Because of the relatively good ground-water conditions in the southern three-fourths of the region, most communities relying on well supplies are able to develop well fields either within their community or within easy reach of their boundaries.

Projections of public water supply withdrawals indicate that water withdrawals by the region's public water supplies may increase to approximately 104 mgd by the year 2000. The 1977 and projected water withdrawals and consumption rates by public water utilities are presented below.

Table 33
The 1977 and projected withdrawal and consumption rates of public water supplies, in million-gallons-per-day.

Public Water Supply	*1977*	*1980*	*1990*	*2000*
Withdrawal	77.3	80.2	92.5	104.0
Consumption	9.9	10.4	12.0	13.5

Industrial Water One of the nation's most important concentrations of heavy industry is located along the Lake Michigan shoreline of Region One-A. These industries are dependent upon an essentially unlimited supply of water and access to the Great Lakes navigation system.

The amount of water withdrawn by industries in this region constitutes eighty-eight percent of all self-supplied industrial water withdrawn in Indiana. An estimated 3,125 mgd of water was withdrawn by Region One-A industries in 1977. Of the total industrial intake, 3,093 mgd is self-supplied from Lake Michigan. Approximately 32.0 mgd is purchased from public water utilities. Water supplied to industries from public water companies in Hammond, Whiting, Munster, Highland, Griffith, Gary, Hobart, Portage, and Burns Harbor is withdrawn from Lake Michigan. About 91.0 mgd is evaporated or otherwise consumed in the manufacturing process.

The largest water-using industry group is primary metals. Bethlehem Steel, Inland Steel, Midwest Steel, U.S. Steel, and the Youngstown Sheet and Tube Company are located on the shoreline of Lake Michigan. These industries support, and in turn are supported by, a host of smaller ancillary industries. The primary metals industry utilizes approximately 2,874 mgd.

The second largest water-using industry group is petroleum and refinery. This industry group uses less than ten percent of the water used by the primary metals group. Other industry groups using significant quantities of water are quarrying operations and manufacturers of chemicals, machinery, transportation equipment, and paper products.

Accurate projections of the future industrial water use in Region One-A are dependent upon the steel industry, which itself is influenced by the demand for steel, new technical processes, foreign competition, ore availability from western Lake Superior, and future environmental regulations. The projections assume that these factors will remain constant and no radical shifts in operating techniques will occur.

Industrial production by the year 2000 is expected to increase sixty-three percent above the 1977 value (United States Water Resources Council). Although industrial output is expected to increase, total industrial water intake is expected to decrease initially due to plant efficiency and then rise slowly as output increases. The current and projected self-supplied withdrawals and rates of consumption for industries located in Region One-A are presented in the following table.

Table 34
The 1977 and projected self-supplied withdrawal and consumption rates for industries in million-gallons-per-day.

Industrial Self-Supply	*1977*	*1980*	*1990*	*2000*
Withdrawal	3,093.0	2,920.0	2,928.0	3,010.0
Consumption	89.7	92.2	117.2	145.8

Rural Self-Supplied Water The majority of rural self-supplied water is withdrawn from ground-water sources. An estimated 73,300 persons lived in homes supplied by individual wells in 1975. It is estimated that residential use of water approached 4.2 mgd in 1975. An estimated 6,500 additional persons may depend on their own wells for household water in the region by the year 2000. The withdrawal of rural self-supplied residential water may increase to approximately 5.8 mgd by the year 2000.

In 1975 an estimated 56,400 head of livestock and 106,000 chickens were located within the region. Collectively, these animals consumed approximately 0.5 mgd. Water withdrawals for livestock and chickens may increase slightly to 0.54 mgd by the year 2000.

The total withdrawal of rural self-supplied water may increase from the current 4.8 mgd to approximately 6.3 mgd by the year 2000, as presented below.

Table 35
The 1977 and projected water withdrawal and consumption rates for rural self-supplied water, in million-gallons-per-day.

