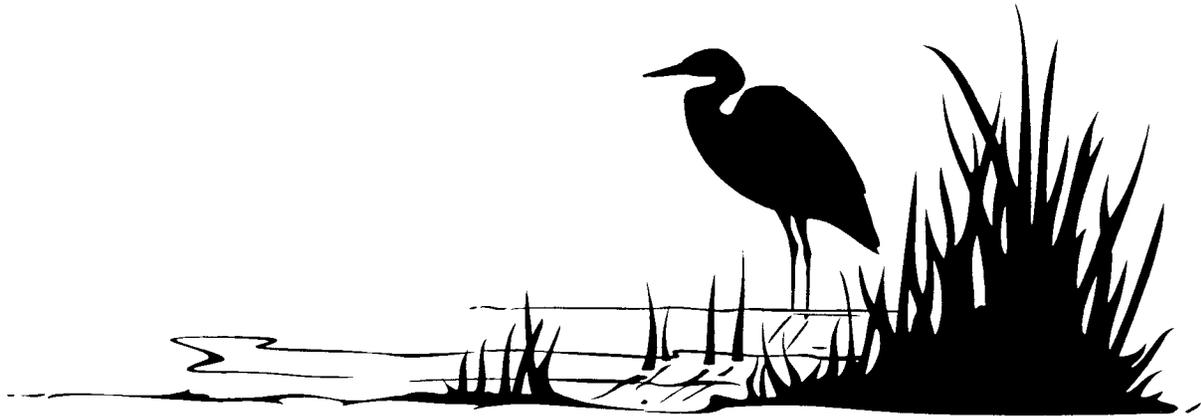


RARE PLANT SPECIES AND PLANT COMMUNITY INVENTORY OF THE LAKE ERIE COAST



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ABSTRACT

The vast majority of natural plant communities along the Lake Erie Coast in Ohio have been destroyed by commercial and residential development and agriculture. Along with this loss of habitat went the decline of many plant species which were once common along the Lake. This project was initiated to survey and inventory the remaining intact plant communities and rare plant populations along the Lake Erie coast. During these surveys, 81 new populations of state-listed plant species were located, including 11 endangered, 25 threatened and 45 potentially threatened plant populations. Thirty-seven older records for plant species were also updated. Historical information relating to the botanical diversity and plant communities along the coast was compiled in order to provide baseline information on the botanical condition of the coast prior to development. The result of this project is a summary of the past and current status of rare plant species and natural plant communities within the Lake Erie coastal region. This information may be used by regulatory agencies, land use planners, developers and consultants to help plan development to minimize impact on natural features. This information will also aid in the efforts of conservation agencies and organizations to protect high-quality natural areas and restore degraded ones.

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PREFACE

Nuttall's travels

The botanist Thomas Nuttall (1786-1859) traveled along Ohio's Lake Erie Coast from June 5 to June 23, 1810. His diary provides us with one of the earliest descriptions of the natural landscape of the region (Graunstein, 1950). Nuttall's descriptions are especially interesting because he names many of the plants which he saw along the way. He entered Ohio from Pennsylvania on a road established on one of the beach ridges which he correctly speculated was the former boundary of a lake. His first mention of a plant is of rose twisted-stalk (*Streptopus roseus*) today a state endangered species found in only one site on the Lake Plain. The fact that Nuttall observed this species indicates that he probably stepped off the ridge and ventured into one of the hemlock swamps which are now so rare in eastern Ashtabula County.

He reached Painesville on June 7 where he observed the now state threatened inland beach pea (*Lathyrus japonicus*) on a beach near the outlet of the Grand River. Nearby, Nuttall saw plains puccoon (*Lithospermum caroliniense*), a state threatened species which formerly occurred on the old beach ridges in eastern Ohio. The species is now extirpated from the coastal region. It is restricted in Ohio to the sand barrens of the Oak Openings.

Nuttall arrived in Cleveland on June 10. He describes a sandy plain he passed through before reaching the town. The few plants he mentions, prairie loosestrife (*Lysimachia quadriflora*) and downy phlox (*Phlox pilosa*), suggest that he observed an open, prairie-like habitat. Some other habitats he mentions in the Cleveland area include sandy woods, a swamp near the Cuyahoga River and the beach along the Cleveland lakefront where he again saw beach pea.

After leaving Cleveland, Nuttall describes his eight-mile journey through unbroken forest, some of which was swampy, from the Cuyahoga to the Rocky River. Along the Rocky River, he reports seeing buffalo-berry (*Shepherdia canadensis*), now a potentially threatened species which can still be seen on cliffs overlooking the Rocky and other northeastern Ohio rivers.

By June 15, Nuttall had reached the Huron River, along the banks of which he reports seeing showy lady's-slipper (*Cypripedium reginae*), now a state threatened species found nowhere in the coastal region. In the same area he locates buffalo clover (*Trifolium reflexum*), which only occurs in one site in Ohio today, in Pike County. From the small settlement at Huron, Nuttall planned to take a boat to Detroit to avoid the necessity of passing through the 150 miles of desolate wilderness between the Fremont of today and Detroit.

While waiting for a boat, Nuttall explored westward towards Sandusky Bay from June 16-19. On June 16 he encountered an extensive prairie which extended 8-12 miles

west from Huron. He mentions a variety of prairie species including: prairie false indigo (*Baptisia lactea*), yellow false indigo (*Baptisia tinctoria*), rattlesnake-master (*Eryngium yuccifolium*), green milkweed (*Asclepias hirtella*), lance-leaved violet (*Viola lanceolata*), goat's-rue (*Tephrosia virginiana*), plains puccoon (*Lithospermum caroliniense*) and inland beach-pea (*Lathyrus japonicus*). Of these, only three, prairie false indigo, green milkweed and lance-leaved violet, can still be found in the limited remnants of this prairie.

On June 17, Nuttall continued toward Sandusky Bay through prairies and groves. He uses the term "savannah" to describe this intermingling of open prairie with groves of trees. In marshes near the bay he observed porcupine grass (*Stipa spartea*), a state threatened species which no longer occurs along the coast. After returning to Huron, Nuttall mentions seeing leafy blue flag (*Iris brevicaulis*) in the Huron River. This remains the only place one can still see this state endangered species in the coastal region.

On June 23, after several days delay, Nuttall ended his visit to Ohio's Lake Erie coast by taking a boat to Detroit during which he notes the Lake Erie Islands in passing. Nuttall's extraordinary natural history narrative gives us a glimpse, albeit a sketchy one, of the original condition of the Lake Erie Coast before extensive European settlement. Most of what Nuttall observed has been lost or severely altered in the intervening years between 1810 and the present.

INTRODUCTION

The vast majority of natural plant communities along the Lake Erie coast have been destroyed by commercial, recreational and residential development and agriculture. This loss of habitat coincided with the decline of many plant species which were once common along the lake. There are many documented cases of aquatic and wetland plants that were abundant in the Lake Erie marshes at the turn of the century that are extremely rare today (Stuckey 1989). Several species which were reported from the coast around the turn of the last century are now extirpated from Ohio and several more no longer occur anywhere in the coastal region. Several plant community types which were more common in the past have nearly been eliminated, including natural marshes, beaches, swamp forests, alvars, sand barrens and prairies. The sprawl of Cleveland has eliminated most of the natural vegetation from the Cuyahoga County Lake Plain as well as from adjacent portions of coastal Lorain and western Lake counties. Commercial and residential development continues to proceed at a rapid pace all along the Lake Plain placing the remaining natural plant communities and populations of rare plant and animal species at risk.

OBJECTIVES

This project began in January 1997 and was completed in April 1999. The objective of the project, funded by a grant from the Lake Erie Protection Fund, was to produce a summary of the status of state rare plant species and high-quality plant communities along the Lake Erie coast. The study area includes the entire narrow band of the Lake Plain Physiographic Region ranging about 3-15 miles wide along the Lake Erie coast in Ashtabula, Lake, Cuyahoga and Lorain counties. The portion of the Lake Plain included in this study widens to the west to include all of Erie and Ottawa counties as well as parts of Lucas and Sandusky counties. The portion of the Lake Plain to the west of the Maumee River, where the Lake Plain spreads out for a great distance away from the coast, was not included in the study.

This study continued a two-year project funded by the US EPA through the Ohio Chapter of the Nature Conservancy to survey and classify plant communities within the Lake Erie Basin of Ohio, an area which encompasses about 30% of Ohio (Schneider and Cochrane 1997). The current study, focused exclusively on the Lake Erie coast, compliments part of the work done in the previous two years and broadens its scope to include rare plant surveys, along with additional plant community inventory.

METHODS

This project combines historical information from published papers, unpublished reports, plant specimens located in herbaria throughout Ohio, and from information in the Division of Natural Areas and Preserves' Heritage Database and files. A complete listing of all known occurrences of rare plant species within this region was generated from the Heritage Database in 1996. The Heritage Database is a comprehensive repository for information on Ohio's rare plants, animals, plant communities and other natural features that have been documented over the last 3-4 decades. As of April 1999, there are 149 known species of state-listed vascular plants in the Lake Erie coastal region, which have been reported since 1980, including 35 endangered, 43 threatened and 71 potentially threatened species. Based on data in the Division's files, at least 75 additional state-listed plant species formerly occurred in this region, but have not been seen in the last 20 years. The Division of Natural Areas and Preserves maintains a list of rare native plant species which is revised every two years with guidance from the Ohio Rare Plant Advisory Committee (Ohio Division of Natural Areas and Preserves 1998). Rare plant species may be classified as either endangered, threatened, potentially threatened, or presumed extirpated. However, only endangered or threatened species have some degree of legal protection in the state of Ohio. The following criteria are used to designate rare species status:

Endangered species (E): A native Ohio plant species may be designated endangered if, based on its known status in Ohio, one or more of the following criteria apply:

1. The species is a federal endangered species extant in Ohio.
2. The natural population of the species in Ohio are limited to three or fewer occurrences.
3. The distribution of the natural populations of the species in Ohio is limited to a geographical area delineated by three or fewer United States Geological Survey 7.5 minute quadrangle maps.
4. The number of plants in all the natural populations of the species in Ohio is limited to one hundred or fewer individual, physically unconnected plants.

Threatened Species (T): A native Ohio plant species may be designated threatened if, based on its known status in Ohio, one or more of the following criteria apply:

1. The species is a federal threatened species extant in Ohio but not on the state endangered species list.
2. The natural populations of the species in Ohio are limited to no less than four nor more than ten occurrences.
3. The distribution of the natural populations of the species in Ohio is limited to a geographic area delineated by no less than four nor more than seven United States Geological Survey 7.5 minute quadrangle maps.

Potentially Threatened Species (PT): A native Ohio plant species may be designated potentially threatened if, based on its known status in Ohio, one or more of the following criteria apply:

1. The species is extant in Ohio and does not qualify as state endangered or threatened species, but it is a proposed federal endangered or threatened species or a species listed in the Federal Register as under review for such proposal.
2. The natural populations of the species are imperiled to the extent that the species could conceivably become a threatened species in Ohio within the foreseeable future.
3. The natural populations of the species, even though they are not threatened in Ohio at the time of designation, are believed to be declining in abundance or vitality at a significant rate throughout all or large portions of the state.

Presumed Extirpated Species (X): A native Ohio plant species may be designated presumed extirpated when no natural populations of the species have been documented since 1978.

The Division of Natural Areas and Preserves maintains a list of significant natural

plant communities that occur throughout the state. Dennis Anderson, an ecologist in the Division from 1976 to 1986, produced a preliminary classification of Ohio plant communities in 1982 (Anderson 1992). This classification was in use until 1997 to document high quality plant communities in Ohio for the Division's Heritage Database. The Division's plant community classification was modified in 1997 based on the work of Schneider and Cochrane (1997). Only sites with plant communities of excellent quality are considered to be significant plant communities and are entered into the Heritage Database. The Ohio plant community classification currently recognizes 37 distinct plant community types. Thirteen of these plant community types are represented in the coastal region:

- Alvar
- Beach-dune community
- Big bluestem prairie
- Hemlock-hardwood forest
- Hemlock-hardwood swamp
- Maple-ash-oak swamp
- Mixed emergent marsh
- Mixed mesophytic forest
- Prairie fen
- Riverine marsh
- Sand barren
- Slough grass-bluejoint prairie
- White pine-red maple swamp

Sites for survey were chosen by reviewing the data from the Heritage Database, reviewing USGS topographic maps, and ODNR Division of Geological Survey Glacial and Surficial Geology maps. Knowledgeable individuals were consulted for additional information. This work was conducted from January-March 1997 and November-March 1998 in preparation for the field seasons. Data was collected during two seasons of field research (1997-1998) during which field surveys were conducted from April to October in the coastal region to locate new sites for rare plant species and high-quality plant communities as well as to relocate older records of rare species and plant communities. The attempt was made to relocate populations of presumed extirpated, endangered and threatened plants based on Heritage Database records. Special emphasis was placed on sites where a state endangered or threatened species had not been relocated for 5 or more years, although potentially threatened plant populations were also recorded when discovered or relocated. When a population of rare plants was located, a voucher specimen was collected and submitted to an herbarium in Ohio. High-quality natural plant communities were surveyed, classified and evaluated based on methods used in

Schneider and Cochrane (1997). Data on rare species and plant community occurrences was submitted to the Heritage Database at the end of each field season.

Based on the author's research and experience from the previous project (Schneider and Cochrane 1997), eight major groupings of natural areas and plant community types were identified at the outset of the project and these became the focus of historical and field research. The majority of these sites were surveyed during the two field seasons.

1. Coastal marshes: The diked, managed marshes between Toledo and Port Clinton were surveyed, including such federally managed sites as the Cedar Point and Ottawa National Wildlife Refuges, state wildlife areas such as Magee Marsh and Metzger Marsh, as well as state parks such as Crane Creek and Maumee Bay. Sheldon Marsh near Huron and the marshes at East Harbor State Park were also surveyed. Additional coastal marshes, which had already been surveyed during the previous study and are included in this report, are Fox's Marsh on North Bass Island and North Pond on Kelleys Island.

2. Estuary marshes: Most of the estuary marshes of the larger rivers along the coast in northeastern Ohio have been destroyed by industrial development or construction of harbors and marinas, including such rivers as the Cuyahoga, Black, Vermilion, Ashtabula, and Grand. Whereas most of the mouths of these larger rivers which empty into Lake Erie have been drastically altered, estuary marshes still occur in several smaller streams in northeastern Ohio. Sites surveyed include marshes at Arcola Creek and at Mentor-on-the-Lake in Lake County, as well as Wheeler Creek, Cowles Creek, Indian Creek and No Name Creek in Ashtabula County. The river mouths in northwestern Ohio have also been greatly degraded as the rivers have been impacted by agricultural runoff, marina construction and diking. One of the only relatively intact estuaries is at Old Woman Creek in Erie County. Diked, managed marshes occur in the Little Portage and Toussaint Rivers and around Sandusky Bay. A large, riverine marsh also occurs at DuPont Marsh in the Huron River.

3. Prairies and fens: The largest and best preserved prairies in Ohio are at the Resthaven Wildlife Area on the south side of Sandusky Bay. This site which contains the remnants of the formerly extensive Castalia Prairie consists of a complex of fen and wet to mesic prairie. The site contains numerous rare plant records and high-quality prairie and wetland plant communities.

4. Beach and dune communities: Examples of beach communities occur in northeastern Ohio at Walnut Beach and Conneaut Beach in Ashtabula County, as well as at Headlands Dunes in Lake County and the Mentor Lagoons in Lake County. A few smaller, less well preserved beaches occur in northwestern Ohio including the beaches at Sheldon Marsh in Erie County, Bay Point, East Harbor State Park and Magee Marsh Wildlife Area in

Ottawa County, as well as the Cedar Point Wildlife Area in Lucas County. There are also several additional sites along the Lake Erie Coast which are smaller, or less well preserved, but contain rare plant species.

5. Sand ridges and associated seepage swamps: There are several sites in Ashtabula and Lake Counties where forested swamps occur on flat terrain at the base of ancient beach ridges. The plant communities on the tops of the ridges have mostly been severely degraded or destroyed by roads and sand mining. The best remaining site is the North Kingsville Sand Barrens in Ashtabula County which supports the only intact sand barren/oak savanna community remaining in northeastern Ohio. Most of the swamps at the base of these ridges have also been severely altered by development, logging, mining, agriculture and commercial nurseries. However, a few high-quality hemlock seepage swamps and other swamp forest communities still occur, primarily in Ashtabula County.

6. Alvars and alvar remnants: The Marblehead Peninsula, Green Island and Kelleys Island contain Ohio's only alvar communities. The globally rare alvar community has only recently been recognized in North America. Alvars are open, barren communities which occur on glaciated, horizontal limestone or dolomite bedrock. They are populated by a complex of drought-resistant, calcium-loving plant species. There is an intact alvar on the north shore of Kelleys Island and a series of small alvars on one side of Green Island. In addition, alvar vegetation, which includes many rare species, persists in abandoned limestone quarries on Kelleys Island, the Marblehead Peninsula and in the Castalia Quarry.

7. The islands in western Lake Erie: There are rare plant species and unusual plant communities on several of the islands including Green Island, Kelleys Island, West Sister Island and the Bass Islands. Plant communities include marshes and alvars, as well as some unusual forest associations.

8. Submersed communities: Recent changes in the quality of Lake Erie waters caused by the introduction of zebra mussels have brought about a resurgence of some submersed aquatic plant communities. The recovery of these plant communities, which had declined dramatically in the past, is especially evident in Put-in-Bay Harbor.

After the field research was completed, the coastal area was divided into ten geographical regions of special interest for rare species and natural plant communities. These regions are arranged from west to east:

1. Lake Erie Coast from Port Clinton to the Maumee River
2. Western Sandusky Bay

3. Castalia Prairie (Resthaven Wildlife Area) and Castalia Quarry
4. Marblehead Peninsula
5. The Western Lake Erie Islands
6. Central and Eastern Erie County
7. Lorain and Cuyahoga County Lake Plain
8. Lake County Coast
9. Arcola Creek to Ashtabula
10. Eastern Ashtabula County

All post-1980 locations of endangered or threatened plants and significant plant communities occur within one of these regions. These regions are described in ten sections in the report. Each section is subdivided into major habitat types. Within each habitat type, areas with significant plant communities or rare species are described. All occurrences of endangered and threatened plants, as well as all significant plant community sites are listed. Maps were generated using the MapTech TopoScout software. Each occurrence of a state threatened or endangered species confirmed since 1980 was designated on a map; potentially threatened species were not mapped. The year 1980 was chosen because only data on plant populations from the previous 20-year period is considered in designating endangerment status; 1980 will be used as the cutoff year in the upcoming meeting of the Ohio Rare Plant Advisory Committee (January 2000). All records were mapped even if the plant could not be relocated in 1997 or 1998 since it is difficult to confirm the absence of a species. A plant may be overlooked or remain dormant in the seed bank. High-quality plant communities were also placed on the same maps.

HISTORICAL ACCOUNT OF THE FLORA AND NATURAL AREAS

Western Lake Erie Coast

Extensive documentation of the flora of the western Lake Erie region began around 1900. E. L. Moseley published the Sandusky Flora (1899) which cataloged nearly 1300 species of terrestrial and aquatic species in Erie County, the Marblehead Peninsula and the Lake Erie Islands. Moseley's work gives us an historical perspective on such areas as the islands, the Marblehead Peninsula, the Castalia Prairie, Castalia Ridge (now destroyed), Cedar Point and the prairies in Oxford and Perkins Townships west of Huron in Erie County. Moseley collected thousands of plant specimens many of which are at the Bowling Green University Herbarium. Many of his collections were of species which are now very rare, or have been eliminated from the region.

Around the same time, A. J. Pieters, working for the U.S. Fish Commission, published an inventory of the wetland and aquatic flora of Put-in-Bay Harbor, East and West Harbor, Winous Point, Cedar Point and the Portage River (Pieters 1901). Cedar Point was the focus of research for Ohio State University Professor William A. Kellerman and his assistant Otto E. Jennings. They published a flora of Cedar Point (Kellerman and Jennings 1904) and Jennings produced a detailed ecological and plant community study of the area (Jennings 1908). These botanists and their students collected many plant specimens from Cedar Point, most of which were deposited at the Ohio State University Herbarium. Even though Cedar Point had a remarkable diversity of plant species in 1908, Jennings states that the area had already been significantly modified. At least twenty-three species of plants now considered threatened or endangered as well as an additional five species now extirpated from Ohio were documented on the peninsula around 1900. This work, combined with that of Moseley and Pieters provides a significant picture of the status of the western Lake Erie coast around the turn of the century before it had been significantly altered by human activity.

Another important researcher was Earl L. Core who published a flora of the Lake Erie Islands (Core 1948) and prepared an unpublished follow-up to Pieters' 1901 study (Stuckey 1989). Core's work not only provides a detailed flora of the islands, but gives us an insight into the decline in the natural flora which was already taking place by the middle of this century, especially evident at Put-in-Bay harbor (Stuckey 1971).

