

CLEAR TECHNICAL REPORT NO. 301



Environmental Assessment of a Proposed
Marina Development Project on the
Portage River, Port Clinton, Ohio

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Environmental Assessment of a Proposed Marina Development Project on the Portage River, Port Clinton, Ohio

Introduction

The R. B. Chase Company of Port Clinton, Ohio proposed to construct a residential condominium/marina complex on the Portage River at the site of an existing marina facility. The project site is located approximately 4800 feet upstream from the river mouth as defined by the entrance jetties to Port Clinton harbor (Figure 1). The existing marina is presently operated by John Zetzer and is flanked on the east (downstream) side by Brand's Marina and on the west (upstream) side by Clinton Reef Marina (Figure 2). The main channel of the Portage River fronts the marina on the south and Ohio Route 163 borders the north side of the property.

The proposed marina complex known as "Harbor Side," will consist of solid east and west piers (located in the approximate position of the existing dikes on the downstream and upstream sides of the site), 80 feet wide by 655 feet long and 80 feet wide by 645 feet long, respectively. A new solid pier will be constructed at the south end of the marina to provide protection from boat wash. Internal docks will be established within the marina approximately as shown in Figure 3. The east and west pier will be faced with limestone rip-rap on a 2:1 slope and the south pier will be concrete capped steel sheet piling. The interior docks will be a combination of fixed (pilings) and floating structures.

The method of construction will consist of erecting a dike along the south and a portion of the west side of the property. Once the dikes are completed, the interior basin will be dewatered and the earth moving equipment will be used to excavate the basin to a depth of 10 feet below Low Water Datum. All spoil material will be deposited upland on the project site. When completed, the combination of the east, west, and south piers will result in the covering of 82,515 sq. ft. (about 2 acres) of former river bottom. Approximately 60% of this area will be faced with limestone rip-rap on a 2:1 slope.

The purpose of this report is to document the environmental setting of the proposed project site and to provide an assessment of the potential impacts of the construction and operation of the marina facility on the Portage River environment. The report contains the results of field investigation conducted during August 1984 and pertinent data from the scientific literature. This information has been used to evaluate the environmental quality of the project site.

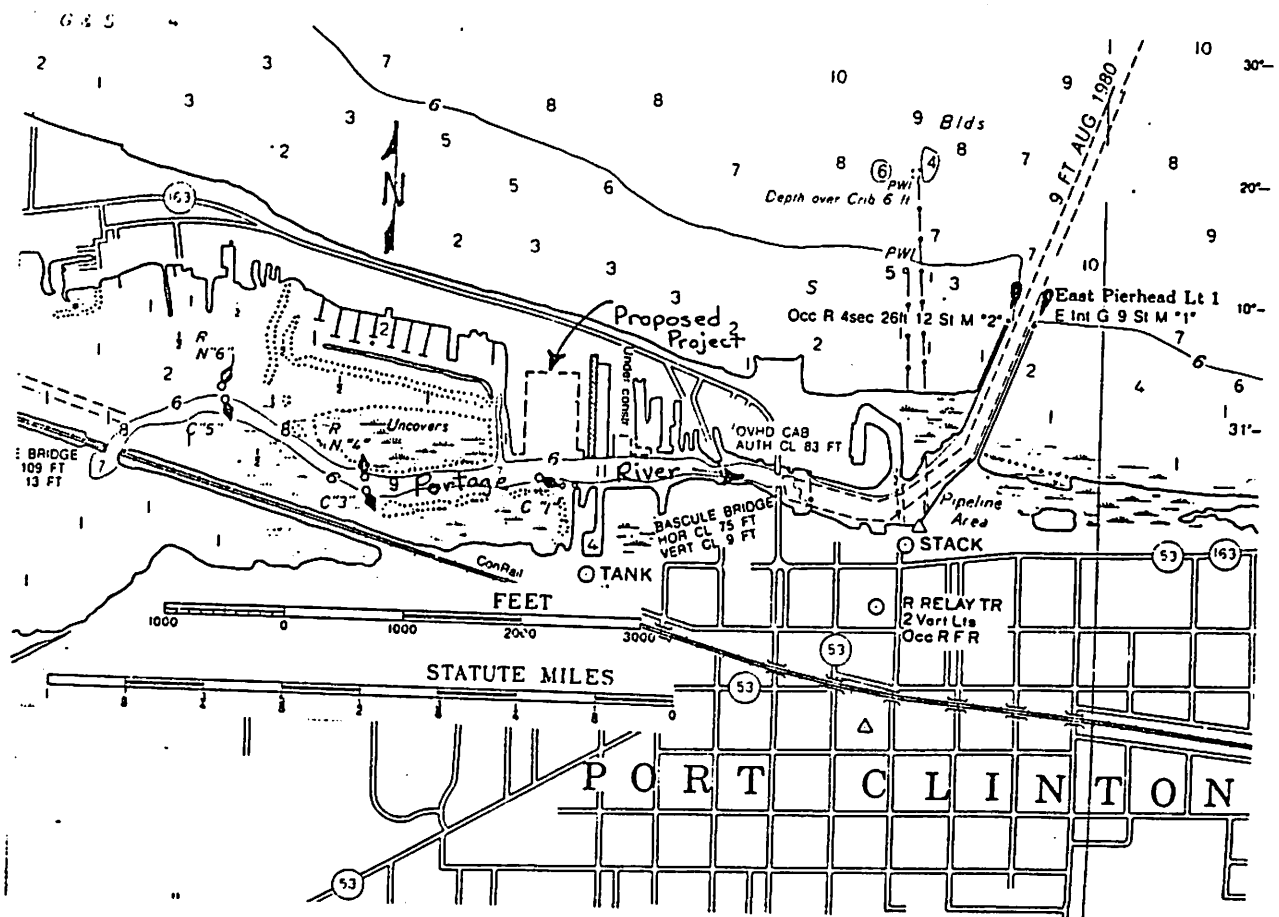


Figure 1. Location Map of Proposed Marina Complex.