Rural Self-Supply	*1977*	*1980*	*1990*	*2000*
Withdrawal	4.8	5.0	5.7	6.3
Consumption	4.8	5.0	5.7	6.3

Irrigation Water The soil associations with irrigation potential as shown in Figure 58 are located mainly in the north among the dune and old beach ridges

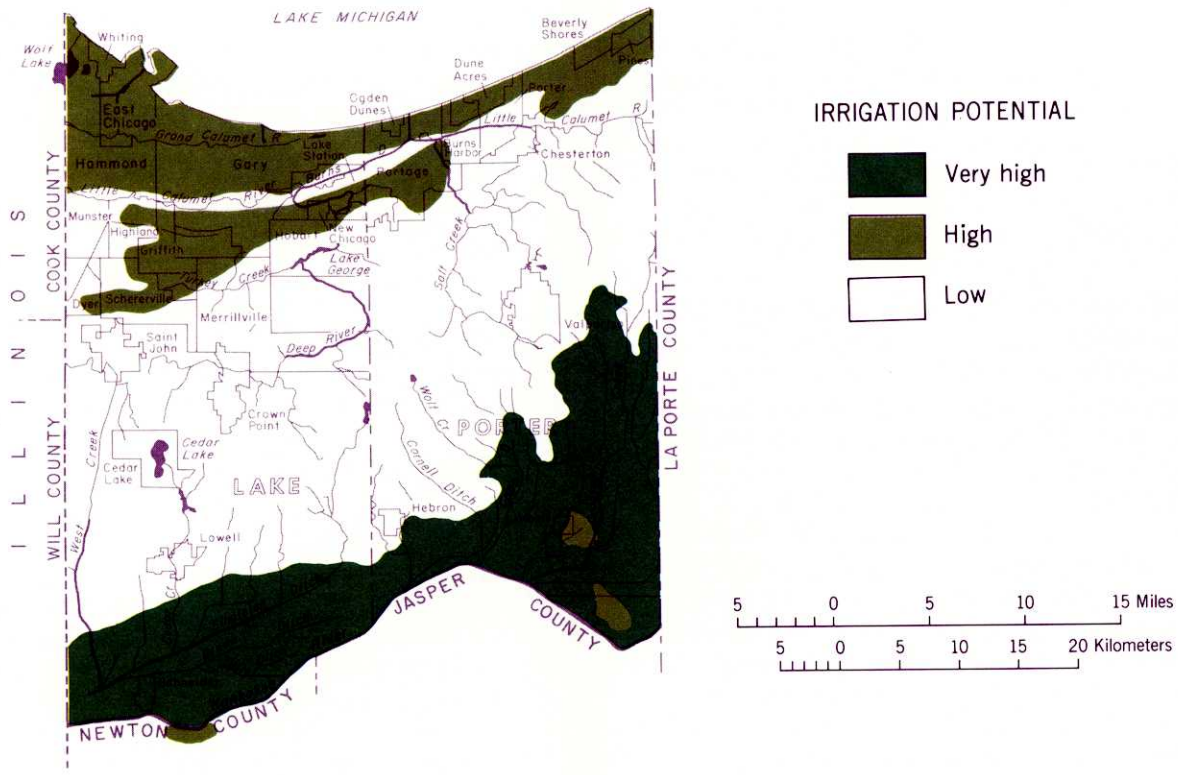

Figure 58
Map of Region One-A showing the general location of the soil associations that appear to possess an economic potential for the irrigation of croplands.

along Lake Michigan and in the south in the outwash plain and dunes of the Kankakee valley. Poorly drained soils are found in the Kankakee valley where irrigation is through water table control or subirrigation.

Based upon the survey of irrigated croplands, approximately 2,000 acres were irrigated in the region in 1977: 1,200 acres in Lake County, and 800 acres in Porter County. The principal crops irrigated were vegetables and corn.

Assuming 1977 as a normal growing year, these crops would have required about 5.4 mgd during the peak irrigation period of July and August.

It is estimated that about 40,000 acres of croplands could be profitably irrigated. Approximately 5,500 acres of croplands may be irrigated by the year 2000. Almost all of this additional irrigated acreage will be in the Kankakee valley. The expansion of irrigation acreage is expected to increase the peak July–August irrigation demand in an "average" season to 14.7 mgd. The "average" season increase in ground-water withdrawal for irrigation is expected to increase from the current 0.7 to 3.7 mgd by the year 2000.

In addition to the irrigation for agricultural use, there are about 655 acres of irrigated fairways and greens on the region's golf courses. About 2.0 mgd is applied to these areas during the peak July–August irrigation period.