Ohio State University professor Ronald Stuckey and many of his students surveyed the aquatic and wetland flora of western Lake Erie during the 1960's and 1970's from their base at Stone Laboratory on South Bass Island. The results of this work are presented in a series of publications and Master's Theses. Many papers compare the contemporary flora of their time to that of the past using the aforementioned work of Pieters, Moseley, Kellerman, Jennings and Core.

Some of the more significant floristic studies by Stuckey and his students include the following:

- 1) a survey of the fen flora at the Resthaven Wildlife Area (Foos 1971) as well as of the prairie flora (Hurst 1971);
- 2) a flora of Winous Point with historical comparison to Pieters (1901) work in western Sandusky Bay (Lowden 1969);
- 3) a report on changes in the flora at East Harbor State Park with reference to Moseley (1899) and Pieters (1901) (Moore 1976);
- 4) an analysis of the flora of abandoned quarries on Kelleys Island (Reinking 1979);
- 5) two papers on the changes in the flora of Put-in-Bay (Stuckey 1971 & Stuckey and Moore 1995);
- 6) a comprehensive overview of the changes in the overall flora of the western Lake Erie area (Stuckey 1989).

Beginning in the late 1970's, botanists from the Division of Natural Areas and Preserves and other institutions, have surveyed the coastal region and provided additional data on rare species and plant communities. This rich history of botanical exploration in the western Lake Erie coast provides the framework for the analysis of the current status of plant communities and rare species at the close of the 20th century provided in this report.

Eastern Lake Erie Coast

Far less historical data is available for the eastern half of Ohio's Lake Erie coast. The most substantial historical account can be found in a study of the original vegetation and flora of Ashtabula County (Hicks 1933). More recently, Isard (1966) and Bissell (1982) conducted studies of the Mentor Headlands Area and Bissell (1982) produced a study of the vegetation of Geneva State Park. An additional resource is a survey of selected areas in the Lake and Ashtabula County Lake Plain by Van Natta (1990). However, none of the above reports are published. Much of what is known about the flora of the region comes from research and survey work done starting in the 1970's. Dennis Anderson, former ecologist with the Division of Natural Areas and Preserves, surveyed many unusual plant community sites in the region, especially in Ashtabula County. Allison Cusick, Chief Botanist with the Division of Natural Areas and Preserves, has conducted many surveys along the entire Lake Plain, including this eastern portion. James Bissell, Curator of Botany at the Cleveland Museum of Natural History, has been exploring this part of Ohio for almost 25 years. He has discovered a tremendous number of rare species populations on the eastern Lake Plain. Data on rare species and plant communities collected by these and other researchers is available in the Heritage Database and files of the Division of Natural Areas and Preserves.

I. LAKE ERIE COAST FROM PORT CLINTON TO THE MAUMEE RIVER (Figures 1.1-1.3)

The southern shore of western Lake Erie was occupied by extensive areas of coastal marsh and swamp forest at the time of European settlement. The stretch from Port Clinton to Toledo was occupied by a diverse wetland complex which extended inland away from the lake for several miles. This area is now severely reduced as much of it was drained and converted to farmland. Three major habitat types remain in this region: coastal marshes, swamp forests and beaches.

Coastal Marshes: The remaining coastal marshes are preserved today in managed, mostly diked units. These managed marshes occur primarily at the Ottawa and Cedar Point National Wildlife Refuges as well as the Mallard Club, Magee Marsh and Metzger Marsh State Wildlife Areas and the Maumee Bay State Park. These sites preserve some of the botanical diversity, if not the natural ecological processes of the original coastal marshes.

Several rare aquatic and wetlands species occur in these coastal marsh remnants, many of these were first located during the survey work for this project in 1997-1998. No significant plant communities were documented from these diked coastal marshes since they are not natural areas and are thus not treated as significant communities. However, they serve as habitat for many native wetland species.

Botanical diversity in these marshes is threatened by several aggressive, non-native species such as: purple loosestrife (*Lythrum salicaria*), flowering-rush (*Butomus umbellatus*), narrow-leaf cattail (*Typha angustifolia*), giant reed-grass (*Phragmites australis*) and reed-canary grass (*Phalaris arundinacea*).

The following threatened or endangered species occur in these coastal marshes:

Carex aquatilis (T): A small population of leafy tussock sedge was discovered in 1998 in the Cedar Point National Wildlife Refuge. Two other locations within the refuge were documented in 1992. A very small population also occurs in the marsh within the Maumee Bay State Park.

Carex pseudocyperus (E): Northern bearded sedge was discovered at the Maumee Bay State Park in 1995, where it was documented again in 1998. This is the only confirmed occurrence of this sedge in Ohio.

Lophotocarpus calycinus (T): Southern wapato was discovered in 1998 in three locations within the Ottawa National Wildlife Refuge. One population was very large and represents the largest known population of this species in the state.

Platanthera leucophaea (T): A small population of the federally threatened Eastern prairie fringed orchid was discovered in 1998 at the Mallard Club Wildlife Area. A larger population on land owned by the City of Toledo near Yondota Road has been the subject of study by staff at the Division of Natural Areas and Preserves since 1992 (Windus and Cochrane 1997). A small population at the Maumee Bay State Park has been documented since 1995, but could not be relocated in 1998.

Sagittaria cuneata (E): A large population of wapato was located in 1998 in the marsh at the Mallard Club Wildlife Area. A substantial population of the plant was also located in 1998 in two managed pools at the Ottawa National Wildlife Refuge. The Mallard Club site represents the largest population of this species known in Ohio.

Sagittaria rigida (T): A large population of deer's-tongue arrowhead was located in 1998 in the same two connected pools at the Ottawa National Wildlife Refuge as wapato (*Sagittaria cuneata*). This species has become very rare in the coastal region; only two sites are currently known (the other is at Winous Point). Moseley (1899) listed this species as frequent in the Sandusky area.

Zizania aquatica (T): Wild rice was abundant in coastal marshes at the turn of the century (Stuckey 1989). It is now known on the Lake Plain only from the Cedar Point National Wildlife Refuge where it was discovered in 1994.

Swamp Forests: Maple-ash-oak swamps were very common throughout much of the Lake Plain in northwestern Ohio before settlement. They were especially common in northwest Ohio where they were the dominant feature of the extensive Lake Plain Great Black Swamp. Today the Black Swamp has been almost completely drained and there are very few significant remnants of this community type left in the coastal region. The only remnant in this area that still represents a significant plant community is in the Pearson Metropark:

Pearson Metropark - Maple-ash-oak swamp: This forested park contains about 100 acres of mature, second-growth swamp. Silver maple (*Acer saccharinum*) is the dominant tree species. White ash (*Fraxinus americana*), box-elder (*Acer negundo*), American elm (*Ulmus americana*) and red oak (*Quercus rubra*) are all common within the forest. A few large examples of silver maple, red oak, bur oak (*Quercus macrocarpa*) and cottonwood (*Populus deltoides*) are present. It is significant as one of the last remnants of the Black Swamp and the only one close to the Lake Erie Coast. Two rare species are known to occur in the park:

Carex alopecoidea (E): Northern fox sedge was discovered at Pearson Metropark in 1995 and observed again in 1997. This remains the only currently known population of this species in Ohio.

Actaea rubra (T): Red baneberry is rare in the Pearson Metropark and was last observed in 1995. This is the only location of the species in the coastal region.

Beaches: Few sand beaches remain in this region. Those that do exist are cut off from the mainland by dikes. In the past, the beaches in this region had formed natural barriers which protected the marshes from the wave action of the lake, a function now performed by the dikes. The best existing sites in this region include two beaches at the Cedar Point National Wildlife Refuge, a beach at Magee Marsh Wildlife Area and a small beach at the Navarre unit of the Ottawa National Wildlife Refuge on the west side of the mouth of Toussaint Creek. None of these beaches would qualify as significant plant communities and only the following rare species have been documented since 1980:

Artemisia campestris (T): Beach wormwood was reported from a beach at the Cedar Point National Wildlife Refuge in 1981, but could not be relocated in 1994 or 1998. It was also reported on a small beach at the Ottawa National Wildlife Refuge in 1981, but this beach had washed away by 1997.

Oenothera oakesiana (E): A small population of Oakes' evening-primrose was discovered on the beach at Magee Marsh Wildlife Area in 1998.

Potentilla paradoxa (T): Bushy cinquefoil was collected on a beach at the Cedar Point National Wildlife Refuge in 1981, but could not be relocated in 1994 or 1998.

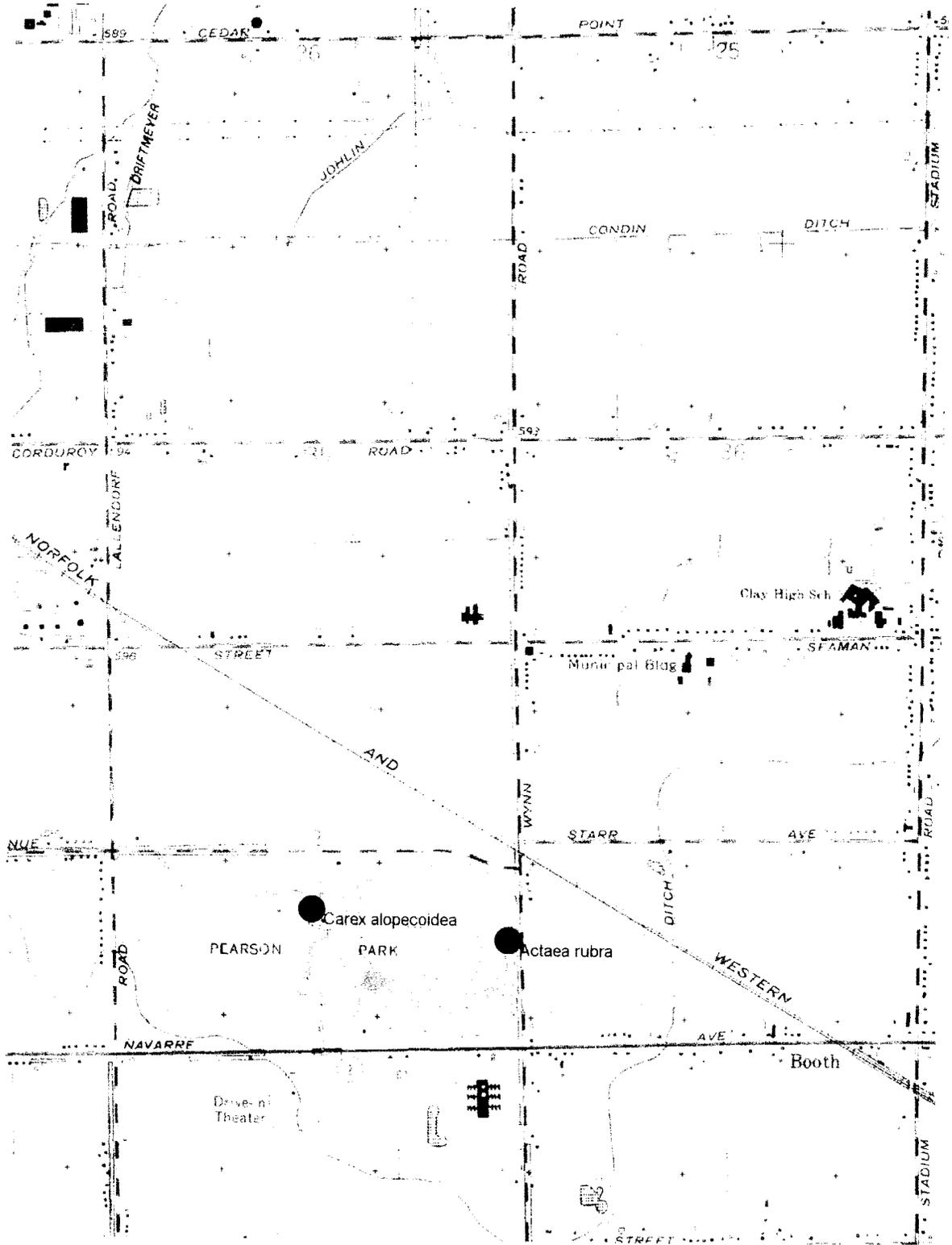


Figure 1.1. Pearson Metropark, Oregon Quad.

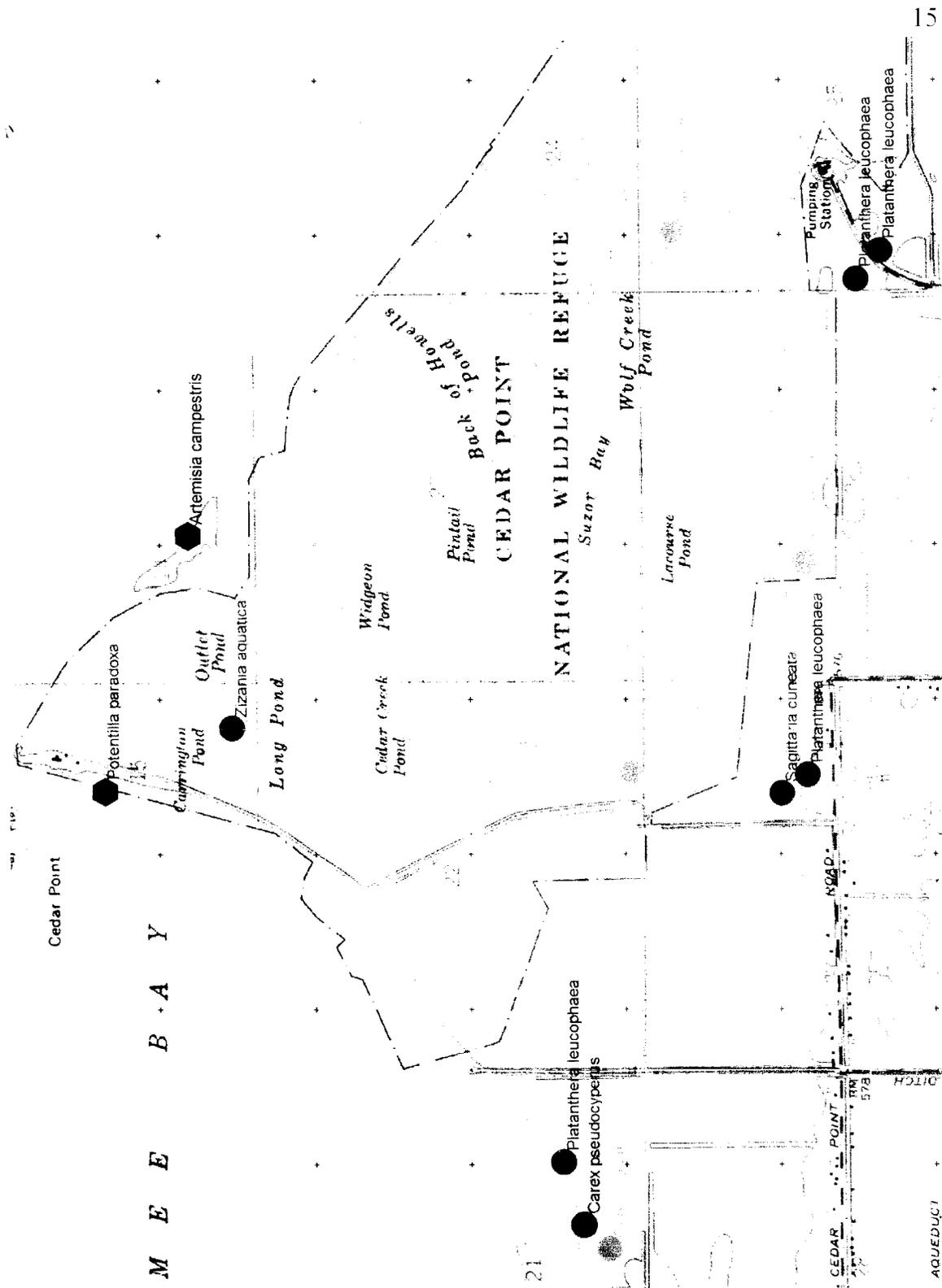


Figure 1.2. Cedar Point National Wildlife Refuge, Mallard Club Wildlife Area and Maumee Bay State Park, Reno Beach Quad.

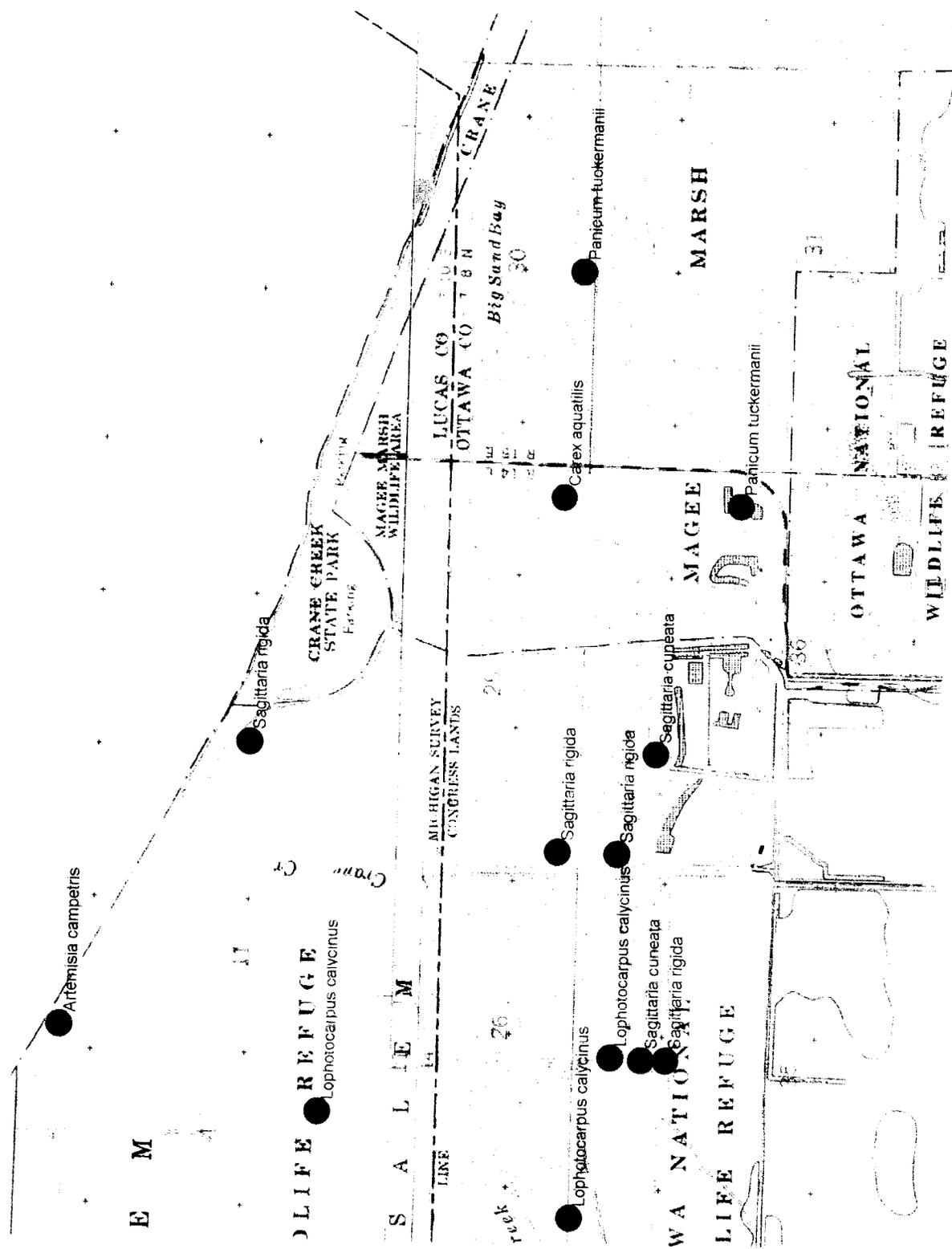


Figure 1.3. Ottawa National Wildlife Refuge and Magee Marsh Wildlife Area, Metzger Marsh Quad, and Oak Harbor Quad.

II. WESTERN SANDUSKY BAY (Figures 2.1-2.3)

Prior to European settlement, the western end of Sandusky Bay consisted of vast areas of marsh, wet prairie and fen. Almost all of the wetlands of this region were drained for agriculture and the marshes immediately surrounding the bay were also extensively degraded. A.J. Pieters published the results of a survey of the aquatic and wetland flora of the western end of the Bay in 1901 (Pieters 1901). He reported the presence of many species which are considered rare today that are now absent from the bay including:

Myriophyllum sibiricum (T): American water-milfoil

Potamogeton gramineus (E): grass-like pondweed

Potamogeton robbinsii (E): Robbins' pondweed

Sagittaria graminea (E): grass-leaf arrowhead

Lowden (1969) points to three factors which have contributed to the decline in the marsh flora in western Sandusky Bay: 1) increasing flow rate of the Sandusky River and Muddy Creek, due to the extensive construction of drainage ditches, with the resulting increase in turbidity; 2) destruction of vegetation due to wave action; 3) the construction of dikes to reclaim land for agriculture and prevent flooding. Lowden (1969) also mentions the immediate impact on the clarity of the water in the bay after carp were introduced in the late 1800's. The native vegetation has also been adversely affected by introduction of non-native species, especially narrow-leaf cattail (*Typha angustifolia*), reed-canary grass (*Phalaris arundinacea*), flowering-rush (*Butomus umbellatus*) and purple loosestrife (*Lythrum salicaria*).