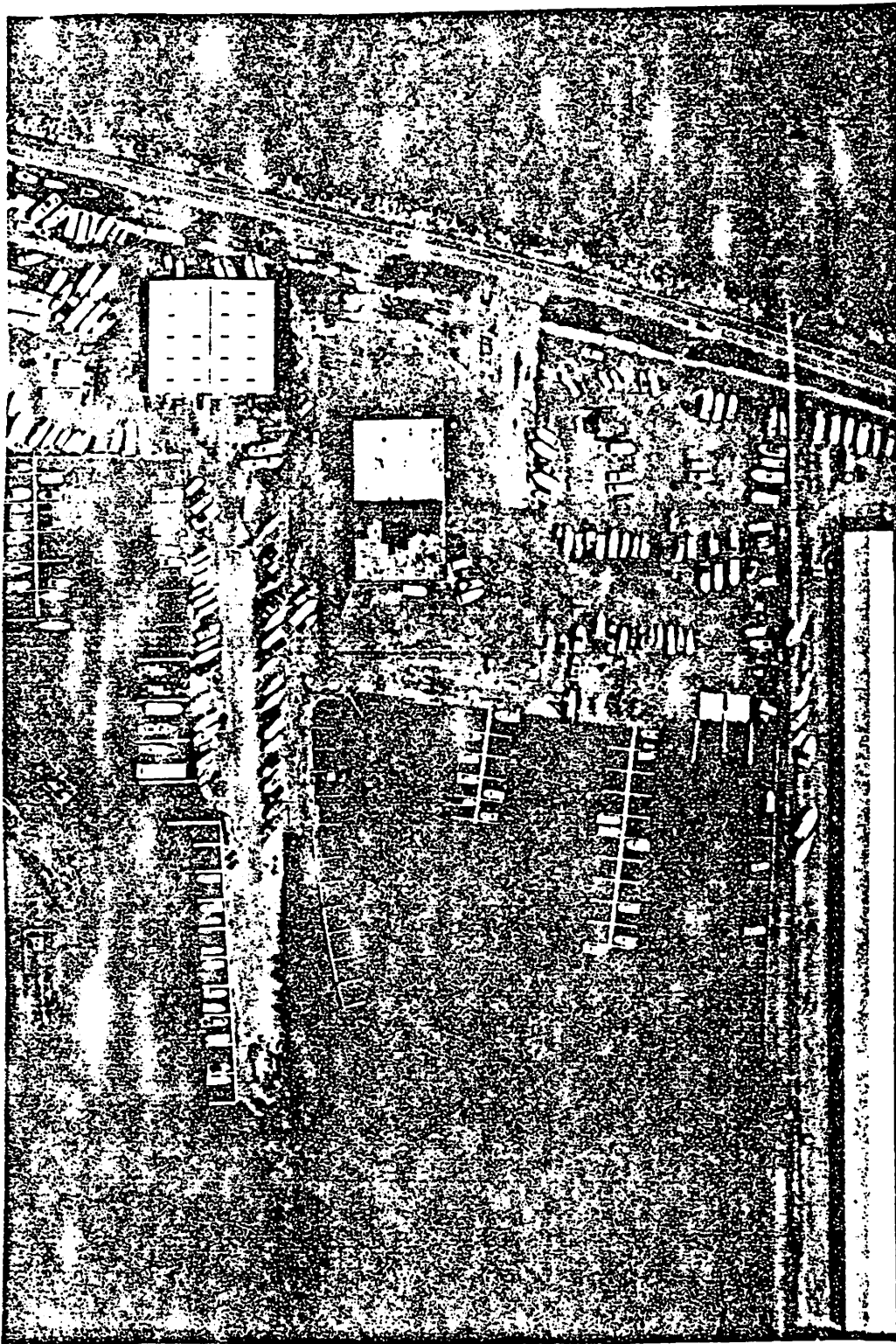
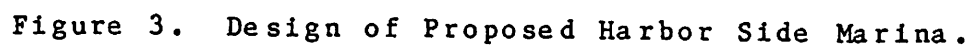


Figure 2. Aerial Photograph of Existing Marina in July 1984.



Environmental Setting

The Portage River has its headwaters in Hancock County (elevation 777 feet) and flows a distance of 60.6 miles to Lake Erie at Port Clinton (elevation 573 feet). The average gradient from head to mouth is 3.3 feet/mile. However, the lower 10-12 miles of this stream functions as an estuary arm of Lake Erie and fluctuates in level in direct response to lake water levels (Langlois 1965). The discharge of river water to Lake Erie averages 400 cubic feet per second (cfs), and ranges between 14,400 cfs (February 1950) and 3 cfs (September 1955). The river has a total drainage area of 581 square miles. Annually the Portage River transports approximately 112,000 tons of sediment from the drainage basin to Lake Erie. The maximum concentrations of suspended sediment can exceed 1,200 mg/l during high flow (Ohio Division of Water 1966). This circumstance results in the turbid nature of the river water throughout much of the year.

Adjacent to the project site, the main channel of the Portage River has a depth of 6-11 feet and a width of 200 feet. Calculated flows in this portion of the river average 0.2 feet per second and range from nil to a maximum of 7.2 feet per second. In response to short-term Lake Erie water level fluctuations, primarily due to wind induced currents, water in the lower reach of the Portage River can flow either downstream or upstream. Water level fluctuations in excess of 8 feet in a 24-hour period have been observed at Port Clinton. Because of the limited fetch, waves in the river at the site rarely exceed 1-2 feet in height.