The total withdrawal for irrigation of croplands and golf courses during the "average" irrigation season of 1977 was approximately 7.4 mgd. These withdrawals may increase to 18.0 mgd during the "average" growing season by the year 2000, as presented here.

Table 36
The 1977 and projected withdrawal of irrigation water for croplands and golf courses during the average growing season, in million-gallons-per-day

Irrigation	*1977*	*1980*	*1990*	*2000*
Withdrawal	7.4	9.5	13.7	18.0
Consumption	7.4	9.5	13.7	18.0

Electric Energy There are three electric generating stations all located on Lake Michigan. The three existing stations are the State Line Generating Station, the Dean H. Mitchell Generating Station, and the Bailly Generating Station. The State Line plant is owned by the Consolidated Edison Company which exports all power generated by this facility to Illinois. Mitchell and Bailly are owned and operated by the Northern Indiana Public Service Company which serves northwest Indiana.

The State Line plant is rated at 968 megawatts (mw), the Mitchell Station is rated at 581.6 mw, and the Bailly Station is rated at 649.5 mw. Intake requirements are 750 mgd for State Line, 398 mgd for Mitchell, and 341 mgd for Bailly.

The Northern Indiana Public Service Company is in the process of enlarging its generating capacity by adding a nuclear-powered generating unit to the Bailly Generating Station. The new unit, now under construction, is rated at 685 mw. The new unit will use a closed cycle cooling system. The addition of the Bailly unit will increase the intake requirements to 353 mgd. About 9.2 mgd will be lost through evaporation.

Water withdrawals for the production of electricity during 1977 were approximately 1,489 mgd. Water withdrawals are expected to decrease to 432 mgd by the year 2000 as presented below.

Table 37
The 1977 and projected water withdrawal and consumption rates for the production of energy, in million-gallons-per-day

Energy	*1977*	*1980*	*1990*	*2000*
Withdrawal	1,489.0	1,501.0	1,501.0	432.0
Consumption	6.0	11.8	11.8	9.4

EXCESS WATER

Flooding

Approximately 24,600 acres of the region are subject to flooding. The major flood plains are shown in Figure 59. The average annual damages due to flooding were estimated in 1977 to be $19.3 million, of which some ninety-two percent occurred in urban areas. Most of the urban damage occurs along the Little Calumet River in Lake County. This flooding problem has long been considered by the Department of Natural Resources to be the most serious urban flooding problem in Indiana. Figure 60 shows the estimated average annual flood damages in Region One-A.

Virtually all of the streams are subject to flooding. Flash flooding on streams in the area is uncommon due to the flat topography. The Kankakee, Little Calumet, and Grand Calumet Rivers are subject to slow rates of rise and long flood durations.

Flood Control Partial flood protection along the Kankakee River is provided by levees (spoil banks) that were constructed from dredge spoil. The levees are of variable top elevation and exhibit little uniformity in cross section. The levees along the Kankakee River in southern Lake County, coupled with the Singleton Ditch drainage system, kept Kankakee River