Wetland Habitats: There are no high quality natural areas remaining in the western Sandusky Bay area, but there are extensive wetlands, some of them diked marshes, which provide habitat for the few rare species which still occur in the area. The most important wetland areas remaining occur in the Winous Point Shooting Club, the Pickerel Creek Wildlife Area, the Sandusky County Blue Heron Reserve, Miller's Blue Hole and the Metzger Orchid site.

Winous Point Shooting Club: The Winous Point Shooting Club has been in existence since before the turn of the century. The site preserves the best marshes remaining in Sandusky Bay within a network of dikes. Sherman et al (1996) document the diversity of wetland plants in Winous Point Marshes and demonstrate that the vegetation in the diked wetlands is far more abundant than that in adjacent undiked wetlands. Four species of endangered and threatened plants have been reported at Winous Point since 1980:

Apocynum sibiricum (E): Two separate small populations of clasping-leaf dogbane were located on disturbed ground at Winous Point in 1996.

Sagittaria cuneata (E): A very small population of wapato was discovered at Winous Point in 1996.

Sagittaria rigida (T): One of the two known populations of deer's-tongue arrowhead in the western Lake Erie region occurs at Winous Point in one of the managed marshes. The population was confirmed in 1996.

Zizania aquatica (T): A small population of wild rice was reported in 1984, but the species has not been seen for many years. The species is no longer present.

Pickerel Creek Wildlife Area: This state wildlife area has no high-quality natural areas, although it does contain some significant wetland acreage and has been the site for some large wetland restoration projects. Two rare plant species are present:

Platanthera leucophaea (T): One of the most significant populations of the federally threatened Eastern prairie fringed orchid on the continent occurs at Pickerel Creek Wildlife Area (Windus and Cochrane 1997). In some years, several thousand flowering plants have been counted. The population numbers of this species fluctuate dramatically from year to year and are monitored annually by the Division of Natural Areas and Preserves. Over 1000 plants were observed in 1998.

Spenopholis obtusata var. *obtusata* (T): A small population of prairie wedge grass occurs in the small field with the Eastern prairie fringed orchid.

Blue Heron Reserve: This Sandusky County Park contains a 1-acre, degraded remnant of a Lake Plain prairie fen. It is important as one of the few fen remnants around Sandusky Bay. The site may also have good restoration potential since there are active springs in the adjacent fields where water flows directly into drainage tiles. One rare species occurs here:

Apocynum sibiricum (E): A small population of clasping-leaf dogbane was located in an open, reverting field at the park in 1995.

Miller's Blue Hole: Miller's Blue Hole was formerly part of a wet prairie/fen complex (Pinkava 1961). As recently as 1959-1961 there were still many prairie and fen species present. The water that wells up out of the spring at a tremendous rate formerly spread out over the landscape creating the conditions suitable for fens and wet prairies.

However, now the water is channeled out through a ditch and consequently the natural plant communities have been severely degraded and no prairie or fen species persist.

Metzger's Orchid Site: The sites does not represent a high quality natural plant community and does not have a significant number of native plant species, but it does provide habitat for a state and federally threatened orchid.

Platanthera leucophaea (T): Over 100 plants of the Eastern prairie fringed orchid were counted in this wet field in 1998 (Windus and Cochrane 1997). The Division of Natural Areas and Preserves has a management agreement with the landowner to manage this site and monitor the orchid population.

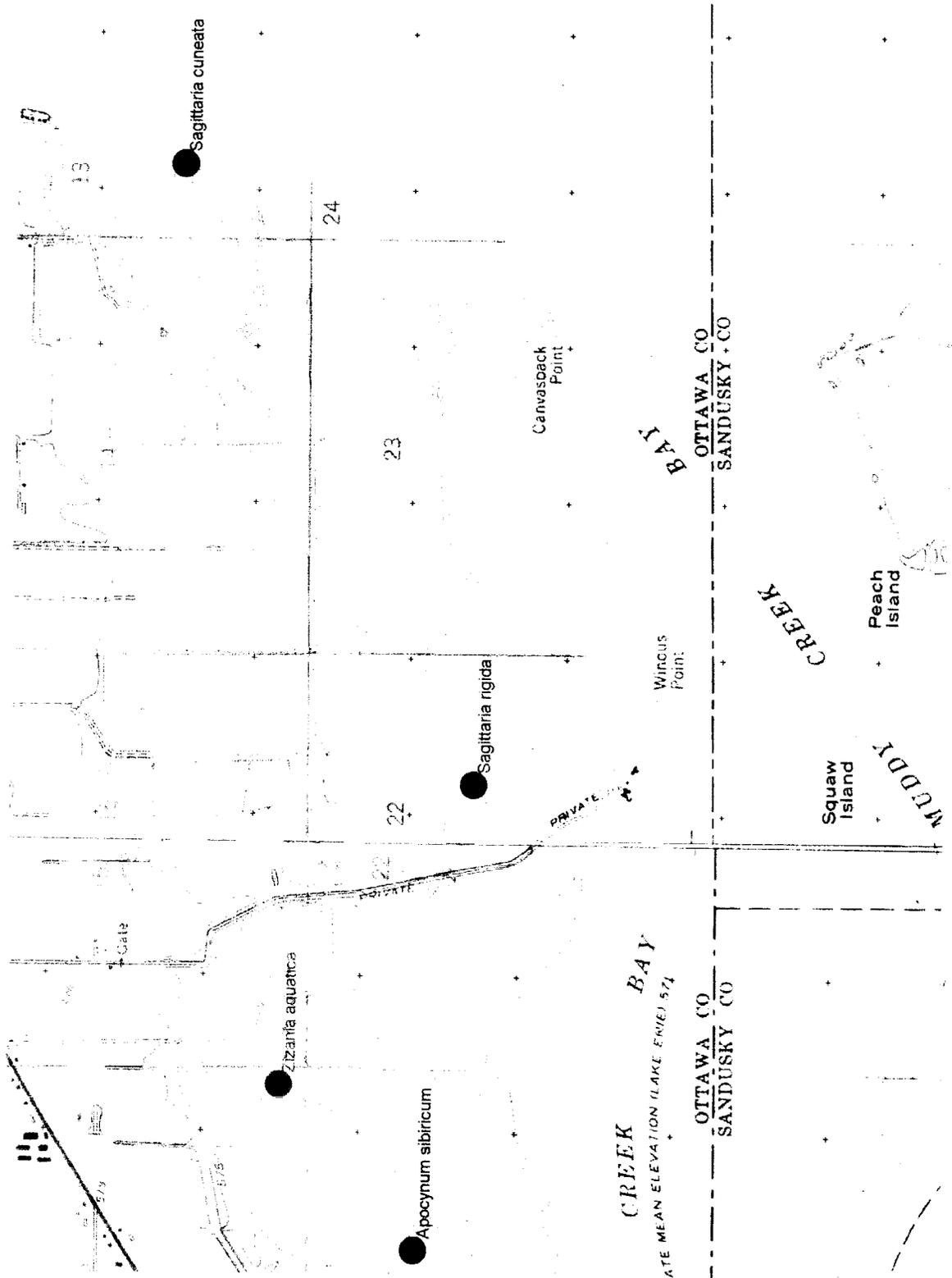


Figure 2.1. Winous Point Shooting Club and Northwest Sandusky Bay, Wightman's Grove Quad, and Vickery Quad.

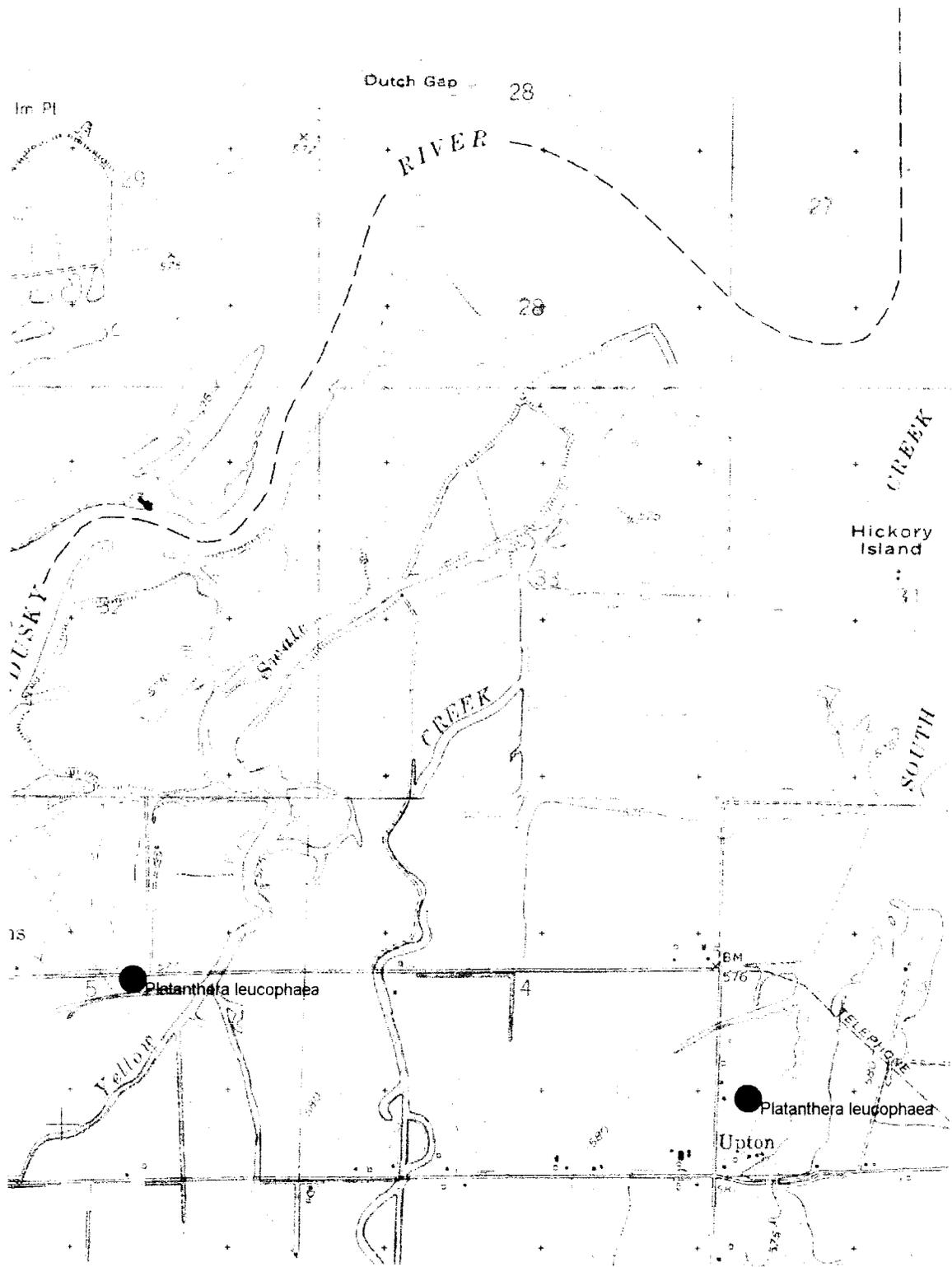


Figure 2.2. Southwest Sandusky Bay, Wightman's Grove Quad.

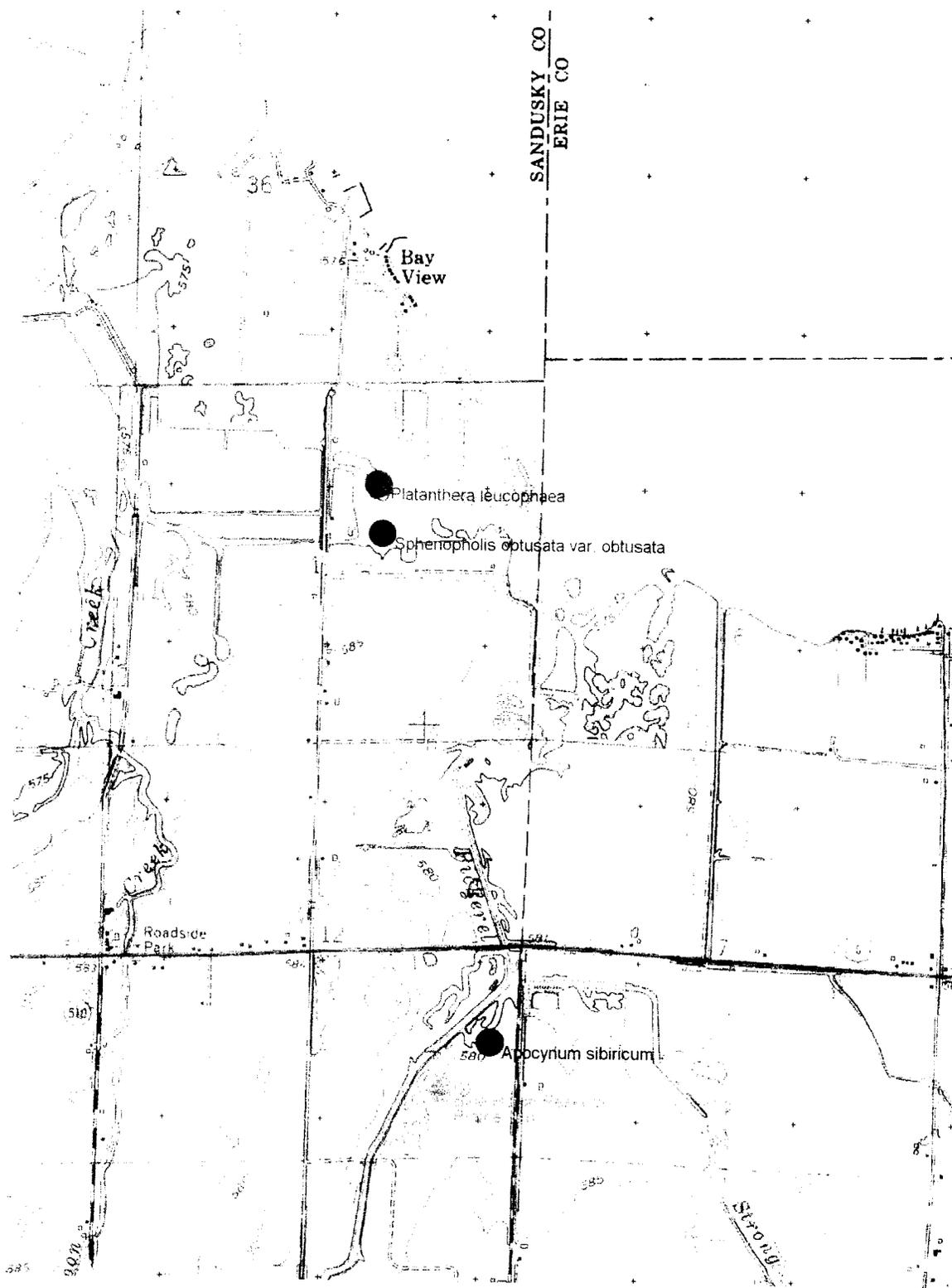


Figure 2.3. Pickerel Creek Wildlife Area and Blue Heron Reserve, Vickery Quad.

III. CASTALIA PRAIRIE (RESTHAVEN WILDLIFE AREA) AND CASTALIA QUARRY (Figures 3.1-3.2)

The most significant plant associations of this region are the remnants of the Castalia Prairie within the Resthaven Wildlife Area and the alvar-like habitat in the abandoned quarries at the Castalia Quarry Reserve and at a small, abandoned quarry on private land south of Castalia.

Prairies: The Castalia Prairie was described by Dachnowski (1912) as a 3500-acre, marshy prairie which extended to the west and north of Castalia. By 1912, the northwestern portion of the prairie had already been drained, but large areas of peaty marl were still present along with the cinquefoil fen plant association. Also present at the site was the Portland Cement Company which would later dredge most of the site while harvesting marl. Marl and tufa were mined at the Castalia Prairie until about 1958, while other parts of the former prairie were being farmed (Foos 1971). The State of Ohio purchased land in the area between 1942-1969 to form the Resthaven Wildlife Area (Foos 1971).

Despite the destruction of the original wet prairie and fen complex, there are still many rare plant species present within the Resthaven Wildlife Area. There are more tall-grass prairie remnants at Resthaven than any where else in Ohio. In fact, the Resthaven Wildlife Area contains some of the most significant prairie remnants anywhere in the Great Lakes region. The best prairie remnants occur in two large fields which have approximately 100 and 200 acres of open prairie and are separated by about 1000 feet. There are also several other, smaller fields which contain prairie scattered around the wildlife area. The area on both sides of Herr Road was heavily disturbed by marl dredging. What remains is a fascinating complex of artificial ridges and trenches. The trenches remain very wet and their substrate is composed of calcareous marl. They provide habitat for many unusual fen species. The low ridges are drier and are occupied by shrub thickets or prairie forbs. Significant plant communities at Resthaven Wildlife Area occur in the two large prairie fields:

Resthaven Prairie 1 - Big bluestem prairie: Although both fields contain wet and mesic prairie components, the 100-acre field on the east side of Northwest Road is classified as big bluestem prairie. Dominants in this field are Indian grass (*Sorghastrum nutans*) and big bluestem grass (*Andropogon gerardii*). Little bluestem grass (*Schizachyrium scoparium*) is also common. Some slightly wetter areas, where prairie dock (*Silphium terebinthinaceum*) along with several species of sedges (*Carex spp.*) become dominant, could be qualified as slough grass-bluejoint prairie.

Resthaven Prairie 2 - Slough grass-bluejoint prairie: The 200-acre field between the abandoned Railroad embankment and Oxbo Road is classified as slough grass-bluejoint prairie. Dominants in the wet prairie fields are prairie dock (*Silphium terebinthinaceum*), Indian grass (*Sorghastrum nutans*) and prairie cord grass (*Spartina pectinata*). A few areas have small sedge meadows with various sedges (*Carex spp.*) present.

Twenty-two potentially threatened plant species occur at Resthaven Wildlife Area, in addition to the following eleven endangered or threatened plants:

Apocynum sibiricum (E): The clasping-leaf dogbane grows in the fen meadows on the east side of Herr Road .

Carex aquatilis (T): Leafy tussock sedge was first discovered in 1998 in an emergent marsh and fen area along the edge of one of the ponds on the west side of Herr Road.

Cypripedium candidum (T): The white lady's-slipper orchid is extremely abundant at Resthaven with a population of many thousands. They occur in both large prairie fields and in the fen area. This site represents the only large population of this very uncommon species in Ohio.

Descurainia pinnata (T): A small population of tansy-mustard was located in 1990 near a series of limestone outcrops.

Draba reptans (T): The diminutive Carolina whitlow-grass is very rare in Resthaven where it grows on a few limestone outcrops.

Hypericum kalmianum (T): Kalm's St. John's-wort, a Great Lakes endemic species, is common in the fen remnants at Resthaven. This is the only location for this species in the Coastal Region, but it is fairly common in wet prairies in the Oak Openings Region near Toledo.

Rosa blanda (T): Smooth rose was last reported at Resthaven in 1980, but efforts to relocate it were unsuccessful in 1997 and 1998.

Satureja arkansana (T): Limestone savory is abundant throughout all of the open, prairie habitats at Resthaven.

Senecio pauperculus (T): Balsam squaw-weed occurs in several locations at Resthaven including wet prairie and fen communities.

Sisyrinchium mucronatum (E): Narrow-leaved blue-eyed grass was reported for the first time at Resthaven in 1998 in a small population along Northwest Road.

Smilax herbacea var. *lasioneura* (T): A small population of 12 pale carrion-flower plants was located along the brushy edge of a road within the wildlife area in 1992.

Abandoned Quarries: Abandoned limestone quarries in northwestern Ohio often provide habitat for unusual, calciphilic alvar species. The large Castalia Quarry Reserve and a tiny, unnamed abandoned quarry south of Castalia occur in this region.

Castalia Quarry Reserve: This large quarry was abandoned in 1965 and was donated to the Erie Metroparks in 1987. The vast area of open limestone bedrock exposed at this site provides habitat for many species which are typical of alvars, even though no natural alvar was known to occur here before the quarrying operation began. Nine potentially threatened species occur here in addition to the following five endangered and threatened plants:

Anemone cylindrica (T): About two dozen individuals of the prairie thimbleweed were located in the quarry in 1991.

Draba reptans (T): Two large populations of Carolina whitlow-grass totaling about 500 individuals were reported in the quarry in 1991.

Panicum lindheimeri (E): Several large colonies of Lindheimer's panic grass were located on the open quarry floor in 1992.

Senecio pauperculus (T): Balsam squaw-weed is extremely abundant in the quarry. Over 4000 plants were reported in 1995.

