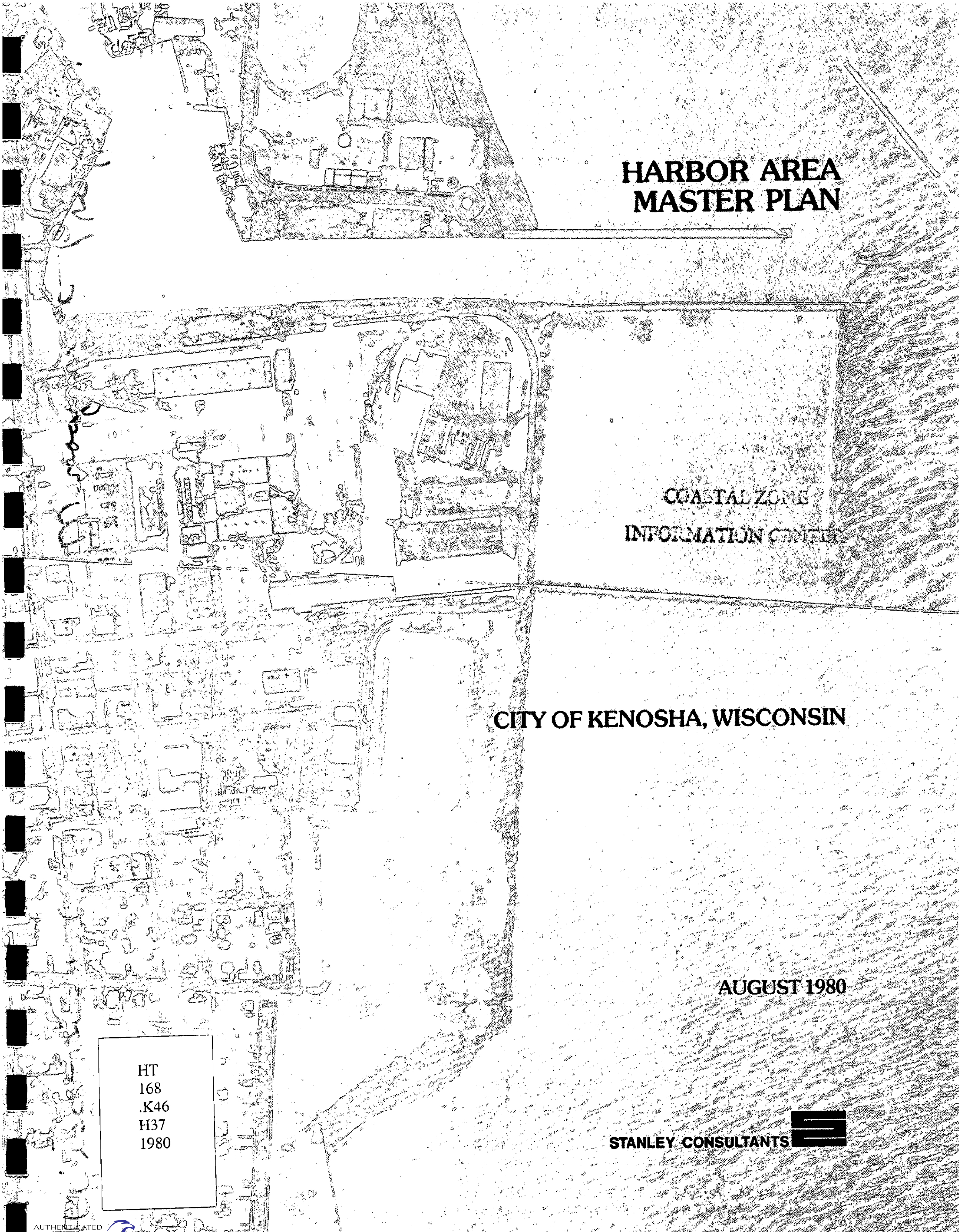

HARBOR AREA MASTER PLAN

CITY OF KENOSHA, WISCONSIN

AUGUST 1980

STANLEY CONSULTANTS

STANLEY CONSULTANTS, INC.

8501 WEST HIGGINS ROAD
CHICAGO, ILLINOIS 60631
TELEPHONE: 312/693-9624

August 22, 1980

Mr. Jim Kuzdas
Secretary
Kenosha Harbor Master Plan Committee
Municipal Building
625 - 52nd Street
Kenosha, Wisconsin 53140

Dear Jim:

Enclosed is the final harbor master plan for Kenosha Harbor. This report documents the results of our analysis of the harbor and provides recommendations for its continued operation and development.

This report is based on the draft and comments received from the city, interested state and federal agencies, and the public.

We look forward to working with you again if the opportunity presents itself, and stand ready to assist the city in implementing the features of the plan.

Sincerely,

STANLEY CONSULTANTS, INC.

John H. Beasley
Project Manager

TWW:rad:7692-01

HARBOR AREA MASTER PLAN

CITY OF KENOSHA, WISCONSIN

PREPARED BY

STANLEY CONSULTANTS, INC.

AUGUST 15, 1980

Financial assistance for this report was provided by the State of Wisconsin, Coastal Management Program, Department of Administration, and the Coastal Zone Management Act of 1972, as amended, administered by the Office of Coastal Zone Management, National Oceanic and Atmospheric Administration.

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SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Marina Facilities

Market Analysis - Our review of market data and projections for recreational boating activity in southeastern Wisconsin reveals strong and growing demand for additional marina facilities at Kenosha. The market area for a new facility would encompass the northern Chicago suburbs, as well as Kenosha County. A conservative estimate of minimum demand growth for the 1980-2000 time frame is that an additional 300 berthed boats could be supported, even if substantial competing facilities are developed. If the development of competing facilities is minimal, the potential market is larger than can be realistically accommodated at study area sites. In either case, the market will support prices significantly higher than currently in effect.

Site Selection - Of 6 sites identified as potential locations for the development of a new marina, 4 were eliminated from study based on obvious problems or constraints.

A site at the Pike River mouth was ruled out in light of the large quantity of dredging required in an environmentally sensitive area. A site offshore of Simmons Island Park was judged to present severe difficulties with landside development and would have required extensive wave protection structure development. The possibility of developing a new marina within the existing harbor turning basin was ruled out based on interference with port operations and limited space. Finally, a proposed site at the Wisconsin Electric property was dropped from further study due to site acquisition problems.

The two remaining candidates for marina siting were the U.S. Army Corps of Engineers diked disposal area and an area in Lakefront Park immediately south of this area. This combination of sites was the focus of detailed evaluation, and it is in this area where marina development is recommended.

Site Constraints - Within the area selected after preliminary screening, site factors play a major role in determining the potential for and feasibility of marina development. The hydraulic factors of large design waves and water depths indicate that the physical structures required for wave protection must be substantial. Design criteria for marina layout, combined with the size of marina indicated by the market analysis, require a fairly large protected area.

Landside constraints are also present. Any viable marina facility will require significant land development for parking, administration, and other associated activities. These functions must be in close to proximity to the boat berthing and launching areas and integrated with the adjoining land uses.

The area selected for marina alternative development includes the Corps of Engineers diked disposal area and Lakefront Park. This area presents several constraints for marina layout. First, any facility utilizing the interior of the disposal area for boat berthing requires special design treatment for successful integration of landside functions. The existing land use (by AMC Corporation) adjacent to this site is intensive and could not be relocated.

Second, although there is a substantial amount of land available within Lakefront Park, a large marina, and associated landside facilities would pose some space availability problems.

A third major class of concern involves integration and competition with existing adjacent uses. These include demands for additional parking for industrial and commercial uses near the site, preservation of adequate traffic flow and access, and provision of greenbelt areas to screen the intensive marina activity from existing single and multifamily residential uses.

Development of Marina Alternatives - Three alternative layouts were developed to reflect these market and site considerations. These included: 1) a facility for 278 berthed boats, located within the southern half of the spoil disposal area ("Alternative 1"); 2) a facility located in and offshore of Lakefront Park and utilizing a combination of breakwaters and dredging to provide space for 612 berthed boats ("Alternative 2"), and 3) a combination of these two designs which would utilize both areas and allow for 898 berthed boats.

These three preliminary designs span the economic and engineering possibilities of the site. A marina much smaller than Alternative 1 would not provide economies of scale for financial feasibility, while a facility significantly larger than Alternative 3 is not possible at the site without violating generally accepted space criteria.

All of the preliminary designs developed include provisions for six launch lanes, parking for slip and launch ramp users, "non-project" parking areas, marina administration, fuel docks, and pump-out facilities. Each would allow for development of some associated private facilities.

Evaluation of Alternatives - Each of the three preliminary designs was evaluated from economic, land use, and administrative perspectives. Construction cost estimates were prepared based on design criteria and current unit costs. The tabulation below summaries our findings on probable capital costs for each alternative.

	1980 Dollars			
Alternative #	Total Capital Cost	Federal Share	State Share	Net Local Cost
1	$ 5,458,000	$ 1,549,000	$1,543,000	$2,366,000
2	$ 8,348,000	$ 2,760,000	$2,044,000	$3,544,000
3	$ 12,262,000	$ 3,636,000	$3,006,000	$5,620,000

These net local capital costs, when annualized over a 20-year life at 10 percent interest and combined with our estimates of operation and maintenance expenses for each alternate, result in the following total annual costs and average costs per berthed boat.

Alternative #	Annualized Capital Cost	Annual Operation and Maintenance Cost	Total Annual Cost	Average Cost Per Berthed Boat
1	$277,900	$ 50,000	$327,900	$1,180
2	$416,300	$100,000	$516,300	$ 844
3	$660,100	$122,000	$782,100	$ 871

While each of these projected unit costs are significantly higher than the current slip rental fees for city docks, they are not thought to be prohibitive in light of future market potential. This analysis indicates a small economic advantage for Alternative 2.

The land use and associated development aspects of Alternative 2 are also relatively favorable. This option would provide for land-side facilities in close proximity to the water area. This alternative also avoids the problem of difficult landside-waterside linkages involved in the use of the diked disposal area as a marina site.

Development Recommendations - Based on these analyses, it is recommended that the city proceed with development of a new marina facility for approximately 600 berthed boats at the Lakefront Park site. Construction of this facility would cost $8.3 million (1980 dollars), of which it is estimated that $4.8 million will be available through federal and state grant sources. The probable availability of funds in these grant programs, and the remaining design and administrative steps that must be undertaken indicate that the facility could be completed in the 1987-1989 time frame.

It is recommended that the city finance this development with the use of short-term financing (bond anticipation notes) followed by a long-term general obligation issue. Slip rental and other user fees should be set to cover all operating and debt service costs in order to assure financial self sufficiency.

It is emphasized that the city should continue with the negotiations aimed at clarifying the potential use of the diked disposal area as a marina site. Resolution of at least two major unknowns could favor this alternative. The first concerns the possibility of environmental problems with site excavation for Alternative 2. Should this material prove to be contaminated, disposal may be a problem. Another possibility is that the COE estimate (that at least 50 percent of the diked area should be retained for disposal use) could be lowered. In this event, the area available for slips would be increased, improving the economic feasibility.

Of several management options investigated, it is recommended that the city pursue a build/lease approach under which an operator(s) would contract for provision of user services at a city owned marina.

Port Facilities

Market Analysis - Market analysis of the Kenosha port indicates that the operation is a relatively stable general cargo facility with substantial competitive advantage due to location and specialization in cold storage cargo. Although the relative proximity of larger general cargo ports in Milwaukee and Chicago places a limit on the market potential here, growth in the Kenosha port's market area will create opportunities for some expansion in port volumes.

This expansion potential, as estimated by the port operator, could more than double cargo tonnages from the existing base of about 80,000 tons/year. This expansion in volumes would be expected to occur primarily in existing types of cargo. Addition of bulk facilities is not felt to be warranted by the existing market.

Site Analysis - The port operates under severe space limitations with its location between AMC, the harbor channel, and the diked disposal area. These space limitations are felt in terms of open storage and marshalling areas, general covered storage, and cold storage.

The only possibility for significant physical expansion of port operations is the use of land created within the diked disposal area.

Alternative Development - In light of the results of market and site analyses, all three marina development options were designed to permit the use of the northern half of the diked disposal area for port use. Marina Alternatives 1 and 3, which provide for construction of an interior wall in the piked area, would partition off about 10 acres of land for this purpose. Alternative 2 would allow the entire area to fill, and would also allow ultimate use of about 10 acres for port functions.

A long-term improvements plan for this area was developed, including construction of wharf, rail siding and apron, and a building housing additional covered and cold storage.

Feasibility Analysis - The feasibility of some degree of port expansion seems assured. Even if improvements are limited to provision of space for open storage and marshalling, some economic benefit will accrue to the operator. Our preliminary estimate of construction costs for the new storage facilities, dockage, and cargo handling systems is over $6 million. Given the high interest rates and short maturities in current capital markets, this major level of investment would not appear to yield an acceptable rate of return

The overriding concern with regard to the feasibility of port facility improvements, however, is one of timing. Based on the current rate of dredged material discharge into the disposal area, even the reduced volume under Alternatives 1 or 3 would require from 12 to 15 years to fill. Given that some time would be required for dewatering, the creation of useful land in the disposal area is obviously a long-term prospect.

Development Recommendations - While the short-term prospects for major expansion of port facilities are limited, the long-term market potential seems strong. In light of this long-term potential, it is suggested that the city secure legal opinion on the procedures for sale or lease of this land to industrial interests.

Other Waterfront Development

Navigational Facilities - Of concern to both port operations and recreational boaters are the sometimes turbulent conditions within the existing harbor, and the consequent risks to property. Even with the development of major new marina facilities, protection of this area should remain a high priority. An analysis of these conditions (generated by southeast wind and wave conditions) indicates that two remedial measures are possible.

The most effective option would be a new breakwater structure at the channel entrance. Construction of such a structure would cost about $1.9 million, but would provide adequate protection from waves.

Based on accounts of the frequency and extent of damage to date, however, the cost of this structure is economically unwarranted.

Another solution to the rough water problem could be found in the placement of an energy absorbing medium at the western corner of the harbor. This would be less effective for channel protection, but would quiet the water significantly in the turning basin and sailboat slip area. The cost of this solution would be from $500,000 to $750,000.

Marina Associated Commercial Development

The provision of a major new marina facility will generate some additional demand for commercial development. Based on statistics gathered during the Wisconsin Coastal Zone Management Program, the total increase in commercial activity would be about one million dollars per year for the marina alternative recommended. While this is a significant dollar volume, its distribution among business types does not indicate that the marina alone would support major general commercial redevelopment.

While the statistics available did not identify a specific category for marina associated commercial activity, the development of a 600+ boat facility will undoubtedly create new thresholds of demand for boat repair and associated services. It is recommended that the city allow for the development of additional private facilities of this type, either within the marina complex or on adjoining land.

50th Street Bridge - The historic swivel bridge which now spans the entrance to the city docking area has been identified as a point of concern. Inspection by the state of Wisconsin indicates severe structural and potential safety problems. Our analysis of traffic data for this facility indicates an important traffic function, which should be retained in a replacement facility. An additional concern is whether or not replacement with a high span is justified. While this would allow for sail and larger power craft to pass to the berthing area, the extra cost is clearly not justified.

SECTION I

INTRODUCTION AND REPORT ORGANIZATION

Introduction and Goals

The current report is the result of a six-month investigation by Stanley Consultants, Inc., under contract to the city of Kenosha, Wisconsin. The study was coordinated through the Harbor Commission and the City Planning Department.

The primary goal of the study has been to identify realistic opportunities for future public and private development of the central city waterfront, with particular emphasis on provision of additional marina facilities, improvements to existing port facilities, and associated development and redevelopment opportunities.

The study investigates the issues involved with siting and feasibility of a major new marina in Kenosha, including the detailed development and assessment of three marina layouts. A long-range plan for port facilities expansion is developed based on market and physical constraints, and the management and implementation aspects are addressed.

Organization

The organization of the report follows the major analytical steps undertaken during the study. Section II, Site Analysis investigates those features of the site which will influence the development of marina, port, and associated activity. Among these are the hydraulics and bathemetry of the lake, which govern the degree of wave protection (and to a large measure cost) for marina development, climatological and soils features, study area land use, and regional economic setting.

Section III, Market Analysis, investigates economic trends and their implications for probable future levels of demand for both marina facilities and port activities. These demand levels represent facility sizing criteria in the development of alternatives.

Section IV addresses the development of marina alternatives, including design criteria, preliminary site screening, and facility layouts for three alternatives. Section V investigates alternatives for other waterfront development, including port facilities expansion and commercial redevelopment.

Alternatives for development, including the three marina concepts from Section IV, are evaluated in detail in Section VI. This evaluation includes the estimation of capital and operating and maintenance costs, financing options, economic impacts, and physical-environmental impacts.

Section VII, Management and Implementation, explores the advantages and disadvantages of three major concepts for marina management, and sets forth implementation milestones and suggested timing.

SECTION II
SITE ANALYSIS

Regional Setting

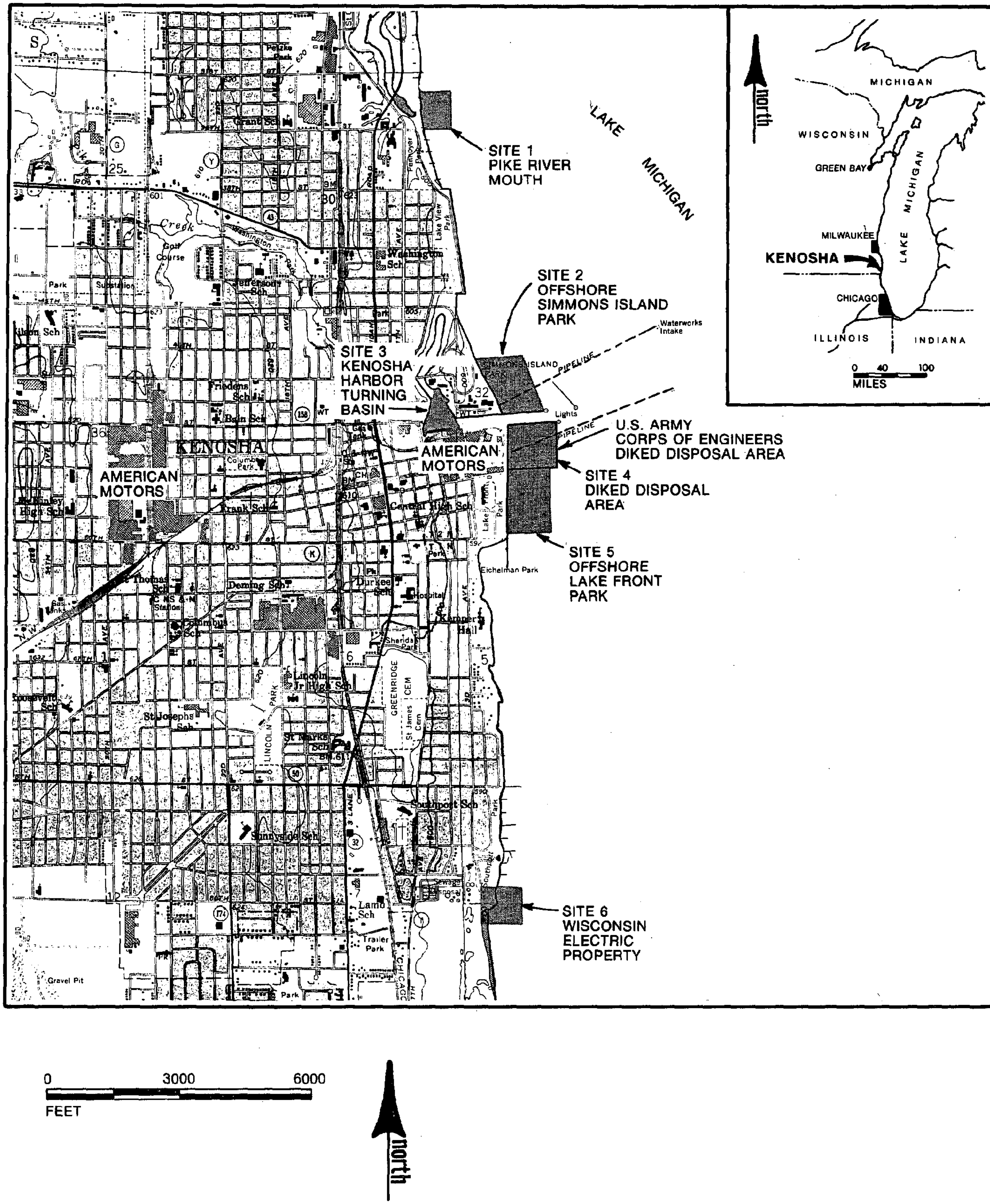
The city of Kenosha is located in southeast Wisconsin along the west shore of Lake Michigan. The city is 57 miles north of Chicago, Illinois, and 26 miles south of Milwaukee, Wisconsin. The location of the study area and major features of the regional setting are given on the location and vicinity maps of Figure II-1. The following section discusses the physical features of the regional setting in general, and the water-oriented aspects of the study area in particular. The boundaries and major features of the study area are given on Figure II-2.

It should be noted that for the purposes of this study, land elevations and water depths are referenced to Low Water Datum (LWD) which is taken at 576.8 feet above the International Great Lakes Datum (IGLD) at Father's Point, Quebec. Actual lake levels are generally 1 to 2 feet above LWD.

