5 was judged as probably unnecessary.

For those plans allowing the Riverside Park cut, Plan #3 was preferred by attendees since the dry-storage facility of Plan #4 could be added at any time by non-Federal interests. Responses were noted which favored the dry-storage facility as a potential add-on to any of the harbor configuration plans.

Several people commented on various design and planning topics related to the small-boat harbor study. The Corps representatives explained how the recreational and commercial studies for Lorain Harbor were coordinated, and they described the possibility of using Section 107 of the Continuing Authorities Program to advance the completion time of the recreational study. For all plans, berthing capacities were described as conservative, with assurance that densities could be increased over that contained in Corps planning guidance used to make initial estimates. Also, the area required for parking and other land facilities was described as being somewhat flexible. Potential methods for hastening the creation of land within the Diked Disposal Area were presented as being variations of internal retention basins. The newly created lands were described as having low load-bearing capacities. Detailed design decisions were indicated as occurring in subsequent study stages.

No adversity to project results was recorded on the basis of social or environmental impacts. Expected boating demand figures (640 boats in the year 1990, and 1020 boats in the year 2000) were not challenged as being optimistic. In general, attendees seemed anxious that a recreational harbor configuration with large capacity and conforming to final commercial channel plans be implemented as soon as practicable at the Inside East Breakwater location.

ALTERNATIVE WORKSHOP ATTENDEES

John Sulpizio
Director
Lorain Port Authority

Stanley Orlowski
Lorain Port Authority

Dick Hoven
Lorain Yacht Club

Doug Johnson
Division of Wildlife

Ralph Bernhagen
ODNR
Division of Water

Mr. & Mrs. Andrew Skowanik
Lakeside Bait & Carryout

Richard Bartz
ODNR
Division of Water
CZM

Bill Zehel

Wayne Ponn
Lorain Port Authority

Mathew Pribanic
Polish Fisherman's Club

R.A. Jaycox
Lorain Harbormaster

S. Sandy Satullo
Copper Kettle Marina

Bob Rulli
for
Congressman Donald Pease

Doug Klein
Klein Steel Company

Bob Klein
Klein Steel Company

Roger Doane

Harvey Swack
NOACA

Joseph F. Brove

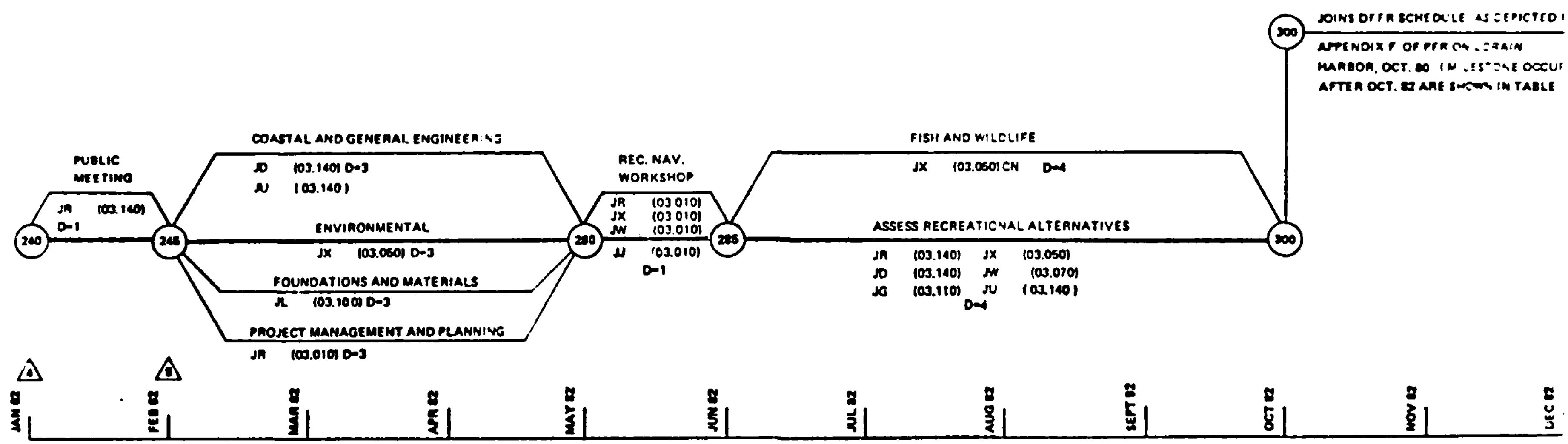
APPENDIX E

STUDY MANAGEMENT

APPENDIX E

STUDY MANAGEMENT

A study flow network for Phase 3 of the feasibility study for Lorain Small-Boat Harbor is depicted in Figure E-1 as noted, this schedule coincides with the commercial navigation schedule contained in Appendix F of the PFR on Lorain Harbor, October 1980. The commercial and recreational studies join in October 1982, such that unified report production begins at that time. Figure 15 in Section F of this report reveals milestone scheduling subsequent to October 1982.



LORAIN HARBOR FEASIBILITY STUDY

LEGEND:

D– DURATION IN MONTHS

(10) ACTIVITY DESCRIPTION (20)
(DURATION IN MONTHS)

ORGANIZATION CODE (ACCT NO. SUB ACCT. NO.) / ORGANIZATIONAL ELEMENT

△ MILESTONE

ORGANIZATION ELEMENT:

BLANK– HIRED LABOR
CN– CONTRACT (A/E OR OTHER GOV'T AGENCY)

NOTE:

1. ACTIVITY DOLLAR AMOUNTS INCLUDE EFFECTIVE RATES x 1.25
2. SUPERVISION AND ADMINISTRATION IS APPROX. 20% OF HIRED LABOR COST (EFFECTIVE RATE x 1.25) AND REPRESENTS O.H

ORGANIZATIONAL CODES:

- JD– COASTAL ENGR. SECT.
- JG– DESIGN SECTION
- JL– GEOTECHNICAL SECT.
- JR– PLANNING WESTERN
- JW– ECONOMICS SECT.
- JX– ENVIRONMENTAL SECT.
- JU– GENERAL ENGINEERING

APPENDIX F

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