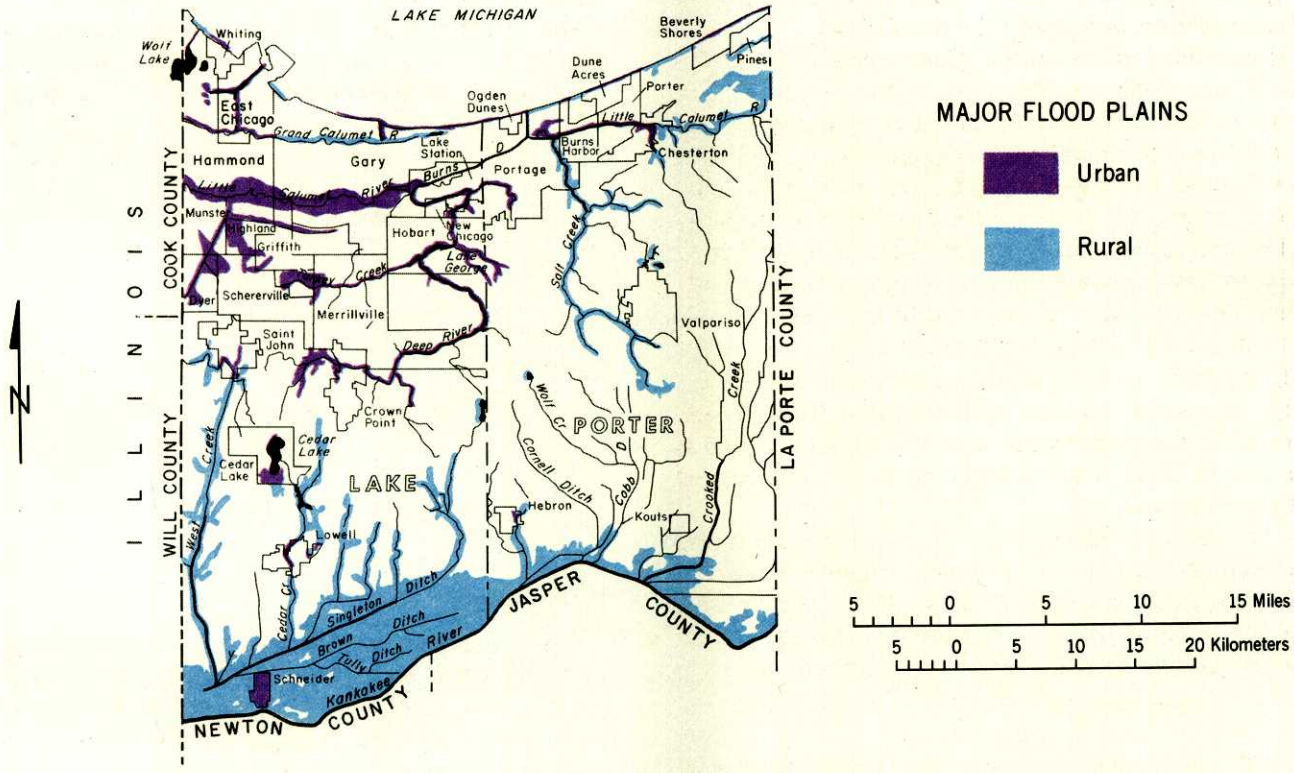

Figure 59
Map of Region One-A showing the major flood plains.