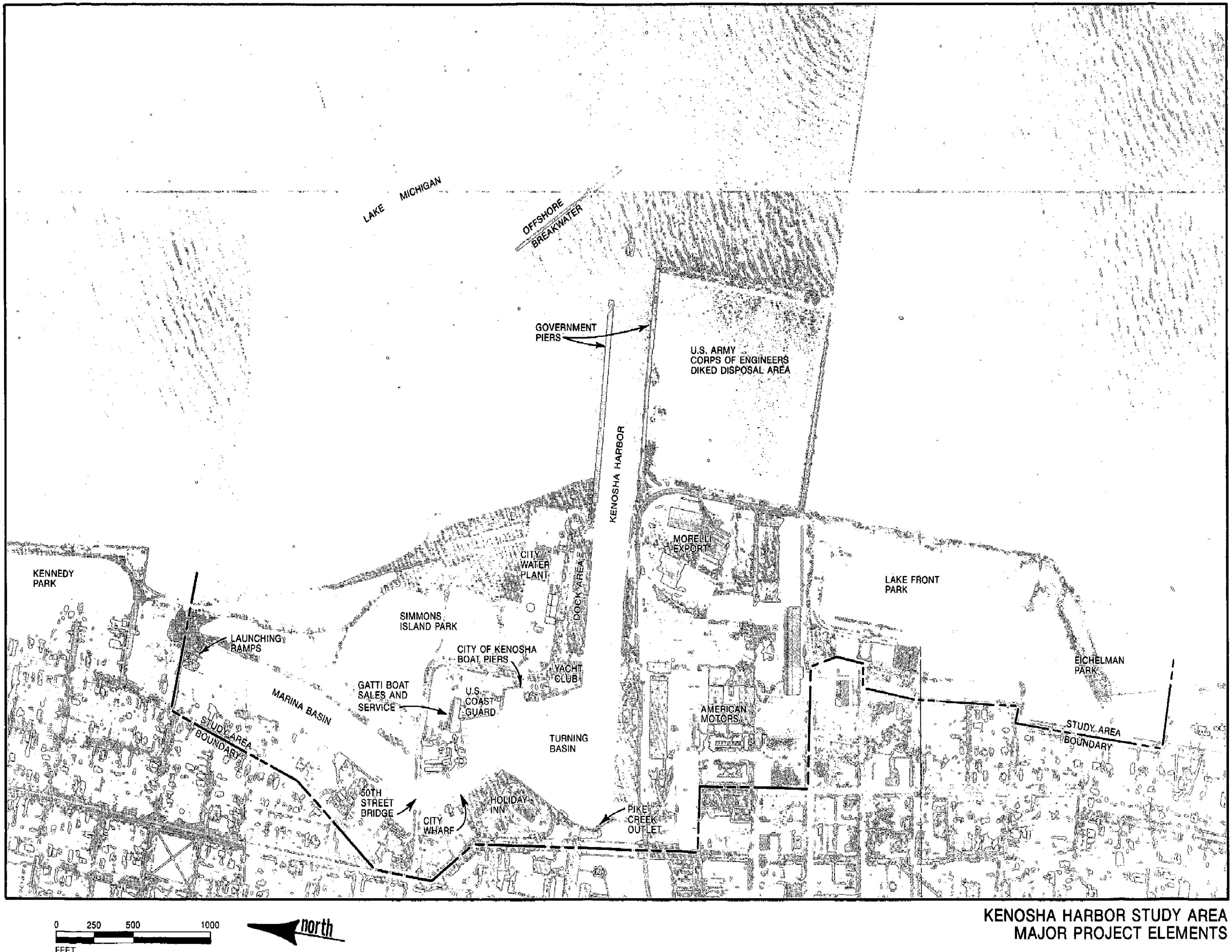
Climate

Southeastern Wisconsin experiences prevailing westerly winds, and has a modified continental climate, with relatively long, cold winters. Warm summers with occasional hot and humid periods are experienced. Winter storms generally move eastward across the upper Ohio River Valley and the Great Lakes region. Lake Michigan exerts a considerable influence on the nearshore climate. During spring and early summer, lake induced wind circulation may cause shifts in wind from the offshore to onshore direction resulting in sudden drops in temperature.

Temperature range varies widely with the seasons and on a long-term basis. Days with temperatures above 90° F have ranged from 5 to 40 in any given year whereas days with temperature below 0° F have ranged from 1 to 27 days (Reference 1).



KENOSHA HARBOR AREA
LOCATION MAP
AND POTENTIAL MARINA SITES
Figure II-1



KENOSHA HARBOR STUDY AREA
MAJOR PROJECT ELEMENTS

Figure II-2

No wet and dry seasons are clearly discernible. Precipitation falling between May through September usually accounts for 50 percent of the annual amount. A moderate snow cover can be expected each winter, ranging from 11 to 83 inches. Violent thunderstorms with their associated heavy rain, (or hail), strong winds, and heavy lake seas can be expected.

Topography

Land Area - Land topography in the region is generally flat to slightly rolling hills. Average elevations of the nearshore inland areas are 10 to 15 feet above LWD with lake and harbor front property at 10 to 20 feet above LWD. Shore frontages slope to the water level. Essentially the entire waterfront has some extent of development.

Land topography within the bounds of the study area (shown on Figure II-2) is dominated by the centrally located harbor and marina basins. Lakefront Park, the Kenosha downtown area, the American Motors Corporation Plant, and Morelli Overseas Export are located on flat land between 10 and 14 feet above LWD. A shallow depression exists south of the municipal buildings crossing Sixth Avenue and leading to the west end of the harbor. This depression is the remnant of the Pike River streambed. A moderate bluff (20-30 feet above LWD) exists between Fifth Avenue and the marina basin.

Existing topography does not pose any serious constraint to port or marina development in the study area.

Water Area - Subwater topography or bathymetry of the site is characterized by three predominant features: 1) the natural fall of the lake bed from the shore; 2) the dredged areas of the harbor approach, harbor channel, and turning basin; and 3) the partially filled area of the Corps of Engineers diked disposal area.

The natural topography of the offshore area is typical of that found along major bodies of water. At Kenosha, the bottom drops rapidly from 0 feet LWD at the shore to 6 feet below LWD between 100- and 200-feet offshore. After the nearshore drop the bottom gently falls away into the lake at bottom slopes ranging between 1 in 100 to 1 in

150. The relationship between water depth and required size of protective structure is dependent upon the bottom topography as the height of a wave (and hence its energy) is related to the depth of water through which the wave is propagating. The cost of protective structures increases significantly as the depth of water increases.

At Kenosha Harbor, the harbor channel and turning basin are both maintained at a depth of 25 feet below LWD. The harbor approach channel between the east end of the channel jetties and the offshore breakwater is dredged at 26 feet below LWD and an 800-foot wide, 27-foot deep channel is maintained for a distance of 2,800± feet east into the lake. The federal harbor dredging program also maintains a 21-foot channel north of the turning basin to the 50th Street bridge. North of the 50th Street bridge, the marina basin is formed by a natural depression. Variable depths are encountered in this area; the depths are sufficient for recreational boat usage.

Soils and Geology

Appraisal of the soil and geological conditions at a site is necessary to determine the technical feasibility of project alternatives. Structural components of the project require a sound base to ensure their stability; determination of the type and magnitude of marina dock systems is dependent upon the bottom conditions. Subsurface investigations were conducted during the design and study of the diked disposal area. Nine borings were taken in 1974 along lines now occupied by the dike breakwater. This data was used in conjunction with data given for the adjacent harbor channel to form an overall assessment of the subsurface conditions at Kenosha (References 2 and 3).

The geology of the area is characterized by overburden soils deposited in the region during the Pleistocene Era in the form of glacial material. Kenosha County lies within the limits of the Valparaiso and Lake Border Morainic systems. These morainal systems form the rolling terrain and lakeshore bluffs commonly found along the Wisconsin shore. The reach along Lake Michigan from Kenosha to Milwaukee typically exhibits beach deposits from the glacial Lake

Chicago as well as the present beach deposits of Lake Michigan. In general, the overburden soils in southeastern Wisconsin are underlain by Devonian limestone.

During the design of the diked disposal area, investigations of the subbottom conditions at the site found that the conditions were suitable for construction of the dike structures. Extremely hard glacial deposits of clay and sandy clay were found at depths of 25 feet beneath the lake bed. The glacial fill was overlain by sands, gravel, and sandy silt. The density of these materials vary from loose to medium densities toward the surface and extremely dense near the glacial till. In some areas of the site, clay materials form a compressible, low strength foundation. During the dike construction a decision was made to leave this compressible material in place and design a stable dike breakwater cross section which allowed for some settlement. This arrangement has proved satisfactory.

It is anticipated that any proposed modifications to the dike, or construction of additional protective structures for marina or port development will encounter similar conditions to those described above, thorough subsurface exploration would be required before additional structures are placed. Preliminary indications are that bottom conditions will be suitable for several types of marina dock mooring systems.

A matter of potential concern to the project is the composition of soils under Lakefront Park. This area was formally used as a landfill area until 1915 and some remnant decomposing material may be found. Stability for future construction and potential disposal problems will be discussed in the development of port and marina alternatives.

Hydraulic Conditions

The following discusses technical data and information related to the hydraulic conditions in the Kenosha region. The predominant hydraulic feature of Kenosha is the presence of Lake Michigan. Fluctuations in lake water elevation and waves propagating from the lake to shore will impact the shoreline and any waterfront activities.

The purpose of the following analysis is to determine the water level, wave, basin surge/seiche, and ice conditions at the site. The information developed will be used in evaluating existing coastal structures at the site and in the design of proposed harbor improvements.

Design Criteria - For the purposes of this study, the following hydraulic design criteria have been employed. These criteria are compatible with U.S. Army Corps of Engineers requirements (Reference 4).

For design of structural improvements, a 20-year frequency, full season design wave is used in conjunction with a 10-year frequency lake level. (A "ten-year" frequency event will occur once in ten years.) For port or marina entrances, a 10-year frequency wave for the boating season only (May through October) was used in conjunction with a 20-year lake level. Maximum wave heights permitted within a small boat mooring area are set at one foot.

The geometry of a proposed small boat marina facility should be such that conditions of wave surge or seiche are minimal. Movement of large bodies of ice during the spring thaw should be avoided. Orientation of the proposed berthing system for the marina should consider the direction of attack for the prevailing wind and waves in the area.

Design Lake Levels - The water surface level of Lake Michigan depends upon a balance between the quantity of water received and the quantity released from the lake. If the quantities received are larger than those removed, the volume of water in the lake increases and the lake level rises.

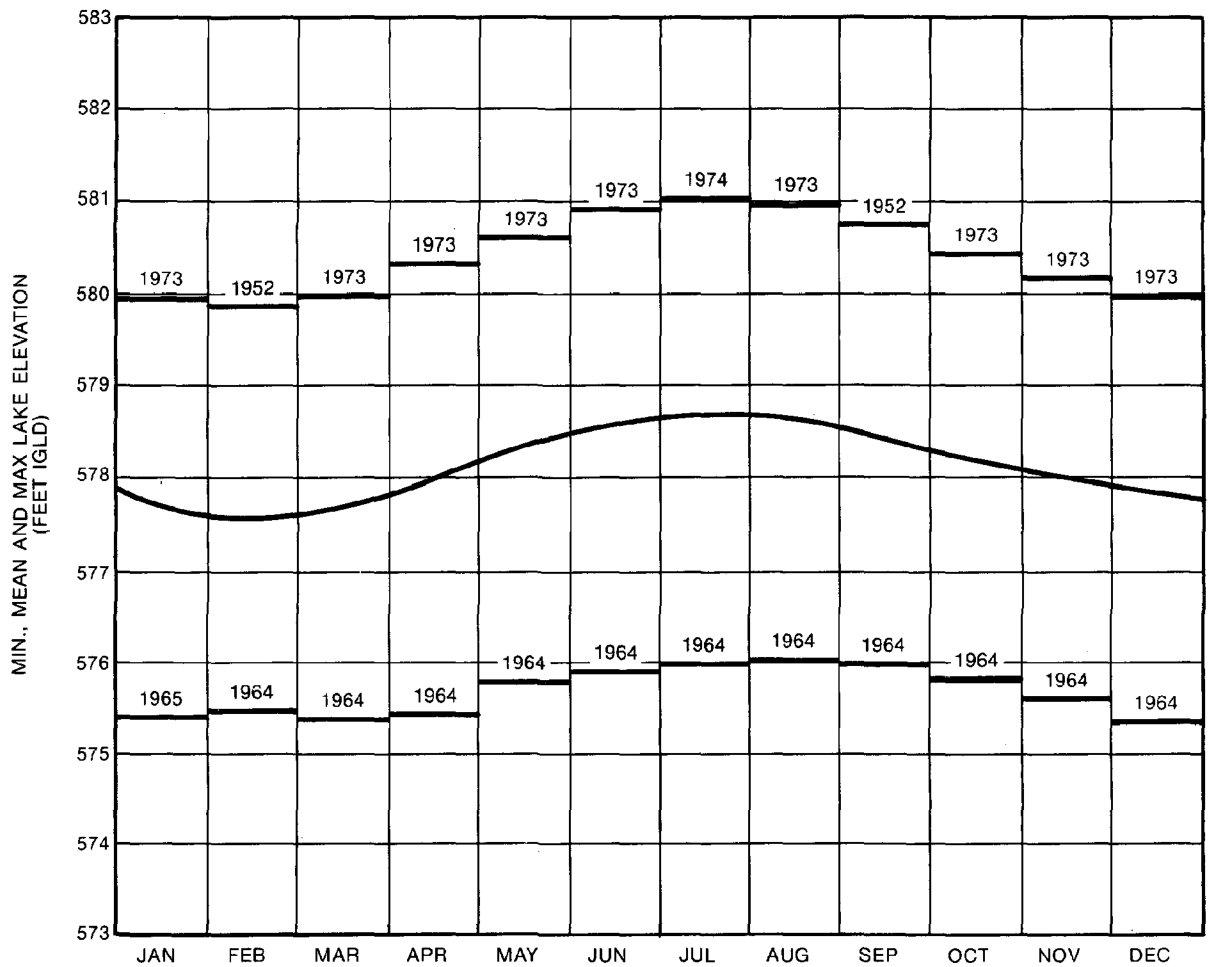
Three categories of water level fluctuations can be expected on Lake Michigan: long-term, seasonal, and short period. Long-term fluctuations are the result of persistent low or high water supply conditions for the lake. The record low levels of the mid-1960's and the record high levels experienced in 1972-73 are the result of long-term fluctuations. The main factor affecting these supplies is precipitation and runoff on the upper Great Lakes and their tributary basins. For example, from 1967 to 1973, the precipitation over the upper Great Lakes basin was above normal resulting in high lake elevations (Reference 5). For Lake Michigan, long-term fluctuations in water level have resulted in a maximum level of 581.2 feet (IGLD) recorded in July, 1974, to a minimum of 575.4 feet (IGLD) recorded in March, 1964. The long-term mean water level for the 120-years of recording is 578.8 feet (IGLD) for the full year and 579.1 feet (IGLD) for the boating season (May through October).

Seasonal fluctuations in Lake Michigan water levels reflect the annual hydrologic cycle. This is characterized by higher water levels in mid- to late summer and seasonal lows in winter and early spring. The magnitude of these fluctuations is quite small, averaging approximately one foot for Lake Michigan. Average seasonal highs of 579.4 (IGLD) and lows of 578.4 feet (IGLD) are experienced on Lake Michigan. Seasonal distribution of lake level is given on Figure II-3.

Short-period fluctuations lasting from a few hours to several days are the result of meteorological disturbances. Wind and barometric pressure differences can cause temporary imbalances in the water levels of the lake. These variances are commonly termed lake "set-up." Variances of up to 2 feet either above or below still water level occur with extreme events in excess of 8 feet having been recorded.

For the analysis and design of port and marina facilities at Kenosha, it is necessary to determine the 10- and 20-year lake levels as outlined in the design criteria. Total lake stage-frequency curves, developed for the boating and nonboating seasons at Milwaukee, Wisconsin, will be applied to the Kenosha site. The curves are displayed on Figure II-4. The curves include short-term fluctuations and are considered representative of the lake levels of Kenosha. The 10-year water level for the boating season is 4.3 feet above LWD or 581.1 feet (IGLD) and the 20-year water level for the nonboating season is 3.8 feet above LWD or 580.6 feet (IGLD).

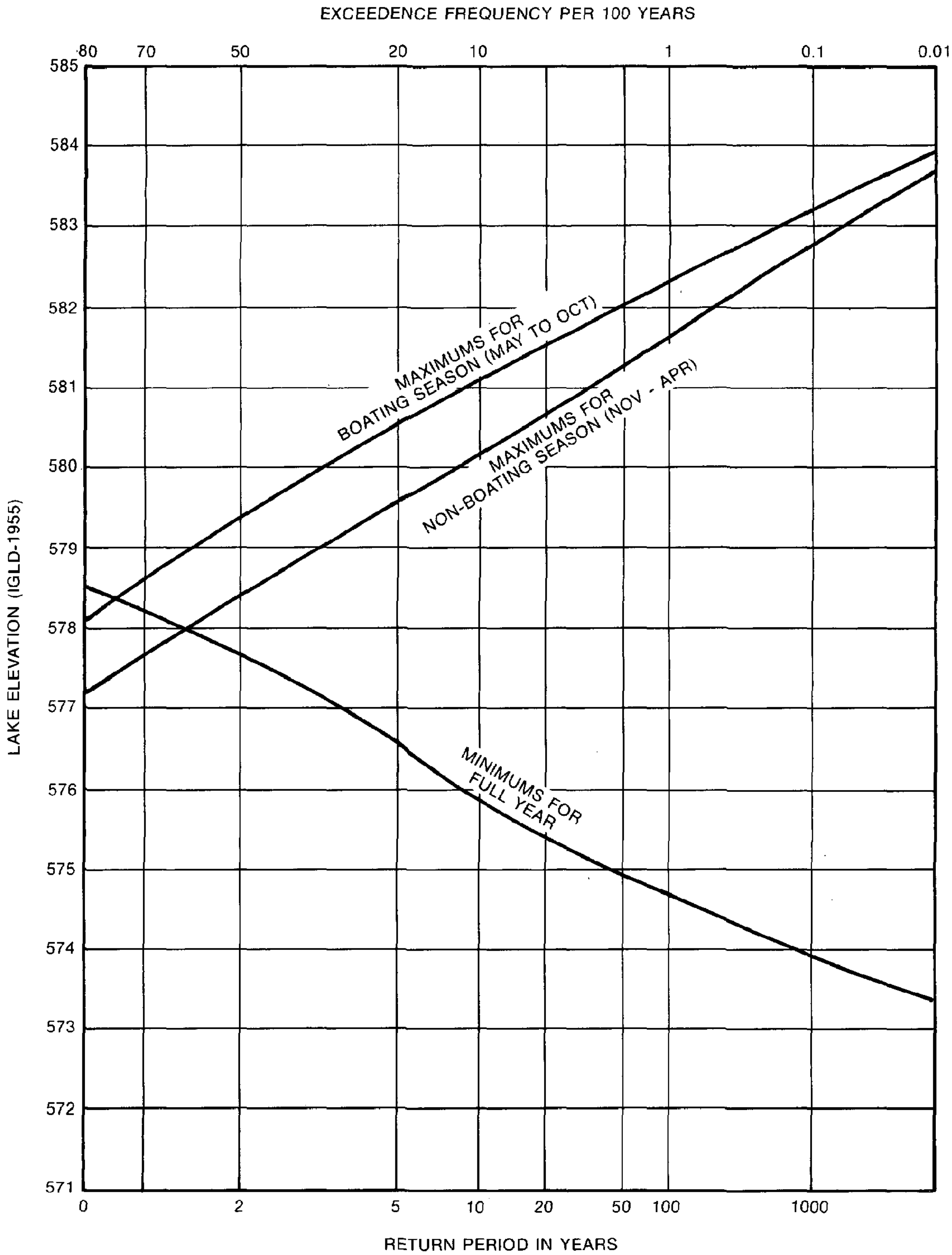
In addition to the maximum design levels given, minimum lake levels are required in order to determine if wave breaking conditions exist at the harbor structures and to establish dredging depth elevations for the projects. U.S. Army Corps of Engineers gives a



SOURCE: DEPARTMENT OF THE ARMY
MONTHLY BULLETIN OF LAKE
LEVELS FOR THE GREAT LAKES

SEASONAL DISTRIBUTION
OF LAKE MICHIGAN
LAKE ELEVATIONS

Figure II-3



NOTE: LAKE ELEVATION FOR PORT HURON, MICHIGAN WITH
LAKE SETUP SUPERIMPOSED FOR MILWAUKEE, WISCONSIN

LAKE STAGE AND SET-UP
FREQUENCY CURVES
LAKE MICHIGAN
PERIOD OF RECORD 1860-1979

Figure II-4

minimum lake level of 1.3 feet below LWD or 575.5 feet (IGLD). This value is derived from the frequency curve displayed on Figure II-4 and has a recurrence interval of 20 years.

Waves - In order to lay out and design port or marina facilities, it is necessary to examine the wave conditions in the open water, at the entrance to port or marina facilities, and inside the port or marina basin. Such information determines the structural design of the facility and the conditions of safe operation of the facility to users and their property.

The exercise of control upon wave conditions in deep or open water is not possible, although knowledge and understanding of the deep wave conditions is essential for the design of port or marina facilities and their subsequent use. Control of waves in shallow water conditions is possible by providing a barrier to the wave propagation. Partial control is available at the entrance to the port or marina basin entrance and within the basin itself, although complete elimination of all waves from the basin is difficult and usually unnecessary. For this reason, a set of acceptable criteria for wave conditions within the basin have been determined. With the given wave criteria, structure requirements are designed to meet these conditions.

For recreational marina basins, internal wave heights greater than one foot may result in danger to the dock structure, navigation in the basin, and property security at the site. Long-period waves, including seiche and surge conditions, are unacceptable within the basin. The geometry of the basin must be such that long period waves are prevented from entering or forming within the basin. In a port facility, the larger ships are less sensitive to larger short period waves although long period waves may be hazardous. Further aspects of wave conditions to be considered in marina or port facilities are: 1) wave heights must not cause boats or ships to ground in the wave troughs; 2) entrances to facilities where breaking waves are encountered are inadvisable; and 3) entrances where boats or ships are forced to broach the wave crests should be avoided. In this study, the wave factors considered include:

1. Open or deep water wave conditions on Lake Michigan.
2. Local or nearshore wave conditions impacting upon shoreline structures.
3. Wave overtopping of the existing breakwater structures of the diked disposal area.
4. Wave conditions within the proposed marina sites.

Deep Water Waves - Deep water wave conditions were developed in Reference 5 using data given in Reference 4. Seasonal design waves for various directions of wave attack are given in Table-II-1.