The existing marina boat basin is shallow, flat-bottomed and blanketed with a layer of fluffy, brown silt-rich material. Existing water depths within the marina are approximately the elevation of Low Water Datum (LWD, 568.6 feet above mean water level in the Gulf of St. Lawrence at Father Point, Quebec) to 3.5 below LWD. The soft layer of mud averages 1 to 1.5 feet thick and overlies firm clay. The clay layer (approximately 25-40 feet thick) in turn overlies dolomite bedrock. The east, north, and inner portions of the west shore of the existing marina consist primarily of rip-rap and bulkheads. The outer portion of the west shore appears to be an earthen dike. A narrow sandy beach has developed along the west dike near its river terminus. Docks within the marina consist of a combination of floating and piling design, which can accommodate approximately 100 vessels (Figure 2).

Method of Investigation

Investigators from the Ohio State University, Center for Lake Erie Area Research visited the study area on three occasions in August 1984:

August 16 - general inspection of site with developers.

August 18 - collection of plant species and observation of avifauna

August 19 - comprehensive limnological survey of site including 1) collection of plankton, benthos, and fish samples, 2) measurement of water quality parameters, and 3) inspection of underwater habitat using diving technique.

The following specific techniques were used to characterize the environmental quality of the project site.

Water Quality. Measurements were made near the center of the existing marina, and included the following parameters: 1) water temperature, 2) dissolved oxygen (DO), 3) conductivity, 4) transparency, 5) transmissibility, and 6) solar illumination. Temperature, DO, and conductivity were measured with Yellow Springs Instrument (YSI) meters; transparency was determined with a Secchi disc; percent light transmission was obtained with a P-H Tamm Laboratories meter; and solar illumination was recorded with a Protomatic submarine photometer. All measurements were taken from the surface to the bottom at 0.5 meter intervals.

Aquatic Macrophytes Aquatic plants were sampled by hand from the shoreline and dikes surrounding the existing marina. The method proved effective for emergent and upland transition plants. Submersed plants were sampled by using a hand-tossed plant drag and diving techniques. Representative specimens were identified in the laboratory using the taxonomic keys given in Fasselt (1957) and Weishaupt (1971). Confirmation of questionable specimens was made by Dr. Ronald L. Stuckey, Professor of Botany at The Ohio State University.

Plankton Planktonic organisms were sampled near the center of the existing marina using no. 25 mesh (64 u aperture) conical plankton net with 0.25 meter diameter opening. Samples were taken by making vertical net tows from near the bottom to the surface. Samples were preserved in 10% alcohol and identified in the laboratory using 100x magnification. Standard references for phytoplankton and zooplankton identification included Taft and Taft (1971), Palmer (1962), Edmondson (1959), Eddy and Hodson (1961), Needham and Needham (1962), and Pennak (1978).

Benthos. The collection of benthic macroinvertebrate organisms involved several techniques. First, samples of the bottom sediments were obtained with an Ekman dredge from near the center of the existing marina. This material was sieved in the field through a benthos screen (no. 30 mesh) and the organisms retained on the screen were carefully removed and preserved in 10% alcohol. Identification was done using 10-40x magnification and the taxonomic keys given by Clarke (1981), Eddy and Hodson (1961), Edmondson (1959) and Pennak (1978). Other methods included using dip nets in the nearshore waters and visual inspection of Cladophora beds, rip-rap boulders, and beached mollusk shells. Diving techniques proved effective in obtaining live mollusks.

Fish. Information on the fish utilizing the existing marina was obtained from three methods: 1) interviews with local fishermen, 2) observation of beached specimens on all three shores of the marina, and 3) direct test netting. Both a 10-ft and 25-ft long shore seine were used to collect fish samples along the west and north shores of the marina. Test netting was conducted from the shore out to a depth of five feet. Representative specimens were preserved in 10% alcohol. The identification of fish specimens was confirmed using the taxonomic keys presented in Trautman (1981).

Other Vertebrates. Information on the reptiles and birds utilizing the study area was obtained from direct observation. No evidence of aquatic mammals was found at the site.

Results of Investigations

Water Quality. The results of water quality determinations near the center of the marina basin show isothermal conditions and well-oxygenated water (Table 1). The dissolved oxygen (DO) concentration ranged from 7.5 mg/l at the surface to 6.6 mg/l at the bottom. This yields a range in DO saturation from 90% to 79% respectively. Oxygen concentration in excess of 5 mg/l are considered adequate for sensitive organisms.

The water was turbid, having a Secchi disc transparency of only 0.3 meters. The high suspended solids (sediment and algal cells) attenuated over 60% of atmospheric light across the 42 mm path length of the transmissometer indicated an estimated concentration of nearly 200 mg/l. Solar radiation at the surface (incident light) was reduced to less than 1% at a depth of 1 meter. At least 1% of incident light is required for sustained photosynthetic activity.

Conductivity is indicative of the concentration of dissolved solids (TDS) in the water. A factor of 0.65 times conductivity (umhos/cm) yields an estimate of TDS in mg/l. The water in the marina basin ranged from 172 to 221 mg/l, which is typical for western Lake Erie water. Studies by the Ohio Division of Water (1966) show that the dissolved substances in Portage River water at Elmore consist of the following:

<u>Parameter</u>	<u>Range</u>
Calcium	50-142 mg/l
Magnesium	11- 52 mg/l
Bicarbonate	132-365 mg/l
Sulfate	54-269 mg/l
Sodium/Potassium	9-308 mg/l
Chloride	11-640 mg/l
Nitrate	0.5- 23 mg/l
Iron	0.12-0.12 mg/l
Silica	1.2-18 mg/l
TDS	249-1,700 mg/l

The data from the marina shows that the more highly mineralized Portage River water is diluted by Lake Erie waters well inside the river mouth. The river can be up to 10 times more mineralized than Lake Erie water above the zone of lake influence.