Sisyrinchium montanum (E): A small population of the extremely rare Northern blue-eyed grass was found in the quarry in 1995.

Small unnamed abandoned quarry: A small abandoned quarry south of Castalia contains one threatened plant species:

Senecio pauperculus (T): Balsam squaw-weed was located in this small abandoned quarry in 1980.

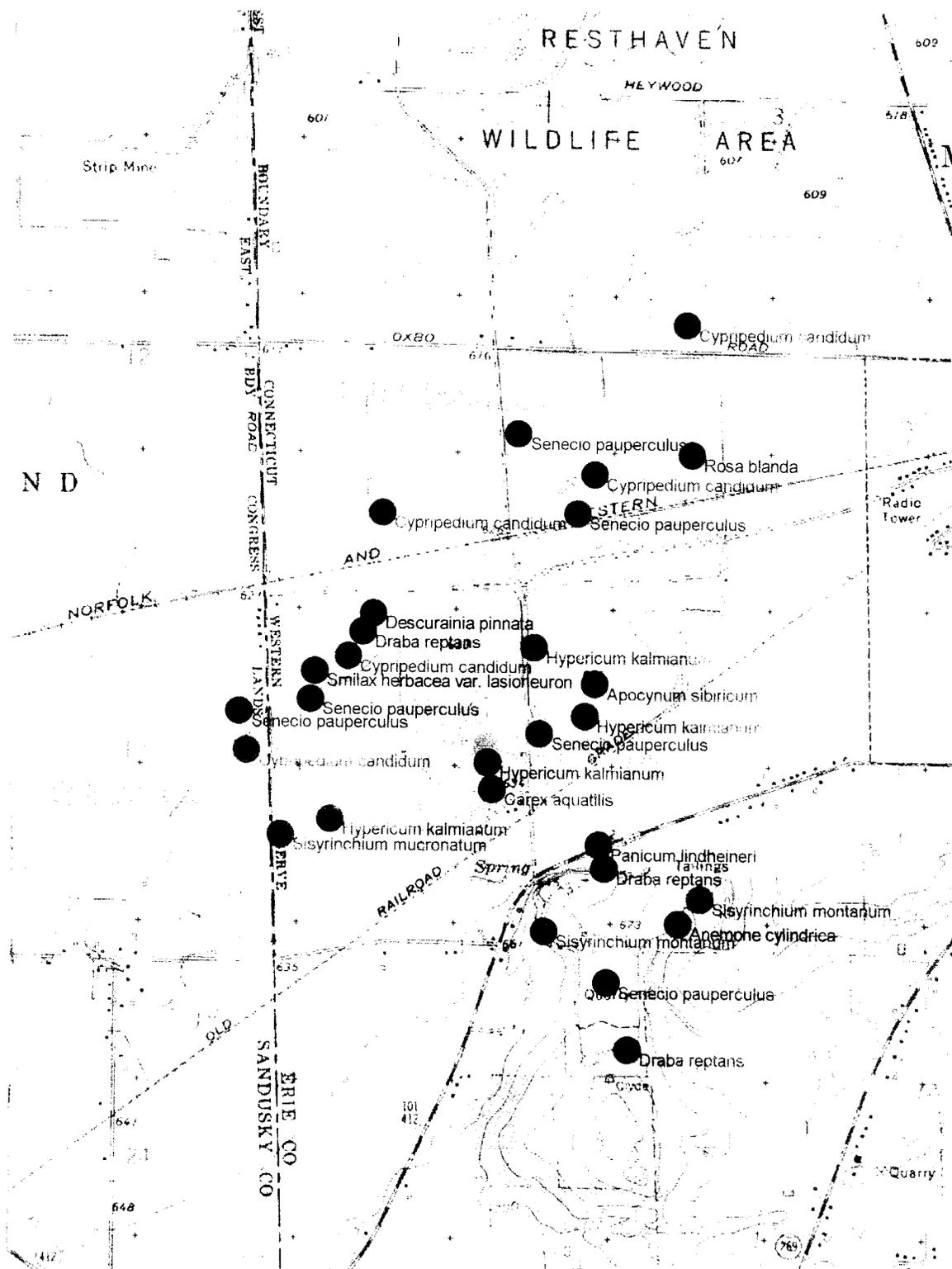


Figure 3.1. Resthaven Wildlife Area and Castalia Quarry Reserve, Castalia Quad.

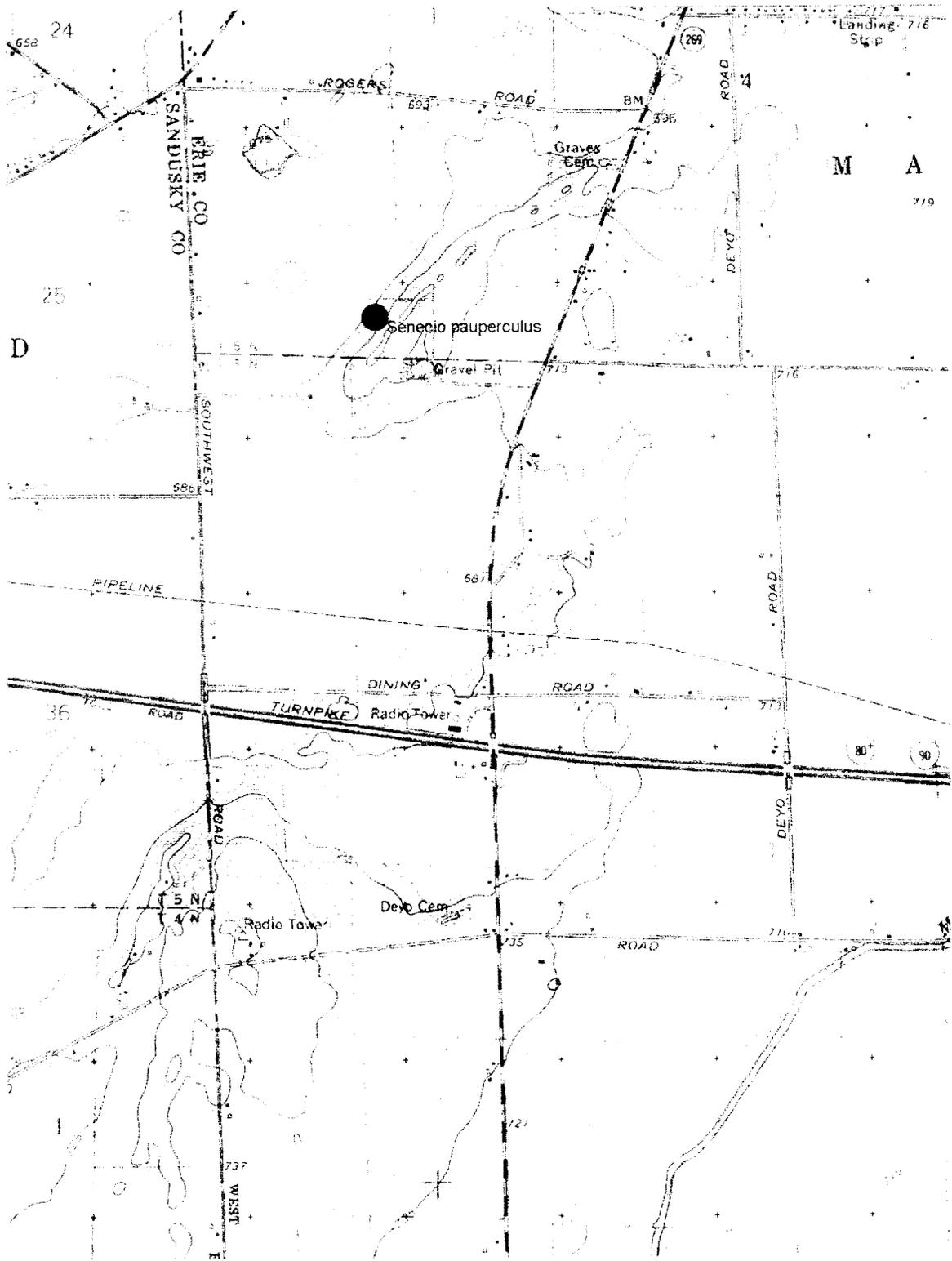


Figure 3.2. Abandoned Quarry, Bellvue Quad.

IV. MARBLEHEAD PENINSULA (Figures 4.1-4.4)

Several significant areas for rare species occur today on the Marblehead Peninsula. The Marblehead Peninsula was formerly occupied by an alvar community which has been essentially destroyed by quarrying, although many remnants of alvar vegetation still persist. In fact, many of the species which occurred on the original alvar are probably more common now than they were in the past because the quarrying operations actually enhanced the habitat for these sun-loving species. In addition to the alvar, an area of extensive coastal marsh and beach occurred around what is now East Harbor State Park. Even though this area has been severely degraded since the 1940's, many rare species still remain.

Inactive and Abandoned Quarries: Alvar communities have only recently been recognized in Ohio. Alvars occur on glaciated, horizontal limestone or dolomite bedrock. Alvars are populated by drought-resistant, calcium-loving plant species. These plants are a combination of boreal and prairie species which are relics of both the colder post-glacial environment and the warmer, dryer period which followed (Schneider and Cochrane 1997).

Ohio alvars are of two basic types: shoreline alvars and alvar grasslands. Shoreline alvars occur on limestone bedrock within the scouring zone of ice. It is therefore a very sparsely vegetated environment with little soil. Plants are only able to grow in cracks in the bedrock. Alvar grasslands are a more stable, though harsh environment which supports more permanent vegetation. Ohio's only grassland alvar on the Marblehead Peninsula was destroyed by quarrying activities, but many alvar species have found refuge in the inactive or abandoned quarries. Although previously disturbed by quarrying, the Lakeside Daisy State Nature Preserve, and other inactive or abandoned sections of the Lafarge quarries, are considered to be a significant alvar plant community.

Lakeside Daisy State Nature Preserve and adjacent inactive quarry sites - Alvar : This 19-acre preserve protects one of the best abandoned quarry sites on the Marblehead Peninsula. This site provides habitat for 19 state-listed species, including many of the area's former alvar species, as well as species of wet calcareous habitats. Many additional state-listed species occur in other inactive or abandoned quarry sites within the 2500 acres of the Lafarge Quarry. The state-endangered and federally-threatened Lakeside daisy (*Hymenoxys herbacea*) is the most famous alvar species in Ohio and it occurs in abundance within the Preserve as well as on approximately 400 acres of the Lafarge Quarry (USFWS 1990). Many species of threatened and endangered plants occur in and around the State Nature Preserve:

Calamintha arkansana (T): Limestone savory occurs in several places in inactive or abandoned sections of quarry.

Carex garberi (E): Garber's sedge is locally common in the Lakeside Daisy State Nature Preserve and in several places throughout the Lafarge Quarry.

Ceanothus herbaceus (E): Prairie redroot was last seen in 1980 in an inactive part of the Lafarge Quarry. The species was also located at a different place in the quarry in 1970. Several recent attempts by staff of the Division to relocate the species in 1997 and 1998 were unsuccessful. These records represents the last known occurrence of the species in Ohio and if the species is not found here or elsewhere in the next few years, its status will change to extirpated.

Cypripedium candidum (T): Two individuals of white lady's-slipper were seen along abandoned railroad tracks in the quarry in 1986. Several recent attempts to relocate these plants have been unsuccessful.

Draba reptans (T): The diminutive Carolina whitlow-grass was discovered in 1996 in one location in the Lafarge Quarry.

Eleocharis caribaea (E): Caribbean spike-rush occurs in moist, shallow soil and in the shallow pools in the Lakeside Daisy State Nature Preserve and in several other locations around the quarry.

Eleocharis compressa (T): Flat-stem spike-rush occurs in moist, shallow soil and in the shallow pools in the Lakeside Daisy State Nature Preserve and in several other locations around the quarry.

Hedeoma hispidum (T): A small population of rough pennyroyal was recorded in the Lafarge Quarry in 1990, but could not be relocated in 1997-1998.

Hymenoxys herbacea (E): The federally threatened Lakeside daisy is abundant in the Lakeside Daisy State Nature Preserve and throughout inactive or abandoned sections of the Lafarge Quarry. An estimated one million adult plants occur in these quarries (USFWS 1990). This species is regularly monitored by staff of the Division of Natural Areas and Preserves (Cochrane and Windus 1998).

Potentilla arguta (E): Tall cinquefoil was reported in the Lakeside Daisy State Nature Preserve in 1989. Two small, separate populations were also located in the Lafarge Quarry in 1970 and 1980. However, recent efforts to relocate the species on the

Marblehead Peninsula have been unsuccessful.

Rosa blanda (T): Three separate populations of smooth rose were found in the Lafarge Quarry in 1980. However, two of these consisted of only one plant each and the third had about 25 plants. None of these populations were relocated.

Senecio pauperculus (T): Balsam squaw-weed occurs in the Lakeside Daisy State Nature Preserve and a new population was discovered in an inactive section of the Lafarge Quarry in 1998.

Sisyrinchium mucronatum (E): Narrow-leaved blue-eyed grass occurs in three locations in the Lafarge Quarry.

Coastal Marsh and Beach: Moore (1976) describes the changes which occurred in the flora of the marshes at East Harbor State Park between the turn of the century and 1976. For historical reference, he uses the works of Pieters (1901) and Moseley (1898), both of whom had surveyed the area. The natural marshes which occurred at East Harbor were altered in 1945 by the construction of a causeway and then essentially destroyed when they were dredged to accommodate boats in 1967 (Moore 1976). Moore lists 17 species of rooted submersed or floating-leaved species which had disappeared after 1945, including four which are now endangered, threatened or extirpated in Ohio today: water-marigold (*Megalodonta beckii*) - (X), grass-like pondweed (*Potamogeton gramineus*) - (E), red-head pondweed (*Potamogeton perfoliatus*) - (X), and Robbins' pondweed (*Potamogeton robbinsii*) - (E). Three additional missing species of pondweeds (*Potamogeton*) are now potentially threatened. American water-milfoil (*Myriophyllum sibiricum*), a state threatened species, was also absent by 1973, although Moore erroneously reported it as present in 1973. Bullhead lily (*Nuphar variegatum*), a state endangered species, was reported by Moore in 1973, but is no longer present today. Among emergent wetland species, several species that were reported by Moore as still present in 1973 are absent today. These include two state endangered species, grass-leaf arrowhead (*Sagittaria graminea*) and wapato (*Sagittaria cuneata*), and two state threatened species, deer's-tongue arrowhead (*Sagittaria rigida*) and wild rice (*Zizania aquatica*).

Ironically, Moore reports that giant reed grass (*Phragmites australis*) was diminished in abundance after the dredging of 1967. Today, the species has occupied and degraded virtually all of the wetland habitat on the small peninsula where wetlands still occur at East Harbor. The only place where rare wetland species occur is in one meadow where an experimental project to remove giant reed grass was initiated. Sadly, this is all that remains from the once diverse assemblage of wetland species that formerly were found at East Harbor State Park. Eight potentially threatened aquatic and wetland species

have been reported since 1980 at East Harbor, in addition to the following three threatened and endangered species:

Carex garberi (E): Garber's sedge was last reported here in 1980 in a marsh that is now dominated by Giant reed grass.

Eleocharis caribaea (E): Caribbean spike-rush still occurs in the wetland where the giant reed grass was experimentally removed. This annual species persists in the seedbank and benefits from the disturbance of the soil that occurred when the giant reed grass was plowed under. However, the species will not persist unless the giant reed grass is repeatedly controlled.

Lophotocarpus calycinus (T): Several dozen individuals of Southern wapato were seen in shallow water and on mudflats in the experimental wetland in 1998. This species will also not persist unless the giant reed grass is controlled, although it probably can survive in the seed bank for a long period of time.

Degraded beach-dune habitat also occurs at East Harbor State Park. Much of the beach was washed away in high water in the late 1960's and early 1970's. However, new sand has accumulated and some beach plants have returned. Four endangered or threatened species have been seen sporadically on the beach since 1980, but none were seen in 1996-1998. These species include:

Ammophila breviligulata (inland beach grass) (T) - last seen in 1986

Artemisia campestris (beach wormwood) (T) - last seen in 1981

Eleocharis ovata (ovate spike-rush) (E) - last seen in 1988

Scirpus smithii (Smith's bulrush) (E) - last seen in 1988

Additional Isolated Rare Species Populations: Two additional rare species have been reported on the southwest part of the Peninsula:

Rosa blanda (T): Smooth rose was reported in 1980 along old State Route 269 near the old bridge, however the species could not be relocated in 1997.

Sagittaria cuneata (T): A small population of wapato had been reported as recently as 1994 in a roadside ditch along old State Route 269. However, the species was no longer present in 1997 or 1998.

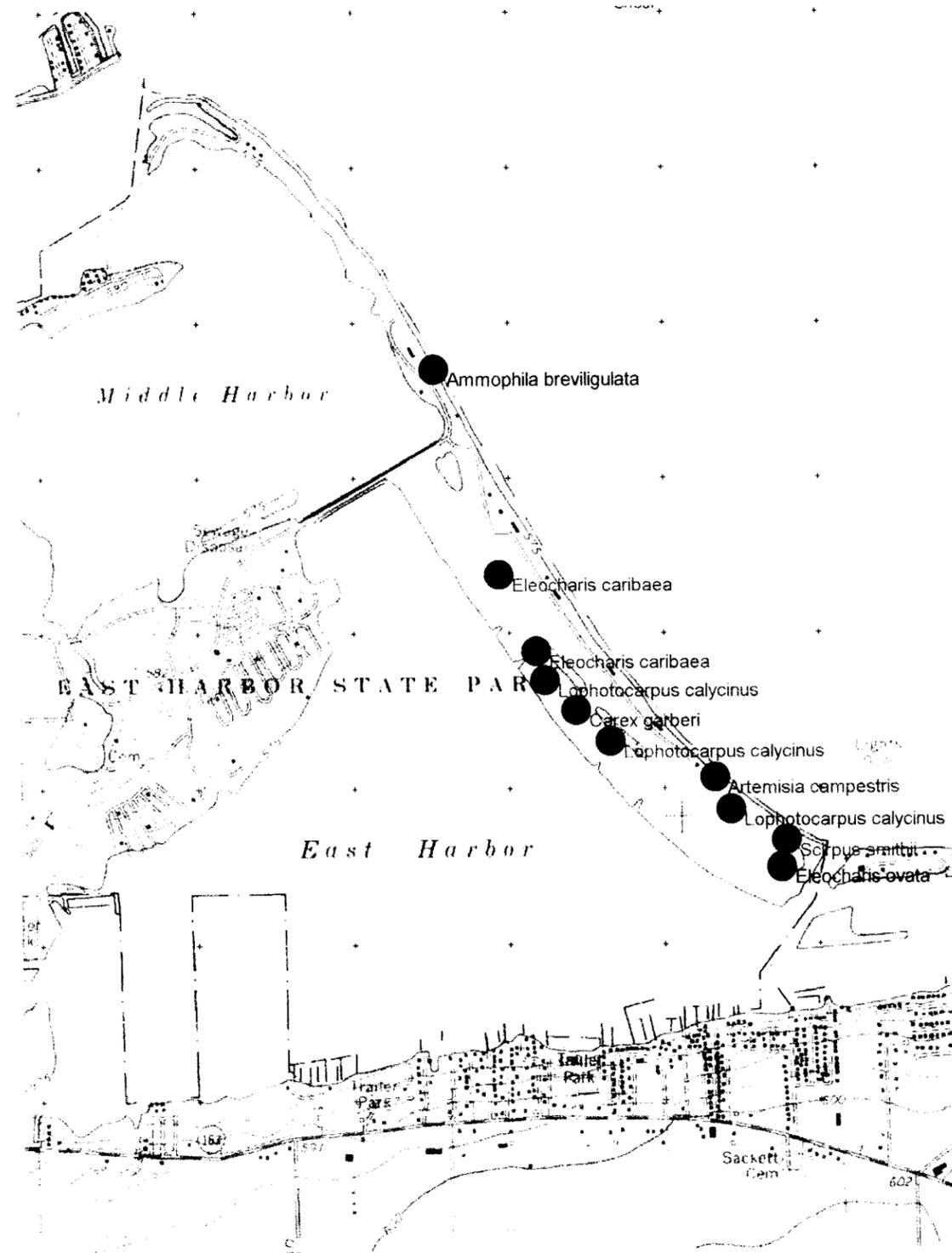


Figure 4.1. East Harbor State Park, Gypsum Quad.