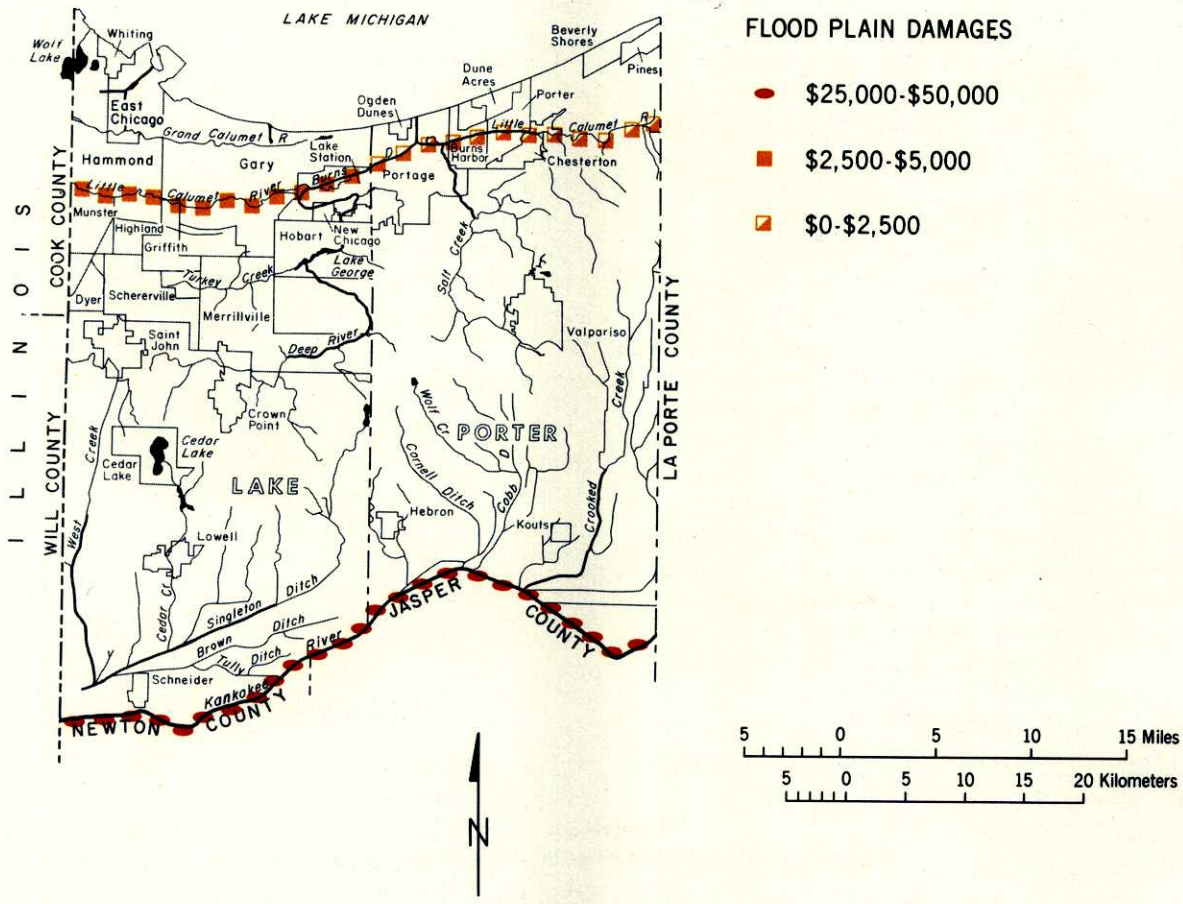

Figure 60
Map of Region One-A showing the estimated average annual flood damages per mile along selected streams.

floodwaters out of southern Lake County for many years. Very little maintenance has been performed and the degree of protection varies with the condition of the levee. The major flood damages in this watershed are agricultural in nature.

The major flooding problem on the Little Calumet River occurs in the highly urbanized area located between the Indiana-Illinois state line and Deep River. Large areas of the flood plain have been developed for residential and commercial purposes. Over 9,000 residences and commercial buildings have been constructed in areas that are subject to flooding.

The Grand Calumet River, a minor system in the region, drains a narrow strip of flat areas and beach ridges along Lake Michigan. Flooding along the Grand Calumet River is influenced by high stages on Lake Michigan.

The Chicago District, United States Army Corps of Engineers, is currently doing advanced engineering and design work on the proposed Little Calumet River project. This project consists of twenty-three miles of work on the West Arm of the Little Calumet River, Burns Ditch, and Burns Waterway to provide a safe outlet for floodwaters. Associated with the flood control facilities will be recreational facilities and a marina providing access to Lake Michigan.

The Kankakee River Basin Commission was formed in 1977 to study the problems of the Kankakee River. The basin commission has adopted a plan of channel work, levees, floodplain zoning, and land treatment, which protects, enhances, and maintains the wildlife and fisheries habitat and provides for land and water based recreation.

The Porter County – Kankakee River subarea is the only small watershed project, authorized for planning, located within the region.

Flood Plain Management All of the political jurisdictions in the region are participating in the emergency phase of the National Flood Insurance Program. Griffith, Highland, and Beverly Shores are participating in the regular National Flood Insurance Program. Residents of the areas can purchase insurance against property losses due to flooding.

Agricultural Drainage

Approximately thirty-six percent of the soil associations have "severe" wetness characteristics, fifty-nine percent have "moderate" wetness characteristics, while five percent have "slight" wetness characteristics. The general location of the soil associations with these wetness characteristics are shown in Figure 61.

Extensive investments in private and public surface and subsurface drainage systems have been made to overcome the high water table. There are 1,600 miles of legal drains in the two-county region. In much of the agricultural rural area paralleling the Kankakee River, lift pump drainage systems have been installed to carry water from the drainage system catch basin up and over river levees. Water table control, by regulating the water level in the drainage ditches, is also practiced. The complex drainage networks are dependent on the size and maintenance of the river and stream outlet system.

The urban areas of the region experience the drainage problems typical to most urban areas in Indiana. These include undersized drainage systems which lack capacity to handle the runoff from storms of any significant magnitude; combined storm water and sanitary sewer systems which contribute heavily to treatment plant bypassing and consequent stream pollution; and inadequate maintenance, primarily from lack of adequate local funding.

Soil Erosion

The erosion potential of soil associations within Region One-A is shown in Figure 62. Forty-four percent of the 601,000 acres is rated as having a "medium" soil erosion hazard. This land area lies in a belt across the central portion of the region. The remaining fifty-six percent of the land is predominantly level and ranks as having a "low" erosion potential.