More recent measurements of plant nutrients in the Portage River are reported by the U. S. Army Corps of Engineers (1975). During spring storm events the concentration of total phosphorus can exceed 0.6 mg/l. This concentration is well within the amount required to simulate abundant algal growth of both plankton and attached filament forms (i.e. Cladophora). During the period June 1974-July 1975, the following loadings to Lake Erie were estimated for the Portage River:

<u>Parameter</u>	<u>Loading</u>
Total Phosphorus	112 metric tons
Ortho-phosphorus	38 metric tons
Nitrate-Nitrite Phosphorus	2,100 metric tons
Ammonia Phosphorus	57 metric tons
Organic Phosphorus	203 metric tons
Silica Phosphorus	2,090 metric tons
Chemical Oxygen Demand	9,600 metric tons
Chlorides	14,200 metric tons
Suspended Solids	48,000 metric tons

Although the Portage River ranks among the lowest of the major tributaries to Lake Erie in terms of nutrients and sediment delivered to the lake, phosphorus concentrations are high enough to stimulate abundant algal growth at the surface, but sediment limits most of the growth to the upper 1-2 meters of the water column.

Aquatic Macrophytes. The higher aquatic plants and upland transition plants occurring in the vicinity of the proposed marina complex are listed in Table 2. This list also contains a "quality rating" index number which will be described in the environmental assessment section of this report. In general, the existing marina basin is depauperate of submerged vegetation. Only minor beds of Potamogeton pectinatus (sago pondweeds) and Vallisneria americana (eel grass) were found after repeated tows with an aquatic plant drag and numerous diver transects, and these were restricted near to the north shore. The higher turbidity and siltation rate of the Portage River, which limits the depth to which light can penetrate and tends to bury bottom plants, along with disturbances from vessel traffic most likely accounts for the low populations.

Emergent aquatic plants are also scarce in the basin, being limited to a narrow band along the west dike. The most common species, Phalaris arandinocea (reed-canary grass), is generally abundant from the water's edge to about one foot above river level. Minor stands of Scirpus americanus (three-square bulrush), Hibiscus palustris (swamp rosemallow), and Calamagrostis canadensis (bluejoint grass) also occur at the water's edge in the northwestern portion of the marina.

The only floating plants observed were small patches of Spirodela polyrhiza (large duckweed). These occurred in association with Cladophora (filamentous, green algae) beds in the northeastern portion of the basin.

In addition to these plants, 23 other transition and upland species were identified from the site. No threatened, rare or endangered species were found during the field surveys or found in the scientific literature.

Phytoplankton. A total of 28 taxa of algae were identified from field samples, including 5 blue-greens, 1 euglenoid, 1 dinoflagellate, 8 diatoms, and 13 greens (Table 3). The most abundant genera are the blue-green Microseptis and the green Pediastrum. Microcystis and many of the other taxa, particularly the blue-greens, are indicative of nutrient-enriched (eutrophic) conditions. Palmer (1962) indicates that six of the genera present are typical of organically enriched waters and five of the genera primarily occur in clear water. This mixed nature of the algal flora in the Portage River estuary is typical of the populations found in western Lake Erie nearshore waters. Dorosoma cepedianum (gizzard shad) and Cyprinus carpio (carp) are the only fish species common to the site that feed directly on the phytoplankton.

Zooplankton. The animal plankton was represented by 15 taxa in the field samples, and included 1 protozoan, 6 rotifers, 1 ostracod, 4 cladocerans, and 3 copepods (Table 4). The most abundant zooplankters are the cladoceran Eubosmina, the copepods Cylops and Diaptomus, and the rotifers Keratella and Asplanchna. These organisms serve as forage for many of the fish species of the lower Portage River. The character of the zooplankton population is typical of moderately enriched, warm-water environments.

Benthos. This group of organisms inhabits the bottom surfaces of the marina basin. Several types of bottoms are available to invertebrates in the basin, including 1) organic mud bottom, 2) silty mud bottom, 3) sandy shore, 4) aquatic plant beds, and 5) artificially placed limestone rip-rap along most of the shore except the west dike. A total of 25 different taxa of benthic invertebrates was identified in field samples from all of these habitats (Table 5).

The organic bottom muds found in the northern half of the basin contained a considerable amount of plant debris. These muds are typified by oligochaetes (sludge worms), chironomid (midge) larvae, and spherid (fingernail) clams. The large oligochaete, Branchiura sowerbyi is one of the most abundant benthic forms and does serve as food for some of the bottom feeding fish species.

The silty muds occur in the southern part of the marine basin and contain less organic debris. In addition to the worm and midge populations, large-sized unionid clams are widely scattered in the sediments. The highest numbers, but still very low density, were found by diver-survey in the southwest part of the basin. The sandy nearshore areas yielded few organisms other than beached mollusk shells. The Cladophora and other aquatic plant beds contain a diverse population of invertebrates, including leeches, snails, fingernail clams, amphipods, crayfish, and beetles. Many of these organisms are in the food web of Portage River fish species. The stone rip-rap shore also contains a number of interesting invertebrates, including

freshwater sponges, bryozoans, Japanese snails, and isopods. These organisms are less utilized in fish food webs. However, Cladophora beds often require a solid substrate, such as rip-rap, for filament attachment.

No rare, threatened or endangered invertebrate species were found at the project site.

Fish. A total of 8 families and 18 species of fish were either collected or observed as beached specimens within the project site. (Table 6). Dorosoma cepedianum (gizzard shad), and Notropis hudsonius (spottail shiner) were the most abundant species collected. Ictalurus melas (black bullhead), Ambloplites rupestris (rock bass), Micropterus dolomieu (smallmouth bass), and Perca flavescens (yellow perch) were only observed from beached specimens. Ictalurus punctatus (channel catfish) was taken in the basin by a local fisherman. Other species were only occasionally taken in seines.

Trautman (1981) reports that 62 species of fish have been taken in the lower Portage River since the turn of the century (Table 7). Approximately 30% of these species were observed during a one-day field survey in mid-August (Table 6). It is likely that an additional 10-20 species utilize the boat basin at various times throughout the year.

No species of important commercial or sport interest, other than several sunfishes, were collected during the field survey. Beached specimens, such as yellow perch, smallmouth bass, and catfishes, indicate that there is some utilization of the marina by sport and commercial species. Based on the field survey and habitat conditions it is unlikely that sizeable populations of these species exist in the marina.