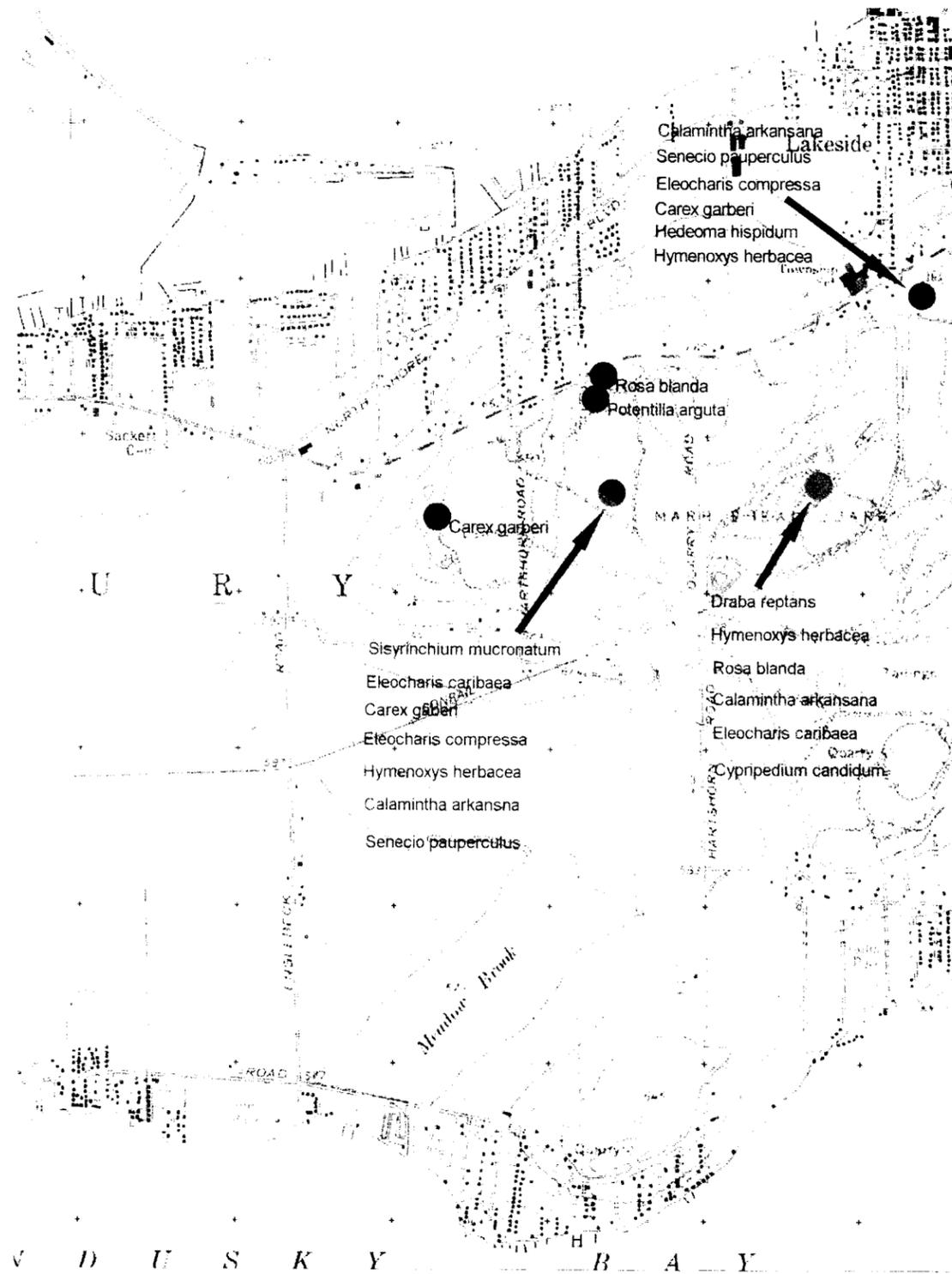


Figure 4.2. Marblehead Quarry West, Gypsum Quad.

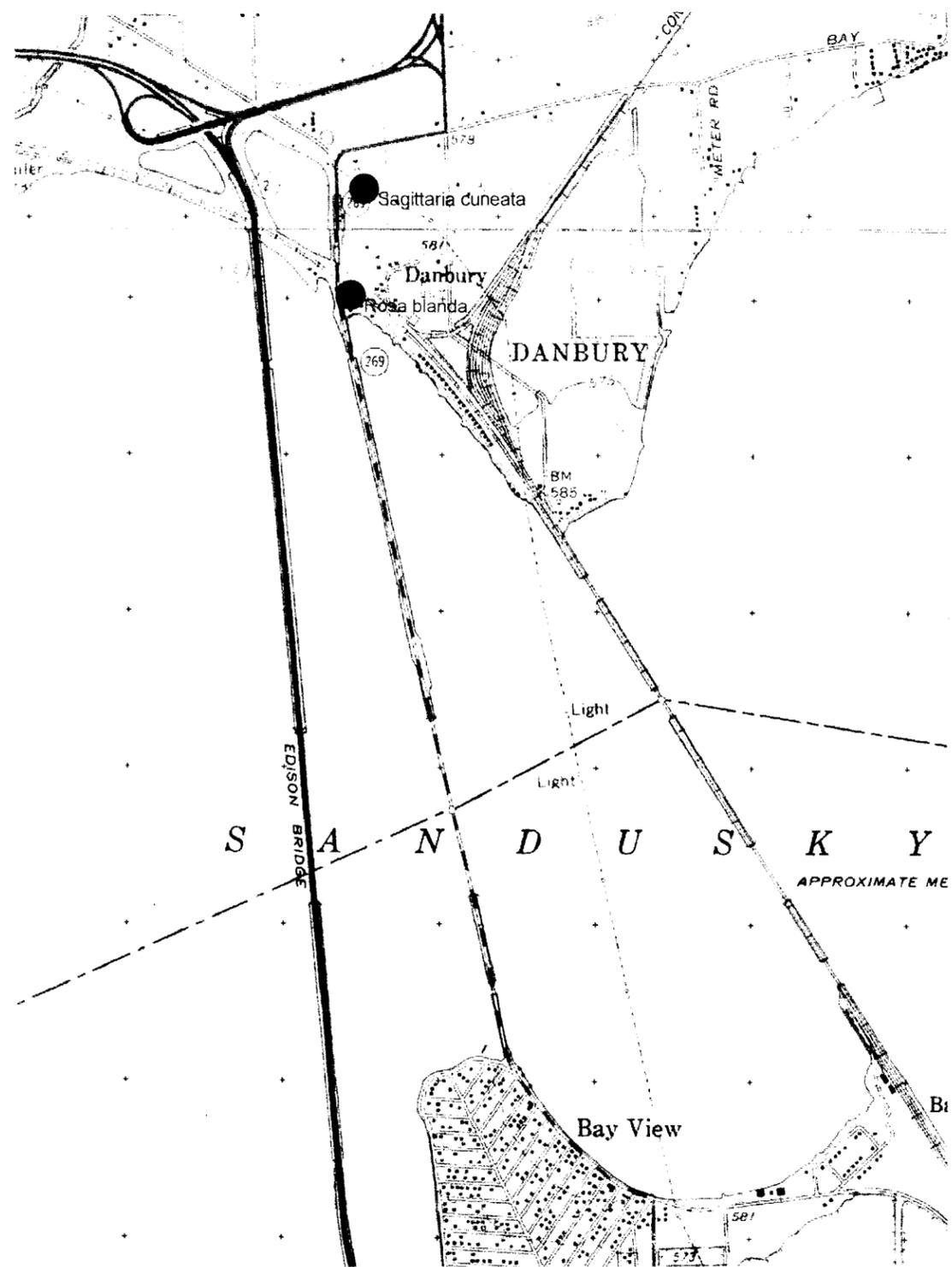


Figure 4.4. Sandusky Bay. Gypsum Quad and Castalia Quad.

V. THE WESTERN LAKE ERIE ISLANDS (Figures 5.1-5.4)

KELLEYS ISLAND: Kelleys Island is one of the most significant areas for rare plant species in Ohio. The majority of rare species occur in abandoned limestone quarries. The natural plant communities on the island which also support rare species include a shoreline alvar and a mixed emergent marsh.

Abandoned Limestone Quarries: Two large, abandoned limestone quarries within Kelleys Island State Park along with an abandoned quarry owned by The Cleveland Museum of Natural History on the southeast side of the island, provide habitat for a large diversity of plants. These are mostly species which normally grow in alvars and other lime-rich environments. This habitat, though not natural, resembles that of an alvar. Both upland and wetland habitats are present which enhances the diversity of unusual plants present. However, other than the shoreline alvar on the north side of the island, which does not provide habitat for most of these rare species, it is unclear whether alvar communities occurred on Kelleys Island in pre-settlement time as they did on the Marblehead Peninsula. Very few of the species that occur in the abandoned quarries had been reported prior to the late 1970's, despite the attention given to the Lake Erie Islands by botanists since the turn of the century (Reinking 1979). This, coupled with the fact that the two largest former quarries were only recently abandoned (1924 and 1941) and that alvars were not known to occur historically on the island, suggests that many of these species could be relative newcomers to the island. The following endangered or threatened plant species occur in these abandoned quarries:

Calamintha arkansana (T): Limestone savory is very common in the abandoned quarries of the island.

Carex garberi (E): Garber's sedge is relatively common in all the abandoned quarries on the island. However, this species, which is endemic to the Great Lakes region, is restricted in Ohio to Kelleys Island and the Marblehead Peninsula.

Eleocharis caribaea (E) : Caribbean spike-rush occurs in muddy, calcareous soil along the edge of the large pond in the central quarry. This species is also restricted to Kelleys Island and the Marblehead Peninsula in Ohio.

Eleocharis compressa (T): Flat-stem spike-rush is very abundant in shallow pools and moist soil in abandoned quarries on Kelleys Island.

Hymenoxys herbacea (E): The federally threatened Lakeside daisy was introduced into both state park quarry sites beginning in 1989 by the Division of Natural Areas and

Preserves as part of a federal recovery plan for the species (Cochrane and Windus 1998). More than 11,000 plants were observed in 1998 and the species appears to be surviving well. These plants are monitored annually by the Division of Natural Areas and Preserves.

Panicum philadelphicum (T): Philadelphia panic-grass occurs in the Cleveland Museum of Natural History's quarry site and was located in 1993 along a disturbed roadside in Kelleys Island State Park.

Senecio pauperculus (T): Balsam squaw-weed is abundant in all of the abandoned quarries.

Sisyrinchium mucronatum (E): Narrow-leaved blue-eyed grass is very uncommon in the north quarry of Kelleys Island State Park where it was first documented in 1998.

Shoreline Alvar : The North Shore Alvar is a significant plant community:

North Shore Alvar - Alvar: The North Shore Alvar in Kelleys Island State Park is one of two and by far the largest undisturbed alvar community still extant in Ohio. The alvar is maintained in an open state by the scouring action of waves and ice. Herbaceous species grow in the cracks and crevices of the limestone bedrock. The alvar also features small, shallow glacial grooves which add interest to the site. The most common species on the alvar include prairie loosestrife (*Lysimachia quadriflora*), Kalm's lobelia (*Lobelia kalmii*) and Pringle's aster (*Aster pilosus* var. *pringlei*). Two state-listed species have been reported from the site:

Senecio pauperculus (T): Balsam squaw-weed is rare on the alvar, but is abundant in the abandoned quarries on the island.

Viola nephrophylla (E): Northern bog violet is frequent on the North Shore Alvar. It also has been reported from rocky shorelines on several of the western Lake Erie Islands.

Mixed Emergent Marsh: Kelleys Island contains one of the best natural marshes in the coastal region. North Pond State Nature Preserve contains a highly significant mixed emergent marsh community.

North Pond State Nature Preserve - Mixed emergent marsh: This 18-acre pond contains a diverse marsh with many native species of submergent, floating-leaved and emergent plants. The marsh exhibits a classic zonation pattern. A shallow open water zone is surrounded by a floating-leaved zone which is in turn ringed by an emergent zone. The

marsh has an outlet to Lake Erie which enables its water levels to fluctuate naturally with those of the lake. The marsh has a good diversity of native wetland species. This marsh is of high significance for being the best natural marsh community remaining in the western Lake Erie coastal region; almost all of the others must be maintained with dikes. North Pond also provides habitat for one endangered species:

Sagittaria cuneata (E): Wapato was reported as recently as 1993 in North Pond, but could not be relocated in 1998. Lake Erie water levels have been high in the last few years and this may have caused this species to disappear, at least temporarily.

Additional Isolated Rare Species Populations: Three additional rare species have been recorded in various locations around the island since 1980:

Ulmus thomasii (T): Rock elm is one of the rarest trees in Ohio and is currently known from only five sites in the state. It occurs in a nearly monospecific grove of young trees at a site on the eastern side of the island, part of which is owned by the Cleveland Museum of Natural History and part by the Division of Parks and Recreation. Normally the tree occurs as a minor component of forest communities.

Artemisia campestris (T): A very small population of beach wormwood was discovered in a disturbed site along the south shore on Kelleys Island in 1996. The species normally occurs on sandy beaches along the lake.

Carex mesochorea (T): Midland sedge was reported in 1985 near the cemetery on Kelleys Island. It could not be relocated in 1998.

SOUTH BASS ISLAND: South Bass Island has been very heavily developed over the last few decades and very few areas have maintained their original, natural botanical diversity. However, the harbor at Put-in-Bay contains perhaps the most extensive and diverse submergent aquatic plant community in the state and Terwilliger's Pond, a small marsh on the southwest side of the bay provides habitat for many floating-leaved and emergent species. Stuckey (1971) and Stuckey and Moore (1995) document the dramatic decline in the flora of the harbor from 1900-1971 and its subsequent partial recovery in the 1990's. Pieters (1901) had documented several species of submersed aquatic species in the harbor which are rare or absent in Ohio today. Most of these species died out in the harbor shortly after 1900, or at least by 1940 (Stuckey and Moore 1995). Three of these species are now extirpated from Ohio. The rare species lost to the harbor include:

Carex aquatilis (T): leafy tussock sedge
Megalodonta beckii (X): water-marigold
Myriophyllum sibiricum (T): American water-milfoil
Potamogeton perfoliatus (X): red-head pondweed
Potamogeton friesii (E): Fries' pondweed
Potamogeton praelongus (E): white-stem pondweed
Potamogeton filiformis (X): filiform pondweed
Potamogeton gramineus (E): grass-like pondweed
Sagittaria rigida (T): deer's-tongue arrowhead
Scirpus expansus (T): woodland bulrush.

Many submersed species have returned to the harbor, or have increased in abundance during the 1990's (Stuckey and Moore 1995) due to a dramatic increase in water clarity brought about by the effect of the recently introduced Zebra mussel (*Dreissena polymorpha*) on the ecology of Lake Erie. However, no state endangered or threatened species have returned to the harbor.

Only two endangered or threatened species are currently known to persist on the island:

Campanula rotundifolia (T): Harebell occurs on several shoreline rock outcrops around the island and is fairly common in appropriate habitats, especially on Gibraltar Island in the bay.

Eleocharis ovata (E): Ovate spike-rush was discovered in 1995 on the edge of Terwilliger's Pond in the bay. This site represents one of only two recent sites for this species in Ohio. The other population was located at East Harbor State Park, but has not been relocated since 1988.

Several more threatened and endangered species were found on the island between 1950 and 1970, but have not been seen since. These include:

Arabis hirsuta var. *pyncocarpa* (E): western hairy rock-cress - last seen in 1968
Arabis drummondii (E): Drummond's rock-cress - last seen in 1977
Elymus trachycaulus (T): bearded wheat grass - last seen in 1964
Iris brevicaulis (E): leafy blue flag - last seen in 1955
Populus balsamifera (E): balsam poplar - last seen in 1964
Sagittaria cuneata (E): wapato - last seen in 1974
Senecio pauperculus (T): balsam squaw-weed - last seen in 1977
Viola nephrophylla (E): Northern bog violet - last seen in 1977.

Arabis drummondii, *Senecio pauperculus* and *Viola nephrophylla* occurred on the tops of cliffs along the coast of the island. Most of these areas are now occupied by houses and yards and are difficult to survey. It is difficult to know whether these species are still extant on the island.

GREEN ISLAND: Green Island Wildlife Area, supports an immature forest community consisting of sugar maple (*Acer saccharum*) and hackberry (*Celtis occidentalis*) as the dominant species. In addition to being young, the forest floor has been invaded by several non-native species, including garlic mustard (*Alliaria petiolaris*). The east and northeast shores of the island contain a limestone alvar which supports vegetation similar to the shoreline alvar on Kelleys Island. The island contains several rare species:

Campanula rotundifolia (T): Bellflower was relocated on the small alvar in 1998.

Viola nephrophylla (E): Northern bog violet was also relocated in 1998 on the alvar.

Ulmus thomasi (T): Rock elm was reported in 1998, although an historic record from 1939 was also known. Several dozen occur in the understory of the forest on the south side of the island.

Ohio's last known population of the extirpated snowberry (*Symphoricarpos albus* var. *albus*), last seen on the island in 1966, could not be relocated, nor could a 1966 record of the threatened Sprengel's sedge (*Carex sprengelii*) be relocated. A 1939 record of the endangered Drummond's rock-cress (*Arabis drummondii*), which is restricted in its distribution in Ohio to the western Lake Erie Islands, was also not relocated.

MIDDLE BASS ISLAND: Middle Bass Island today has very few areas of natural vegetation. Haunck's Pond was formerly a high-quality Lake Erie marsh, but now has been severely diminished in quality. The site was recently acquired by the Ohio Division of Wildlife as the Kuehnle Wildlife Area. The site formerly hosted many rare species including:

Calamintha arkansana (T): limestone savory - last seen in 1959

Lophotocarpus calycinus (T): Southern wapato - last seen in 1976

Myriophyllum verticillatum (E): green water-milfoil - last seen in 1889

Sagittaria cuneata (E): wapato - last seen in 1976.

Only two rare species have been documented on the island since 1980. The only rare species still present occur on a small area of dolomite cliffs on the south side of the island:

Arabis drummondii (E): Drummond's rock-cress occurs in a small area of dolomite rock outcrops on the south side of the island.

Campanula rotundifolia (T): Bellflower also occurs with the rock-cress on the dolomite rock outcrops.

NORTH BASS ISLAND: The majority of North Bass Island is now occupied by vineyards which have all but replaced the native vegetation. The most significant natural feature on the island today is the 35-acre Fox's Marsh. This marsh was, until fairly recently, a diverse plant community. However, most of the emergent zone has been occupied by giant reed grass (*Phragmites australis*) and reed-canary grass (*Phalaris arundinacea*), which have crowded out most of the other species. In 1996, very few floating-leaved species were present in the shallow open water of the central portion of the marsh, which is exceptionally turbid. In 1980, one plant of the state and federally threatened Eastern prairie fringed orchid (*Platanthera leucophaea*) was reported in a small sedge meadow adjacent to the marsh, but several attempts to relocate the species in recent years have been unsuccessful. This sedge meadow is mostly occupied by blue-joint grass (*Calamagrostis canadensis*), wheat sedge (*Carex atherodes*), a potentially threatened species, and other sedges of the genus *Carex*. Manila Bay, which forms a small protected opening to Fox's Marsh, supported a diverse submergent plant community at the turn of the century which included the endangered grass-like pondweed (*Potamogeton gramineus*) and as recently as 1970, the state extirpated filiform pondweed (*Potamogeton filiformis*). The endangered wapato (*Sagittaria cuneata*) was also located on the island in 1974, but has not been relocated.

WEST SISTER ISLAND: This National Wildlife Refuge contains a forest consisting almost entirely of hackberry (*Celtis occidentalis*) and Kentucky coffeetree (*Gymnocladus dioica*). Three species of endangered or threatened plants have been reported since 1980:

Arabis drummondii (E): Drummond's rock-cress was first discovered in small numbers on a shoreline rock outcrop in 1996.

Aster drummondii (T): Drummond's aster was found on the island in 1981, but not relocated in 1996.

Euthamia remota (T): Great Lakes goldenrod was collected in 1981, but not relocated in 1996.

RATTLESNAKE, BALLAST AND STARVE ISLANDS: None of these small islands was visited during this survey, but old records of rare species do exist:

Rattlesnake Island

Arabis drummondii (E): Drummond's rock-cress - last reported in 1939

Campanula rotundifolia (T): harebell - last reported in 1967

Spenopholis obtusata var. *obtusata* (T): prairie wedge grass - last reported in 1900

Viola nephrophylla (E): Northern bog violet - last reported in 1967

Ballast Island

Arabis drummondii (E): Drummond's rock-cress - last reported in 1939

Campanula rotundifolia (T): harebell - last reported in 1969

Starve Island

Campanula rotundifolia (T): harebell - last reported in 1967.