WATER QUALITY

The surface streams routinely surveyed for water quality in 1978 by the Indiana State Board of Health were the Grand Calumet River, Little Calumet River, Burns Ditch and Waterway, Salt Creek, Indiana Harbor Ship Canal, and the Kankakee River. In addition, Lake Michigan and Wolf Lake were surveyed. Water quality standards for the region were established by the Stream Pollution Control Board regulations SPC IR-4 (Water Quality Standards for the State of Indiana), SPC 4R-2 (Water Quality Standards for Lake Michigan and Contiguous Harbor Areas, 1978), SPC 7R-3 (Water Quality Standards for the Grand Calumet River and the Indiana Harbor Ship Canal, 1978), SPC 10R-2 (Water Quality Standards for Wolf Lake, 1978) and SPC 12R (Natural Spawning, Rearing, and Imprinting Areas, 1978).

The dissolved oxygen concentration at the Gary water intake on Lake Michigan has ranged above the minimum standard. In addition, the concentration of total coliform bacteria was within the standards for raw drinking water. The fecal coliform bacterial level

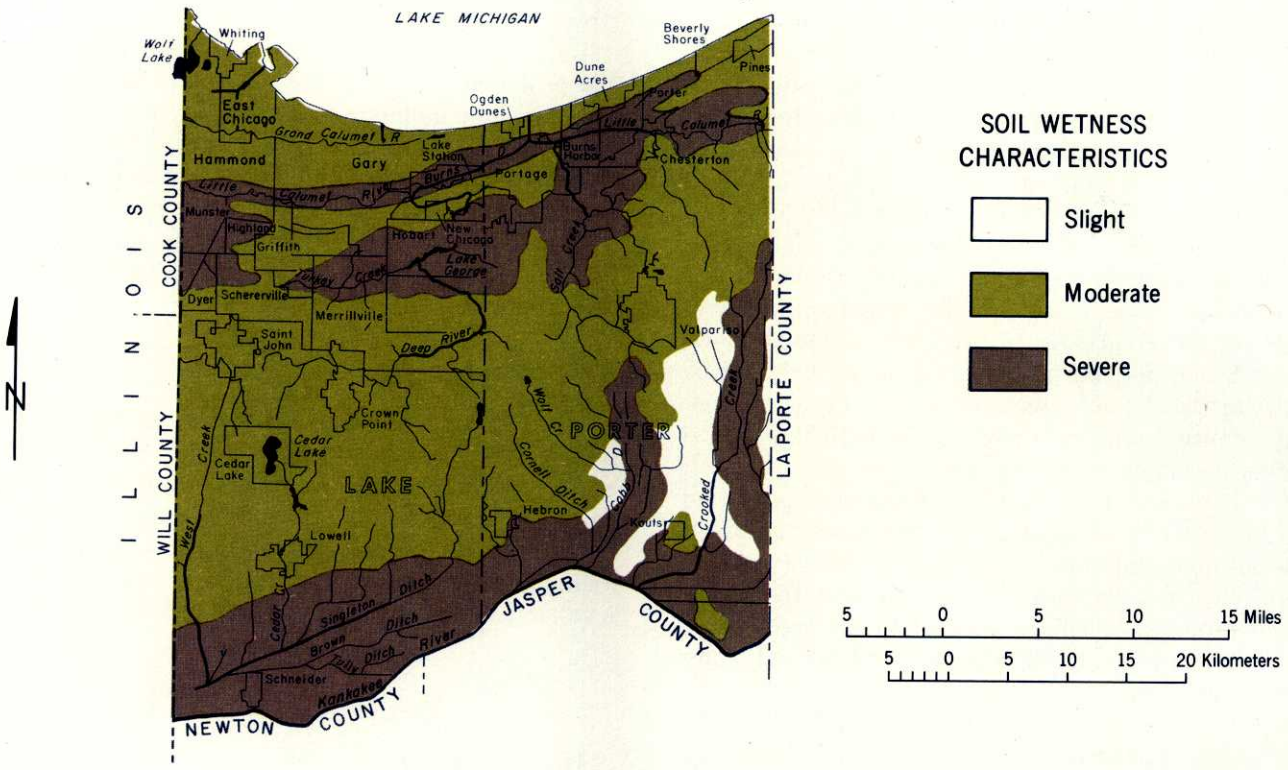

Figure 61
Map of Region One-A showing the general location of the wetness characteristics of soil associations.