One species of fish, Ichthyomzon unicuspis (silver lamprey), which is on the Ohio list of endangered species has been reported for the lower reach of the Portage River. No specimens of the fish were observed during the present survey. However, in 1982, the author collected a specimen in the Catawba Island lagoon which is now being developed as the LaMarin condominium/marina complex (approximately 7 miles northeast of the present study site). This species utilizes Lake Erie tributaries in the spring and it is relatively common in south shore streams at that time of year. The proposed project site is not considered critical to the survival of this species.

Reptiles and Birds. One species of snake, Natrix sipedon sipedon (northern water snake), two species of gulls and one species of waterfowl were observed utilizing the marina basin (Table 8). The water snake was found in the rip-rap and nearshore waters at the east side of the site. The gulls and ducks were seen throughout the basin.

LWD and that approximately 2 acres of river bottom will be covered with earthen dike faced with limestone rip-rap.

Because of the highly disturbed nature of the site and the similarity of present and proposed use, no significant environmental loss is anticipated from the construction and operation of the proposed marina complex. The greater depth will have a temporary impact of the benthic and fish population, but should be reestablished in few seasons. Because the present turbid nature of the water does not permit the growth of significant higher aquatic plants, the greater depth of the new basin will be of no consequence in this regard. Because Cladophora beds appear to support some of the best food-chain organisms, the greater amount of rip-rap should enhance these beds due to the increase availability of suitable substrate.

In conclusion, the lack of evidence suggesting any significant environmental quality at the project site lead to the assessment that there are no environmental reasons for withholding approval. On balance the proposed project should either enhance or have a negligible impact on the environment of the lower Portage River.

Environmental Assessment

Quality Rating Index. Swink and Wilhelm (1979) developed a numerical rating system for evaluating the quality of an environmental setting based on the plant life at a particular location. Each species has numerical quality (-3 to +20) depending on its relative autecological value with respect to all other taxa of the flora. The formula for expressing the quality of a setting is simple:

$$I = \frac{R}{N} \sqrt{N}$$

where I = the rating index, R = the sum of the numerical ratings for all taxa recorded for an area, and N = the number of recorded taxa. Natural areas that yield a rating index of 35 to 90 are considered to be of significant environmental importance. Areas above 50 are of paramount importance, while areas which rate less than 35 can usually be assumed to have suffered significantly from abuse or degradation.

A total of 30 plant taxa was identified from the study site. Most of these species were collected from the earthen dike and nearshore water on the west side of the project area. The individual numerical ratings for each plant (Table 2) were obtained from the evaluation checklist given by Swink and Wilhelm (1979). Based on their formula a rating index of 14.6 was calculated for the study area. Because of the low quality rating, one can assume a relatively high degree of disturbance for the site. Based on this technique the area can be judged to have low environmental quality.

Sensitive Species. The Natural Heritage Program within the Ohio Department of Natural Resources, Division of Natural Areas and Preserves, maintains lists and maps of sensitive species and unique natural areas identified throughout the State of Ohio. The location of such features are plotted on U. S. Geological Survey topographic maps (7 1/2 minute series) for the entire state. An inspection of the maps and files for the Port Clinton area yielded the information concerning the occurrence of the endangered lamprey (Ichthyomyzon unicuspis) in the lower Portage River. No other rare, threatened or endangered plant or animal species are listed by Ohio Department of Natural Resources as being potentially present within the study area. Four species of commercial/sport importance are listed as spawners in the river upstream from the proposed project, including, channel catfish, white bass, yellow perch, walleye, and freshwater drum.

Potential Impacts. Investigations of the study site reveal that the project site is highly disturbed, particularly as documented by the plant quality analysis. The current use of the site is similar to the proposed use, both in type and potential intensity. The major differences between the present use and the proposed use is that the basin will be excavated to 10 feet below

Acknowledgements

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References Cited

- Clark, A. H. 1981. The freshwater molluscs of Canada. National Museums of Canada, Ottawa, Canada. 446 pp.
- Eddy, S. and A. C. Hodson. 1961. Taxonomic keys to the common animals of the north central states exclusive of the parasitic worms, insects and birds. Burgess Publ., Minneapolis. 162 pp.
- Edmondson, W. T., ed. 1959. Ward and Whipple's fresh-water biology, 2nd ed., John Wiley and Sons, Inc., New York. 1248 pp.
- Fassett, N. C. 1957. A manual of aquatic plants. McGraw Hill Book Co., New York. 191 pp.
- Langlois, T. H. 1965. Portage River watershed and fishery. Ohio Dept. Nat. Res., Div. Wildlife, Pub. W-130. 22 pp.
- Needham, J. G. and P. R. Needham. 1962. A guide to the study of fresh-water biology. Holden-Day, San Francisco. 108 pp.
- Palmer, C. M. 1962. Algae in water supplies, an illustrated on the identification, significance, and control of algae in water supplies. U. S. Dept. Health Service, Cincinnati, Ohio. 88 pp.
- Pennak, R. W. 1978. Fresh-water invertebrates of the United States. 2nd edit. John Wiley, New York. 803 pp.
- Ohio Division of Water. 1966. Water inventory of the Portage River and Sandusky River basins and adjacent Lake Erie tributary areas. Ohio Dept. Nat. Res., Div. Water, Rept. No. 20. 131 pp.
- Swink, F. and G. Wilhelm. 1979. A method for environmental assessment of open land. Pages 850-881, in Plants of the Chicago region. Morton Arboretum, Lisle, Michigan.
- Taft, C. E. and C. W. Taft. 1971. The algae of western Lake Erie. Ohio Biol. Surv. 4(1):1-89.
- Trautman, M. B. 1981. Fishes of Ohio. 2nd Ed. Ohio State Univ. Press, Columbus. 782 pp.
- U. S. Army Corps of Engineers. 1975. Lake Erie wastewater management study. Vol. 1. Buffalo Dist. 172 pp.
- Weishaupt, C. G. 1971. Vascular plants of Ohio. 3rd Ed. Kendall/Hunt Pub. Co., Dubuque, Iowa. 292 pp.