TABLE II-1

DEEP WATER WAVE HEIGHTS

Direction of Wave Attack	20-Year Nonboating		10-Year Boating	
	Height (ft)	Period (sec.)	Height (ft.)	Period (sec.)
NNE	18.4	10.3	10.3	7.8
NE	21.3	10.5	10.5	7.9
ENE	21.3	10.5	10.5	7.9
E	21.3	10.5	10.5	7.9
ESE	12.1	8.3	4.9	7.0
SE	12.1	8.3	4.9	7.0
SSE	12.1	8.3	4.9	7.0

Source: Corps of Engineers, Kenosha GDM, Reference 5

Nearshore Waves - To determine the magnitude of waves impacting upon the protection or shoreline structures, the deep water waves were propagated into the shallower water adjacent the Wisconsin shore. For the design of protection or shoreline structures, the nonboating season (20-year) wave was considered. Analysis of wave heights at the mouth and within the harbor basin was performed for the boating season (10-year) wave.

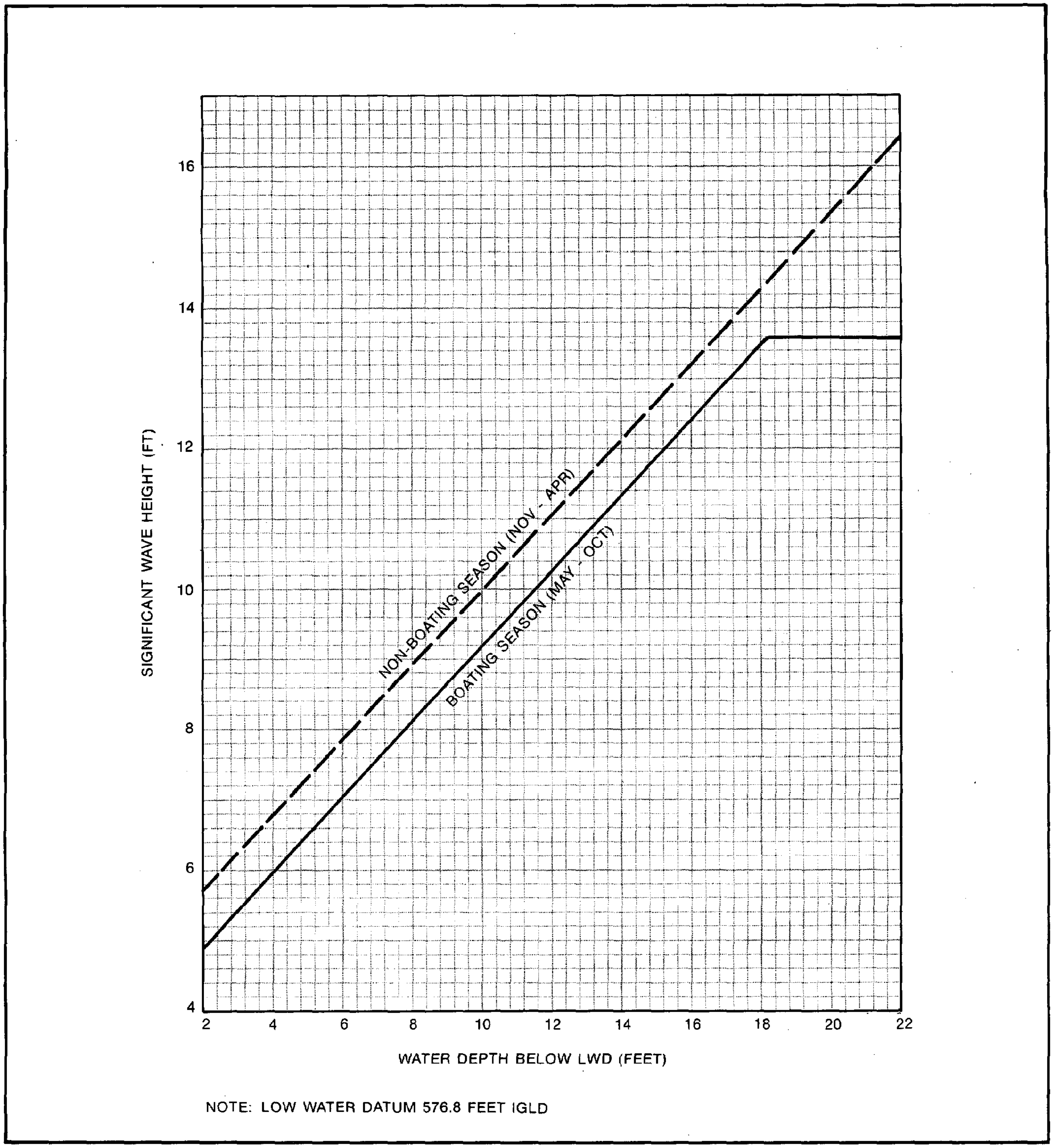
Refraction and attenuation of the waves as they approach the shore from deep water has been performed by the U.S. Army Corps of Engineers (Reference 5). As a wave approaches the shore, its magnitude is dependent upon the depth of water through which it is propagating. Curves relating the design wave height versus the water depth below LWD are displayed on Figure II-5.

From this data the east breakwater of the Corps of Engineers confined disposal facility with structure depths between 13 and 16 feet below LWD will be impacted by waves ranging from 11.5 to 13.5 feet. The design wave height for any structure placed in the nearshore can be estimated in a similar manner.

A feature of protective breakwaters is the allowance for wave overtopping. It is neither technically necessary nor economically beneficial to provide a total barrier to all wave energy. A minor quantity of wave overtopping of the existing Corps disposal area breakwater is expected. The maximum criteria for wave overtopping is that the transmitted wave into the harbor basin is less than one foot. The crest elevation of proposed marina or port protection will have to be sufficient to preclude transmitted waves in excess of this limit.

Seiche and Surge Conditions - Harbor surge normally takes one of three forms: short period oscillations; long period oscillations; or water level responses to climatological conditions. Short period oscillations result when lake waves reflect off harbor structures and accumulate energy within the basin. Such conditions can be avoided by limiting use of vertical walled structures surrounding the basin perimeter. Seiches are long period (10 to 60 minute) water level changes resulting from wind or pressure differences on the lake. Short-term, climatological changes have been discussed under design lake levels.

Local boaters and city officials have indicated that a surge/reflection problem exists in the turning basin area at the west end of Kenosha Harbor. Severe damage has been experienced by boats moored in this area. The rough water problem in the turning basin is a direct result of waves directly entering the harbor channel from



WATER DEPTH VS.
SIGNIFICANT WAVE HEIGHT

Figure II-5

the east to southeast quadrant and reflecting in a west direction along the vertical sheet pile walls lining the harbor channel. This wave energy concentrates in the turning basin. Elimination of the rough water problem throughout the entire harbor will require construction of an offshore breakwater perpendicular to and directly south of the existing offshore breakwater. Positioning of this breakwater will be dependent upon the navigational requirements of shipping using the port. Construction of this second offshore breakwater will be costly. Mitigation of rough water conditions may be achieved through construction of wave absorbers (sloped rubble surfaces) around the perimeter of the turning basin. These measures will be investigated under the development of waterfront facilities.

Wind

Winds at the site are primarily responsible for wave generation. In general, all waves encountered on Lake Michigan are wind generated.

For the Kenosha study area, localized effects of wind include: 1) its ability to generate waves within a marina or port basin, and 2) the lateral design force of the wind upon the boats and dock system.

For the proposed port or marina development concepts, the potential of internal basin wind generated waves was examined. For all possible basin configurations considered, it was found that the maximum potential wave height was well within the one-foot limit.

A lateral shear force exists between the wind and any structure exposed to it. This is particularly true with boats. It is desirable to expose the least possible surface area of the boat to the wind. This can be achieved by orienting the bow to stern axis of the boat in the same direction as the prevailing wind. At Kenosha, the prevailing wind is from the west and so it becomes desirable to align the boat slips in an east-west direction. Where this is not possible, adequate design of dock anchorage systems can ensure stability of any alignment. Mooring facilities for large shipping in Kenosha Harbor are already oriented on an east-west axis; no change is anticipated in this arrangement.

Ice

A potential destructive element to a marina dock system is shifting ice within the basin. A thick (12 to 24 inches) covering of ice can be expected to form in the harbor and any proposed marina site each winter.

Ice cover itself does not represent a significant problem in the operation of a marina. The proposed dock system would possess sufficient strength to withstand ice forces. (It is desirable to have the dock system remain in the water throughout the year to reduce operation costs.) Numerous marinas in the Great Lakes region operate their dock system successfully in all year conditions. Sufficient structural protection to the basin should eliminate exposure of the ice to moving (wave and current) forces. The existing dock system in the inner harbor at Kenosha is removed each winter to protect it from damage.

Littoral Drift

During field investigations of the site, no significant indications of shoreline accretion or erosion resulting from construction of the two main harbor channel jetties, the offshore breakwater, or the diked disposal area were apparent. Littoral drift along the Lake Michigan coast is typically from north to south. Some material accumulation from the littoral process results in the formation and maintenance of a beach at Simmons Island Park.

It is not anticipated that modifications or improvements to either Kenosha Harbor or the diked disposal area, or the construction of additional facilities south of the diked area will have a further effect on the littoral process. Consequently, there are no anticipated problems with down drift erosion or up drift accretion from the study area.

Because of the problems experienced with rough water in the turning basin, the possibility exists for construction of a second offshore breakwater perpendicular and south of the existing structure. It is expected that construction of this second offshore breakwater will have little effect on the littoral process; maintenance of a stable outer navigation channel indicates that little to no material is passing around the east ends of the harbor jetties.

It has been reported that some sediment buildup and the associated required Kenosha Harbor dredging results from sediment discharges from Pike Creek (Reference 3). Littoral drift only contributes a minor amount to sediment buildup in the harbor. This material is the primary source of harbor sediments at Kenosha and initiates the necessity for harbor dredging which resulted in construction of the Corps of Engineers diked disposal area. The limited supply rate from this source is apparent from the inability of Kenosha dredged material to fill the diked disposal area on schedule.

Environmental Considerations

The development of marina or other shoreline facilities must be accomplished with minimal disruption of the environment. State, federal, and local regulations will require assessment of the environmental impact of any proposed project, and the issuance of several permits prior to construction.

The study area for the harbor project is to some extent almost entirely developed. The existing shoreline consists of developed and undeveloped parkland, marina and port facilities, a motel, American Motors Corporation, the Corps of Engineers diked disposal area, and private residences. There are no natural areas of ecological concern which would be heavily impacted by a shoreline project (e.g., wetlands or unique habitats). Further discussion of environmental impacts is given in Section VI.

Existing Water Oriented Facilities

Kenosha Harbor - The dominant feature of the Kenosha waterfront is the harbor. The harbor has been formed by channelization and dredging of Pike Creek for the lower 1,150 feet of the river and a further 850 feet has been gained by construction of parallel jetties into Lake Michigan. Available navigation widths in the harbor channel vary from 150 to 170 feet. A turning basin with a potential radius in excess of 250 feet exists to the west of the harbor channel. The channel from the turning basin north to the 50th Street bridge is considered part of the harbor. The perimeter of the harbor and turning basin are lined with vertical walls except for rubble placed at the present outlet of Pike Creek and at the toe of the harbor jetties.

The harbor channel and the turning basin are dredged to a depth of 25 feet below LWD. The north channel to the 50th Street bridge is maintained at 21 feet below LWD. From the mouth of the harbor to the eastward limit of the offshore breakwater, a 26-foot below LWD transition channel meets the 800-foot wide, 27-foot deep channel which extends 2,800 feet into the lake. The harbor geometry is displayed on Figure II-2.

An 800-foot long offshore breakwater lies 550 feet northeast of the north harbor jetty. This breakwater is oriented on a northwest to southeast axis. The breakwater provides harbor protection for wave attack from the northeast. The breakwater has a low profile compared to the water surface and is frequently observed to be awash with wave overtopping. Rough water conditions in the turning basin and north channel are not attributed to wave attack from this direction and as such, the structure is considered satisfactory. Rough water in the turning basin is the result of wave attack from the east-southeast quadrant.

<u>Diked Disposal Area</u> - The Corps of Engineers constructed a diked disposal area in 1975 to contain and consolidate dredge spoils from Kenosha and Racine Harbors. The disposal area lies adjacent to the south pier of Kenosha Harbor occupying approximately 32 acres of which about 25 acres is available for the disposal of dredge material. Prior to construction and placement of the dredge material, water depths at the site ranged from zero at the shore to about 14 feet in the south-east corner. The design capacity for dredgings in the structure was 750,000 cubic yards to be filled over the 10-year design life for the structure.

The disposal area has rubble mound structures on the south (1,130 feet) and east (1,100 feet) walls. The north wall is formed by the existing Kenosha Harbor government pier. The west boundary of the disposal area is formed by the existing natural shoreline. The rubble mound structures of the disposal area are lined with a driven sheet-pile core which ensures that the disposal area is virtually watertight. Displacement of confined water into Lake Michigan is achieved by a filter structure that has been placed near the southeast corner of the disposal area on the south wall.

Although the structure has reached 50 percent of its design life (5 out of 10 years in 1980), only 15 percent of the disposal area's capacity, or 110,000 cubic yards, have been filled. The Corps of Engineers has indicated that they may only require 300,000-400,000 cubic yards for disposal of dredged material[1]. The reduced estimated dredge quantities result from material never being supplied to the disposal area from Racine Harbor, and substantially reduced quantities being dredged from Kenosha Harbor. As of 1980, the disposal area has been used twice for material from Kenosha only. At the present fill rate, design holding capacity will not be reached for 30-35 years.

Of concern to the development of a marina in the residual (non-filled) area of the disposal area, is the occurrence of wave overtopping. For the breakwater crest heights of 13.5 feet above LWD, and with the maximum 20-year design wave of 13.5 feet, it is possible to have a transmitted wave of 1.2 feet propagated within the disposal basin. This will be considered acceptable to the safe operation of a marina where the limiting criteria requires wave heights to be kept below one foot. If this site were to be used as a marina basin, modifications in the form of increasing the breakwater height or providing a buffer/dissipation zone in the lee of the breakwater would not be required.

Kenosha-Simmon's Island Park Marina - A marina for recreational power boats exists in the body of water north of the 50th Street bridge and west of Simmon's Park. The marina area is restricted to small power boats because of the low clearance capability of the 50th Street bridge. The area has a capacity to moor 142 boats to the city dock system and 125 on private moorings. The body of water is approximately 1,500 feet long from north to south, and averages 200 feet wide. Water depths in the basin range from 9 to 2 feet below LWD. The basin perimeter

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[1]This in the event that Racine contributes no spoil.

is predominantly lined by vertical walls and some rough water problems are experienced.

The main pier of the municipal boat slips lies parallel to the west bank of Simmons Island Park. Boats are moored on both sides of the pier. Additional slips are provided by private individuals along the west bank of the basin. Equipment and facilities of the municipal slips are new (1978) and in excellent condition. Electricity and water are provided. Quality and serviceability of equipment in the private docks is variable. Access to the private facilities is by way of a strip of public land that lies adjacent the west bank of the basin.

Six boat launching ramps are located at the north end of the basin. Although set in an unfavorable position from a water and land aspect, the ramps experience heavy usage. From the land aspect, the ramps have limited access, poor traffic maneuverability, and inadequate parking capacity. Water-oriented problems include adequate boat holding capacity, distance from the lake, and traffic movement through the recreational and port mooring areas.

Although the marina basin experiences physical constraints from its narrow width leading to undesirable navigation, traffic, and maneuvering area, the basin is very popular. Continued use of all facilities, with the possible exception of the launch ramps, is expected in any future development plan for the study plan.

Recreational Boating - Other existing recreational boating facilities at Kenosha Harbor include the city wharf, Gatti Boat Sales and Service, the city of Kenosha Boat Piers, and the Kenosha Yacht Club. Excepting the city wharf, these facilities occupy the southwest end of Simmon's Island between the harbor channel and the 50th Street bridge. The U.S. Coast Guard Station also occupies a site in this area. The city wharf area occupies land south of the 50th Street bridge on the west side of the channel. This land is relatively undeveloped. The location of these facilities is displayed on Figure II-2.

Because sailboat access is denied to the Simmon's Island Park marina by low clearance on the 50th Street bridge, mooring areas south of the bridge tend to be dominated by sail craft. It is boats moored in this area that have experienced damage from waves propagating into the turning basin.

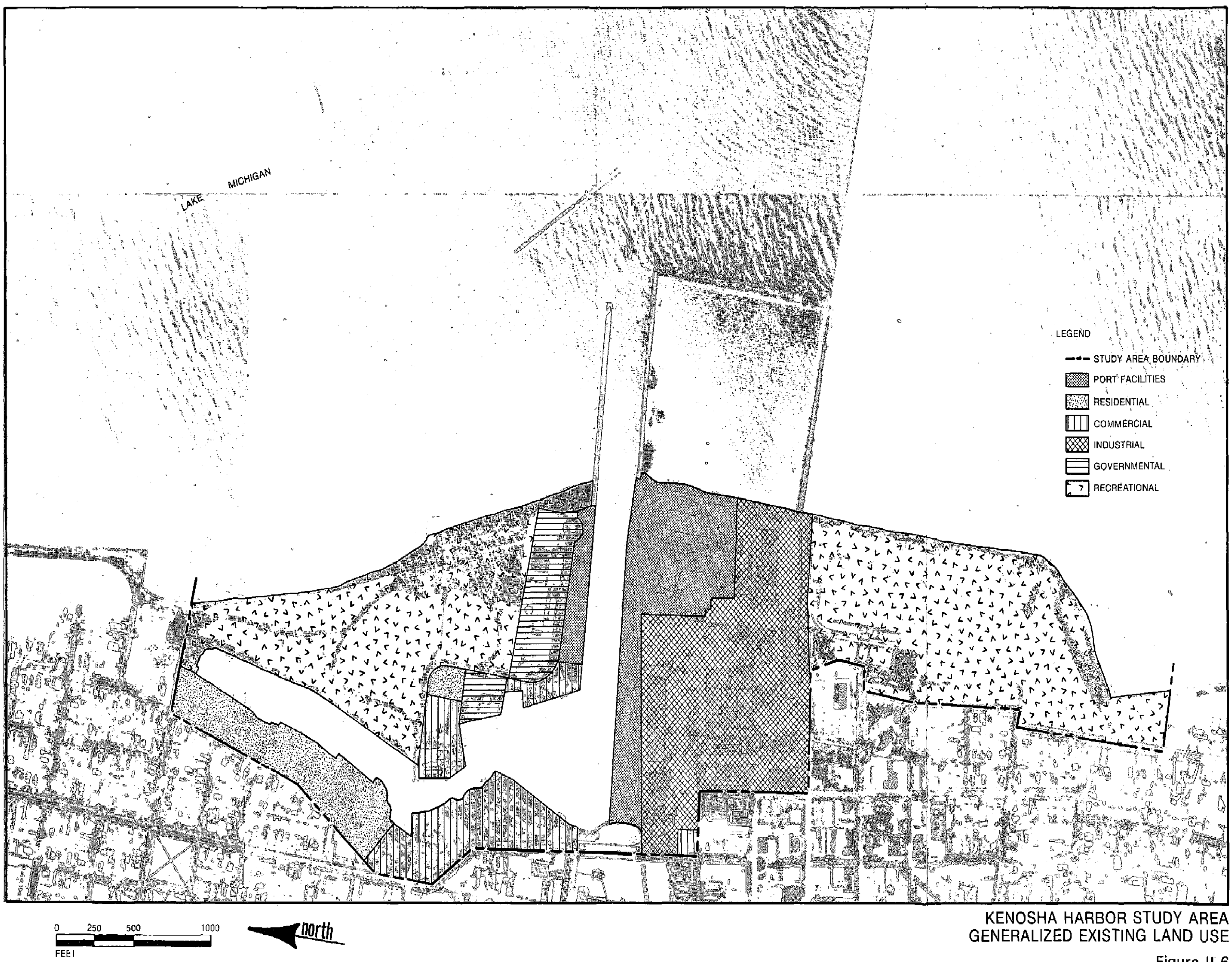
Existing Land Use

The following is an evaluation of existing land use conditions and concerns within and immediately adjacent to the designated study area for the Kenosha Harbor Master Planning Project. The study area constitutes approximately 200 acres of land and water located between 45th and 63rd Streets, and bounded generally by 3rd Avenue, 5th Avenue, and Lake Michigan. Within this designated area there exists a wide range of land uses including recreational, residential, commercial, industrial, institutional, and governmental; (see Figure II-6). For purposes of discussion and analysis the study area will be divided into three segments. Segment I extends from 45th to 50th Street, Segment II from 50th to 57th Street, and Segment III from 57th to 63rd Street.

Segment I is bounded by 45th Street on the north, 50th Street on the south, 5th and 7th Avenues on the west, and Lake Michigan on the east. The principal land uses include Simmons Island Park, the city's public boat launching facilities at 45th Street, public and private boat mooring facilities, and a portion of an older, established residential neighborhood located adjacent to 5th Avenue. There is a small amount of commercial use at the intersection of 7th Avenue and 50th Street. Land use conflicts appear minimal and the entire area appears well maintained. Adjacent land uses reflect those in the study area and are compatible.

Segment I is almost totally developed with only one parcel adjacent to 50th Street available for development. This parcel is only .04 acre and could be used only for some sort of ancillary or support function.

The concerns relate to vehicular movement and the congestion created by boat launching activities, marina, recreational (Simmons Island Park) and residential traffic. There is additional concern regarding the practice of 5th Avenue residential property owners leasing waterfront space for recreational boat docking facilities. This significantly increases congestion and parking conflicts along 5th Avenue.



KENOSHA HARBOR STUDY AREA
GENERALIZED EXISTING LAND USE

Figure II-6

Segment II is bounded by 50th Street on the north, 57th Street on the south, 5th and 3rd Avenues on the west, and Lake Michigan on the east. This area is centrally located in the heart of Kenosha. It is immediately adjacent to the Central Business District (CBD) and contains a wide mix of land uses. Principal uses are: commercial, industrial, recreational (both public and private), and governmental. Adjacent land use reflects development within the study area.