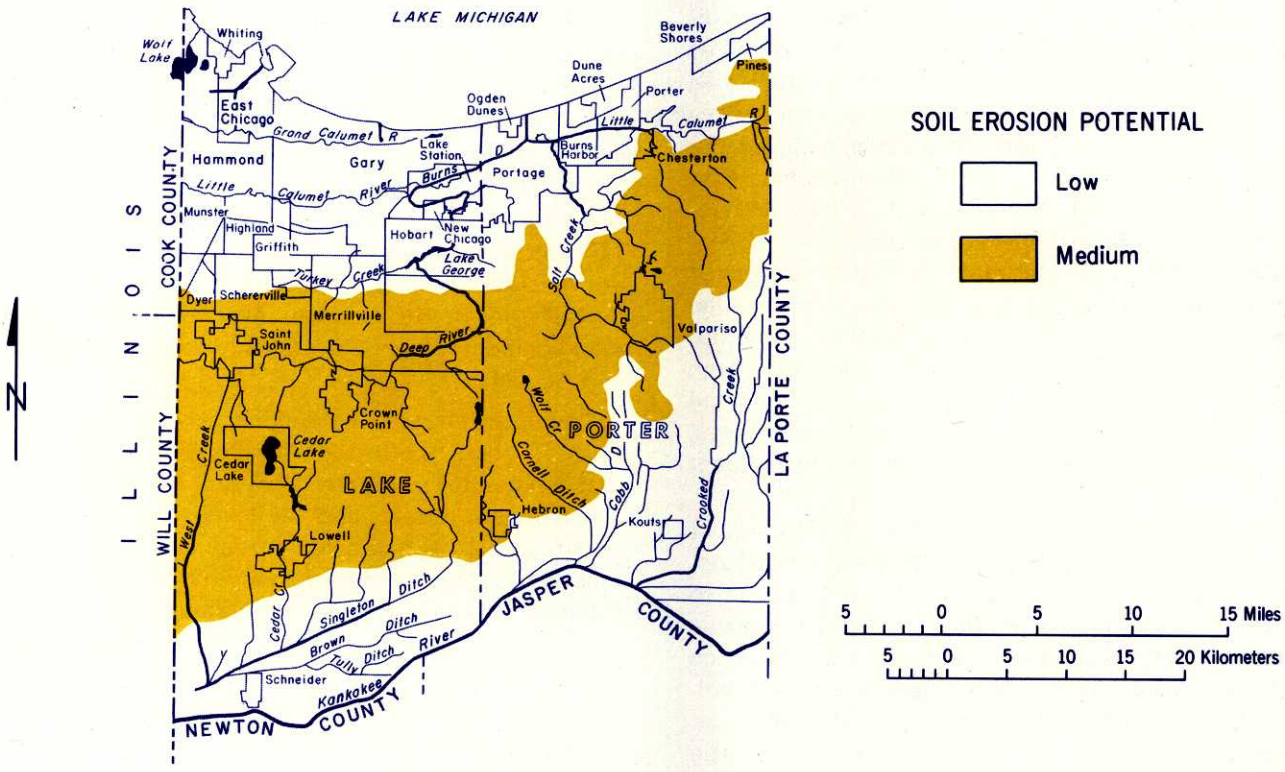

Figure 62
Map of Region One-A showing the erosion potential of the soil associations under fallow land conditions.

at various sampling points in Lake Michigan was not exceeded from April through October, when whole-body contact recreation was allowed. The pH, a measure of the acidity or alkalinity of a substance, of the water at the Gary intake generally remained within the recommended range as established by SPC 4R-2.

The Grand Calumet River consists almost entirely of both treated wastewater and wastewater of nonpoint source origin. The unnatural character of the stream indicates that even when all wastewater discharges are provided with best available treatment technology, the Calumet River may not be capable of sustaining a diverse fishery. The Grand Calumet River is classified as waters for partial body contact and limited aquatic life.

In this region, the Grand Calumet River experiences temperature violations, usually occurring during the months of October and November. The dissolved oxygen content at the Indiana-Illinois state line has violated the standard established by SPC 7R-3 approximately fifty percent of the time. Most of the dissolved oxygen violations occurred during the summer. One contributing factor to the low oxygen levels is the uptake of oxygen by bacteria decomposing the large amount of organic material discharged into the Grand Calumet by natural runoff, stormwater from sewers, and discharge from municipal and industrial treatment plants.