TABLE 1. WATER QUALITY MEASUREMENTS TAKEN AT THE
PROPOSED PORTAGE RIVER MARINA SITE
August 19, 1984

Depth (m)	Temperature (C)	Dissolved Oxygen (mg/l)	Conductivity (umhos/cm)	Light Transmission (%)	Solar Radiation (ft-candles)
Air	24.4			100	8,000
Surface	24.0	7.5	265	43	5,500
0.5 m	23.9	7.2	280	44	550
1.0 m	23.8	6.9	300	45	60
1.2 m	24.0	6.6	340	38	45

Transparency (Secchi disc) = 0.30 m

* Secchi Disc Transparency x 3.0 = Depth of Light Extinction
(1% Surface Light)

* Coefficient of Light Extinction = 4.9/m

* Conductivity x 0.65 = Dissolved Solids (mg/l)

* approximate relationships

TABLE 2. MACROPHYTES OBSERVED AT PROPOSED
PORTAGE RIVER MARINA SITE

	<u>Quality</u>	<u>Index</u>
Phylum Tracheophytes (vascular plants)		
Class Angiospermae (flowering plants)		
Subclass Monocotyledonae (monocots)		
Family Potamogetonaceae (pondweeds)		
1. <u>Potamogeton pectinatus</u> (sego pondweed)	6	
Family Hydrocharitaceae (frog's bits)		
1. <u>Vallisneria americana</u>	7	
Family Gramineae (grasses)		
1. <u>Calamagrostis canadensis</u> (blue joint grass)	3	
2. <u>Phalaris arundinacea</u> (reed-canary grass)	0	
Family Cyperaceae (sedges)		
1. <u>Cyperus esculentus</u> (yellow nut-grass)	7	
2. <u>Scirpus americanus</u> (three-square bulrush)	7	
Family Lemnaceae (duckweed)		
1. <u>Spirodela polyrhiza</u> (large duckweed)	7	
Subclass Dicotyledonae (dicots)		
Family Salicaceae (willows)		
1. <u>Populus deltoides</u> (cottonwood)	2	
2. <u>Salix alba</u> (white willow)	0	
3. <u>Salix amygdaloides</u> (peach-leaved willow)	5	
4. <u>Salix interior</u> (sandbar willow)	1	
Family Ulmaceae (elms)		
1. <u>Ulmus rubra</u> (slippery elm)	4	
Family Leguminosae (peas)		
1. <u>Melilotus alba</u> (white sweet clover)	-3	
2. <u>Strophostyles helvola</u> (trailing wild bean)	7	
Family Anacardiaceae (sumacs)		
1. <u>Rhus typhina</u> (staghorn sumac)	3	
Family Aceraceae (maples)		
1. <u>Acer negundo</u> (boxelder)	0	
2. <u>Acer saccharinum</u> (silver maple)		

	<u>Quality Index</u>
Family Balsaminaceae (jewel-weeds)	
1. <u>Impatiens capensis</u> (spotted touch-me-not)	3
Family Vitaceae (grapes)	
1. <u>Vitis riparia</u> (riverbank grape)	4
Family Malvaceae (mallows)	
1. <u>Hibiscus palustris</u> (swamp rosemallow)	10
Family Onagraceae (evening-primroses)	
1. <u>Oenothera biennis</u> (evening-primrose)	1
Family Umbelliferae (parsleys)	
1. <u>Daucus carota</u> (wild carrot)	1
Family Asclepiadaceae (milkweeds)	
1. <u>Asclepias incarnata</u> (swamp milkweed)	4
Family Verbenaceae (vervains)	
1. <u>Verbena hastata</u> (blue vervain)	4
Family Labiatae (mints)	
1. <u>Lycopus asper</u> (western water horehound)	2
Family Caprifoliaceae (honeysuckles)	
1. <u>Lonicera japonica</u> (Japanese honeysuckle)	-2
Family Compositae (composites)	
1. <u>Ambrosia artemisifolia</u> (common ragweed)	0
2. <u>Bidens connatus</u> (purple-stemmed swamp beggar tick)	8
3. <u>Cirsium arvense</u> (Canada thistle)	-3
4. <u>Sonchus uliginosus</u> (sow-thistle)	-2
TOTAL	80

TABLE 3. PHYTOPLANKTON COLLECTED AT PROPOSED
PORTAGE RIVER MARINA SITE

Phylum Cyanophyta (blue-green algae)

1. Microcystis aeruginosa
2. Spirulina sp.
3. Anabaena flos-aquae
4. Aphanixomenon flos-aquae
5. Nostoc sp.

Phylum Euglenophyta (euglenoids)

1. Phacus sp.

Phylum Chrysophyta (golden-brown algae)

Class Bacillariophyceae (diatoms)

Order Centrales (centric diatoms)

1. Melosira sp.
2. Cyclotella sp.

Order Pennales (pennate diatoms)

1. Tabellaria sp.
2. Asterionella sp.
3. Fragilaria sp.
4. Gyrosigma sp.
5. Cymbella sp.
6. Surirella sp.

Phylum Pyrrophyta (fire algae)

Class Dinophyceae (dinoflagellates)

1. Ceratium hirundinella

Phylum Chlorophyta (green algae)

1. Volvox sp.
2. Gloeocystis sp.
3. Cladophora glomerata
4. Pediastrum spp.
5. Coelastrum sp.
6. Ankistrodesmus sp.
7. Oocystis sp.
8. Spirogyra sp.
9. Zygnema sp.
10. Eudorina sp.
11. Actinastrum sp.