A review of city tax maps indicates there is one residential lot available for development within the entire segment. This lot is located on 50th Street immediately adjacent to the park.

Traffic flow and vehicular congestion is the most critical problem identified within this segment. Conflicts between industrial traffic and commercial traffic were noted during field investigations. City officials indicated a need for added off-street parking in this immediate area. This parking is to be utilized by both industrial and commercial workers and CBD patrons. Land availability appears to be a major constraining factor.

Segment III is bounded by 57th Street on the north, the southern boundary of Eichleman Park on the south, 3rd Avenue on the west, and Lake Michigan on the east. Existing land use within this segment is almost entirely recreational. The northern portion is utilized by the Lakefront Stadium and associated parking. During times when the stadium is not used, the parking is utilized by adjacent institutional office commercial, and industrial uses. The central and southern portions contain two city parks, Wolfen-Buttel and Eichleman, respectively. Adjacent land uses are varied but not a significant problem. The area from 57th to 59th Street is a portion of the CBD and its various uses. The American Motors plant is also located in this area. From 59th Street south is a well-established, residential neighborhood which takes advantage of its lakefront location.

As with the other two segments, there is presently no vacant, developable land.

Identified problems are also similar. A mixture of industrial, institutional, recreational, and commercial traffic around 57th Street creates significant congestion in a restricted area.

In summary, the designated study area is presently extensively and intensively developed. Although present uses are varied, all are well established and they have coexisted for an extended period of time without major conflicts. Based on discussions with local officials and field observations, there is little evidence that pressures exist for major changes in the existing land use pattern.

Regional Economy

Although not strictly a characteristic of the geographic study area, the level and type of economic activity in the Kenosha area has important influence on the type of development desirable in the harbor area.

The Kenosha economy is heavily weighted to manufacturing. Of a total of 36,164 employees in 1977, 13,261, or 37 percent were employed in manufacturing industries (Reference 6). Within the manufacturing sector, the American Motors Corporation is dominant, employing over one-half of all manufacturing workers at its two Kenosha plants.

Among the more direct influences expected on the study area by economic forces is the presence of one of these AMC plants in the center of the harbor study area. This facility generates traffic and parking demands which must be reconciled with those of new marina and/or port facilities, and indirectly generates a large fraction of the downtown retail sector demand due to its location.

Another implication of the regional economic structure is drawn from the fact that the wage rates and thus average incomes are very high in Kenosha and Kenosha County. A 1977 survey (Reference 7) ranked the Kenosha SMSA as 16th out of 300 SMSA's in median household effective buying income. This high personal income, combined with the lakefront location, maximizes interest in and demand for recreational boating.

Although the presence of a large manufacturing sector, dominated by a single firm has positive features, this structural characteristic of the Kenosha economy carries some disadvantages. The relative lack of diversification makes the regional economy more subject to sudden shocks than would otherwise be the case.

As in most American cities, the retailing function in Kenosha has spread from the CBD to suburban locations. Kenosha has four major shopping centers in addition to the CBD, but retains a fairly healthy downtown business section. This is reflected in a relative lack of vacant land for development in the study area.

It is also important to note that the economic sectors most likely to benefit from new marina development (e.g., hotel, restaurants, convenience retail) are already represented in the study area. Thus no "threshold" problems will prevent the accrual of these benefits, which have been estimated between $300,000 and $1,300.00 per year in terms of revenue increases.

SECTION III

MARKET ANALYSIS

Introduction

Market forces will dictate demand for and feasibility of expansions in both marina and port operations, and overall downtown development. This section examines these forces and their implications for the Harbor Master Plan.

Marina Facilities

Forecasts of demand for marina services are of obvious importance for the Harbor Master Plan. Even in the absence of the physical constraints present in the harbor environment, incorrect judgment of future demand for marina services has important fiscal implications for the city. Due to economies of scale typical in both capital and operating costs, an underdesigned facility will result in higher unit costs (and thus higher fees on a cost of service basis). In an extreme case, this could lead to a poor competitive position vis-á-vis other Lake Michigan facilities. An overdesigned facility will have lower unit costs, but could result in an oversupply, and inability to cover costs from user fees.

The most structured existing information on future marina demand is provided in the 1974 Corps of Engineers study "Lake Michigan Regional Boating Survey and Analysis." This study sets forth the concept of excess demand, or the quantity of marina services which would result from a true market equilibrium at existing prices.[1] The numerical estimates of demand (number of slips) derived in the study, however are not based on this concept, but are statistical estimates

[1] This excess demand concept presumes that existing prices are not market prices, but constrained to some lower level. This is an appropriate representation of the existing situation, since prices are not set on a profit maximization basis.

of quantities that are independent of price. These estimates were derived from survey data for Wisconsin and Illinois coastal counties, and relate the number of slips demanded to a number of independent variables, including population (or population density), median family income, travel time to marinas, inland lake acreage, and numbers of launch lanes and berths within 50 miles of the county.

Five equations were developed, one for each of the COE recreational boat classes.[2] Each equation explained the variation in boat registrations among counties in terms of a constant term and variations in the independent variables among counties. On a statistical basis, population or population density was by far the most significant variable in all of the equations. Income was not significant in any of the equations (at the 95 percent level of confidence).

Acreage of inland lake was significant for both outboard class equations, but insignificant for other types of boats. The number of launch lanes proved significant in explaining registrations for small outboards only, and number of berths were a statistically significant variable for inboards greater than 25 feet length overall.

Several comments on these estimating equations are relevant to the question of appropriate marina size at Kenosha. First, the equations are strictly "cross-sectional," i.e., developed from data at one point in time. As such, they fail to measure the effect of increasing popularity of boating over time. This effect is of national scope and well documented. This omission would tend to make the equations underestimate future demand. Second, the inclusion of supply side variables (number of berths and moorings) is questionable for demand estimation. Third, and most important, these equations attempt to predict total registrations in a county and not the appropriate supply of marina facilities.

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[2] Inboards 16'-25', 25'+, outboards 16'-25', 25'+, and sailboats over 25' (all LOA).

With these comments in mind, the results of the COE equations are put in context. Table III-1 presents estimations for 1970, 1980, 1990, and 2020 for each class of boat for Kenosha County.

TABLE III-1

COE BOAT REGISTRATION FORECASTS - KENOSHA COUNTY

Year	Outboards 16'-25'	Outboards 25'+	Inboards 16'-25'	Inboards 25'+	Sailboats 25'+	Total
1970	1,000	16	180	40	80	1,316
1980	1,512	29	352	78	581	2,552
1990	2,075	35	414	45	629	3,198
2020	3,710	50	569	-73	761	5,017

Source: U.S. Army Corps of Engineers and Stanley Consultants, Inc.

These growth forecasts indicate roughly a doubling in the total number of boat registrations in the county between 1980 and the year 2020, which approximates the design lifetime for a marina addition in the harbor. Although these overall results seem reasonable, the results generated for inboards of 25 feet and over represent an obvious failure of the statistical forecasting technique. Once again, these forecasts should be considered only as general indications of demand increases for recreational boating activity in the county. Interpreted in this light, the implications of the forecasts are quite reasonable and indicate steady, continued growth in demand for recreational boating activities based on local demand. Should the overall forecast prove valid, and the proportion of recreational boaters desiring permanent berths or slips remain roughly constant, then the forecasts would indicate the demand for at least an additional 250 to 300 slips over the 1980 to 2020 time frame.

Based on examination of current slip holders and the waiting list for slips at Kenosha, the geographic market area for a new marina appears to include the northern Chicago suburbs. This is a rapidly growing area, with incomes significantly above average, generating strong demand for recreational boating. This demand will be allocated among several competing Lake Michigan marinas.

A 1974 COE study was based on this concept, and forecasted excess demand for slips for several groups of Lake Michigan harbors. Kenosha Harbor was combined with Racine for the purposes of this analysis; demand from Kenosha and other nearby counties was allocated to the two harbors on the basis of proximity, plans for additional harbor improvements, and other factors. While this analysis was not as statistically rigorous as the forecast of boat registrations by county, it is more directly relevant to the question of appropriate marina design size for the city. This analysis indicated an excess demand for 265 slips would exist between the harbors of Kenosha and Racine in 1980, with excess demand growing to 470 slips by 1990, and 935 by the year 2020. While no definite split between the harbors at Kenosha and Racine was predicted in the Corps report, allowance for current plans at Racine Harbor have indicated a remaining year 2020 excess demand of 620 slips for Kenosha.

Table III-2 indicates the allocation of excess demand projected by this study among several nearby competing marinas. The "market area" totals are probably of more significance than individual marina allocations, since these will be affected by capacity additions. On this market area basis, demand for slips is growing by about 80 per year.

An analysis similar to that performed for berthed boats was also carried out for boats utilizing launch facilities during the COE study. This analysis indicated excess demand for launching facilities of 14 lanes for Kenosha and Racine in 1980 increasing to a total of 37 lanes in the year 2020.

While it is not possible to directly verify the accuracy of the excess demand projections for either number of berths or launch lanes at the combined harbors of Kenosha and Racine, some measure of indirect verification is possible. This indirect verification is possible since the forecasts of excess demand for berthed boats is based on an allocation of the total number of boats projected to be owned in each of several Wisconsin and Illinois counties indicated above. When the

TABLE III-2

PROJECTED EXCESS DEMAND, KENOSHA, AND COMPETING MARINA FACILITIES

Name	LMRBS#	SLIPS[1]	"Excess" Demand 1974	1980
Port Washington	31	35	15	70
Milwaukee and South Milwaukee	32&33	893	180	330
Racine and Kenosha	34&35	360	110	265
Pompeii, Waukegan, and Great Lakes Trailer Court	36-38	408	295	395
Highland Park and Wilmette	39&40	281	180	235
TOTALS	NA	1,977	780	1,295

[1] Includes moorings

Source: U.S. Army Corps of Engineers

COE boat ownership forecasts for the area consisting of Cook, Lake, McHenry, Kane, and Dupage Counties, Illinois, are compared with actual boat registration data for 1979, it is found that the COE estimating equations significantly underestimated growth in boat ownership from 1971 to 1980. As indicated earlier, this may be due to the exclusion of time trend information in the popularity of recreational boating in formulating the equations.

On this basis, it is concluded that the COE recreational boating demand forecasts are a fairly conservative estimate of the potential for recreational boating activity growth for the Lake Michigan coastal zone. The major remaining economic problem in selecting an appropriate design size for a marina facilities in Kenosha concerns the extent of competition in the allocation of boats among Kenosha and other coastal zone harbors. As noted above, the market area for a marina facility at Kenosha should be considered a fairly extensive area including at least the northern Chicago suburbs. A great portion of the future demand growth generated for a marina facility will originate in this area. To the extent that other marina facilities are developed in competition with the Kenosha project, effective demand at the site could be significantly reduced.

Of particular interest in this regard is the proposed Zion project. While the project has encountered significant delays based on environmental concerns, construction of this project in larger configurations (up to 3,000 slips) could seriously undermine the demand level for a marina facility at Kenosha. The basic reasons for this are twofold. First, the Zion facility would be slightly closer to the location of much of the demand growth in the Kenosha market area, e.g., the northern Chicago suburbs. Second, the proposed Zion facility would be larger and in all likelihood could exploit greater economies of scale than any facility which is physically possible within the constraints of the Kenosha site.

Thus, there are two basic and quite distinct perspectives that emerge in selecting an appropriate design size for the marina facility in Kenosha Harbor. Based on considerations of forecasted boat ownership in the harbor's market area, and on the considerations associated with economies of scale in marina construction and operation, a strong argument exists for making the marina facility as large as can be accommodated within the physical constraints of the site. A more conservative perspective on the appropriate marina design size for the harbor evolves from consideration of the risks associated with such a large facility. Under this concept, a marina would be sized to accommodate only that fraction of the total future demand which could be relatively assured to accrue to the Kenosha location even in the face of extensive marina development in the Kenosha market area. This local fraction of demand would call for a much smaller facility. Based on our analyses and considerations of these factors, we have adopted the approach of setting upper and lower limits for marina design sizes within the harbor. The lower limit, which reflects our judgment concerning local demand growth over a reasonable marina lifetime would be for 250 boats. The upper limit, based on considerations of physical site constraints has been set at 900 slips.

Price Considerations

While the discussion of demand levels is in terms of quantities, any meaningful assessment of demand must include a price component. Although information on this aspect is less structured than that available on numbers of boats and slips, it does seem to indicate substantial demand for slip rental even at prices higher than currently charged.

The most direct evidence of this is furnished by some of the prices paid for privately owned slips in the existing harbor. These slips rent for annual rates as high as $1,600, over three times the average cost of a city slip. While not all boat owners would pay this price, it is indicative of demand levels.

Port Facilities

The port of Kenosha is a general cargo facility located roughly in the center of the harbor study area. This port facility is operated primarily on privately owned land by Morelli Overseas Export Company. Due to its location, facilities, and cargo mix, the port is classified as "a gateway port" by the Wisconsin Department of Business Development. A gateway port is a port which:

> "handles commodities which have generally been transferred to or from the port hinterland area as opposed to ships terminating at the port itself. These ports are the only ones with substantial amounts of overseas trade and handle more of a variety of cargo than any other group of ports."

This status as a gateway port and a market area which encompasses portions of eight states give the facility an economic stability which has prevented the declining tonnages apparent at some smaller Wisconsin ports. Primary commodities handled through the port of Kenosha include food and kindred products, machinery, and motor vehicles. Current volumes are about 80,000 tons/year.

Facilities at the port include 131,000 feet of closed storage, 185,000 square feet of reefer storage, 19 acres of open storage, 2 container cranes, and 2 forklifts. In addition, both truck and rail access are provided and the port has the use of a rail siding on the property. Rail and highway links to the hinterland are excellent.

Dockage on the south and north side of the channel totals approximately 2,500 feet, sufficient to accommodate as many as 3 typically sized freighters at one time. Waterside facilities associated with the port include the main shipping channel with a project depth of 25 feet and turning basin at the head of the channel, and the breakwater to the northeast of the channel mouth.

Future Cargo Volumes

Expansion of cargo volumes at the Kenosha Port could come from three basic sources:

1. Normal growth of businesses and consumer sectors within the port's market area.
2. Switching in transport modes by existing shippers within the market area.
3. Increase in market share due to competitive advantage vis-â-vis other ports.

The first of these potential sources of growth would normally provide for real increases averaging from 2 to 3 percent in cargo volumes and fees. Such growth will probably not manifest itself as smooth and steady, but will come in discrete steps. Both the recent historical record of cargo volumes at Wisconsin ports and a generally slow national economy indicate that cargo growth of this type may be minimal in the near term.

The second potential source of market growth probably offers more prospect for significant increases in the near future. This is the case since water transportation is generally more energy efficient than rail or truck. As energy costs become a larger fraction of total transport costs, the incentive for switching modes increases.

The Kenosha regional economy includes several potential candidates for new port business of this type, and the larger market area includes many potential shippers in the food products and transportation equipment industries.

An increase in market share due to competitive advantage vis-á-vis other ports may be possible with improved facilities. As a general cargo port, Kenosha's competition is primarily at Milwaukee and Chicago. (Racine is a "limited cargo" port oriented to local shippers.) While effective competition with the larger ports of Chicago and Milwaukee for bulk commodity shipments would be difficult, competition for a greater share of the general cargo market could easily result in major increases in Kenosha volumes.

Based on an assessment of these factors, and other confidential marketing information, the port's operators have estimated potential increases for various commodities as set forth in Table III-3.

TABLE III-3

CURRENT AND POTENTIAL CARGO VOLUMES,
PORT OF KENOSHA

Shipper	Present	Potential
USDA	12,000	24,000
Steel	0	100,000
Twine	4,000	12,000
Containers	0	3,000
General Cargo	13,000	16,000
Reefer Cargo	40,000	50,000
Vehicles/Tractors	7,000	13,000
TOTAL	76,000	218,000

Source: Morelli Overseas Export Company

SECTION IV
DEVELOPMENT OF MARINA ALTERNATIVES

General

The demand for boat slips in the Kenosha region, as discussed previously, indicates that a marina for 250 or more boats can be successful as an economic and operational unit. Several other neighboring communities are also presently considering marina development. The construction of these other facilities will, of course, have some effect on the demand for slips at Kenosha. Indications are that a harbor at Kenosha could berth as many as 600 to 700 boats under any coincident development conditions. If no other recreational boating facilities are established in the region, a harbor for 700 to 900 boats could be established. If this regional competition does not exist, site space availability and access conditions, rather than potential demand and market, impose limitations to development. The development of the proposed marina plan at Kenosha involves the following steps:

1. Specification of design criteria.
2. Selection of the site, or sites, most suited for marina facilities.
3. Development of facilities layout within the preferred site(s), including both land and water elements.

Development Criteria

The criteria developed herein are primarily designed to: provide safe navigation conditions between Lake Michigan and the marina, provide safe mooring conditions for the boats berthed in the marina under all wave and hydraulic conditions; and provide secure conditions for the boat owners to store their property. The design criteria given summarizes the requirements outlined in References 8, 9, 10, and 11.

For the site selection process, several sites in the Kenosha vicinity were evaluated based on the following criteria:

- Physical and hydraulic factors, as discussed previously.
- Water area available, based on a general requirement for one acre of water space for each 20 boats.
- Harbor entrance requirements, primarily channel dredging or breakwaters.
- Harbor protection required to limit waves to less than one foot in the marina basin.
- Economics of each of the above factors.
- Environmental conditions; anticipated environmental impacts.
- Land area available; one acre for each 100 boats.

The U.S. Army Corps of Engineers has initiated a harbor study of Kenosha and has completed preliminary evaluation of several harbor sites and sizes. The following discussion of alternative sites incorporates their findings where appropriate.

Following site selection, the layout of specific facilities to best utilize that site is undertaken. General factors that have been considered are summarized below with the criteria for Kenosha.

Item	Criteria at Kenosha
Marina Basin	Dredging; breakwaters, excavation and landfill; diked area.
Wave Protection	Breakwaters and revetments as required.
Provision of Launch Lanes	Six launch lanes.
Number of Boats	250 boat minimum, 900 boat maximum.
Size Distribution of Boats	Boat lengths, 18-50 feet.
Sailboats	25-40 percent, boat lengths, 25-50 feet.
Power Boats	60-75 percent, boat lengths, 18-50 feet.
Type of Dock	Floating piers-chain, winch, and deadman anchorage.
Utilities on Docks	Electricity and water-possibly telephone.
Fuel Dock, Sewage Pump-Out	To be provided.
Hoist or Crane	Provided near administration area.
Parking Facilities	3-4 acres, launch ramp and berthed car parking required.

Other considerations such as channel alignments, turning basins, dock configuration, site access, traffic patterns, and related landside facilities must be determined for each site plan.

Navigation - Safe navigation conditions will occur when there is provision of adequate channel depths; maneuvering widths, navigation system aids, and protection from waves, currents, and shoaling. At least two feet of additional clearance is required below the draft of the deepest boat to use a channel. The largest draft for most power boats is 4 feet, thus requiring a minimum channel depth of 6 feet. Some sailboats may have a draft of up to 8 feet requiring depths in excess of 10 feet. Fluctuations in lake water levels will be accommodated by taking these depths to be below LWD. Dredging requirements can be minimized by marina management policies which require shallower draft boats to be berthed in the shallow inshore waters, whereas larger boats would be moored further offshore. Mooring larger boats further offshore will have the secondary advantage of placing these larger, less maneuverable boats nearer the exit to open water.

Channel widths should be kept as wide as possible to allow for safe passage and maneuverability for all boaters. A compromise between safe navigation and efficient mooring space utilization must be made. As a general rule, clear channel widths are to be twice the length of the largest boat using the facility. For marina development at Kenosha, it is recommended that channel widths in excess of 100 feet be maintained.

Wave conditions within the marina basin, at the entrance channel, and in the approach area must be considered. As previously discussed, wave heights within the marina basin must be kept below 1 foot to ensure that boat and property damage does not occur. Such conditions can be achieved by the size and placement of breakwaters, revetments, and wave dissipation structures. Wave conditions at the basin mouth and approach area must not result in boats using the basin to hit bottom in the wave troughs. The channel should be aligned so that boats will not broach the wave crests.

Navigation aids, such as channel markers, lights, fog horns, etc., must be in compliance with U.S. Coast Guard regulations. Water currents are not of particular concern in the region. Shoaling is not a problem because of the limited quantities of littoral material available in the area.

Site Access - Easy access to the marina site from the major road traffic routes must be provided. Specific requirements depend upon the size of the marina and related land facilities provided. For all but the largest developments, a two-lane paved road is adequate for the marina and launch ramp facilities. The site must have adequate space to permit easy maneuvering between the main access road, berth unloading areas, ramps, and parking.

Site Physical Characteristics - Approximately one acre of water area should be provided for every 15 to 25 boats planned for the marina. Preliminary knowledge of bottom conditions is required to design dock anchorage and dredging needs. Adequate land area is as essential as water space. Parking should be in the ratio of 3 cars for every 4 boat slips. About 90 cars may be parked per acre; therefore, one acre of parking should be provided for every 5 to 6 acres of water area (100 to 120 boats). Space will also be required for site access roads, trailer turnaround, and launch-waiting areas.

For the boat launching ramps, approximately 1 1/2 acres of land should be provided for each launch ramp lane. This will provide sufficient space for parking 25 to 30 car-trailer units. If a boat hoist is required, a level area for hoist installation, and adequate water depth are the primary concerns.

Environmental Factors - Although environmental factors vary with each specific site, the following general criteria should be considered to help avoid conflicts with environmental concerns and attendant costly delays.

- Sites in or adjacent to marshes or wetlands should be analyzed carefully for environmental conflicts.
- The presence of any rare or endangered species should be investigated during the selection process. Sites providing habitat for such species should be avoided.

- Sites adjacent to areas where commercial fishing, trapping, or harvesting of sea life occurs should be avoided.

Preliminary evaluation of water pollution problems and socioeconomic conditions may help one to anticipate the nature and degree of future conflicts.

Detailed assessment of all environmental, social, and economic impacts of a proposed project will be necessary during the Corps of Engineers permit approval phase of development.