Other parameters evaluated for the Grand Calumet River include nitrate, pH, and biochemical oxygen demand: a measure of the amount of oxygen consumed in the biological processes that breakdown organic matter in water. Nitrate levels of the Calumet River fell within acceptable levels. Water quality samples collected in Gary indicated the biochemical oxygen demand was at an acceptable level. However, the biochemical oxygen demand levels that occurred at the Indiana-Illinois state line were higher than desirable. The pH values of the Grand Calumet River fell within the recommended range at both stations.

The Grand Calumet River is designated for partial body contact recreation. The levels of fecal coliform bacteria appear to exceed the criteria for partial body contact at the Indiana and Illinois state line. This violation could possibly be associated with chronic chlorination problems at the Gary wastewater treatment facility.

No temperature violations were recorded for the Indiana Harbor Ship Canal, but dissolved oxygen values were often not in compliance with the standards. In the canal, both nitrates and the biochemical oxygen demand were usually at acceptable levels and maximum and minimum pH values were found to be within standards.

Portions of the Little Calumet River and Burns Ditch are designated for partial body contact recreation and are capable of supporting a cold water fishery. Data for the Little Calumet River and Burns Ditch did not indicate temperature violations, although temperatures taken at Hohman Avenue Bridge in Hammond and State Road 149 northwest of Porter indicated the presence of thermal inputs between the two stations.

In the upper reaches of the Little Calumet River, a cold-water fishery migration route, the concentration of dissolved oxygen met the standard. The dissolved oxygen concentration in the reaches near Hammond usually met the water quality standard for warmwater fish. Most dissolved oxygen violations occurred in late summer and early autumn. Data indicates that nitrate and pH levels were generally within the recommended levels, but the biochemical oxygen demand often exceeded its levels, especially during the fall.

The Little Calumet River is designated for partial body contact recreation at the station at State Road 149 northwest of Porter. However, this standard was not met during summer and fall months. The station downstream at the Hohman Avenue Bridge in Hammond could not meet this standard except during June and August.

One of the streams that augments the Little Calumet River is Burns Ditch. Data for Burns Ditch indicated that temperature, dissolved oxygen, biochemical oxygen demand, nitrate, and pH levels were acceptable year-round. Designated for partial body contact recreation, the fecal coliform bacterial levels in Burns Ditch occasionally exceeded the standards.

Salt Creek, which also augments the Little Calumet River, has twelve wastewater dischargers, the largest of which is the city of Valparaiso. The standard for dissolved oxygen was met above the Valparaiso treatment plant but dropped below the standard downstream from the plant. Similarly, the biochemical oxygen demand met the recommended level upstream of Valparaiso but exceeded the recommended level downstream from the treatment plant. The number of fecal coliform bacteria exceeded the standard downstream of Valparaiso. It is anticipated that once Valparaiso completes its additional ammonia-nitrogen and disinfection facilities, instream standards will be achieved.

Temperature, dissolved oxygen, and nitrate levels for the Kankakee River were acceptable. The biochemical oxygen demand seldom exceeded the standard.

Regulation SPC 10R-2 (Water Quality Standards for Wolf Lake, 1978) designates Wolf Lake to be maintained not only for full body contact recreation but also for a warmwater fishery. Temperature, dissolved oxygen, and fecal coliform bacterial levels were within the state standards. Some monthly pH maximums have exceeded the limit for Wolf Lake.

The trophic or age classification of those lakes surveyed by the Stream Pollution Control Board in Region One-A follow.

Table 38
Trophic classification of lakes surveyed.

Lake	*County*	*Age Classification*
Clear	Porter	I
Flint	Porter	I
Morgan	Porter	II
Sagars	Porter	II
Wahab	Porter	II
Long	Porter	II
Billington	Porter	II
Canada	Porter	II
Spectacle	Porter	II
Fancher	Lake	II
Eliza	Porter	II
Mink	Porter	II
Dale Carlia	Lake	III
Lake George (Hammond)	Lake	III
Lake George (Hobart)	Lake	III
Loomis	Porter	III
Wolf Lake	Lake	III
Cedar	Lake	III