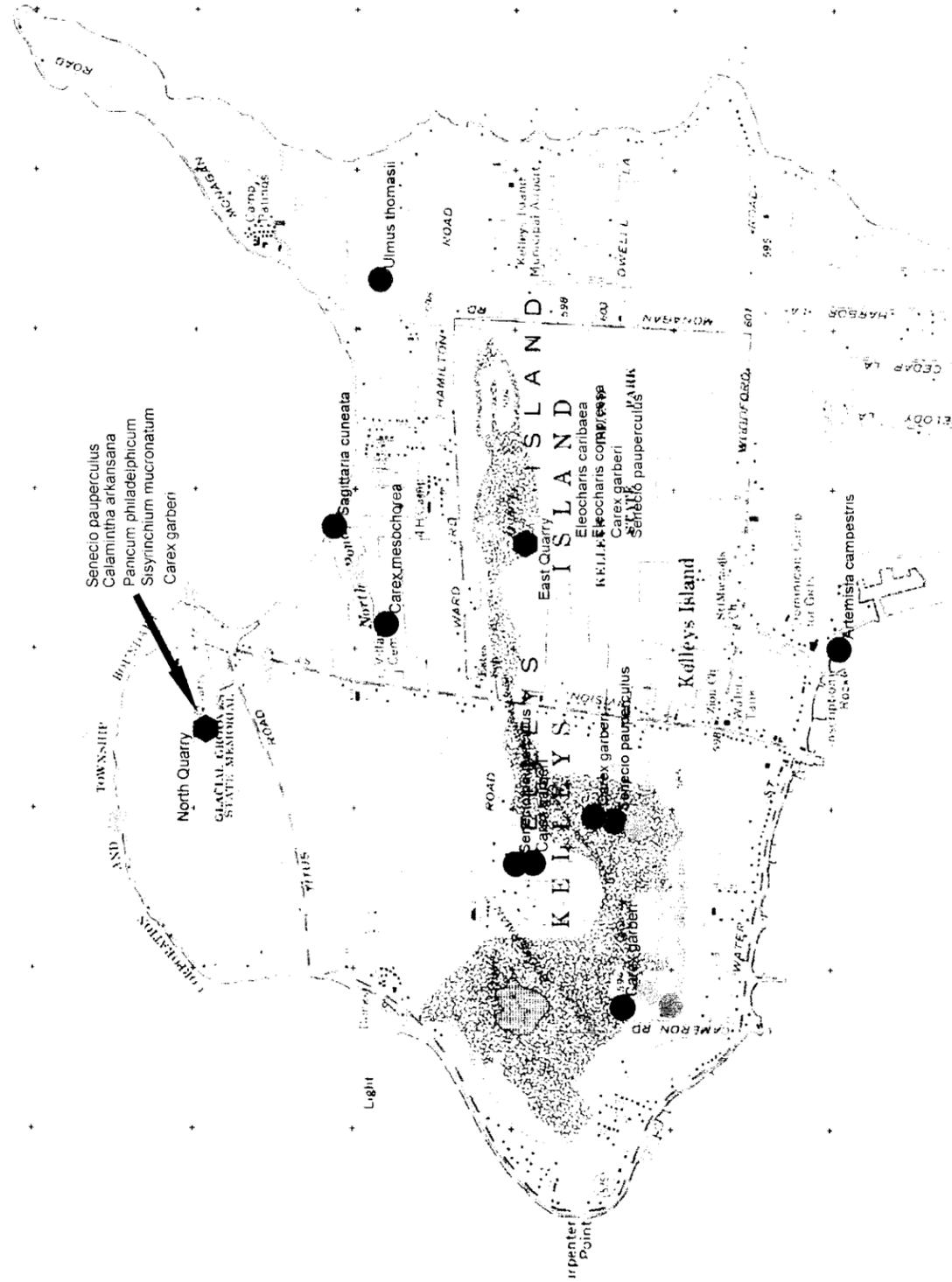


Figure 5.1. Kelleys Island, Kelleys Island Quad.

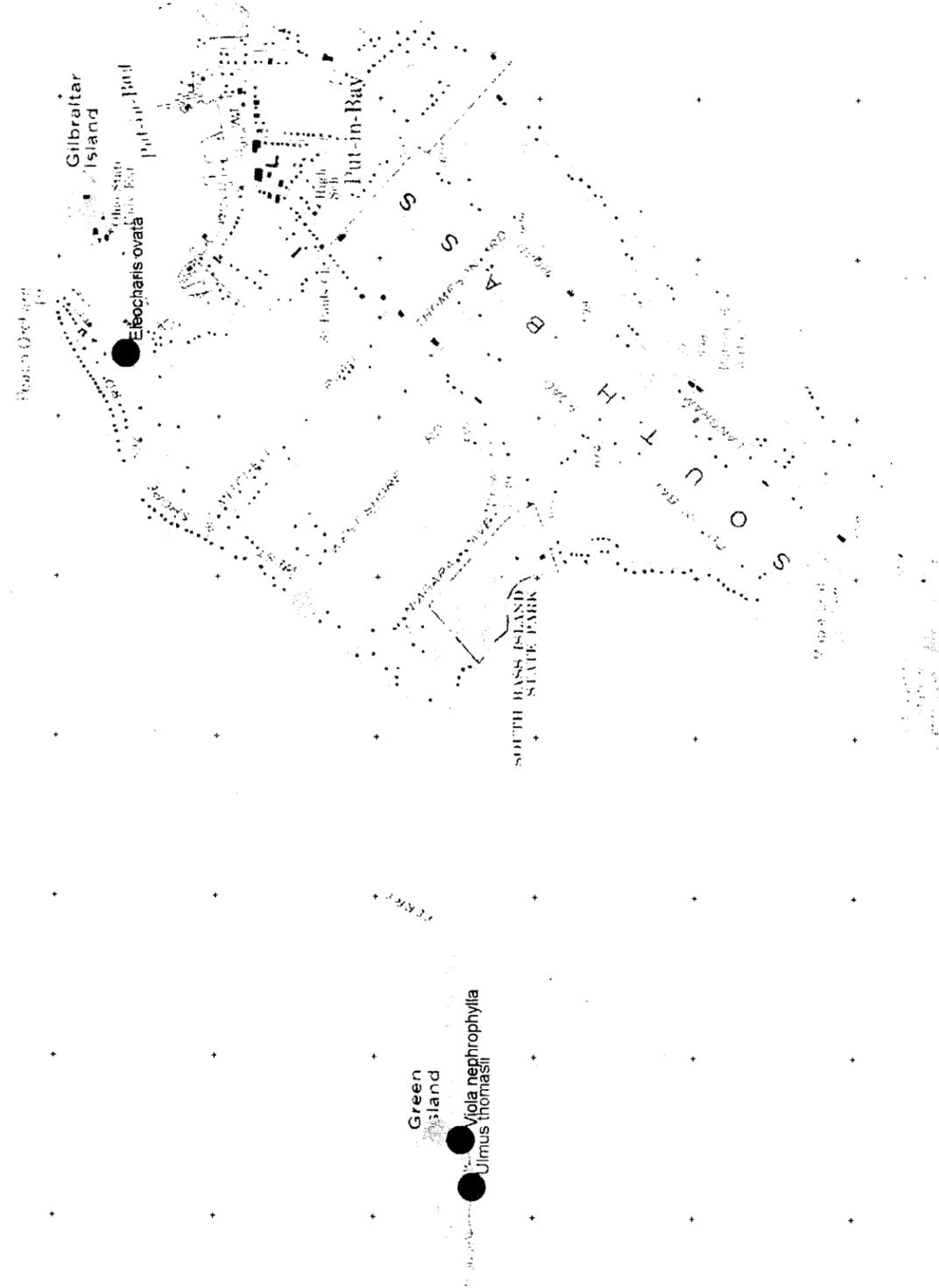


Figure 5.2. South Bass Island and Green Island, Put-in-Bay Quad.

A K E . . . E R I E .



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Figure 5.3. Middle Bass Island, Put-in-Bay Quad.

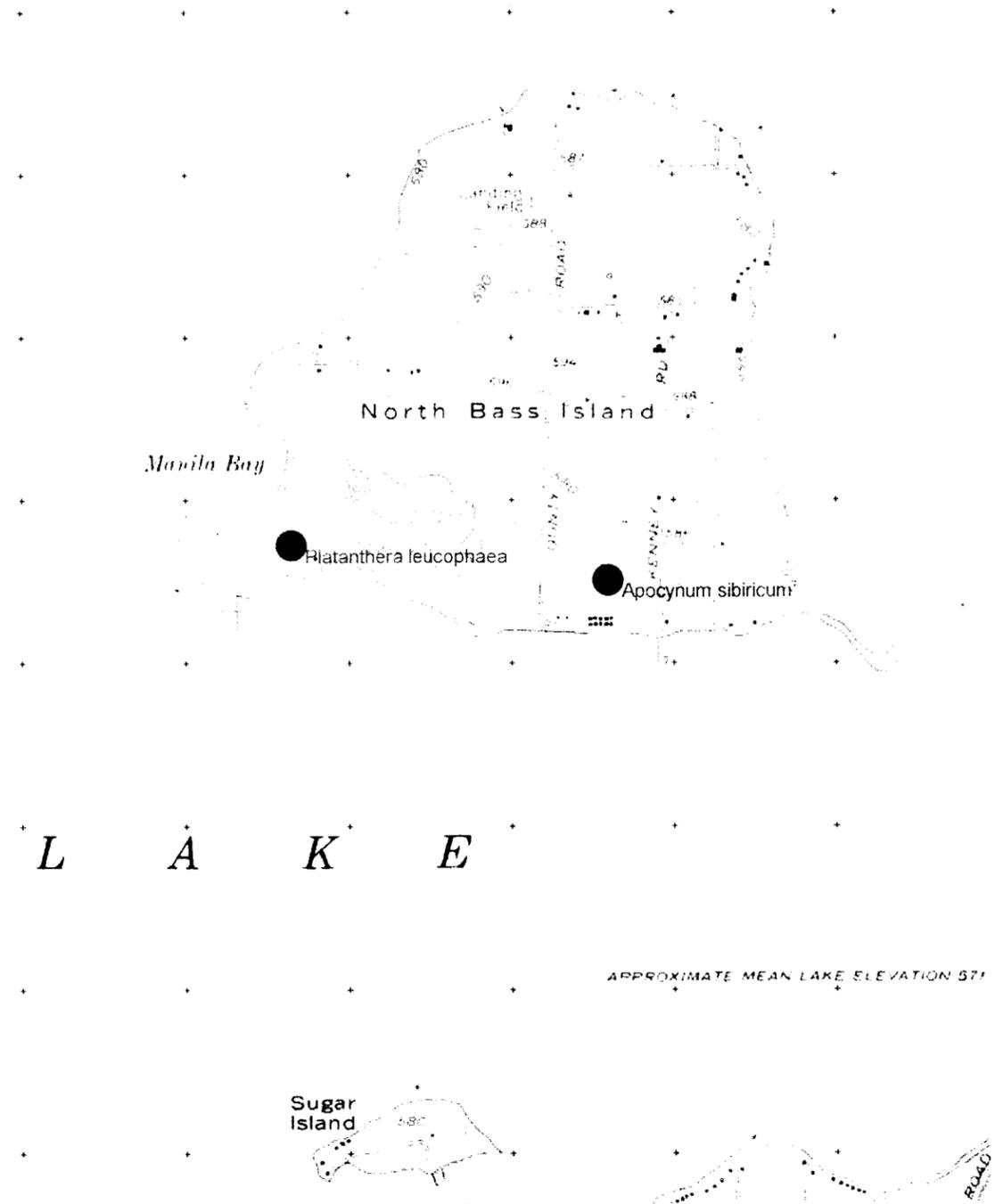


Figure 5.4. North Bass Island. Put-in-Bay Quad.

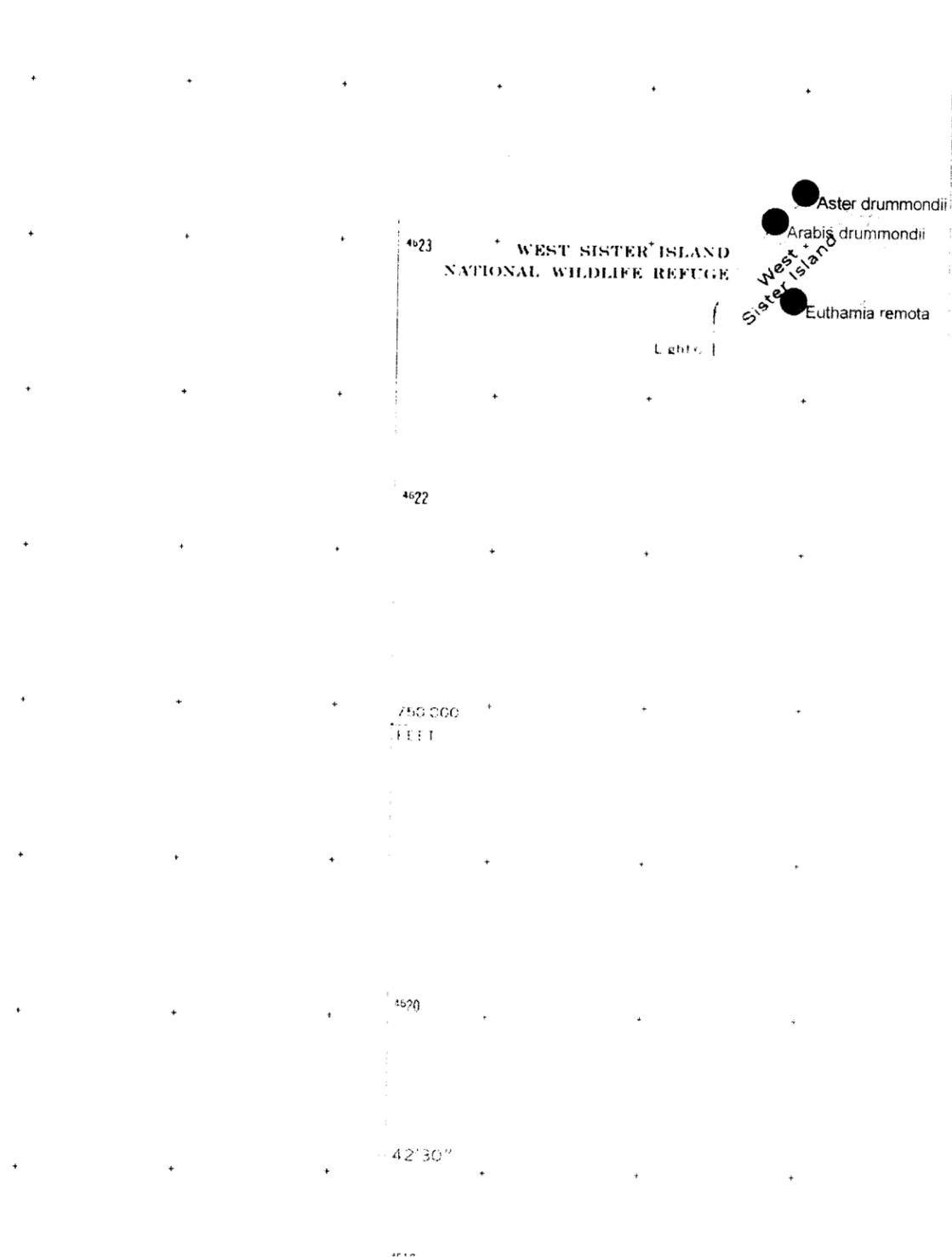


Figure 5.5. West Sister Island, Metzger Marsh Quad.

VI. CENTRAL AND EASTERN ERIE COUNTY (Figures 6.1-6.6)

This section of the coast extends from Sandusky to the border of Lorain County. The area contains an excellent diversity of habitat types including prairies, beach and marsh complexes and forests.

Erie County Prairie Remnants: In 1810, the botanist Nuttall, while traveling along the Lake Erie coast, commented on a huge prairie which extended west of Huron for 10-12 miles. He describes the area as being mostly open with small groves of trees. He used the term savannah to describe this habitat (Graustein 1951). Around the turn of the century, E. L. Moseley collected plants in these extensive prairies. He collected several species which are now extremely rare in Ohio and many prairie species which are no longer found in this part of the state. Some of the significant species which were found in the area around 1900, but are no longer present include:

Anemone cylindrica (T): prairie thimbleweed
Apocynum sibiricum (E): clasping-leaf dogbane
Botrychium multifidum (T): leathery grape fern
Carex arctata (E): drooping wood sedge
Carex siccata (E): hay sedge
Comptonia peregrina (T): sweet-fern
Cuscuta coryli (E): hazel dodder
Cuscuta pentagona (X): five-angled dodder
Elymus trachycaulus (T): bearded wheat grass
Equisetum variegatum (T): variegated scouring-rush
Gentiana puberulenta (E): prairie gentian
Helianthemum bicknellii (T): plains frostweed
Lechea minor (T): thyme-leaf pinweed
Polygonum careyi (X): Carey's smartweed
Prenanthes aspera (E): rough rattlesnake-root
Prunus pumila var. *cuneata* (T): sand cherry
Rhynchospora globularis (E): grass-like beak-rush
Rosa blanda (T): smooth rose
Salix petiolaris (T): slender willow
Scleria pauciflora (T): few-flowered nut-rush
Viburnum opulus var. *americanum* (T): high-bush cranberry.

Many of these species are indicators of a sand barrens habitat which is not uncommon today in the Oak Openings portion of the Lake Plain, but is now found in only one site in the coastal region, North Kingsville Sand Barrens in Ashtabula County. Some of the

other species listed suggest a wet prairie community. No intact remnants of this once very large prairie complex are known today, but some significant species are preserved in four fragmented and for the most part, highly disturbed sites:

Erie Sand Barrens State Nature Preserve: This preserve consists mostly of open, sandy fields that support a few prairie species. The area was plowed in the past and there are no natural prairie communities present. However, it does provide habitat for 14 state-listed species, especially plants that thrive on the disturbance of the substrate.

NASA Plumbrook Station: This large area was surveyed for biological diversity by staff from the Division of Natural Areas and Preserves in 1994 (Ohio Division of Natural Areas and Preserves 1994). Many of the same rare species found at Plumbrook Station also occur at the adjacent Erie Sand Barrens Preserve.

Rhexia Flats: This recently discovered site contains a unique mixture of ponds and open, wet flats of crushed shale. This habitat was created during the construction of the Ohio turnpike. This highly disturbed and unusual habitat contains one of the greatest diversities of wetland plants in the coastal region including 11 state-listed plant species. This privately-owned site has been given the unofficial name of Rhexia Flats because of the huge population of the potentially threatened Virginia meadow-beauty (*Rhexia virginica*) which is present.

Kimball Railroad Prairie: This small prairie remnant consists of a thin strip of prairie vegetation along an abandoned railroad embankment. This site contains more species typical of tall-grass prairies than any other remnant in the area, but does not contain the high number of rare species present at the other three sites.

The following endangered or threatened species occur in these prairie remnants:

Apocynum sibiricum (E): Two hundred plants of clasping-leaf dogbane were located at Erie Sand Barrens State Nature Preserve in 1995.

Aster dumosus (T): Two individuals of bushy aster were reported at Erie Sand Barrens State Nature Preserve in 1989, but the species has not been relocated during many subsequent botanical surveys. The species was also located at the Rhexia Flats in 1997.

Carex conoidea (T): The population of field sedge at the Erie Sand Barrens State Nature Preserve was relocated in 1996. The species has also been recorded in at least two locations at the Plumbrook Station. One of these populations was discovered in the 1994 survey. The other population, a 1982 record, could not be relocated in 1994.

Eleocharis olivacea (T): A huge population of at least 1000 individuals of olivaceous spike-rush, perhaps the largest population in the state, was discovered in 1997 at the Rhexia Flats.

Euthamia remota (T): A large population, at least 1000 plants, of Great Lakes goldenrod was discovered at the Rhexia Flats in 1997. The plant had been seen along the Kimball Railroad Prairie in 1977, but could not be relocated in 1997.

Helianthus mollis (T): A single population of about 50 stems of ashy sunflower was relocated in 1997 along the Kimball Railroad Prairie. Another population of 200 plants was confirmed at the Plumbrook Station in 1994.

Hypericum gymnanthum (E): A small population of least St. John's-wort was reported in 1992 at the Erie Sand Barrens State Nature Preserve. One plant was discovered in 1997 at the Rhexia Flats. A population of at least 40 plants was located in the 1994 survey of the Plumbrook Station. Only one additional population of this species, located in Pike County, is known to occur in Ohio.

Juncus diffusissimus (E): A population of about 20 plants of diffuse rush was discovered at the Rhexia Flats in 1997. This population represents a northern extension of the species' known range in Ohio.

Juncus platyphyllus (E): About 25 individuals of Flat-leaved rush were documented in 1991 at the Erie Sand Barrens State Nature Preserve. This species belongs to a very difficult taxonomic group and the difficulty in identifying it may partially explain its rarity in Ohio.

Lipocarpa micrantha (T): The dwarf bulrush was reported from the Erie Sand Barrens State Nature Preserve in 1992. The species was collected in 1978 at the Plumbrook Station, but could not be relocated in the 1994 survey.

Myriophyllum sibiricum (T): A large population of the rooted, submersed American water-milfoil was discovered in 1998 in a large, artificial pond at the Rhexia Flats site. This formerly abundant native species has become very rare and has been replaced for the most part by the non-native Eurasian water-milfoil (*Myriophyllum spicatum*).

Panicum meridionale (E): The Southern hairy panic grass was discovered in 1994 at the Plumbrook Station.