Site Selection

Initial screening of several sites in the vicinity of Kenosha resulted in selection of the most promising locations for marina development. Six sites were identified in initial screening as given on Figure II-1.

1. Pike River mouth north of town.
2. Simmons Island Park.
3. Present harbor turning basin at Holiday Inn.
4. Corps of Engineers diked disposal area.
5. Park immediately south of diked disposal area.
6. Wisconsin Electric property south of town.

Based on preliminary evaluation, Sites 4 and 5 were selected for further study. A brief description of these sites follows and the screening process is summarized below.

Pike River Mouth - This site is extremely sensitive environmentally, as evidenced by recent controversy over a proposed boat dock installment. It is also limited in land and water space available for marina development. It was decided that this location should be avoided, since it offers no significant advantages over Sites 4 or 5. Wave protection measures would be relatively expensive, since waves from all directions must be blocked.

Simmons Island Park Site - This park, located immediately north of the harbor, is fully developed and heavily used for passive recreation. The site appears to have little advantage over other shoreline areas, and the political and economic problems involved in a major change in use argue against marina development. Wave protection for a marina north of the existing jetties would be significantly more expensive than for Sites 4 and 5. The potential for sediment accumulation and shoaling problems is evidenced by the buildup of Simmons Island Park beach.

Harbor Turning Basin - The existing turning basin could be developed as a small marina. However, the 75-100 boat capacity is significantly less than that justified by demand figures and economic viability. Other disadvantages include:

- Conflict with existing port operations. A marina would eliminate the turning basin.
- Rough water problems related to existing harbor surge.
- Potential boat traffic congestion in the harbor. The inner harbor presently has almost 300 berths.

Corps of Engineers Diked Disposal Area - The diked disposal area was constructed by the Corps in 1975, to receive polluted dredged material from Kenosha and Racine Harbors. Later, disposal of material from Waukegan Harbor was considered. The facility consists of a 26-acre water area, protected by the Kenosha Harbor jetty on the north, and federal rubble mound breakwaters (crest elevation 13.5 feet LWD on the east face and 10 feet LWD on the south). Design capacity was estimated to be 750,000 cubic yards, to be filled by 1985; when filled and consolidated, the reclaimed land would be given to the city for recreational uses. The breakwaters were designed to contain all spoil material. Water is filtered prior to returning to the lake.

Through 1979 (50 percent of the design life), only 111,000 cubic yards had been deposited. All of the material was from Kenosha, resulting from two dredgings. It is apparent that the facility will not be filled by 1985.

The city of Kenosha has asked the Corps to consider development of a portion of the site as a small boat marina. The Corps has agreed to investigate the possibility of obtaining authorization for such use. If approval of this project were granted by the Corps, the Corps would likely reserve 30-50 percent of the site for future disposal operations.

The obvious advantage of this site is the existence of wave protection breakwaters. Development of 60 percent of the site (18-20 acres) would provide water area for 300-350 boats. Although some structural improvements would be necessary, the costs involved may be less, when compared to development of a marina from scratch. The major problem appears to be lack of land area available for support facilities. In addition, the legal questions related to transfer of the facility to a new purpose have not been resolved. Preliminary concepts for development have been included in this report.

Site Immediately South of Diked Disposal Site - The Corps of Engineers work to date has considered several harbor alternatives using the area adjacent to the disposal site. Principal advantages include existing wave protection from northeast waves and adequate adjoining land area (25 acres), in a relatively undeveloped condition. In addition, this site could be developed to accommodate 600-800 boats.

The Corps has considered offshore harbors, formed by breakwaters, and interior harbors, formed by lagoon and channel dredging. Preliminary calculation of benefits and costs indicates that a dredged marina will be more feasible due to the high cost of breakwater construction in deep water. However, a loss of adjoining land will result, thereby limiting facility size. Disposal of the dredged material is a potential problem, particularly since the area is an old sanitary landfill. A combination plan incorporating both breakwaters (in shallower water) and dredging has been considered. The potential for ultimate combined use of the diked disposal area and this site also has been considered.

Wisconsin Electric Site - This site, located just south of the Kenosha city limits, is currently owned by the power company. Originally, it was thought that purchase of the property might be possible. At present, however, the power company has indicated an intention of keeping the land. Even without this reluctance, this site may be environmentally unsound, since sand dunes are present.

Elimination of Sites 1, 2, 3, and 6 leaves Sites 4 and 5 for further investigation for potential marina development. Each of these sites is close to the downtown area and has the potential of adequate land nearby.

Facilities Development Criteria

Guidelines for development of water and land facilities are given below. Launching facilities and marinas are discussed as separate entities. It should be recognized that the criteria will vary slightly for the two sites (Sites 4 and 5).

Boat Launching Ramp - The launch ramp must be designed to facilitate convenient launching and retrieval of small craft. The following criteria should be met:

- Ramp slope should be 12 to 15 percent, to avoid both submerging car wheel hubs and hazardous inclines.
- The surface of the ramp should extend to a depth of three feet below extreme low water and an elevation of two feet above high water. The bottom of the ramp should terminate with a gravel shelf; the top should be rounded into the paved access road.
- Each ramp lane should be at least 12 feet wide; single lane ramps should be 15 feet wide.
- The ramp surface should be paved with concrete for durability. Precast concrete slabs are used for underwater sections, laid over a six-inch gravel bed. Deep grooves should be molded into the concrete surface. An alternate type of ramp that has been used successfully in quiet water areas involves the use of precast concrete planks (six inches by twelve inches by ramp width), placed three inches apart perpendicular to the slope. The gaps are then filled with coarse gravel.
- If wave action or currents are significant, riprap may be necessary along the submerged edge of the ramp.
- Consideration should be given to providing a courtesy dock adjacent to the ramps, for boarding and loading. These

piers should be three feet wide. A wide variety of types has been used, depending on the specific site. Floating docks have the advantage of maintaining a constant height above the water, but are generally more expensive than pile-anchored fixed piers.

- An area should be provided for wash-down of retrieved boats. Space for one car-trailer unit for each ramp lane is adequate. A turnout (waiting) area next to the ramp and an area available for meeting friends are items that may be included at particular launch facilities.
- Adequate parking and maneuvering space must be provided. Although local demand will determine parking requirements, generally 25 to 30 spaces per ramp lane for boat-trailer units (occupying one to one and one-half acres) will handle peak periods. Access to both ramps and parking facilities should be adequate to handle the expected peak traffic demands.
- Additional items which may be provided at launching facilities include fire prevention equipment, a restroom (for larger facilities), and lighting.
- An adequate channel and maneuvering area should be available offshore from the ramp. This will require the provision of suitable depths of water (four to five feet).

Marina - An efficient marina should be planned based on the following general criteria:

- Larger boats should be berthed near the harbor mouth, since they are less influenced by waves and require more maneuvering area. It is desirable to keep the larger boats away from the smaller craft docks.
- Launch ramps should also be kept separate from private dock facilities. If possible, launch areas should be near the harbor entrance. Boats using these facilities should not have to travel through the slip areas. Parking for the launch ramp should also be kept separate.

- Docks for transient boaters should be located in close proximity to the administration building, and with easy access to the harbor entrance.
- The best location for a boat fueling and sewage pump-out dock is near the entrance, so boats using this station will not travel through the dock areas.
- Parking facilities should be located so that boaters will not have to walk more than 500 feet to the head of the dock their boat is on. Parking lots for ancillary facilities should be adjacent to lots for the basin, so that overflow may be accommodated during peak periods.
- Water and electricity may be provided on the base docks, with outlets at each slip. Adequate lighting of the marina is also recommended. Telephones should be provided on the site in reasonable proximity to the berthing area.
- Centrally located restrooms and administration offices are normally provided.
- Repair shop or a maintenance yard may be considered.
- Guard or caretaker facilities.
- Restaurants, hotels, or concessions may be considered in the area surrounding the proposed marina.
- Walkways and gangways should be provided to facilitate easy pedestrian access to various site elements.

Alternative Boat Mooring Systems

The dock system to be used in any application is dependent upon the physical conditions of the site. At Kenosha, it is expected that wave conditions will be successfully moderated by the construction of protective barriers (e.g., breakwaters); however, ice and water level fluctuations can be severe. This section describes the different dock and mooring systems typically used, and summarizes the relevant factors involved in choosing a system.

The selection of an appropriate boat dock or berthing system involves detailed analysis of the site, the proposed layout, and the preference of the potential boat owners. The two primary functions of a dock system are to hold the boat safely while not in use and to provide easy access to the boat from shore. The most important factors involved in selecting and designing a dock system include:

- Size and number of boats to be moored in the marina, relative to the geometry and space available.
- Range of water levels at the dock site.
- Bottom and subbottom materials and strengths.
- Wave and current conditions within the marina basin.
- Ice conditions, particularly spring ice breakup.
- Other special site conditions such as location of breakwaters, seawalls, and bank protection.
- Operation and maintenance requirements.
- Financial limitations.

A basic choice exists between mooring boats at single point moorings or berthing them at docks. Any combination between these options is available.

Single Point Moorings

A single point mooring is simply an anchor with a chain (or rope) and a buoy, to which the boat is tied. The boat is free to swing with the wind or current. The primary advantages of single point moorings are low cost, flexibility, and ability to withstand moderate wave conditions. Boats may safely ride out waves up to 3 feet high on single point moorings.

The obvious disadvantages are inconvenience due to poor accessibility from shore and low boat per acre density (5-6 boats per acre) compared to dock systems (20-25 boats per acre).

At Kenosha, single point moorings would be recommended only as temporary berthing measures in areas where it is inappropriate to immediately install more permanent fixtures.

Fixed Piers and Docks

Fixed piers and docks may be constructed of a wide variety of materials (metal, timber, concrete). The basic concept normally includes piles driven into the bottom, supporting stringers, cross bracing, and decking. Construction materials are chosen based upon availability and low cost. In many cases, private clubs have done much of the work in installing the docks. Members knowledge and access to materials then dictate the type of dock.

There are no preconstructed fixed dock "systems" on the market today. Each installation must be custom designed, according to sound engineering practice. Adequate structural support and strength, and compatibility of construction materials are the critical design considerations. Special treatment of materials must be provided to ensure long life in the marine environment. The critical element for good long-term performance is the durability of construction materials in the local environment and adequate design of the anchor pilings.

Fixed docks should normally be positioned about 1 foot above expected design high water. Dimensions of the piers may vary, but base piers are usually 6 to 8 feet wide, and finger piers 3 or 4 feet wide. Larger piers serve larger boats, where lockers or other dock appurtenances may be desirable. In some cases, small finger piers (12 inches) used only for boarding may be adequate. Finger pier lengths are dependent upon the size of the boats to be moored.

Utilities and other appurtenances such as gangways, bridges, gas pumps, sewage pump-outs, firefighting equipment, and locker boxes can be provided on fixed piers. Water and electrical lines are normally located below the deck. Where covered berthing slips are desired, the piles may support a roof as well as the deck.

Advantages of fixed pier construction include generally lower cost, low maintenance (except as noted below), and long life if appropriate materials are selected. The major disadvantage is inconvenient boarding of boats if the water level varies more than 2 or 3 feet. In northern climates, ice may shear off piles or jack piles out of the bottom. Spring maintenance is significant if ice is a factor. A possible disadvantage is the generally less aesthetic appearance of pile supported docks. Fixed docks are also less flexible than floating piers.

For the marina development at Kenosha, fixed piers are not recommended due to lack of flexibility and inconvenience.

Floating Docks

The trend in recent years has been toward installation of floating dock systems. The biggest advantage of floating docks is that a constant distance is maintained between the water and the deck surface. Mooring, boarding, and loading of boats is more convenient when a constant elevation is maintained. For this reason, floating docks are desirable at locations where water level changes more than 2 or 3 feet. Variations of this magnitude or greater occur on the Great Lakes (seasonal, long-term, and storm). The recent emphasis on floating docks is thus understandable.

Another advantage of floating systems is the ease of repair, removal, or modification when modular sections are used. Most systems are designed so that removal of damaged units may be accomplished by two to three men without heavy equipment, facilitating repair or replacement of damaged sections. Easy storage of removable dock modules is an advantage although many installations are left in the water through the winter ice season. In general, floating docks have a more aesthetic appearance than fixed piers.

A wide variety of floating dock systems have been installed over the years. The degree of structural strength and overall sophistication necessary depends upon the installation site, the type of boats to be moored, and available funds. Lightweight systems are perfectly safe for small inland docks or marinas, whereas a major installation along the coast will require greater strength in the dock frame and anchoring system.

Anchorage Systems

Pile Anchors - Driven piles provide excellent stability. A sleeve loop or pile guide is provided for the dock, and the system rides up and down on the pile. The advantage of high stability is often outweighed by the expense of driving piles in deep water (greater than 20 feet) and the tendency for ice to jack or break the piles.

Spud Anchors - Spuds are basically steel or aluminum pipes that are dropped into the bottom. A sleeve or tube mounted on the dock frame allows the system to ride up and down on the spud. The spud must therefore extend above the dock to the elevation of high water. A variation of the spud system involves a telescoping system of 2 or 3 spuds. A capped sleeve 4 to 8 feet long is mounted on the dock, and the spud(s) "Telescope" to permit vertical movement. There is no extension of the spud above the dock system. In either system, the spud slowly works its way into the bottom, increasing the stability over time. The spud system is less costly to install or replace than driven piles. The spuds can be raised in winter to prevent ice damage. Spuds are particularly appropriate for sand or silt bottoms and for applications to smaller marina facilities.

Winch and Cable Anchors - This major anchorage system involves the use of cables to hold the dock system in place. The cables are anchored to the shore or the bottom and adjusted by winches on the dock to maintain the desired tension and position of the system. The specific means of anchoring the cables to the bottom include driven piles, concrete deadmen, or specially designed anchors. Anchoring to shore is usually less costly. Layout of cables varies with the specific dock layout and site conditions. Generally, only the base dock is anchored. Finger piers rely on the strength inherent in their frame for stability. Costs of winch/cable systems and spud systems are generally comparable. Cable systems perform well in ice installations. The cable may be slackened and the system allowed to move, thereby relieving ice induced stresses.

From the preliminary investigation of conditions at Kenosha, and from experience with current marina operating conditions throughout the Great Lakes, it is recommended that a heavy duty floating dock system with winch and cable anchorage be employed. Further soil and subsurface investigation of the bottom conditions would have to be undertaken prior to final design of the anchorage system.

Costs for floating dock systems vary widely with the quality and structure of the system required. However, as a guide, the cost of a fully installed, heavy duty system can be estimated by using $25 per square foot of dock area.

Alternative Marina Layouts

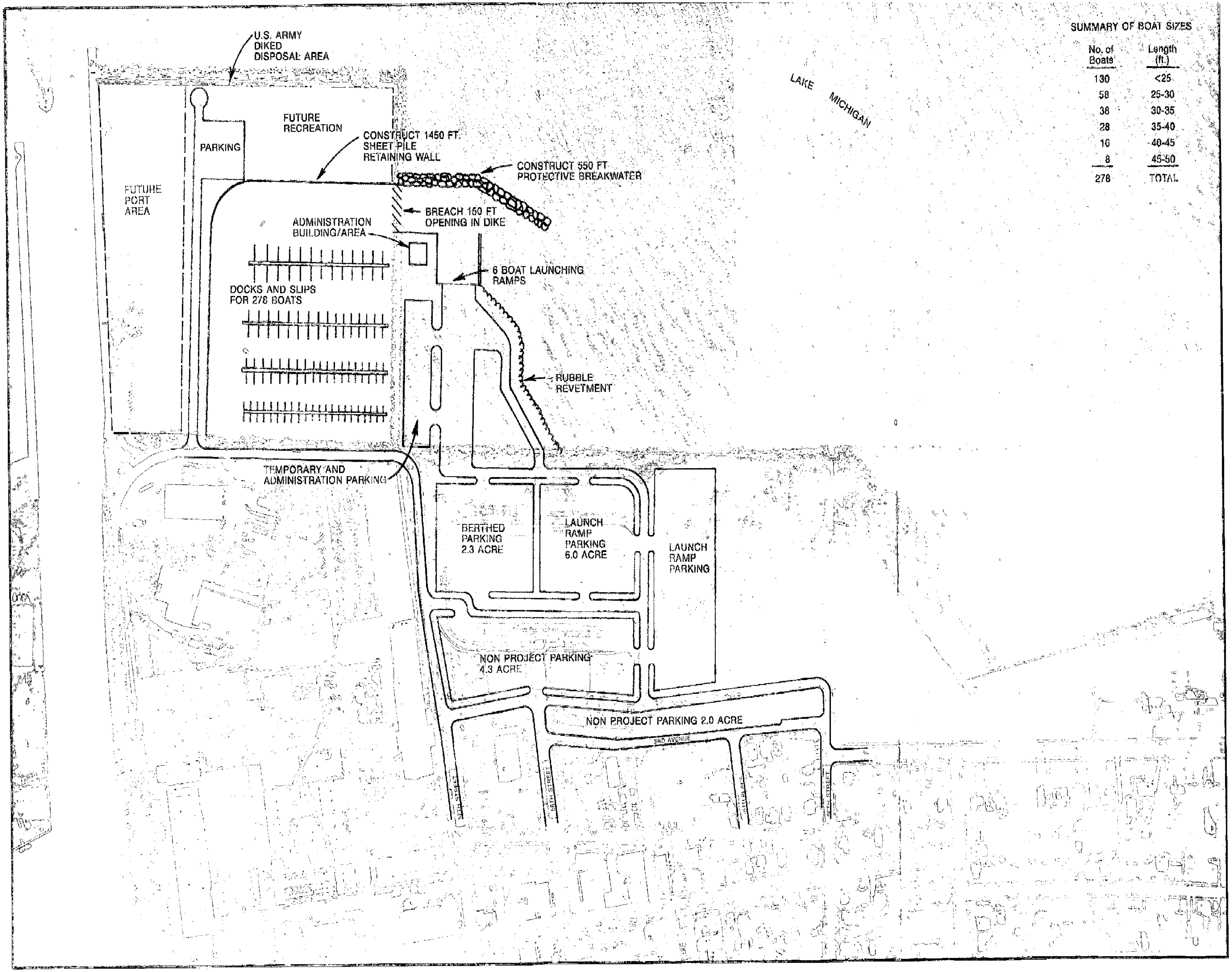
Use of the design criteria and information given above has been used in the development of the following marina layout alternatives. The objective of these alternatives is to provide marina facilities that will effectively utilize the two preferred sites of marina development; these being the Corps of Engineers diked disposal area, and the area of parkland immediately south of the dike.

Three primary alternatives for marina development in these areas have been proposed in accordance with the above conditions. Alternative 1, displayed on Figure IV-1, is for a 278-boat marina to be placed in much of the area now occupied by the diked disposal area. Alternative 2, displayed on Figure IV-2, will be a 612-boat marina situated in and offshore of the present parkland. Alternative 3, displayed on Figure IV-3, can be considered as an "ultimate" marina development which will provide moorage for 898 boats in a combined diked disposal area - parkland plan.

The alternatives presented in the figures and text given in this section do by no means represent the entire spectrum of potential layouts possible, or those examined in this study. Numerous other configurations for each site were examined and either refined into more feasible concepts, or discarded because of the availability of better concepts. The alternatives given herein represent the culmination of this development process and incorporate all the desirable features of many concepts. The alternatives presented are conceptual by nature. Some deviation from the layout and concepts presented might be expected during the detail design and specification of the marina.

A short discussion of each alternative, giving a description of its development, its features, and advantages and disadvantages follows.