Family Desmidiaceae (desmids)

1. Cosmarium sp.
2. Staurostrum sp.

TABLE 4. ZOOPLANKTON COLLECTED AT PROPOSED
PORTAGE RIVER MARINA SITE

Phylum Protozoa (protozoans)

Class Sarcodina (amoeboids)

1. Diffflugia sp.

Phylum Rotifera (rotifers)

Class Digononta (double ovary rotifers)

1. Philodina sp.

Class Monogononata (single ovary rotifers)

1. Polyarthra sp.
2. Trichocera sp.
3. Asplanchna sp.
4. Branchionus sp.
5. Keratella sp.

Phylum Arthropoda

Class Crustacea

Order Cladocera (water fleas)

1. Ceriodaphnia sp.
2. Bosmina longirostris
3. Eubosmina coregoni
4. Diaphanosoma sp.

Order Ostracoda (seed shrimp)

1. Cyprinotus sp.

Order Copepoda (copepods)

1. Diaptomus sp.
2. Cyclops sp.
3. nauplius larvae

TABLE 5. BENTHIC INVERTEBRATES COLLECTED AT PROPOSED
PORTAGE RIVER MARINA SITE

	<u>Habitat</u>
Phylum Porifera (sponges)	
Class Demospongiae (horny sponges)	
Family Spongillidae (freshwater sponges)	
1. <u>Spongilla</u> sp.	rip-rap
Phylum Nematoda (roundworms)	
Class Adenophorea	
Family Tripylidae	
1. <u>Trilobus</u> sp.	organic mud
Phylum Bryozoa (moss animals)	
Class Ectoprocta	
Family Plumatellidae	
1. <u>Plumatella</u> sp.	rip-rap
Phylum Annelida (segmented worms)	
Class Oligochaeta (aquatic earthworms)	
Family Tubificidae	
1. <u>Branchiura sowerbyi</u>	organic mud
2. <u>Limnodrilus</u> sp.	organic mud
3. <u>Pelosclex</u> sp.	organic mud
Class Hirudinea (leeches)	
Order Pharyngobdellida	
Family Erpobdellidae	
1. <u>Erpobdella</u> sp.	<u>Cladophora</u> beds
Phylum Mollusca	
Class Gastropoda (snails)	
Subclass Pulmonata (lung-breathing snails)	
Family Physidae	
1. <u>Physa integra</u>	<u>Cladophora</u> beds
Subclass Prosobranchia (gill-breathing snails)	
Family Viviparidae	
1. <u>Viviparus</u> sp.	rip-rap
Family Pleuroceridae	
1. <u>Pleurocera acuta</u>	beached specimen
Class Pelecypoda (clams)	
Order Eulamellibranchia (naiades)	
Family Unionidae (mussels)	
1. <u>Amblema costata</u>	silty mud
2. <u>Amblema plicata</u>	beached specimen
3. <u>Quadrula quadrula</u>	beached specimen
4. <u>Anodonta grandis</u>	silty mud

Family Unionidae (Continued)

5. Actinonaias carinata

beached specimen

6. Leptodea fragilis

beached specimen

Order Heterodonta

Family Sphaeriidae (fingernail clams)

1. Sphaerium sp.

Cladophora

beds and organic
mud

Phylum Arthropoda

Class Crustacea

Order Isopoda (aquatic sowbugs)

Family Asellidae

1. Asellus sp.

rip-rap

Order Amphipoda (scuds)

Family Gammaridae

1. Gammarus fasciatus

Cladophora

beds

Order Decapoda (crayfishes)

Family Cambaridae

1. Orconectes sp.

Cladophora

beds; silty mud

Class Insecta (insects)

Order Ephemeroptera (mayflies)

Family Ephemeridae (burrowing mayflies)

1. Hexagenia sp.

floating

specimen (adult)

Order Coleoptera (beetles)

Family Gyrinidae (whirligig beetles)

1. Gyrinus sp.

Cladophora

beds

Order Diptera (flies)

Family Chironomidae (midges)

1. Procladius sp.

organic mud

2. Chironomus sp.

organic mud

3. Coelotanypus sp.

organic mud

TABLE 6. FISH SPECIES OBSERVED AT PROPOSED
PORTAGE RIVER MARINA SITE

Class Osteichthyes (bony fish)

Order Clupeiformes

Family Clupeidae (herrings)

1. Dorosoma cepedianum (gizzard shad)

Order Cypriniformes

Family Cyprinidae (carps and minnows)

1. Cyprinus carpio (common carp)
2. Notemigonus crysoleucas (golden shiner)
3. Notropis atherinoides (emerald shiner)
4. Notropis hudsonius (spottail shiner)
5. Notropis spilopterus (spotfin shiner)
6. Pimephales notatus (bluntnose minnow)

Order Siluriformes

Family Ictaluridae (catfishes)

1. Ictalurus melas (black bullhead)
2. Ictalurus punctatus (channel catfish)

Order Percopsiformes

Family Percopsidae (trout-perches)

1. Percopsis omiscomaycus (trout-perch)

Order Perciformes

Family Percichthyidae (temperate basses)

1. Morone americana (white perch)

Family Centrarchidae (sunfishes)

1. Ambloplites rupestris (rock bass)
2. Lepomis gibbosus (pumpkinseed)
3. Lepomis macrochirus (bluegill)
4. Micropterus dolomieu (smallmouth bass)
5. Pomoxis annularis (white crappie)

Family Percidae (perches)

1. Perca flavescens (yellow perch)

Family Sciaenidae (drums)