Xyris torta (E): Over 5000 individuals of twisted yellow-eyed grass were documented at the Erie Sand Barrens State Nature Preserve in 1997. The species was also reported in 1982 at the Plumbrook Station, but could not be relocated in 1994.

Sand Beach and Coastal Marsh: At the turn of the century, Cedar Point was an extremely diverse beach-dune and marsh complex which provided habitat for a vast number of plant species which are today considered threatened, endangered or extirpated from Ohio. Only two of these, Inland beach grass (*Ammophila breviligulata*) (T) and Beach wormwood (*Artemisia campestris*) (T) were still present in the early 1980's and all are gone now. In addition to the two listed above, all of the following rare species were present at Cedar Point in the early 1900's:

Actaea rubra (T): red baneberry
Apocynum sibiricum (E): clasping-leaf dogbane
Arabis divaricarpa (E): limestone rock-cress
Arabis drummondii (E): Drummond's rock-cress
Arabis lyrata (T): lyre-leaf rock-cress
Arctostaphylos uva-ursi (X): bearberry
Botrychium multifidum (T): leathery grape fern
Carex aquatilis (T): leafy tussock sedge
Descurainia pinnata (T): tansy-mustard
Juniperus communis (T): ground juniper
Lathyrus japonicus (T): inland beach-pea
Lithospermum carolinense (T): plains puccoon
Megalodonta beckii (X): water-marigold
Oenothera parviflora (E): small-flowered evening-primrose
Platanthera psycodes (E): small purple fringed orchid
Populus balsamifera (E): balsam poplar
Potamogeton robbinsii (E): Robbins' pondweed
Potentilla paradoxa (T): bushy cinquefoil
Potentilla arguta (E): tall cinquefoil
Prunus pumila var. *pumila* (X): Great Lakes sand cherry
Rosa blanda (T): smooth rose
Salix cordata (X): sand-dune willow
Stipa spartea (T): porcupine grass
Symphoricarpos albus var. *albus* (X): snowberry
Toxicodendron rydbergii (E): Northern poison-ivy
Zizania aquatica (T): wild rice.

Two other sites in the area are somewhat similar to the Cedar Point in that they have sand beaches and marshes, but both have also been greatly altered by human activity and invasive species.

Bay Point: Another site of botanical interest on the peninsula is Bay Point which extends southward into the mouth of Sandusky Bay from the southeast tip of the Peninsula where it parallels Cedar Point. Although we know of no historical records from the peninsula, it was surveyed by Stuckey and others in the 1960's and 1970's. At that time the site consisted of a beach-dune community with an emergent marsh. Four rare species were reported:

Ammophila breviligulata (T): inland beach grass - last seen in 1979

Artemisia campestris (T): beach wormwood - last seen in 1967

Eleocharis caribaea (E): Caribbean spike-rush - last seen in 1967

Potentilla paradoxa (T): bushy cinquefoil - last seen in 1981

None of these species were seen in a 1998 survey. Although the southern tip of the long peninsula is physically intact today, the beach and marsh have been almost totally overrun with giant reed grass (*Phragmites australis*) and sandbar willow (*Salix exigua*).

Sheldon Marsh State Nature Preserve: This preserve consists of a barrier beach with wet swales and an open water marsh behind it. Although disturbed, the beach at this Preserve is considered to be a significant beach-dune community:

Sheldon Marsh State Nature Preserve - Beach-dune: This site contains about 30 acres of a barrier beach mostly dominated by willows (*Salix spp.*), dogwoods (*Cornus spp.*) and cottonwood (*Populus deltoides*). There is no significant dune-grass association present. However, this site is significant for Ohio in having an open marsh behind the barrier beach. The site also has a good diversity of beach plants and is especially notable for the unusual species which occur on its mud flats and temporal pools. Four rare species were located at the site in the late 1980's and early 1990's:

Artemisia campestris (T): beach wormwood - last reported in 1994

Eleocharis engelmannii (E): Engelmann's spike-rush - last reported in 1988

Potentilla paradoxa (T): bushy cinquefoil - last reported in 1990

Oenothera parviflora (E): small-flowered evening-primrose - last reported in 1994 .

However, none of these species has been relocated since that time despite the efforts of many botanists to find them. The beach had been affected in recent years by high lake levels and much of the wet sand habitat that would support *Potentilla paradoxa* and

Eleocharis engelmannii has been overrun with giant reed grass (*Phragmites australis*). The beach at Sheldon Marsh was the only known site in Ohio for *Eleocharis engelmannii*. Inland beach grass (*Ammophila breviligulata*) was reported at the nearby Nickel Plate Park beach in 1980, but could not be relocated.

Old Woman Creek State Nature: This preserve contains a large estuary marsh with one of the most extensive populations of American water-lotus (*Nelumbo lutea*) in the coastal region (Whyte et al 1997). In addition to the estuary marsh, the preserve also contains a small railroad prairie remnant and a small sand beach. Three species of threatened or endangered plant species have been recorded at the Preserve since 1980:

Artemisia campestris (T): Beach wormwood was reported on the beach in 1981, but has not been located in many subsequent botanical surveys.

Carex aquatilis (T): Leafy tussock sedge was documented in the estuary marsh in 1990.

Carex bicknellii (T): Bicknell's sedge was relocated in the small railroad prairie in 1998. This remains the only population of this species in the coastal region.

DuPont Marsh State Nature Preserve: This preserve contains one of the only riverine (and non-estuarine) marshes in the coastal region. It is considered to be a significant riverine marsh community.

DuPont Marsh State Nature Preserve - Riverine marsh: This marsh occupies about 65 acres along the Huron River. The site supports a large floating-leaved zone with American water-lotus (*Nelumbo lutea*) and spatterdock (*Nuphar advena*). Although extensive in size, much of the emergent zone has been overrun by reed-canary grass (*Phalaris arundinacea*), which has reduced the quality of the marsh. However, the site is still significant as one of the larger riverine marshes in northern Ohio. Two rare species have been reported from this site:

Carex aquatilis (T): A very small population of leafy tussock sedge was reported at DuPont Marsh in 1989. However, the species was not relocated during a 1996 survey.

Iris brevicaulis (E): A small population of leafy blue flag was relocated in 1998. DuPont Marsh remains the only site in the coastal region where this rare iris can be seen.

Forests: Very few large forests exist today on the Lake Plain, especially in western Ohio. Perhaps the largest block of forest in the western Lake Plain is the Edison Woods reserve. This site is considered to be a significant plant community site:

Edison Woods Reserve - Maple-ash-oak swamp: This Erie County Metropark contains one of the largest intact blocks of forest in the coastal region. Much of it consists of a significant Maple-ash-oak swamp forest. The dominant tree species include red maple (*Acer rubrum*) and pin oak (*Quercus palustris*). The site also includes mesic forest areas where two rare species are located:

Coeloglossum viride (E): The long-bracted orchid was last reported in 1991 in the Reserve. This site is the only occurrence of the species in the coastal region.

Gymnocarpium dryopteris (T): The Appalachian oak fern was relocated in 1998 near one of the long-abandoned sandstone quarries within the Reserve.

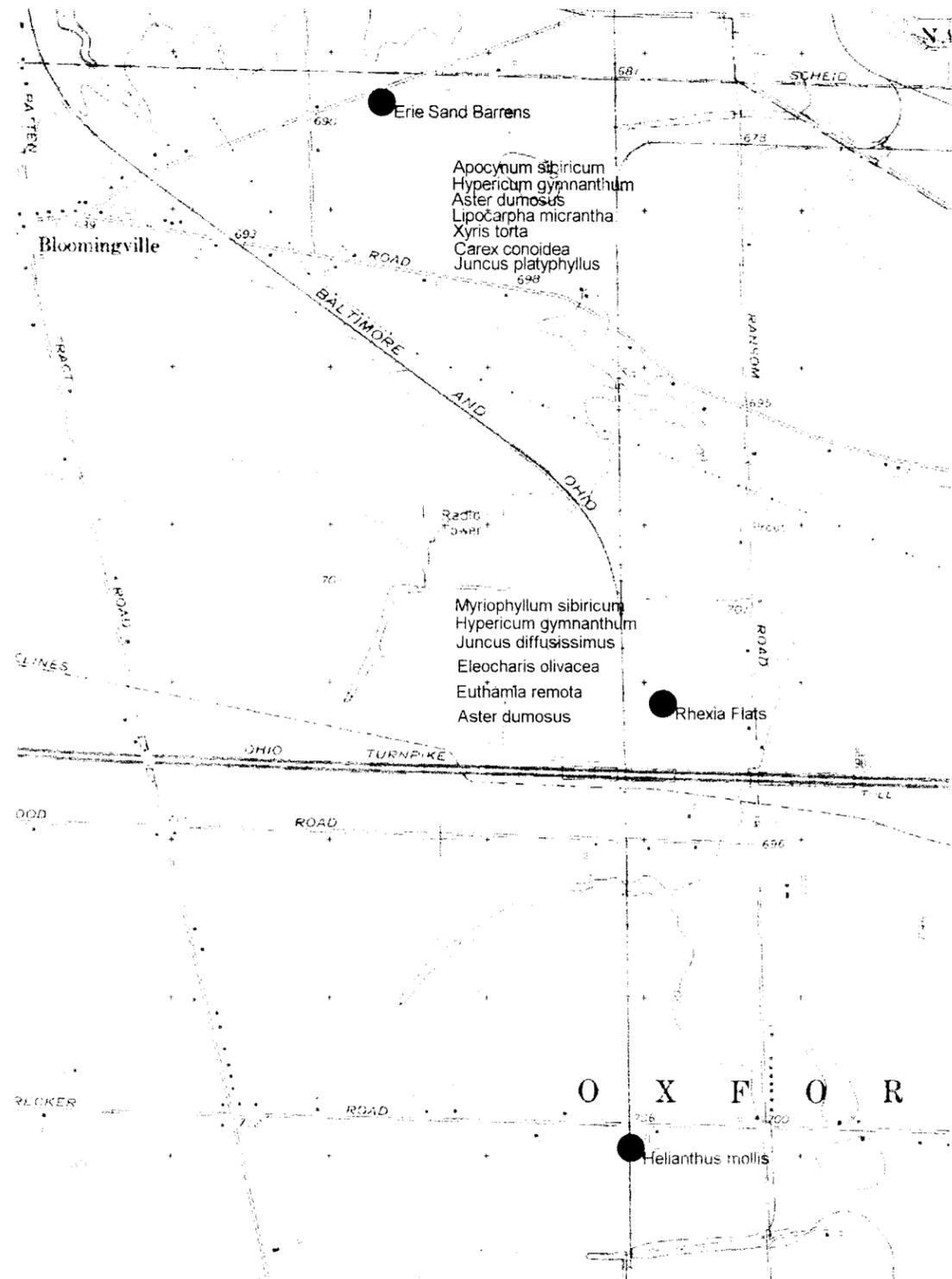


Figure 6.1. Erie Sand Barrens, Rhexia Flats and Kimball Prairie, Kimball Quad.

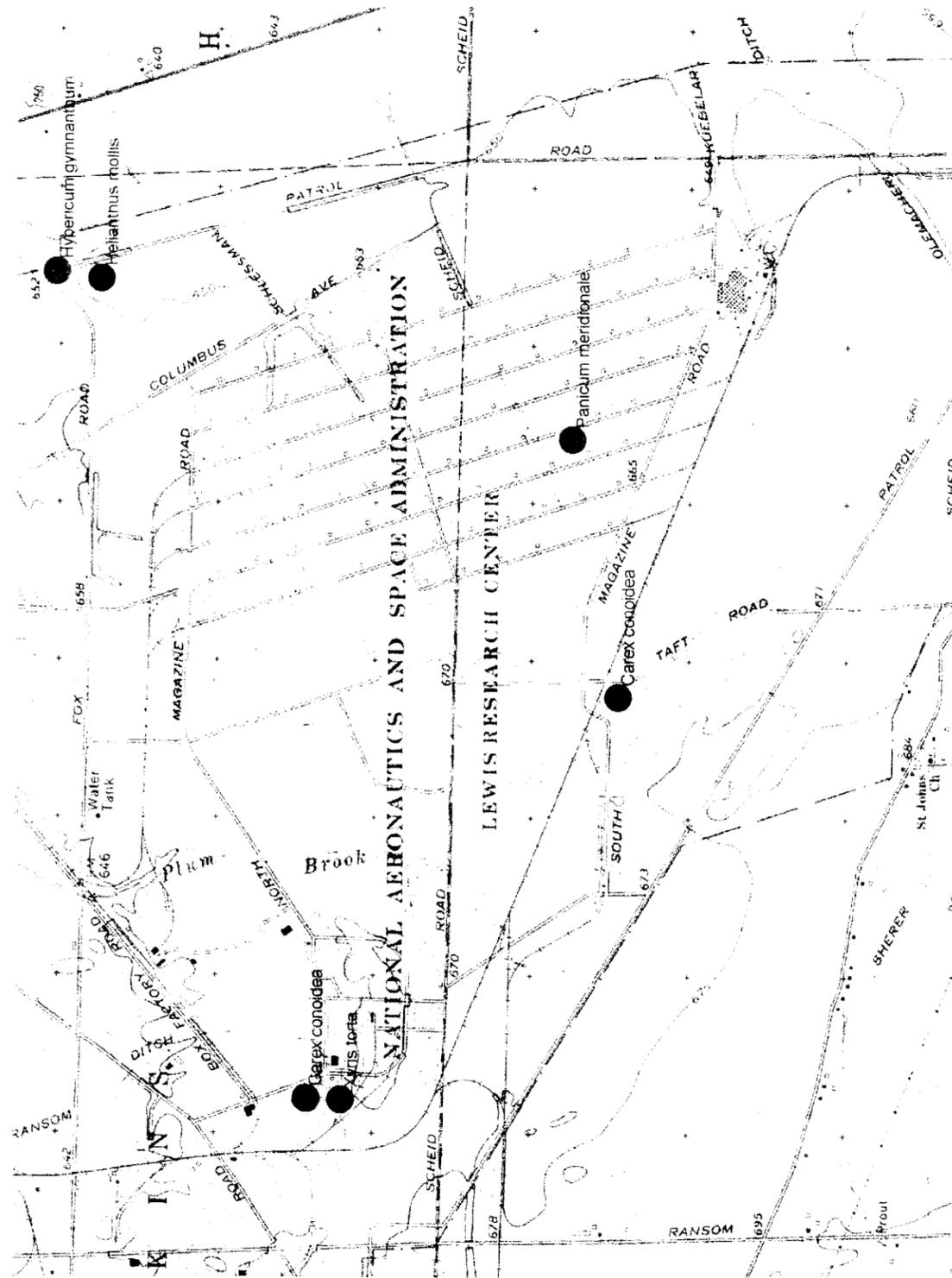


Figure 6.2. NASA Plum Brook Station, Kimball Quad.



Figure 6.3. Bay Point and Cedar Point, Kelleys Island Quad and Sandusky Quad.

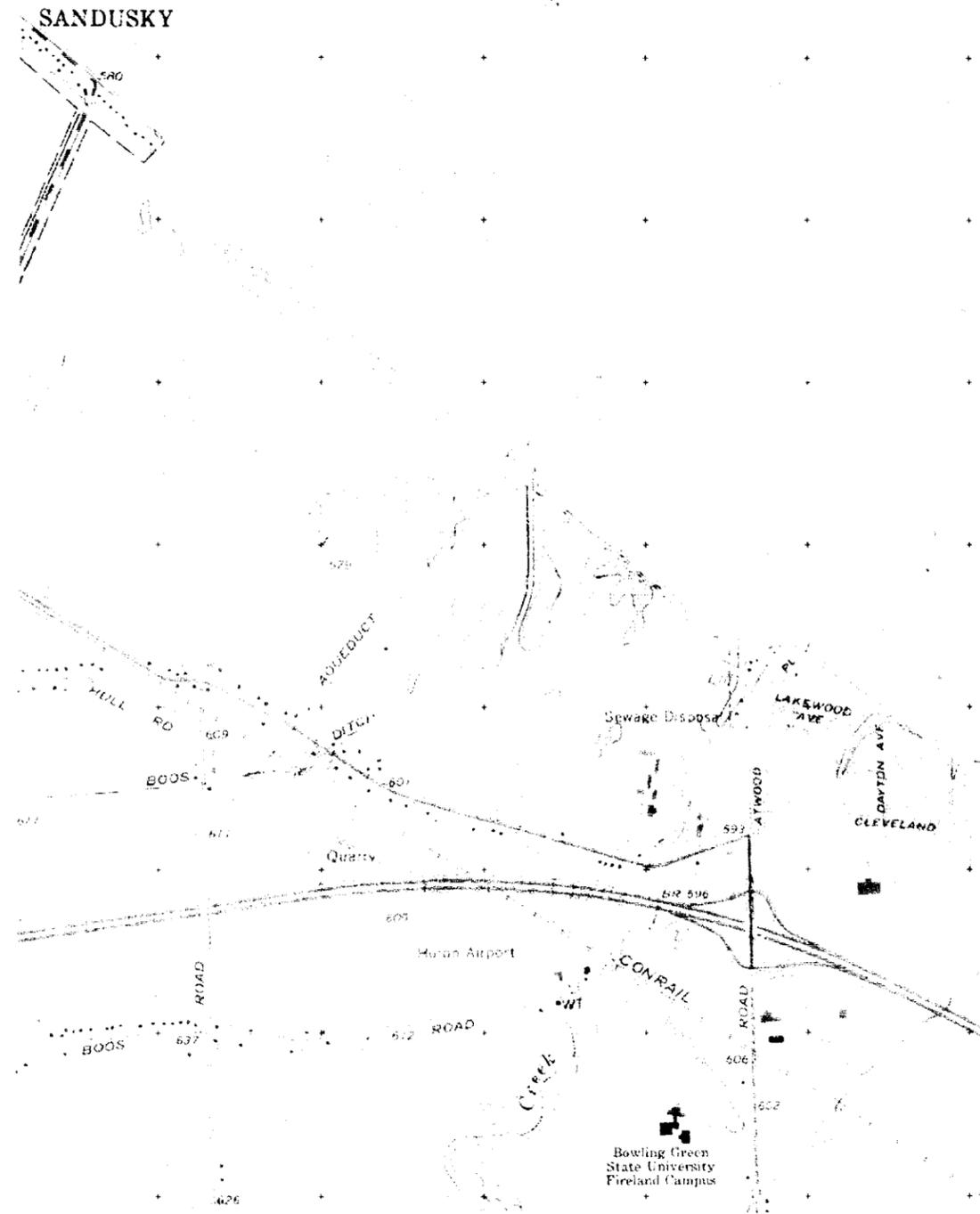


Figure 6.4. Sheldon Marsh, Huron Quad.



Figure 6.5. Old Woman Creek and Dupont Marsh, Huron Quad and Milan Quad.

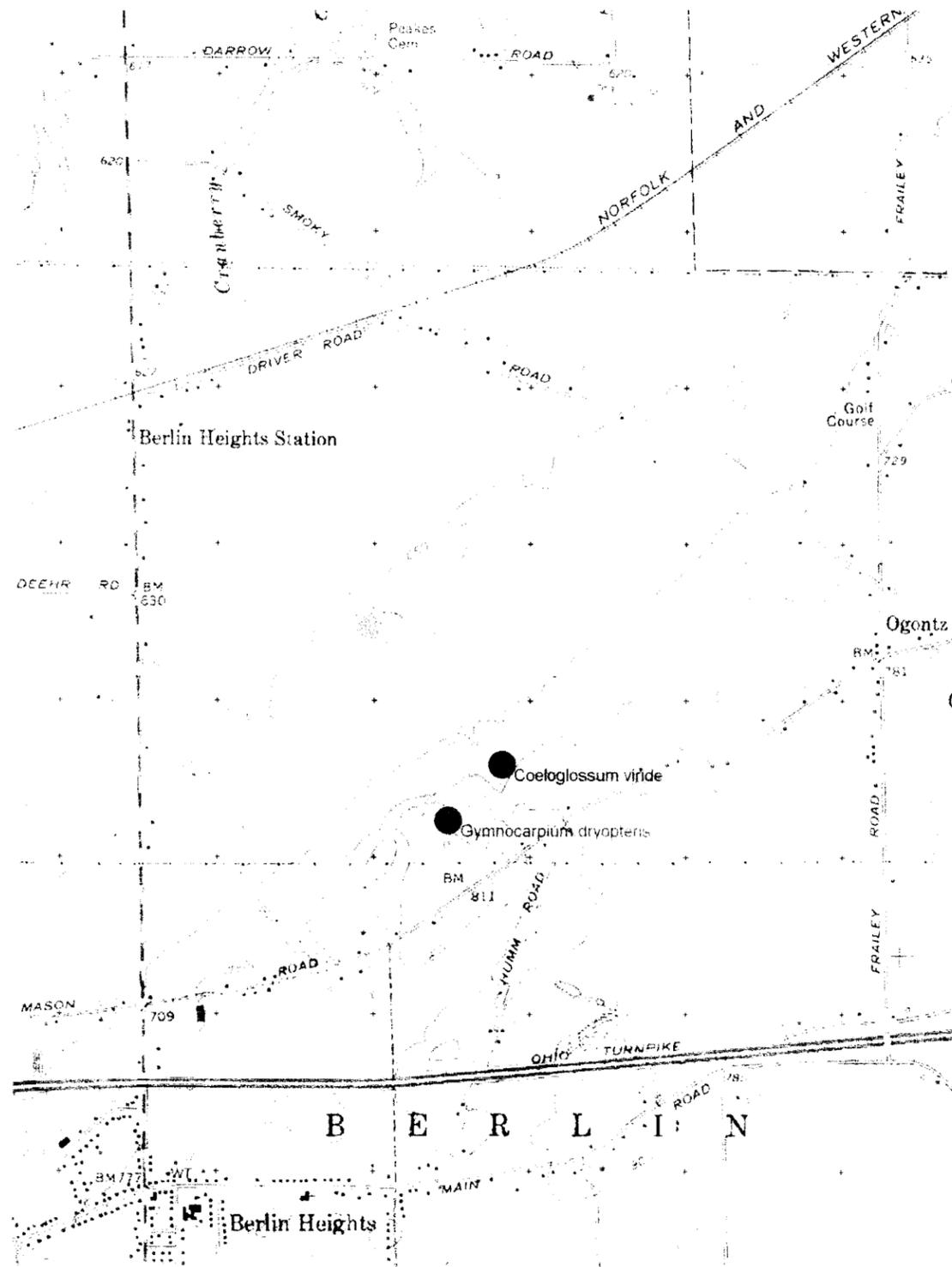


Figure 6.6. Edison Woods Reserve, Berlin Heights Quad.