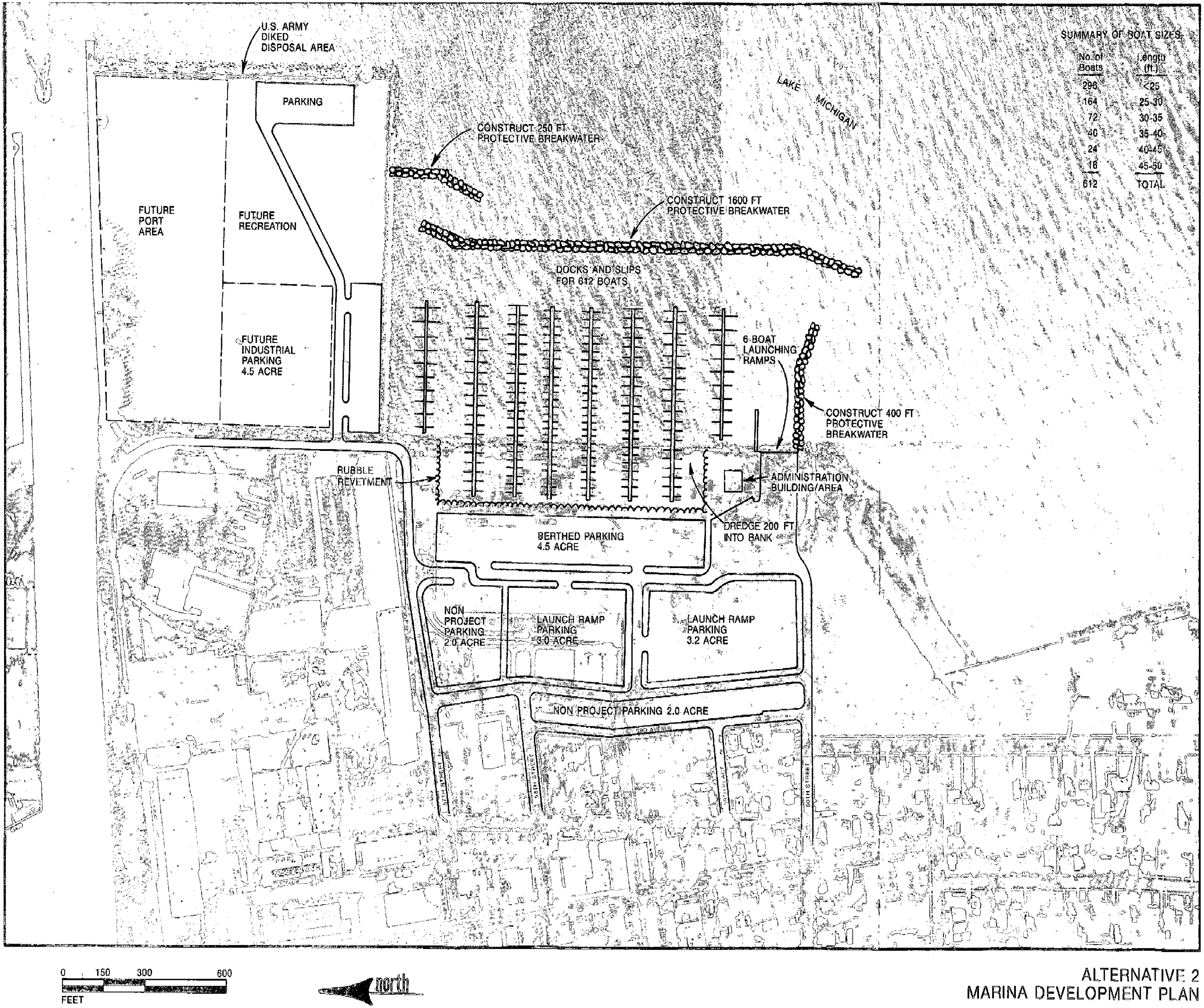
Alternative 1 - Diked Disposal Area - This alternative will accommodate 278 boats in the southwest corner of the diked disposal area, as shown on Figure IV-1. The primary objective of this plan is to utilize the existing wave protection structures formed by the diked



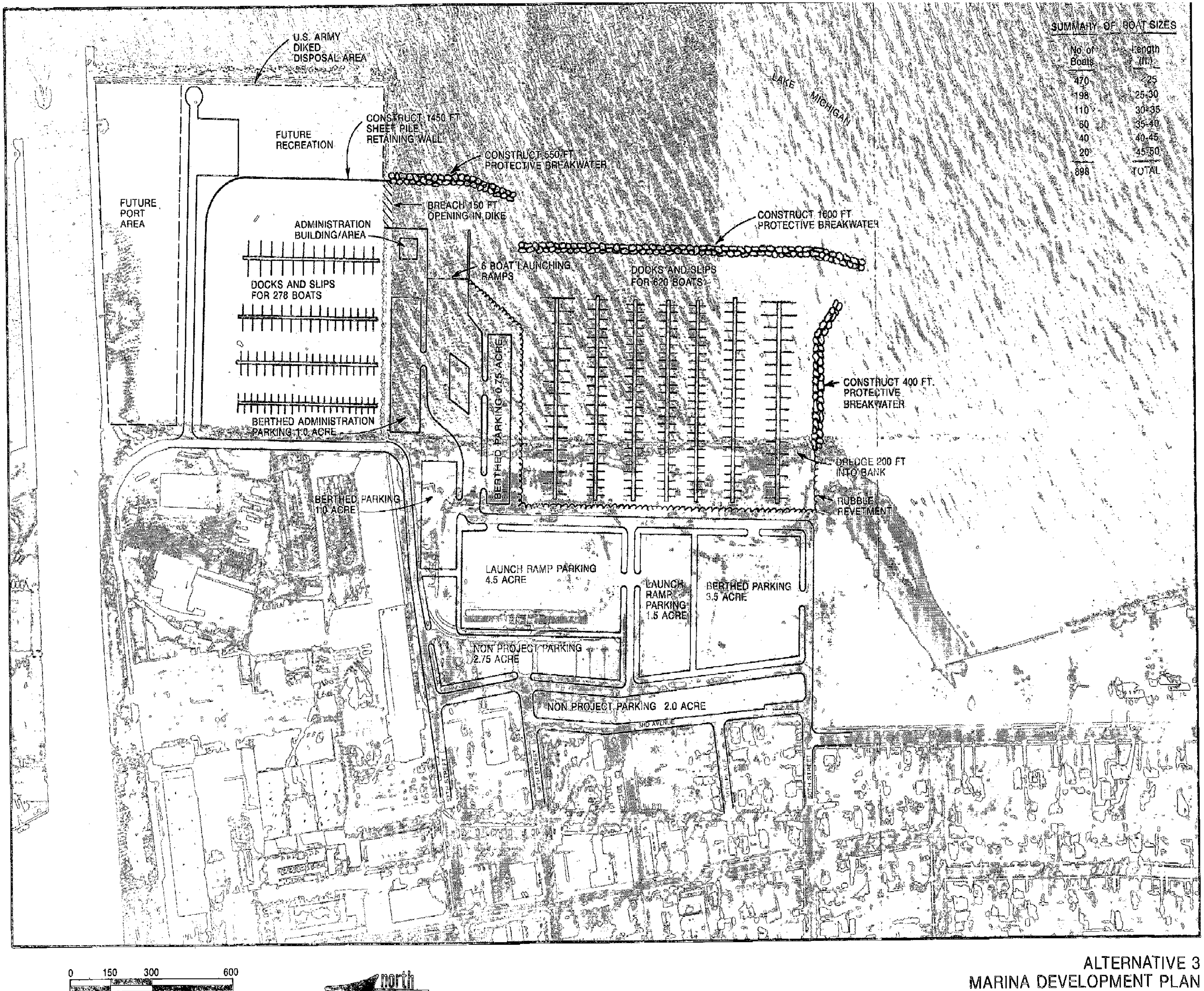
SUMMARY OF BOAT SIZES

No. of Boats	Length (ft.)
130	<25
58	25-30
38	30-35
28	35-40
16	40-45
8	45-50
278	TOTAL

ALTERNATIVE 1
MARINA DEVELOPMENT PLAN
Figure IV-1



ALTERNATIVE 2
MARINA DEVELOPMENT PLAN
Figure IV-2



ALTERNATIVE 3
MARINA DEVELOPMENT PLAN
Figure IV-3

area breakwaters. As previously stated, the disposal area is not currently being used to the extent of its original purpose. A reasonable, conservative estimate is that 50 to 60 percent of the disposal area capacity will not be filled by dredge spoils at the end of its design life (1985).

Discussion of the primary features of the alternative are given below:

- An internal retaining bulkhead will be constructed to separate the potential marina basin from the diked disposal area. Ideally, construction of this bulkhead should be in the shallowest possible water; however, the existing dredge material filters are located in the southeast corner of the dike at the outlet of dredging waters. A further limitation is the requirement that the docks extend from the south face (see discussion below). The configuration shown is compatible with these constraints and provides the required water and land areas. However, a significant length of wall, partly in deep water, is required.
- A 150-foot opening is to be breached in the south dike breakwater and a protective rubble mound wing breakwater will be constructed. For this element, a compromise between water depth requirements and construction cost of a deep water breakwater must be made. The opening is made in the south wall because it allows construction in shallow water and avoids direct exposure to the predominant wave attack from the northeast to southeast quadrant. The wing entrance breakwater will protect the basin opening, the administration "island," and the boat launching ramps.
- For the use of the diked disposal area as a marina, dredging of some deposited dredged material and of the lake bed will be required. Some of the 110,000 cubic yards of dredgings have settled over the entire disposal area. All this material must be removed and placed behind the proposed

retaining wall for environmental quality reasons. For a majority of the basin, water depths are greater than 8 feet below LWD. However, in the nearshore area, the bottom uniformly rises to the surface at the shore. The nearshore portion of the basin will be dredged at a uniform gradient between 6 feet below LWD at the shore and the 8-foot contour. No dredging below the 8-foot contour will be undertaken. Shallower draft boats will be moored in the nearshore area (6 feet below LWD), and larger boats will be moored offshore (natural depths up to 12 feet below LWD).

- An artificial "island" will be constructed as shown on the figure. The reason for construction of this island is the lack of available land space adjacent to any face of the dike. The dike is surrounded by water on three sides, and the American Motors Corporation owns the land on the west face up to the shore. The available land area of the park is separated and distant from the potential marina basin. The lone site access point on the southwest corner would lead to severe traffic problems. The island would contain the marina administration area, the launch ramps and some parking area in addition to providing access to the docks. The concept of this island has advantages of convenience and security, but construction would be expensive.
- The dock system, boat launch ramps, and car parking configuration of this alternative have all been set out in accordance with the criteria previously established in this section. The docks will extend northward from the south face of the dike with smaller boats moored nearshore and larger boats near the outlet. Six launch ramps will be provided together with courtesy docks, transient docks, and fuel and pump-out facilities.

- Vehicular access to the site will be accomplished using existing streets, and the proposed 3rd Avenue relocation. Site access will be from 57th, 58th, and 60th Streets and from 3rd Avenue.
- Parking will be provided in accordance with the previously cited criteria. Provisions will be made for 2.3 acres of berthed parking and 6.0 acres of launch lane parking. These facilities will be located adjacent to the artificial "island" to keep walking distances minimal. In addition, this alternative provides approximately 6.3 acres of non-project parking. These facilities will accommodate industrial and commercial parking needs in the downtown area. No costs have been assigned to the nonproject facilities.
- Provisions have been made to develop pedestrian walkway and planted green strips between the identified parking areas and the major vehicular arteries. By providing the perimeter green space the interior parking will be divided and broken visually. These same areas should accommodate pedestrian walkways. These facilities should be coordinated with pedestrian facilities in the downtown area.
- Boat repair facilities are not a part of this alternative. Land availability and access into the disposal area make locating these impractical. Location on the lakefront land is practical but without the construction of extensive wave protection facilities, boats could not be accommodated.
- The location of the marina on the dike disposal area does provide for some associated landside development. Upon completion of filling and consolidation of the remainder of the disposal area, this land could accommodate expansion of port facilities and, access and parking for a small lake-front park/overlook. Development potentials, either commercial or recreational, exist for the approximate 6 acres

of land south of the launch ramp parking and just north of Eichleman Park. This location is too far removed from the dike disposal site to be considered for added marina development.

- All major utility systems, electricity, sanitary sewer, and water are presently adjacent, on or close to the site. It will be necessary to relocate the 48-inch storm sewer outlet at the east end of 57th Street. This existing outlet is located at the site of the proposed artificial island.

Alternative 2 - Lakefront Park - This alternative will accommodate 612 boats in an area offshore from the park as shown on Figure IV-2. This alternative offers the overall advantage of having adequate water and land base for a large development. The major disadvantage for the site is the lack of protection from Lake Michigan waves. For the over 600-boat marina, an optimization of construction cost (i.e., minimum cost) was determined by considering trade-offs between the offshore location of protective breakwaters and the excavation of parkland for a marina basin. Total land area requirements were also considered in this process. The optimal plan features the nonprotective breakwater 600 feet offshore and land excavation extending 200 feet inshore.

Discussion of the primary features of the alternative are given below:

- Construction of three breakwater elements will be required to provide the required wave protection. Two entrances will be provided to the marina, as shown, to allow uncongested access to the lake or marina facilities, and to facilitate adequate water circulation within the basin.
- A significant feature of this alternative will be the bottom dredging and land excavation requirements. As with Alternative 1, the area of basin with water depths in excess of 8 feet below LWD will be left in its natural state. Bottom dredging will require a uniform gradient from the 8-foot contour to a depth of 6 feet below LWD at the natural shore. Excavation of a 1,000 foot long, 200-foot wide

strip of shore will be required as shown. This excavation will be to a depth of 6 feet below LWD. The present average land elevation of this area is 10 feet above LWD. As with Alternative 1, smaller boats will be moored nearshore and larger boats will be moored offshore. Bank protection and stabilization will be required along the new landside perimeter of the basin; this protection will be in the form of a rubble (riprap) revetment.

- The dock system, boat launch ramps, and parking facilities have again been established in accordance with the given development and design criteria. Docks will extend eastward from the shore as shown. Six launch ramps and courtesy docks will be provided at the south end of the development to avoid potential traffic conflicts and restrictions at the north end of the marina. It is advisable to provide the transient docks, fuel and pump-out facilities, and administration area in this region of the development as well.
- Vehicular access to the Lakefront Park site is provided via existing streets and avenues. Actual access onto the marina site will be from the proposed relocation of 3rd Avenue. Specific points of access will be 57th and 60th Streets.
- Significant acreage will be devoted to parking facilities, as shown on Figure IV-2. The 4.5 acres of berthed parking is ideally located adjacent to the slips. There is 6.2 acres devoted to launch lane parking and 4.0 acres held for nonproject parking. The nonproject parking located in two areas will aid industrial and commercial parking supply in the downtown area. No project costs have been assigned to the nonproject facilities.
- The vastness of the parking areas will be separated and broken by perimeter green strips. It is envisioned these areas would be extensively planted to provide relief and introduce a more "human" scale to the marina area. These

same areas could also accommodate pedestrian walkways which could unify and encourage pedestrian traffic from the downtown to the waterfront.

- Boat repair facilities were not considered as available, protected waterfront land could not logically be diverted from project use to accommodate this activity. Such facilities would be desirable but land constraints and vehicular access and congestion are major developmental problems.
- Associated development relating to the Lakefront site alternative will be confined to utilization of the dike disposal site upon its availability. All other available land is being utilized. Allocation of the completed dike disposal site is as follows: 1.5 acres - berthed parking; 4.5 acres - industrial parking; 9.0 acres - lakefront recreational area, and the remaining area for port expansion.
- The Lakefront Park site presently has all major utility, electric, sanitary sewer, and water, available adjacent on site. The 57th Street storm sewer outlet should be extended to beyond the perimeter of the marina basin if its function as a combined sewer outlet is to continue. If the outlet conveys only storm water runoff, it can remain as is, and would aid marina basin flushing although sedimentation in the basin would increase.
- The construction of the protective breakwaters should be conducted in one work effort. However, if financial or time restrictions limit the complete implementation of this alternative to be a staged form of development, it is recommended that the dock system and its corresponding land support facilities (parking) be added to the marina in component units. The water area not in use during this development could be used as temporary single point mooring sites.

Alternative 3 - Combined Development - This alternative as displayed on Figure IV-3 is one option for the ultimate development of an approximately 900-boat marina. This particular configuration will berth 898 boats. The alternative is simply a combination of Alternatives 1 and 2 with minor modifications to facilitate the blending of these two plans. Features of the individual components of the alternative are identical to those discussed in Alternatives 1 and 2.

Alternative 3 obviously lends itself to a staged type of development. The direction of development, that is from Alternative 1 to 2 vice versa will be dependent on financial and political considerations. Technically, either direction is feasible. However, if this alternative embodies the ultimate goal of development, a decision to this effect should be made at the inception of the project to ensure ultimate compatibility of all development elements.

Consideration of maintenance dredging requirements has been incorporated in each of the harbor alternatives. Due to the lack of sediment sources in the vicinity of either basin, minimal maintenance dredging is anticipated. Continued discharge of the 57th Street sewer will slightly increase sedimentation and therefore future dredging requirements. Consideration of maintenance dredging costs is included in annual operation and maintenance costs.

Flexible ramp gangways from the bulkhead to the dock, lighting of both the docks and parking areas, the provision of a boat hoist in the administration area, and extensive landscaping of the land area is incorporated into each alternative. It is envisaged that the berth and launch ramps parking areas will be used as dry storage area for boats during winter.

Preliminary Breakwater Design

All of the above alternatives require construction of breakwater sections. Because these structures contribute significantly to the overall costs of each alternative, a preliminary design of these structures has been undertaken in this study. The breakwaters will be of rubble mound construction with bank slopes of 1 in 1.5. The primary controlling element for these structures is the depth of water in which they will rest as water depth controls the wave height for waves impacting upon the structures. The following procedure was adopted in the preliminary design of the breakwaters.

1. Determination of water depth. The location of the breakwaters from Figures IV-1, 2 and 3, set the depth of water below LWD. In addition from Figure II-4, and the design criteria outlined in Section II (20-year frequency, full-year event) the water depth for which the structure is to be designed is determined.
2. Determination of design wave height. From Figure II-5, the design wave height for which the breakwater is to be designed is determined.
3. The crest elevation of the breakwater. The crest elevation must be such that the design wave will transmit a wave less the 1 foot in height beyond the breakwater. Wave transmission versus structure height data is given in Reference 14.
4. Armor stone size. Determination of the armor stone size is by the procedure outlined in Reference 15.
5. Crest width. The breakwater crest width can be determined by procedures outlined in Reference 15. The overall geometry of the breakwater is governed by the distance from the lake bed to the crest, the crest width, and breakwater bank slopes of 1 in 1.5.

The overall design conditions and geometry of the breakwaters for the three alternatives is given in Table IV-1. Construction cost of breakwater is based on $60 per cubic yard of breakwater volume.

TABLE IV-1

PRELIMINARY BREAKWATER DESIGN

Alternative	Structure	Design (ft) Water Depth	Design (ft) Wave Height	Structure (ft) Height	Armor Stone Size (Diameter ft)	Crest (ft) Width	Volume (yd^3/ft) Per Unit Length
1	Wing breakwater	12.5	11.5	23.0	6	15	40.7
2	Wing Breakwater	13.0	11.5	22.5	6	15	42.2
	Offshore Breakwater	11.0	10.5	20.5	5	15	34.7
	Tie-back Breakwater	9.0	9.5	15.0	4	10	18.0
3	(As for Alternative 2)						

Source: Stanley Consultants, Inc.

SECTION V
OTHER WATERFRONT DEVELOPMENT

Introduction

As noted in Section I, the goals of this study include identification of both marina and port development opportunities, and associated commercial development and redevelopment. This section addresses the potential and feasibility of port improvements and probable commercial development associated with both port and marina.

Port Improvements

Summary of Market Implications - The market analysis in Section III indicates significant potential for expansion of port activity, primarily along the commodity classes now handled at the facility. While this potential market would require some expansion of facilities, two points should be borne in mind. First, the expansion in cargo volumes indicated in Table III-3 will not happen overnight, even with the provision of unlimited physical improvements. Unlike the marina development potential, which represents a clear excess demand at current prices, the port's cargo and revenue volumes will increase in steps, and the improvements specified below will be subject to significant phasing considerations. Second, the precise nature of improvements required at the port will depend on the particulars of new business volumes. The set of improvements set forth herein was derived based on potential market and physical (site) constraints. Locations and sizes of facilities will require detailing based on specific cargo prospects at the time of implementation.

Port Operations and Site Constraints - Examination of the water and land facilities at the port indicates that the former pose few if any operational problems for the port. Channel and turning basin configuration are adequate for freighters of up to 600 feet, which include the majority of Great Lakes general cargo vessels. Larger vessels can be turned with tug assistance in the lake and backed into the shipping channel. Channel width is adequate for simultaneous docking at the north and south wharfs. Although some Great Lakes bulk carriers would have difficulty navigating at the facility, the market for bulk commodities is limited. In summary, major expansions of the channel, or turning basin do not seem warranted based on market potential.

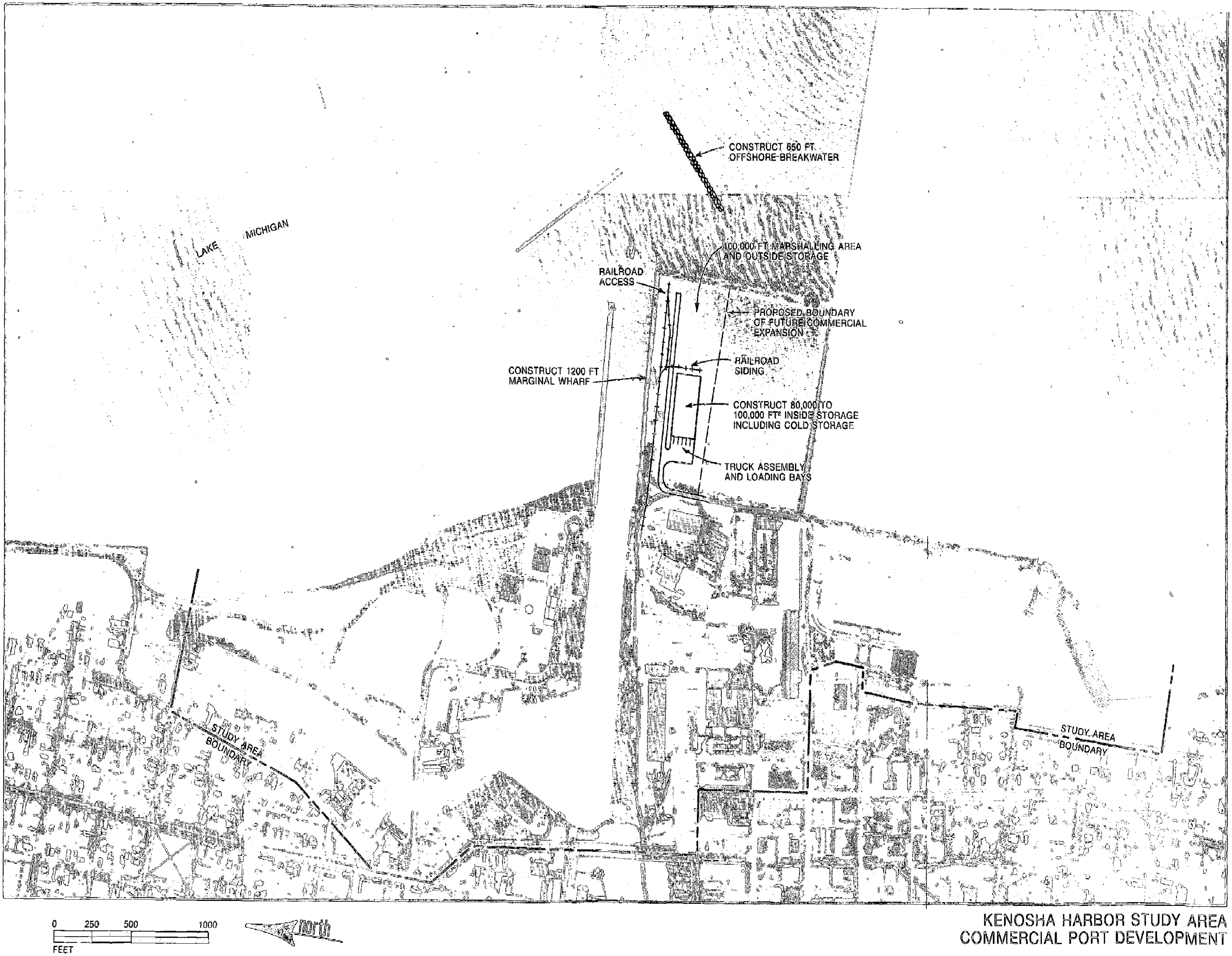
The single significant "waterside" problem found in our investigation is that southeast wind and wave conditions generate heavy turbulence within the channel and turning basin. This turbulence has caused the sinking of recreational craft near the sailboat slips and problems for commercial shipping at dockside. The potential clearly exists for serious damage to both ship and dock structures.