1. Aplodinotus grunniens (freshwater drum)

TABLE 7. HISTORIC RECORD OF FISH SPECIES COLLECTED
IN THE LOWER PORTAGE RIVER

<u>SPECIES</u>	<u>COMMON NAME</u>	<u>OCCURRENCE RECORD</u>
1. <u>Ichthyomyzon unicuspis</u>	silver lamprey	1955-1980
2. <u>Lepisosteus oculatus</u>	spotted gar	1901-1950
3. <u>Amia calva</u>	longnose gar	1901-1980
4. <u>Dorosoma cepedianum</u>	eastern gizzard shad	1901-1980; 1984
5. <u>Hiodon tergisus</u>	mooneye	1901-1935
6. <u>Esox lucius</u>	northern pike	1910-1980
7. <u>Esox americanus vermiculatus</u>	grass pickerel	1901-1955
8. <u>Cyprinus carpio</u>	common carp	1880-1980; 1984
9. <u>Carassius auratus</u>	goldfish	1955-1980
10. <u>Notemigonus crysoleucas</u>	golden shiner	1901-1955; 1984
11. <u>Samotilus atromaculatus</u>	creek chub	1901-1955
12. <u>Phenacobius mirabilis</u>	suckermouth minnow	1939-1980
13. <u>Notropis emiliae</u>	pugnose minnow	1901-1954
14. <u>Notropis atherinoides</u>	emerald shiner	1955-1980; 1984
15. <u>Notropis rubellus</u>	rosyface shiner	1880-1901
16. <u>Notropis umbratilis cyanocephalus</u>	northern redfin shiner	1901-1955
17. <u>Notropis hudsonius</u>	spottail shiner	1926-1952; 1984
18. <u>Notropis spilopterus</u>	spotfin shiner	1901-1955; 1984
19. <u>Notropis heterodon</u>	blackchin shiner	1901-1940
20. <u>Notropis stramineus</u>	sand shiner	1955-1980
21. <u>Notropis volucellus</u>	northern mimic shiner	1901-1955
22. <u>Notropis heterolepis</u>	blacknose shiner	1901-1938

<u>SPECIES</u>	<u>COMMON NAME</u>	<u>OCCURRENCE RECORD</u>
23. <u>Ericymba buccata</u>	silverjaw minnow	1901-1955
24. <u>Pimephales promelas</u> <u>promelas</u>	northern fathead minnow	1901-1954
25. <u>Pimephales notatus</u>	bluntnose minnow	1955-1980; 1984
26. <u>Campostoma anomalum</u> <u>pullum</u>	central stoneroller minnow	1955-1980
27. <u>Ictiobus cyprenellus</u>	bigmouth buffalofish	1901-1980
28. <u>Carpiodes cyprinus</u>	quillback	1880-1980
29. <u>Moxostoma anisurum</u>	silver redhorse	1921-1954
30. <u>Moxostoma erythrurum</u>	golden redhorse	1901-1955
31. <u>Moxostoma macrolepi-</u> <u>datum</u>	shorthead redhorse	1901-1953
32. <u>Catostoma commersoni</u>	white sucker	1901-1980
33. <u>Minytrema melanops</u>	spotted sucker	1925-1954
34. <u>Ictalurus punctatus</u>	channel catfish	1901-1980; 1984
35. <u>Ictalurus natalus</u>	yellow bullhead	1880-1980
36. <u>Ictalurus nebulosus</u>	brown bullhead	1901-1980
37. <u>Ictalurus melas</u>	black bullhead	1901-1980; 1984
38. <u>Noturus micrus</u>	brindled madtom	1901-1955
39. <u>Noturus gyrinus</u>	tadpole madtom	1901-1955
40. <u>Percopis omiscomaycus</u>	trout-perch	1901-1980; 1984
41. <u>Fundulus diaphanus</u> <u>menona</u>	western banded killifish	1880-1980
42. <u>Fundulus notatus</u>	blackstripe topminnow	1940-1980
43. <u>Labidesthes sicculus</u>	brook silverside	1880-1980
44. <u>Morone americana</u>	white perch	1984
44. <u>Morone chrysops</u>	white bass	1901-1980
45. <u>Pomoxis annularis</u>	white crappie	1901-1980; 1984
46. <u>Pomoxis nigromaculatus</u>	black crappie	1901-1980

<u>SPECIES</u>	<u>COMMON NAME</u>	<u>OCCURRENCE RECORD</u>
47. <u>Ambloplites rupestris</u>	rock bass	1901-1980; 1984
48. <u>Micropterus dolomieu</u>	smallmouth bass	1901-1955; 1984
49. <u>Micropterus salmoides</u>	largemouth bass	1901-1980
50. <u>Lepomis cyanellus</u>	green sunfish	1901-1955
51. <u>Lepomis macrochirus</u>	bluegill	1901-1955; 1984
52. <u>Lepomis humulis</u>	orangespotted sunfish	1901-1955
53. <u>Lepomis gibbosus</u>	pumpkinseed	1901-1926; 1984
54. <u>Stizostedion vitreum vitreum</u>	walleye	1901-1980
55. <u>Perca flavescens</u>	yellow perch	1901-1980; 1984
56. <u>Percina copelandi</u>	channel darter	1924-1954
57. <u>Percina carpioides</u>	logperch darter	1901-1934
58. <u>Etheostoma nigrum nigrum</u>	johnny darter	1901-1955
59. <u>Etheostoma blennioides blennioides</u>	greenside darter	1901-1980
60. <u>Etheostoma exile</u>	Iowa darter	1901-1955
61. <u>Etheostoma flabellare</u>	fantail darter	1901-1955
62. <u>Aplodinotus grunniens</u>	freshwater drum	1901-1980; 1984

Data Sources:

Trautman (1981)
Present study (1984)

TABLE 8. REPTILES AND BIRDS OBSERVED AT PROPOSED
PORTAGE RIVER MARINA SITE

Class Reptilia (reptiles)

Order Squamata (snakes and lizards)

Family Colubridae

1. Natrix sipedon sipedon (northern water snake)

Class Aves (birds)

Order Anseriformes (waterfowl)

Family Anatidae (ducks and geese)

Subfamily Anatinae (dabbling ducks)

1. Anas platyrhynchos (mallard)

Order Charadriiformes (shorebirds)

Family Laridae (gulls and terns)

1. Larus argentatus (herring gull)

2. Larus delawarensis (ring-billed gull)

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