Two methods of reducing this turbulence have been identified. The most obvious, direct, and effective method would be an additional breakwater oriented northeast-southwest, and located just east of the existing breakwater as indicated on Figure V-1. Since complete protection of the channel entrance would require ships to turn when entering the channel, the breakwater would terminate at the projection of the channel.

This breakwater would be approximately 650 feet in length and would be in about 27 feet of water. These design parameters yield a preliminary construction cost estimate of $1.9 million.

An economic analysis of this structure, using a 50-year design life and the Federal Water Resources Council discount rate of 7 1/8 percent, indicates that average annual damage prevention would have to be approximately $140,000 in order to justify this structure. While existing data do not indicate this level of damage, the statistical basis for this assessment is somewhat weak.

Since a detailed assessment of the damage prevention value of such a structure would be conducted during a Corps of Engineers study, it is suggested that this improvement be submitted for evaluation and funding under the Corp's Navigation Improvements Program.



KENOSHA HARBOR STUDY AREA
COMMERCIAL PORT DEVELOPMENT

Figure V-1

A second alternative for reducing turbulence would consist of placement of energy absorption media in the western corner of the turning basin. Such media could consist of either large riprap or concrete structures called "igloo's." Approximately 1,400 linear feet of either would be required. Such structures would dissipate approximately 50-60 percent of wave energy, and reduce consequent reinforcement, and turbulence significantly in the inner harbor and turning basin. This option, however, would not be as effective as the breakwater in reducing wave action in the channel.

Preliminary cost estimates for these options are $500,000 for riprap and $650,000 for igloos. Once again, a 50-year design life and 7 1/8 percent discount rate were used to calculate breakeven annual damage prevention. These figures are $36,800 per year for the riprap construction and $47,840 for the igloo system.

Since the smaller recreational craft are more susceptible to damage from inner harbor turbulence, such damage prevention figures appear to indicate the economic feasibility of some wave absorbing medium. This option should be pursued only after a breakwater has been conclusively ruled out, however, and should be investigated with a mathematical or hydraulic model of wave action prior to choice of a system.

Landside Constraints to Port Operation - It is apparent from inspection of the port's landside facilities and operating area that a shortage of space poses a serious obstacle to major expansion. The major operating area on the southern side of the channel is between the AMC plant, diked disposal area, and channel. The open and covered storage areas on the northern side are also constrained from expansion by the water plant and yacht club.

Covered and cold storage space are also at capacity with existing cargo volumes.

Potential Improvements

Since lack of land is the constraining factor in port volumes (with the existing cargo mix) any major expansion will require creation of land in the existing diked disposal area.

Based on our marina alternatives, and the location of the port facilities, the logical portion of the diked disposal area for port use is a strip along the channel. Based on discussions with Morelli Overseas Export Company, a development scheme has been identified which would allow for expansion of dockage, covered storage, cold storage, and open storage areas. This development scheme, as indicated on Figure V-1, would utilize about nine acres of the approximately 26-acre interior area of the diked spoil disposal area.

This development would be consistent with any of our three marina alternatives, and would actually be most compatible with the implementation of Alternate 1 or Alternate 3 (via immediate construction of an interior retaining wall).

A preliminary construction cost estimate for these improvements is presented in Table V-1.

Based on a 15-year borrowing at a typical corporate rate of 15 percent, this investment would be required to generate a little over $1,000,000 per year in net operating revenue and tax savings in order to be economically viable. This range of volume is marginal in light of existing revenues and (market) potential business volumes. It is emphasized however, that the economics of this investment call for more detailed estimates of volumes and costs at a time closer to implementation. It is also noted that the use of industrial revenue bonds could substantially reduce net operating revenue requirements. (An interest rate of 8 percent at 15 years would result in a decrease of over 30 percent in net operating revenue required vis-à-vis the hypothetical corporate financing.)

It is emphasized that the location of the diked material area makes its (land areas) ultimate use for port purposes seem the most productive option. Even if no major facilities were built, the use of the land area indicated for open storage and marshalling would doubtless improve the capacity and efficiency of the port operation.

TABLE V-1

IMPROVEMENTS - CAPITAL COST ESTIMATE

Item	Quantity	Unit Cost($)	Cost
Wharf	9,200 yd^2	$ 30/yd^2	$ 276,000
Railroad - Track	1,900 ft	70/ft	133,000
- Switch	4	10,000	40,000
- Crossing	2	10,000	20,000
- Signaling	Miscellaneous	20,000	20,000
Access Road	1,200 ft	30/ft	36,000
Building - Covered Storage	80,000 ft^2	35/ft^2	2,800,000
- Cold Storage	20,000 ft^2	75/ft^2	1,500,000
Truck Loading Bay Area	2,500 yd^2	12/yd^2	30,000
Open Marshalling Area	9,000 yd^2	5/yd^2	45,000
Cargo Handling Equipment (Estimate)	Miscellaneous	100,000	100,000
Miscellaneous Services	--	40,000	40,000
TOTAL			$5,040,000
Plus 25 Percent for Undeveloped Details, Engineering and Design			$1,260,000
TOTAL Construction Cost			$6,300,000

Source: Stanley Consultants, Inc.

Related Commercial Development

Marina Related Development - The development of recreational boat facilities at either the diked disposal or Lakefront Park sites will have some potential to encourage development of general commercial activities. Given the development of a major marina complex, limited additional accommodation, eating, and retail facilities are conceivable in the business district (CBD). Quantification of new business demand has not been undertaken for two principal reasons. First the 5- to 7-year time lag for development of the marina facility and its associated demand and second, the realization that development of these types of commercial facilities should be incorporated into a broader scope of development. Marina input and demand must be incorporated into the downtown study currently in progress for Kenosha.

Other commercial activities generated as a result of marina development are specifically boat related. These activities include boat repair, sales, and boat storage. Specific site allocations for these facilities were not made, since significant private sector input will be required for these location decisions.

Improvements on Vacant Land - As discussed in the Existing Land Use Section, there is very little unused land within the designated study area. Only two parcels were identified as vacant, one on 50th Street adjacent to the bridge and the second a residential lot on 50th Street across from Simmons Island Park.

50th Street Bridge - Concern has been expressed locally as to the future of the 50th Street Bridge. The structural condition requires either abandonment or replacement. An analysis of traffic data for this facility indicates that abandonment of this link would cause severe traffic problems on the one remaining link to the park. On this basis, it is recommended that the bridge be replaced. It is not felt, however that there is sufficient water traffic to justify an elevated or swing span to accommodate sailboats. If the decision is made locally to replace the bridge, consideration must be given to providing at least the vertical (water to deck) clearance of the existing bridge so as to not hinder boat traffic into the inner harbor area.

SECTION VI

DETAILED EVALUATION OF DEVELOPMENT OPTIONS

Marina Financial Analysis

The basic criterion for determining the feasibility of any of the marina concepts investigated herein is one of financial self sufficiency. This principle was established by the city during the early stages of study, and implies that any marina developed should be able to operate on a self sustaining basis, without any subsidy from the city's general fund. Thus, the basic tool used to analyze financial feasibility of the marina concepts developed in the previous section is a cash flow and revenue requirements analysis. These analyses are based on estimated construction and operating costs for each marina option, and also reflect assumptions regarding the costs of capital and probable operating costs escalation rates.

Cost Estimates

Tables VI-1 through VI-3 present detailed capital cost estimates for each of the three marina alternates retained after preliminary screening. In addition to the total capital costs estimated for each alternate, assumptions on federal and state financial participation are included. The federal participation would be administered by the Corps of Engineers under the "small boat harbor" program. In general, this program will fund up to 50 percent of capital line items associated with improving the navigational features of a harbor. On this basis, Corps of Engineers participation has been assumed for breakwaters and navigation dredging elements.

A state grant program administered by the Division of Natural Resources will provide funding for up to one-half of the remaining costs of any other capital item exclusive of dockage facilities. On this basis, the state grants indicated were calculated for each of the three marina alternatives.

TABLE VI-1

CONSTRUCTION COST ESTIMATE - ALTERNATIVE 1

Item	Quantity	Unit Cost	Total Cost x 10^3	Federal Share	State Share	Local Share
Water						
Bulkhead						
South	600'	$ 880	528	264	132	132
East Face	450'	560	252	126	63	63
Corner	315'	880	277	138	70	70
Basin Dredge	17,700 yd^3	5/yd^3	89	--	45	45
Breach Opening	150' @ 12' dp	525/ft	79	40	20	20
Wing Breakwater	550'	2,440/ft	1,342	671	336	336
"Island" Fill	97,000	6/yd^3	582	--	291	291
Rubble Riprap	600'	140/ft	84	--	42	42
Launch Ramps	6	30,000	180	--	90	90
Boat Docks	18,600 ft^2	25/ft^2	465	--	--	465
			3,878	1,239	1,089	1,554
Land						
Parking	6 acres	10/yd^2	290	--	145	145
Roads	1,250'	27/ft	34	--	--	34
Administration Building	1,000 ft^2	80/ft^2	80	--	--	80
Utilities and Landscape	1	80,000	80	--	--	80
			484		145	339
TOTAL			4,362	1,239	1,234	1,893
Contingencies, Undeveloped Design Detail, and Engineering and Design = 25%				1,549	1,543	2,366

Source: Stanley Consultants, Inc.

TABLE VI-2

CONSTRUCTION COST ESTIMATE - ALTERNATIVE 2

Item	Quantity	Unit Cost	Total Cost x 10^3	Federal Share	State Share	Local Share
Water						
Ramp Bulkhead	100'	$ 400/ft	40	20	10	10
Dredge Basin	40,960 yd^3	5/yd^3	205	103	51	51
Excavate Land	119,000 yd^3	2.50/yd^3	298	--	149	149
Wing Breakwater	450 ft	2,530/ft	1,139	569	285	285
Offshore Breakwater	1,250'	2,080/ft	2,600	1,300	650	650
Tie-back Breakwater	400'	1,080/ft	432	216	108	108
Launch Ramps	6	30,000	180	--	90	90
Boat Docks	39,800 ft^2	25/ft^2	995	--	--	995
Shore Revetment	1,400'	140/ft	196	--	98	98
			6,085	2,208	1,441	2,436
Land						
Parking	8 acres	10/yd^2	387	--	194	194
Roads	1,650'	27/ft	45	--	--	45
Administration Building	1,000 ft^2	80/ft^2	80	--	--	80
Utilities and Landscape	1	80,000	80	--	--	80
			592	--	194	399
TOTAL			6,677	2,208	1,635	2,835
Contingencies, Undeveloped Design Detail, and Engineering and Design = 25%				2,760	2,044	3,544

Source: Stanley Consultants, Inc.

TABLE VI-3

CONSTRUCTION COST ESTIMATE - ALTERNATIVE 3

Item	Quantity	Unit Cost	Total Cost x 10^3	Federal Share	State Share	Local Share
Water						
Bulkhead						
East	450'	$ 880/ft	396	198	99	99
South	600'	560/ft	336	168	84	84
Corner	315'	880/ft	277	139	69	69
Launch	100'	400/ft	40	20	10	10
Dredge Dike Area	17,750 yd^3	5/yd^3	89	45	22	22
Dredge Out Basin	40,960 yd^3	5/yd^3	205	103	51	51
Excavate	130,400 yd^3	2.50/yd^3	326	--	163	163
Wing Breakwater	250 ft	2,530/ft	633	317	158	158
Offshore Breakwater	1,600 ft	2,080/ft	3,328	1,664	832	832
Tie-back Breakwater	400 ft	1,080/ft	432	216	108	108
Breach Dike	150 ft	525/ft	79	39	20	20
Rubble Revet	550'	140/ft	77	--	39	38
Island Fill	97,000	6/yd^3	582	--	291	291
Ramps	6	30,000	180	--	90	90
Boat Dock Dike	18,600 ft^2	25/ft^2	465	--	--	465
Boat Dock Out	56,500 ft^2	25/ft^2	1,413	--	--	1,413
Rubble Seawall	1,500'	140/ft	210	--	105	105
			9,068	2,909	2,141	4,018
Land						
Parking	10.9 acres	10/yd^2	528	--	264	264
Roads	2,000'	27/ft	54	--	--	54
Administration Building	1,000 ft^2	80/ft^2	80	--	--	80
Utilities and Landscape	1	80,000	80	--	--	80
			742	--	264	478
TOTAL			9,810	2,909	2,405	4,496
Contingencies, Undeveloped Design Detail, and Engineering and Design = 25%			12,263	3,636	3,006	5,620

Source: Stanley Consultants, Inc.

In addition to these capital costs, operating and maintenance costs were estimated for each of the three alternatives as presented in Table IV-4. Preliminary economic analysis based on a 20-year capital lifetime at an interest rate of 10 percent indicated annual average per boat costs as indicated below.

Alternate No.	Total Annualized Cost	Number of Berthed Boats	Average Annual Cost Per Boat
1	$327,900	278	$1,180
2	516,277	612	844
3	782,123	898	871

These annual average per unit costs are based strictly on the cost and number of slips available in each of the marina alternates. No consideration was given to existing costs and slip availability for this preliminary analysis. Based on this preliminary analysis, it is evident that Alternatives 2 and 3 are relatively cost effective in comparison to the smaller marina under Alternative 1. Since these two marina alternatives are roughly equivalent in terms of average annual cost per boat, it was elected to prepare detailed financing and cash flow analysis for Alternative 2 only.

Financing, Cash Flow, and Revenue Requirements

Even though the new marina is analyzed on the basis of financial self sufficiency, this does not imply that revenue bonds can be utilized for the financing of these improvements. Even in the best of financial times, the uncertainties and risks associated with marina operation have typically precluded their financing through the use of revenue bonds. Thus, a general obligation bond (or portion of a larger issue) will be required for long-term financing of the capital costs of these facilities. The local share of the capital costs for Alternate 3, is slightly over $5 million. Based on discussions with the city's comptroller, this amount is well within the city's remaining general obligation bonding capacity.

In addition to long-term financing, all of the financing and cash flow analyses presented herein assume the issuance of short-term

TABLE VI-4

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

Item	Number of Boats		
	278	612	898
Labor Costs (salaries and benefits)			
Harbor Master[1]	$ 12,000	$ 24,000	$ 24,000
Assistant; 4 man months at $750[2]	3,000	6,000	6,000
Maintenance (one-half time)	--	3,000	3,000
Spring Task Force; 4 Men - 5 Days at $25	500	1,000	1,000
Expenses			
Utilities	8,000	12,000	15,000
Miscellaneous Supplies and Equipment	2,000	4,000	6,000
Periodic Minor Repairs (Average Annual) (Parking Lot, Docks, Utilities, Navigation Aids)	4,000	7,000	10,000
Periodic Dredging Allowance	7,000	20,000	25,000
Operational Services, Including Insurance	5,000	8,000	10,000
Allowance for Major Dock or Facility Repairs (Contingency)	8,500	15,000	22,000
TOTAL	$ 50,000	$100,000	$122,000

[1]For 278 - 6 months @ $2,000; for 612 - full-time, for 898 - full-time.

[2]For 278 - one-half time, for 612 and 898 - full-time.

Note: Assumes city will operate marina.

Source: Stanley Consultants, Inc.

financing to cover the roughly three years that would be required for final design and construction of the proposed marina.

The development timetable assumed for these financial analyses is set forth in the table below.

TABLE VI-5

DEVELOPMENT TIMETABLE

Milestone	Date(s)
Decision on marina concept	December, 1980
File final grant applications	January, 1982
Final design and specifications	January, 1982-December, 1983
Issue short-term financing	January, 1984
Start construction	January, 1985
Complete construction	December, 1986
Issue long-term financing	December, 1986

Source: Stanley Consultants, Inc.

Table VI-6 sets forth cash flow, financial analyses, and resulting revenue requirements on an annual basis for years 1983 through 1987 and at 5-year intervals thereafter based on financing Option 1. This financing option assumes the following parameters:

- A short-term borrowing rate of 9 percent per year.
- An interest rate on invested funds of 8.5 percent per year.
- A long-term borrowing rate of 10 percent per year and a maturity of 20 years. (It is noted that the 20-year maturity associated with the long-term issue is the maximum allowable under federal law for a general obligation bond of the type that will be utilized for this financing.)

Under Financing Option 1, it is assumed that the short-term financing is issued in an amount exactly equal to the construction costs. Construction disbursement scheduling assumes that 10 percent of the total local share would be spent during calendar year 1984 (basically for final design and specification preparation). The remaining 90 percent of the total local share is assumed to be split

TABLE VI-6

FINANCING, CASH FLOW, AND REVENUE REQUIREMENTS
KENOSHA HARBOR - MARINA IMPROVEMENTS
ALTERNATIVE 2 - FINANCING OPTION 1

Item	Calendar Year ($)							
	1983	1984	1985	1986	1987	1992	1997	2002
Capital Accounts								
Starting Balance	--	--	3,475,778	2,108,640				
Transfer from Operating Accounts	--	--	--					
Short-Term Financing Proceeds	--	3,544,000	--	--				
Long-Term Financing Proceeds	--	--		2,918,705				
Total Sources	--	3,544,000	3,475,778	5,027,345				
Construction Disbursements	--	354,400	1,594,800	1,594,800				
Short-Term Financing Repayment	--	--	--	3,544,000				
Total Uses	--	354,400	1,594,800	5,138,800				
Average Balance	--	3,366,800	2,678,378	1,311,240				
Interest Income	--	286,178	227,662	111,455				
Ending Balance	--	3,475,778	2,108,640	--				
Operating Accounts								
Operating and Maintenance Costs								
Existing Operations	87,230	95,953	105,548	116,103	127,713	205,683	331,255	533,489
Proposed Operations	--	--	--	--	161,050	259,372	417,722	672,746
Total	87,230	95,953	105,548	116,103	288,763	465,055	748,977	1,206,235
Debt Service and Interest Costs				--	--	--	--	--
Existing Issue	56,075	56,075	56,075	56,075	56,075	--	--	--
Proposed Issue	--	--	--	--	342,830	342,830	342,830	342,830
Short-Term Interest	--	318,960	318,960	318,960	--			
Total Revenue Requirements	143,305	470,988	480,583	491,138	687,668	807,885	1,091,807	1,549,065

Source: Stanley Consultants, Inc.

equally between calendar years 1985 and 1986. Financing Option 1 also assumes that short-term interest associated with the $3.5 million note would be paid out of operating accounts. While this has the advantage of lowering the required amounts of both short- and long-term financing, it would impose an almost immediate and heavy burden in terms of current revenue requirements in calendar years 1984 and 1985. Under this scheme, only $2.9 million of long-term financing would be required, but the short-term interest burden during 1984 and 1985 would be close to $319,000 per year.

The operating account portion of this cash flow assumes an annual inflation rate of 10 percent in unit costs applied to calendar year 1980 budget figures for the existing marina operations and an estimated $100,000 per year for operation of the new facility. The most important results of this financing and cash flow analysis are that the total revenue requirement indicated for the first full year of operation of the new marina facility are indicative of a generally feasible financial situation. The annual revenue requirement in this year of just under $690,000 represents an average per slip cost of about $890 for the combined existing and proposed marina operations.

The financing and cash flow analysis presented in Table VI-7 (Option 2) was conducted to reflect the situation in which the amount of short-term financing was increased, in order to lessen the impact of short-term interest costs on revenue requirements in calendar years 1984 and 1985. Like Option 1, this analysis reflects a short-term borrowing rate of 9 percent, an investments rate of 8.5 percent, and a long-term rate of 10 percent. Under this option, the short-term note would be issued near the beginning of 1984 in the amount of $4,000,000. This effectively includes prepaid interest for the proposed 3-year term of the note of slightly over $1,000,000. Under this option, a long-term financing of $4.36 million would be required near the end of calendar year 1986. While this option allows much lower revenue requirements during 1984 and 1985, it does result in a slightly higher revenue requirement for the initial year of facility operation, (and in all subsequent years) due to the higher amount of long-term

TABLE VI-7

FINANCING, CASH FLOW, AND REVENUE REQUIREMENTS
KENOSHA HARBOR - MARINA IMPROVEMENTS
ALTERNATIVE 2 - FINANCING OPTION 2

Item	Calendar Year ($) 1983	1984	1985	1986	1987	1992	1997	2002
Capital Accounts								
Starting Balance	--	--	3,595,238	1,862,954				
Transfer from Operating Accounts	--	--	--	--				
Short-Term Financing Proceeds	--	4,000,000	--	--				
Long-Term Financing Proceeds	--	--	--	4,072,671				
Total Sources	--	4,000,000	3,595,238	5,875,625				
Construction Disbursements	--	354,400	1,594,800	1,594,800				
Short-Term Financing Repayment	--	360,000	360,000	4,360,000				
Total Uses	--	714,400	1,954,800	5,954,800				
Average Balance	--	3,642,800	2,617,858	931,477				
Interest Income	--	309,638	222,516	79,175				
Ending Balance	--	3,595,238	1,862,954	--				
Operating Accounts								
Operating and Maintenance Costs								
Existing Operations	87,230	95,953	105,548	116,103	127,713	205,685	331,255	533,489
Proposed Operations	--	--	--		161,050	259,372	417,722	672,746
Total	87,230	95,953	105,548	116,103	288,763	465,055	748,977	1,206,235
Debt Service and Interest Costs								
Existing Issue	56,075	56,075	56,075	56,075	56,075	--	--	--
Proposed Issue					471,327	471,327	471,327	471,327
Short-Term Interest	--	--	--	--	--	--	--	--
Total Revenue Requirements	143,305	152,028	161,623	172,178	816,165	936,382	1,220,304	1,677,562

Source: Stanley Consultants, Inc.

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borrowing. The revenue requirement for calendar year 1987 would be approximately $816,000, which would represent an average per slip cost of over $1,050 based on the combined existing and proposed marina operations. Results for the latter years in this revenue requirements analysis indicate that while the capital expenditure associated with the proposed 604-boat marina is large in the context of existing marina investments, the continued inflation and operation and maintenance costs would result in their exceeding the capital costs burden in the early 90's.

The financing and cash flow analysis presented in Table VI-8 (Financing Option 3) reflects the effect of a moderated financial and economic environment vis-á-vis today's conditions. Under this alternative, a short-term borrowing rate of 7 percent, an investments rate of 6.5 percent, a long-term borrowing rate of 8 percent, and an inflation of 5 percent for operation and maintenance costs were assumed. As under Option 2, it is assumed that the short-term issue is made in a sufficient amount to result in prepayment of short-term interest charges. Under this alternative, a short-term issue of $4,000,000 would result in a requirement for long-term financing in the amount of $3.9 million near the end of calendar year 1986. The cumulative effect of these reductions in short- and long-term interest rates and inflation rates is approximately a 16 percent decrease in the annual revenue requirement for the first full year of operation (1987). Under these economic assumptions, the combined average costs per resident boat is slightly over $800.

In summary, the financing and cash flow analyses presented herein indicate the basic financial feasibility of a marina development along the lines of Alternative 2 for approximately 600 resident boats. While the total revenue requirements and resulting average costs per boat will obviously vary with changes in interest, inflation rates, and construction costs, the average costs per boat indicated for the first full year of operation does not seem at all unreasonable. Even though costs in the vicinity of $800 represent a significant increase in the roughly $500 average cost per boat now incurred at the

TABLE VI-8

FINANCING, CASH FLOW, AND REVENUE REQUIREMENTS
KENOSHA HARBOR - MARINA IMPROVEMENTS
ALTERNATIVE 2 - FINANCING OPTION 3

Item	Calendar Year ($)							
	1983	1984	1985	1986	1987	1992	1997	2002
Capital Accounts								
Starting Balance	--	--						
Transfer from Operating Accounts	--	--						
Short-Term Financing Proceeds	--	4,000,000	3,604,982	1,903,575				
Long-Term Financing Proceeds	--	--	--	--				
Total Sources	--	4,000,000	--	3,909,358				
Construction Disbursements	--	354,400	1,594,800	1,594,800				
Short-Term Financing Repayment	--	280,000	280,000	4,280,000				
Total Uses	--	634,400	1,874,800	5,874,800				
Average Balance	--	3,682,800	2,667,582	951,788				
Interest Income	--	239,382	173,393	61,867				
Ending Balance	--	3,604,982	1,903,575	--				
Operating Accounts								
Operating and Maintenance Costs								
Existing Operations	87,230	91,592	96,171	100,980	106,029	135,322	172,709	220,426
Proposed Operations	--	--	--	--	127,628	162,890	207,892	265,330
Total	87,230	91,592	96,171	100,980	233,657	298,212	380,601	485,756
Debt Service and Interest Costs								
Existing Issue	56,075	56,075	56,075	56,075	56,075			
Proposed Issue	--	--	--	--	398,176	398,176	398,176	398,176
Short-Term Interest								
Total Revenue Requirements	43,305	147,667	152,246	157,055	687,878	696,388	778,777	883,932

Source: Stanley Consultants, Inc.

existing facility, it is interesting to note that both Financing Options 2 and 3 allow for decreases in this average cost per boat between fiscal year 1986 and 1987.

Economic Impacts

Even though it is desirable to have both marina and port improvements constructed and operated on a financially self sufficient basis, it has long been recognized that these investments generate economic impacts above and beyond the revenues realized by operators. These impacts arise from revenues within the local business sector, and benefit the local economy in terms of incomes, employment, and taxes. The potential for these impacts is discussed below for each of the marina alternatives and the proposed long-term port improvements.

Marina Impacts - A 1976 study (Reference 16) investigated and quantified the potential dollar impact of boating activity in Wisconsin's coastal zone. Ramp user and marina user impacts were addressed separately in surveys of several coastal communities. SCI analyzed this data to yield equations for spending by ramp and marina users. These equations are:

Ramp Users:

$$S_R = \$145,229 + \$21.98 \text{ (Number of Parties)}$$

Marina Users:

$$S_M = \$20,079 + \$1,697 \text{ (Number of Slips)}$$

The statistical fit of these equations is fairly good, and the coefficients attached to number of parties and slips are regarded as reliable measures of expected impact on local revenues.

When these equations (minus the constant terms) are applied to the number of launch lanes and slips proposed for each alternative, the estimated additional expenditures shown in Table VI-9 are derived. These calculations assume that only some fraction of additional expenditures are from nonlocal sources. Only this nonlocal fraction is taken as a potential gain in expenditures due to marina development. This fraction was assumed at 60 percent for ramp users, and from 20-75 percent for slip users, based on the size of proposed marinas.

The total direct increases in local sales from marina development range from about $311,000 per year for Alternative 1 to about $1.36 million per year for Alternative 3. The latter figure represents about 4/10 of 1 percent of current retail activity in the city.

In addition to these direct impacts from expenditures by users, second round impacts will be induced as these monies are respent within the local economy. Studies suggest that ultimate impacts may be from 1.5 to 2.5 initial impacts.

While these expenditures will generate additional sales taxes collected by city businesses, Wisconsin's sales tax distribution formula would not return a prespecified portion of these tax revenues to the city.

In addition to estimated total spending by ramp and marina users, the previous coastal zone management study (Reference 16) provided proportions of spending by business type. Using these proportions, the total direct spending estimates for each alternate were distributed to business type as indicated in Table VI-10.

While these gains may be substantial for individual businesses in the vicinity of a new marina, they do not represent major forces for new commercial development in the overall content of the city.

Physical and Environmental Impact of Alternatives

An additional consideration in the feasibility analysis of marina alternatives is the assessment of environmental effects of each option. In the recent climate of environmental sensitivity, environmental aspects of a project may assume large significance in determining the overall project feasibility. It is important that a preliminary assessment of impacts be considered at this stage of the project.

The development site is under the jurisdiction of the Chicago District, U.S. Army Corps of Engineers (COE). The COE is of principal significance because the permitting processes are led by the Corps; they are, in effect, the "clearinghouse" for other agency review of the project.

TABLE VI-9

SUMMARY OF POTENTIAL MARINA IMPACT ON LOCAL EXPENDITURES

Alternative No.	Number of Lanes	Ramp[1] Spending	Percent Nonlocal	New Expenditures, Ramp Users	Number of Slips	Marina Spending	Percent Nonlocal	New Expenditures, Marina Users
1	6	$361,021	60	$216,613	278	$ 471,766	20	$ 94,353
2	6	361,021	60	216,613	612	1,038,564	64	664,681
3	6	361,021	60	216,613	898	1,523,906	75	1,142,930

[1] Based on 50 launches per day peak capacity and average utilization rate of 15 percent.

Source: Stanley Consultants, Inc.

TABLE VI-10

POTENTIAL DIRECT ANNUAL GAINS IN REVENUES
BY TYPE OF BUSINESS

Business Type	Alternative 1	Alternative 2	Alternative 3
Sporting goods	$62,600	$114,000	$157,000
Lodging	8,700	8,700	8,700
Restaurants	55,100	192,000	306,800
Taverns and Liquor Stores	33,400	130,300	211,600
Auto and Related	48,400	105,500	153,300
Groceries	44,900	158,900	254,600
Other	59,600	173,700	269,300

Source: Stanley Consultants, Inc.

The regulatory function of the COE is performed by the Regulatory (Permits) Branch of the Chicago District. This branch requires that a Section 10 and 404 permit application be submitted for approval before construction is authorized. After permit application submittal, the COE will determine whether an Environmental Impact Statement (EIS) is required. If an EIS is not required, the COE will make a decision regarding the permit in 2 to 3 months.

If an EIS is deemed necessary, which is highly likely in a project of this magnitude, the applicant must prepare a detailed report addressing all areas of environmental concern to relevant agencies, authorized groups, and the public. The process for preparation and review of an EIS may take up to 2 years. Close agency contact and prompt response to requirements will help to expedite the process.

It is recommended that the Section 10 and 404 application be made as soon as preliminary design details are determined. These documents are dealt with by the COE in order of receipt.

Numerous other federal, state, and local agencies and groups will have review and approval authority for the project. These include:

- U.S. Environmental Protection Agency (EPA)
- U.S. Fish and Wildlife Service (FWS)
- U.S. Soil Conservation Service
- Wisconsin Department of Natural Resources (WDNR)
- Wisconsin Department of Transportation
- Southeastern Wisconsin Regional Planning Commission
- Various local and regional agencies and groups.

Each group will be concerned with making sure that the project complies with applicable regulations.

A comprehensive environmental review is beyond the scope of this document. Several of the most important physical and environmental impacts are discussed below. The emphasis is on identification of any factors that would preclude project implementation. The impacts are similar for each of the alternatives under consideration.

1. The most critical impacts will result from dredging or filling operations, which release sediments into the water. The resultant effects on water quality and ecology are temporary, and may be minimized by proper management of dredge and fill operations. Disposal of dredged material must be completed in accordance with USEPA and state regulations. It is expected that most of the material at the site is relatively clean, and may be disposed of at lake or land sites. Any material determined to be contaminated must be disposed of in a contained facility.

   The dredging impacts of Alternative 2 will be somewhat greater than Alternative 1, due to greater quantities. Special attention must be given to assessing the composition of the material at Lakefront Park. The impacts of construction of the landfill (Alternative 1) will offset the environmental advantage of this plan.

2. Construction of breakwaters will remove some bottom habitat for aquatic life, but will add considerable habitat on the surface and in voids of the new structure.
3. Construction of a small boat harbor will alter the water current and sediment transport processes in the area. The effect on shoreline erosion to the south of the harbor is of primary concern. The proposed project is not expected to have a significant effect on the shoreline erosion or accretion. The existing harbor and channel already blocks sand moving down from the north. The present Kenosha shoreline equilibrium (relative to the harbor) will not be altered by the presence of a new marina.
4. Air quality and noise conditions will be affected by construction and operation of a large marina. The impact should be minimal, since the area is already industrialized. Some residences will be affected by the noise and construction activities.
5. Probably the most significant overall impact of either project alternative relates to the change in use of the area. The overall character of the specific project area will change from undeveloped open land to a heavily used water-oriented facility. Vehicular and pedestrian traffic will result in occasional congestion. The visual environment will be significantly altered. The project will also have economic impacts on the downtown area, as discussed later.

In summary, the construction and operation of a major marina will have a significant impact on the waterfront environment and character. At this stage of the project, there appear to be no major environmental issues which would preclude continued development of the project. It is recommended that close coordination with all relevant agencies be continued throughout project implementation.

SECTION VII
MANAGEMENT AND IMPLEMENTATION

Management Options and Issues

The most basic options regarding management of a new marina development revolve around the degree of the city's involvement in marina construction and operation. Three basic management schemes are:

1. City owned and operated - The city would construct and directly operate all marina functions, staffing as required.
2. City owned with contractural operator - The city would build all facilities as designed to its own specifications, and engage a contractural operator to provide required operation and maintenance services.
3. Development rights contract - The city would sell rights to develop a private facility at the site, within some performance specifications.

The relative merits of each of these basic options are set forth below.

City Ownership and Operation

The primary advantage offered by this management scheme is maximization of control by the city. All design, investment, and operations decisions would be under direct and continuing control of commission and council. This control could be especially important when basic priorities of the city change, as they are sure to. Examples would include allocation of parking privileges for multiple use, changes in seasonal operation policies, use of the grounds for city functions, timing of expansions and improvements, and pricing policy.

Another advantage of this managerial format would be found in the elimination of third parties. No matter how carefully operator contracts are formulated, some dissatisfaction among users will occur, with resulting disputes involving users, operator, and the city. This option avoids such three-way disputes and allows direct access between user and owner.

A final advantage of the own/operate mode is economic. To the extent that all investment in the facility is made at municipal, rather than private costs of capital, user cost will be lower.

The primary disadvantage of this option is risk. Although the market studies indicate that a major new marina development is an economically viable venture at Kenosha, two major factors argue for some private involvement. The first has to do with the nature of government and risk generally. Governments are not allowed by the public to make profits. Thus, engaging in risky ventures has traditionally been the province of entrepreneurs.

It is pointed out, however, that the major risk element in the development of a large marina is market failure. Under the own/contract option (No. 2) of management, most equity and investment would be the city's, and little risk would be avoided. Only with a "development rights contract" would capital recovery risks be eliminated.

The second principal disadvantage of the city owned and operated marina is in the area of market responsiveness. While it is in some sense an advantage to control prices and policies, the pressures that will doubtless be brought to bear in these matters will not always reflect market values. Revenues will suffer under these circumstances. A private operator will, within the limits of his contract, adjust prices and service levels to meet demand and changes therein.

<u>City Ownership with Contractual Operation</u>

Under this option, the city would retain the right to basic questions of investment timing and magnitude. As in the own/operate mode, a marina facility would be built to the city's construction specifications. After construction, one or more operators would be selected to operate the facility.

Since the lease terms and method of operator selection can vary considerably, this management method actually represents a broad class of options. The key issues with structuring an operator agreement are the degree specificity or flexibility allowed a potential operator, in matters of operating and pricing policy. A very specific lease can be structured, requiring services within certain seasons and times of day, maximum prices, etc. The advantage of this sort of lease is that the city retains control over what type and level of services are offered. A major disadvantage is that operator input to operating policies is lost. Bids for performing such prespecified services will be less advantageous to the city.

While it is desirable to allow the operator some flexibility in structuring his operation, it is still possible to exercise effective control over the basics of slip rental, season of operation, and basic types of services offered.

Another issue involved in the build/lease option is the appropriate lease term. Prospective operators will want at least five years. Longer term leases would perhaps allow more favorable bids, but would reduce the city's flexibility in restructuring operations over time. In no case should lease terms exceed a normal design life for dockage, e.g., about 15 years.

The form of bid required of a prospective operator is another key variable in the build/lease management structure. At least three major types are possible. Under the simplest type, a prospective operator would simply offer a fixed annual payment to the city for a fixed period, with complete freedom regarding pricing policies. A second type would require fixed payments plus some percentage of gross (or of some revenue components). Finally, a completely variable payment schedule based on business volumes can be structured. Of these, the first two bid forms have the obvious advantage of some reduction in the city's risk with regard to covering debt service.

While it is possible to require strict and specific limitations on prices under an owner-operator contract, too much control takes away the key facet of private sector involvement.

Selection of operators can be handled by a variety of methods, including pure price competition for prespecified services, and submission of bids in the form of draft contracts. Bidders can be required to meet prequalification standards.

To summarize, the build/lease management "option" represents a broad spectrum of management choices. As a class, these methods offer the advantages of risk reduction, market responsiveness, and maintenance of control over basic decisions on investment. Disadvantages include the expenditure of considerable time and effort in operator selection and negotiation, and some risk of interior quality service or exorbitant rates if the contract(s) are not well written.

Development Rights Contract

The "development rights" management option specifies a class of management schemes under which a potential operator would be involved to some degree in final design, investment, and construction. A limiting case would be allowing developers to bid on site development rights for use as a private marina for some time period. In this case, the developer would make all of the basic choices on marina design, construction, and operation. The city would avoid all financial risk and lose all control.

A major flaw in this extreme version of the development rights approach is that the federal and state grants which are estimated cover from 54-57 percent of construction costs would probably be lost under this scheme. This consideration, and the loss of control noted above, suggest that a less extreme form of development rights contract should be considered.

This type of management structure could involve construction of major structural elements (breakwaters, piling, etc.) by the city, and allowing potential developers to specify and construct appurtenant facilities. The city could require specifications to be submitted at the time of operator bidding, reducing the chances of low quality construction to cut operator costs. Since the major structural elements in marina construction comprise the majority of grant eligible items, this approach would not result in loss of significant grant monies. It has the major advantage of making the operator an investor in the facility; creating incentives for continued high quality service. Disadvantages would be centered around the introduction of more contractual variables and actors.

Other Management Issues

In addition to the choice and structuring of a basic management format, at least one other management issue will require resolution during marina development. The issues concern operating and pricing policies for the existing city docks. If the city maintains a two-tier pricing structure, with lower prices at the existing facility, the demand for the new marina may be softened, especially during the first few years of operation. The other side of this issue is the position that current users "should not have to" subsidize new users. While higher quality services at a new facility may justify some price differential on a market demand basis, the current slip rental rates are clearly below market equilibrium prices.

Implementation Schedule

The development of marina and port improvements will require many actions and decisions by the city during the next several years. Many of these are common to all alternatives, but some are particular to individual sites. The chronology of these steps is subject to several factors outside the city's control, but should fall within the "early and late" time frames indicated on the following page.

Milestone	Time Frame Early	Late
Decision on development concept	9/80	3/81
Council resolution of support	10/80	4/81
Resolve use of diked disposal area	9/80	1/81
File state grant application	10/80	4/81
File 404 permit application	9/80	6/82
Initiate Environmental Impact Assessment*	10/80	7/82
Choose management concept	10/80	1/83
Distribute operator solicitation*[1]	1/83	1/84
Initiate final design	6/81	1/83
Issue short-term financing	1/84	1/86
Initiate construction	1/85	1/87
Select operator/developer*	6/83	1/89
Prepare operating budget	1/86	1/89
Prepare promotional material	1/86	1/89
Initiate operation	1/86	1/89
Sell long-term financing	1/86	1/89

*Indicates milestones which may not be required for all alternatives.

[1]Or post notice in trade journals.

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APPENDIX A

PUBLIC HEARING MINUTES

HARBOR MASTER PLAN COMMITTEE
Public Hearing
July 9, 1980

The Kenosha Harbor Master Plan Committee held a public hearing on the draft report of the Harbor Master Plan which was prepared by Stanley Consultants, Inc. The hearing was held on Wednesday, July 9, 1980, in Room 120 of Tremper High School. The hearing was called to order at 7:30 p.m. by Marshall Simonsen.

Present: See attached list.

INTRODUCTION

Marshall Simonsen welcomed everyone to the hearing and introduced the representatives of Stanley Consultants, the Kenosha Harbor Master Plan Committee and various citizens.

Mr. Simonsen went on to give the background information of the plan, including how it was funded, how the consultant was chosen, how the Harbor Master Plan Committee was formed, etc.

Mr. Simonsen then introduced Mr. John Beasley from Stanley Consultants. Mr. Beasley outlined the procedure used for preparing the draft report such as site analysis, market analysis, alternative plans, etc.

Mr. Beasley then conducted a slide presentation which explained the three marina alternatives, the benefits and disadvantages of each, and the expected costs of each alternative. Mr. Beasley further commented on the project area, land access, commercial activity and recreational facilities.

Mr. Bill Allen, Stanley Consultants, continued on in the presentation and gave a more definitive explanation of the marina alternatives outlining the maximum number of slips to be included in each, the available parking, expected costs, etc.

Mr. John Beasley presented a time table of when certain items, such as the filing of appropriate applications to agencies, financing, the initiation of construction, etc. should be accomplished. It was estimated the project could be completed by 1987.

Mr. Ralph Ruffolo, 1710-57th Street, questioned what thoughts were given to changing the traffic patterns in the area. Mr. Allen explained that the traffic was considered, but final design work would still have to be worked out.

Mr. Don Reed, SEWRPC, was present. Mr. Reid stated that the Harbor Plan was reviewed against the Park and Open Space Plan for the Kenosha Planning District. He further indicated that the Harbor Plan is in conformance with the Park and Open Space Plan and an official letter from SEWRPC recommending Alternative #2 would be written within the week.

Mr. Mark Hasenberg, 4037-7th Avenue, questioned what the height of the breakwater would be. Mr. Hasenberg commented it doesnot appear to be sufficient to protect the area. Mr. Bill Allen stated that the breakwater would be approximately 15 feet above the water line, and some of the breakwaters are proposed to be 20 feet above the water line.

Mr. Paul Mohrhart U.S. Army Corps of Engineers, was present. He commented the earliest federal funds would be available would be October of 1982, and possibly not until 1983. He further commented that the facilities would have to be open to all as an equal basis. Mr. Mohart also explained the use and filling of the diked disposal area. He indicated that the filling of the area is essentially on schedule.

Mr. Vern Barber, Wisconsin Waterways Commission, stated the legislators should be made aware of the funds needed and get them to work to make more funds available.

Mrs. Marilyn Baker, 7761-6th Avenue, commented on several aspects of the draft plan.

There being no further comments or questions by those present, the hearing was adjourned at 9:30 p.m.

PUBLIC HEARING

Wednesday, July 9, 1980
Tremper High School
Room 120
7:30 p.m.

HARBOR AREA MASTER PLAN

CITY OF KENOSHA

William Martin	Harbor Master Plan Committee
Pat Martin	2003-21st Street
Frank Niccolai	5626-3rd Avenue
Mr. & Mrs. Schierenberg	4629-5th Avenue
Donald M. Reed	SEWRPC - Coastal Management
Bruce H. McCundy	Harbor Commission
Mark Hasenberg - Pres. KSFCA	4037-7th Avenue
Alfred E. Berg	7927-39th Avenue
Madeline M. Berg	7927-39th Avenue
Ralph Ruffolo	5917-6th Avenue
Paul Mohrhart	219 S. Dearborn-Chicago (Corps of Engineers)
Ed Jenkins	City of Kenosha
Mike Swift	Harbor Master Plan Committee
Chuck Stanley	1310-76th Street
Donna DeBruin	12302-41st Avenue
Robert Vogt	5712-34th Avenue
Dr. Jim Nordstrom	Harbor Master Plan Committee
Casey Miechowicz	Harbor Master Plan Committee
Marshall Simonsen	Harbor Master Plan Committee
Bruce E. Ford	5400 S. Lakeshore Rd. B-7 Somers, WI
Vern Barber	State Waterways Commission - Racine
Ellie Chemerow	8346-49th Avenue

Harvey Elmer	City Engineer & Harbor Master Plan Comm.
Jim Kuzdas	Assistant City Planner & Harbor Master Plan Comm.
John Beasley	Stanley Consultants
Bill Allen	Stanley Consultants
Lois Lipman	WLIP Radio
Bud Brandt	Harbor Master Plan Committee
Marilyn Baker	Harbor Commission