VII. LORAIN COUNTY AND CUYAHOGA COUNTY LAKE PLAIN (Figures 7.1-7.5)

Most of the natural plant communities along the Lorain and Cuyahoga County Lake Plain have been lost to development as the Cleveland Metropolitan Area has continued to expand westward. The most important habitats communities remaining are the cliff and eroding bluff communities associated with the Vermilion, the Black and the Rocky Rivers. The area also contains a few remnants of the swamp forests that were associated with ancient, post-glacial beach ridges and a hemlock-hardwood forest.

Cliff and Eroding Bluff Communities: One of the most interesting habitats for plants in this region are the cliff and eroding bluff communities over the Vermilion, the Black and the Rocky Rivers. Along their steep bluffs, one finds eroding slump habitats and occasionally even calcareous seeps with fen vegetation. Several rare species occur on these bluffs and slumps habitats, including the potentially threatened small fringed gentian (*Gentianopsis procera*), round-leaved dogwood (*Cornus rugosa*), and Canadian buffalo-berry (*Shepherdia canadensis*) as well as the following threatened species:

Juniperus communis (T): A very small population of ground juniper was located in 1997 on a steep slope over the Vermilion River near Swift's Hollow in a new addition to the Lorain County Vermilion River Reservation. A 1984 record for the species on steep slopes over the east branch of the Rocky River, in the Cuyahoga County Rocky River Reservation was not located.

Prenanthes crepidinea (T): Two populations of nodding rattlesnake-root are known from the Lorain County Vermilion River Reservation. One population was located in 1984 and the second in 1993.

Swamp Forests: There are two high-quality swamp forest communities in the region, the North Ridgeville Reservation in Lorain County and Bradley Woods in Cuyahoga County:

Bradley Woods - Maple-ash-oak swamp: This park contains about 120 acres of swamp forest mostly dominated by red maple (*Acer rubrum*) and red oak (*Quercus rubra*) within a 1000-acre contiguous forest. Tuliptree (*Liriodendron tulipifera*) and black cherry (*Prunus serotina*) are also common. Most trees are less than 40 cm dbh. The swamp has several beech-sugar maple inclusions. It is significant as a rare remnant swamp forest on the Lake Plain and for its excellent size. The site also contains one endangered plant species:

Carex louisianica (E): Bradley Woods contains the only currently known site for Louisiana sedge in Ohio. A very small population of five clumps was discovered in 1992.

North Ridgeville Reservation - Maple-ash-oak swamp: This park contains about 100 acres of medium maturity swamp forest. The most important tree species are red maple (*Acer rubrum*), silver maple (*Acer saccharinum*), beech (*Fagus grandifolia*), swamp white oak (*Quercus bicolor*) and pin oak (*Quercus palustris*). The woods also contains an excellent diversity of herbaceous species. It is significant as one of the larger contiguous forest units, along with Bradley Woods and Edison Woods, in the western portion of the coastal region.

Hemlock-Hardwood Forests: A unique and interesting site is the hemlock-hardwood forest along Chance Creek, a small tributary of the Vermilion River. This site, along with another, smaller hemlock forest in a small, Vermilion River tributary just upstream from Chance Creek, contain the westernmost populations of hemlock trees in northern Ohio.

Chance Creek - Hemlock-hardwood forest: Hemlock (*Tsuga canadensis*) is the dominant tree in the deep ravine associated with Chance Creek. Many other tree species characteristic of this community are present, including: Red oak (*Quercus rubra*), tuliptree (*Liriodendron tulipifera*), white pine (*Pinus strobus*) and cucumber magnolia (*Magnolia acuminata*). This plant community occurs in an area of excellent habitat diversity with steep bluffs, small fen seeps, floodplain forests and extensive gravel bars in the Vermilion River.

Additional Isolated Rare Species Populations: One additional endangered plant species in this region is:

Oryzopsis racemosa (E): A small population of mountain-rice was recorded in 1991 in a forest on the edge of an abandoned quarry.

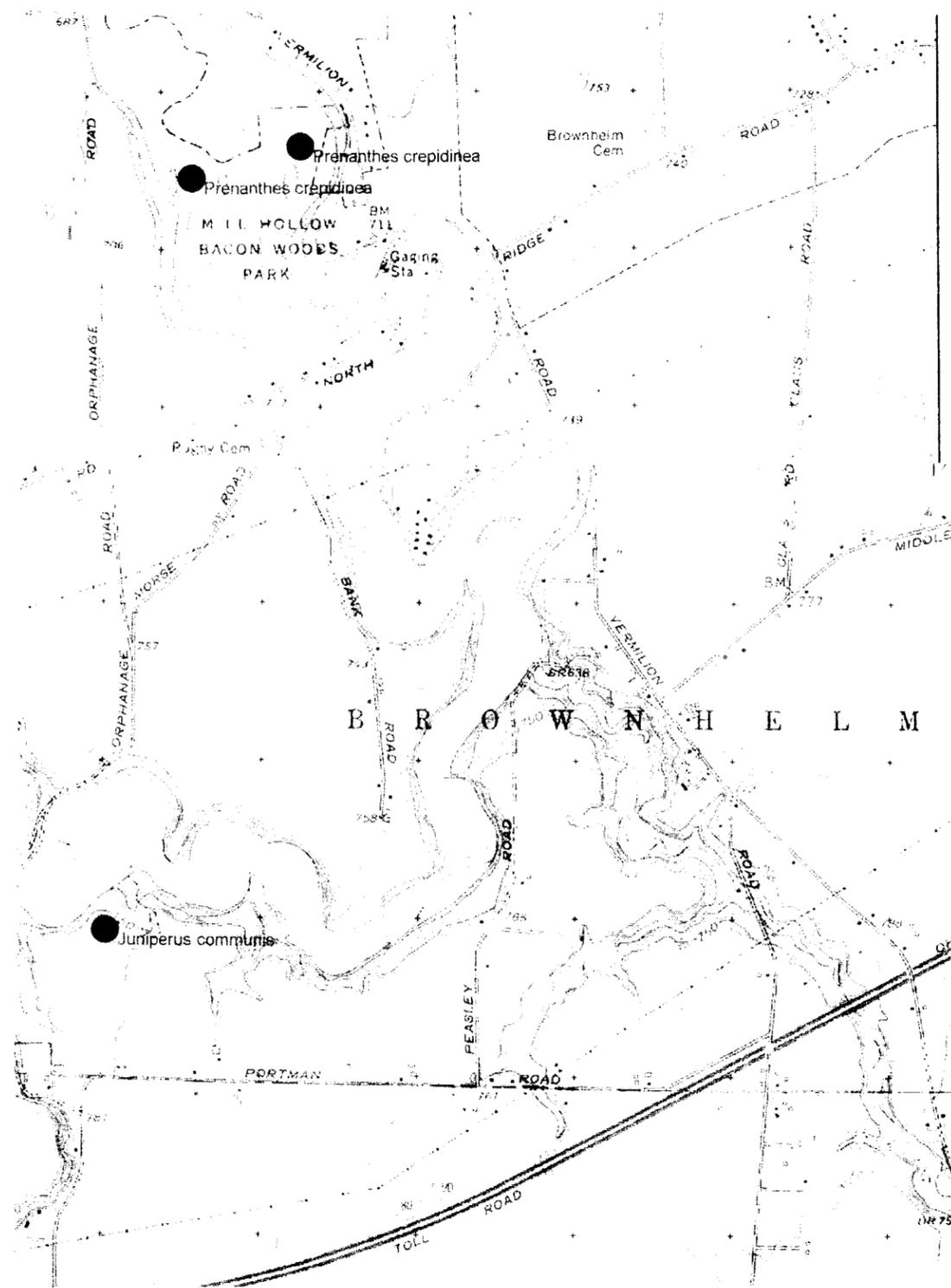


Figure 7.1. Vermillion River and Chance Creek, Kipton Quad and Vermillion East Quad.

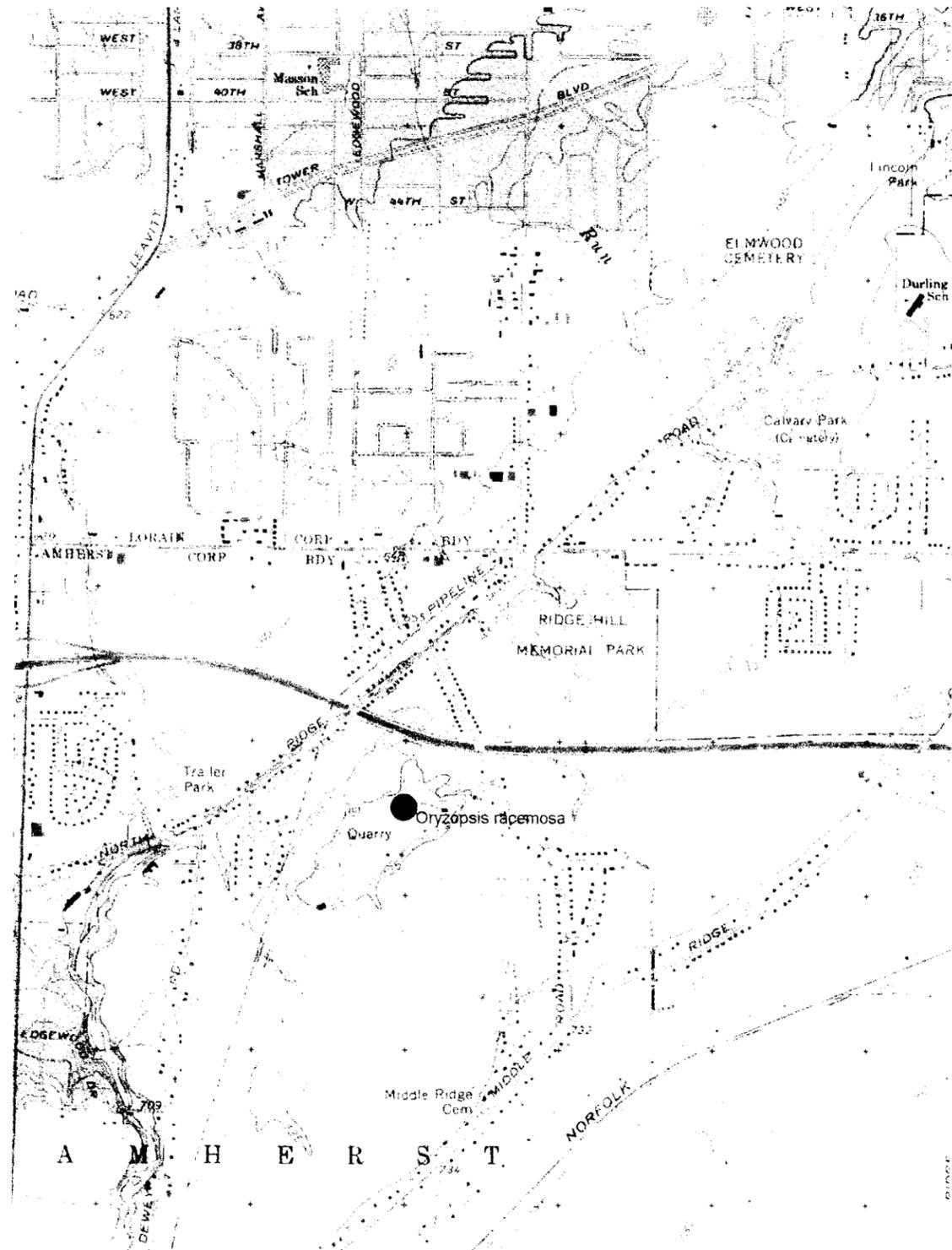


Figure 7.2. Quarry East of Amherst, Lorain Quad.

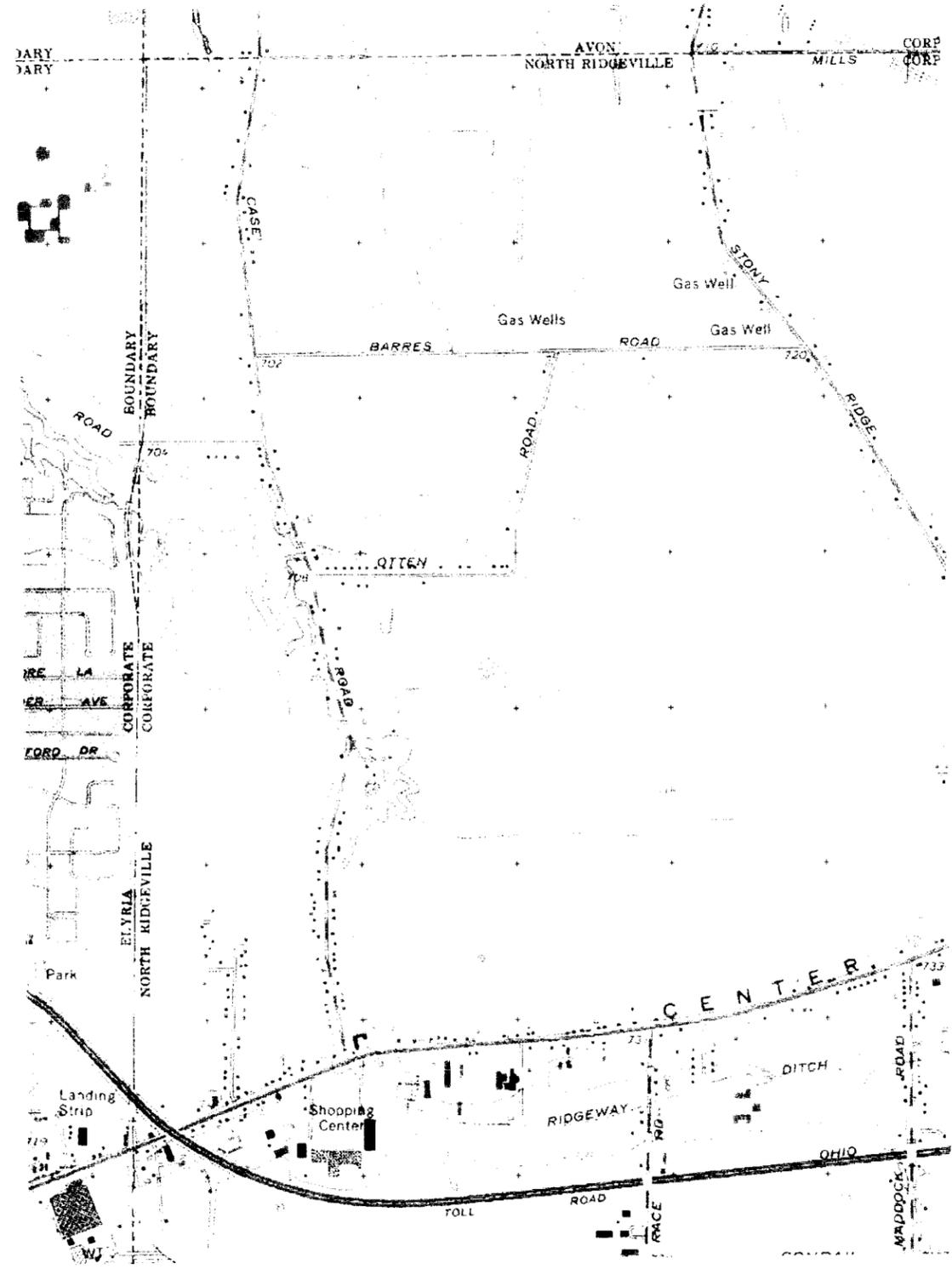


Figure 7.3. North Ridgeville Reservation, Avon Quad.

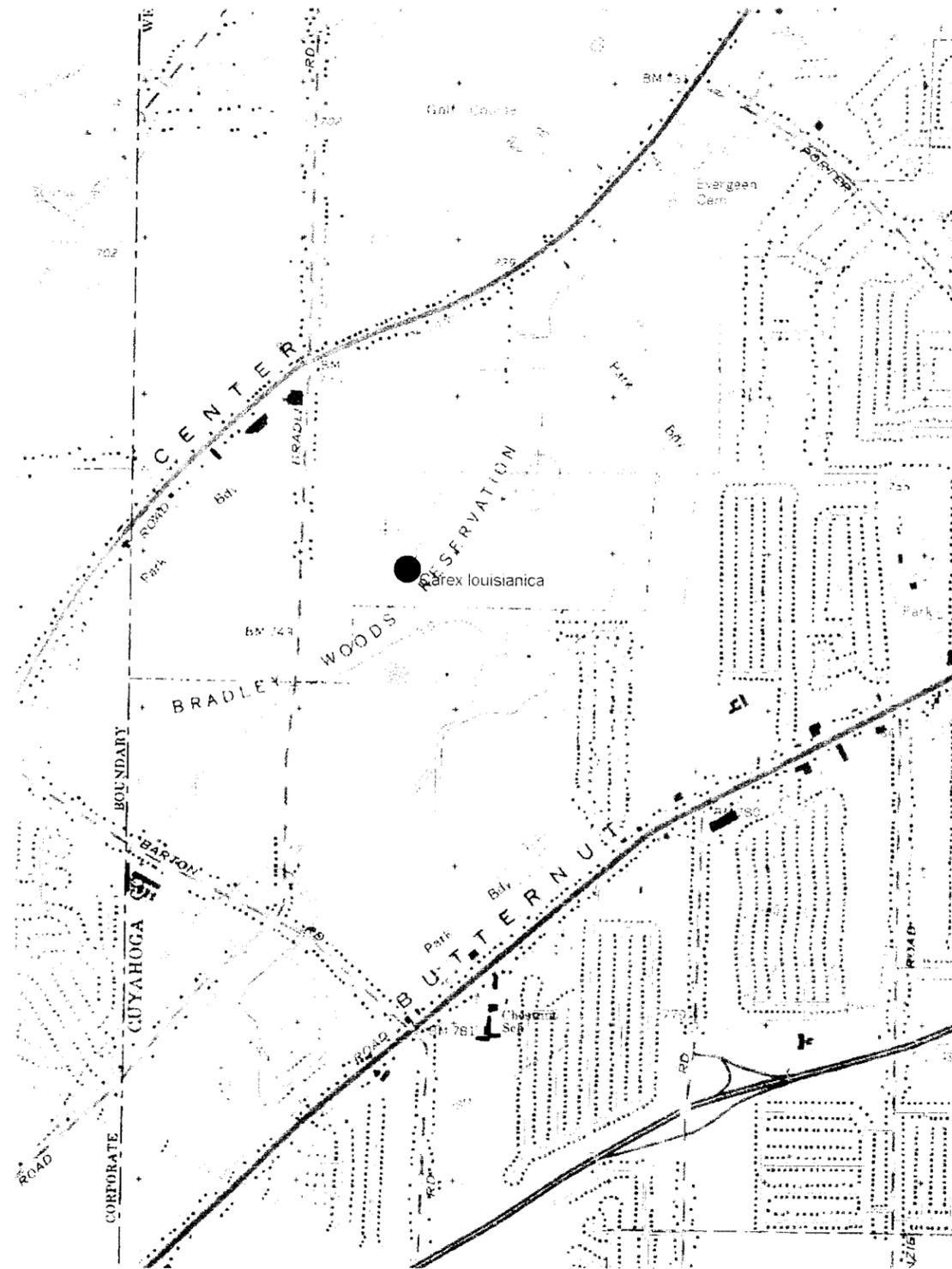


Figure 7.4. Bradley Woods Reservation, Avon Quad.

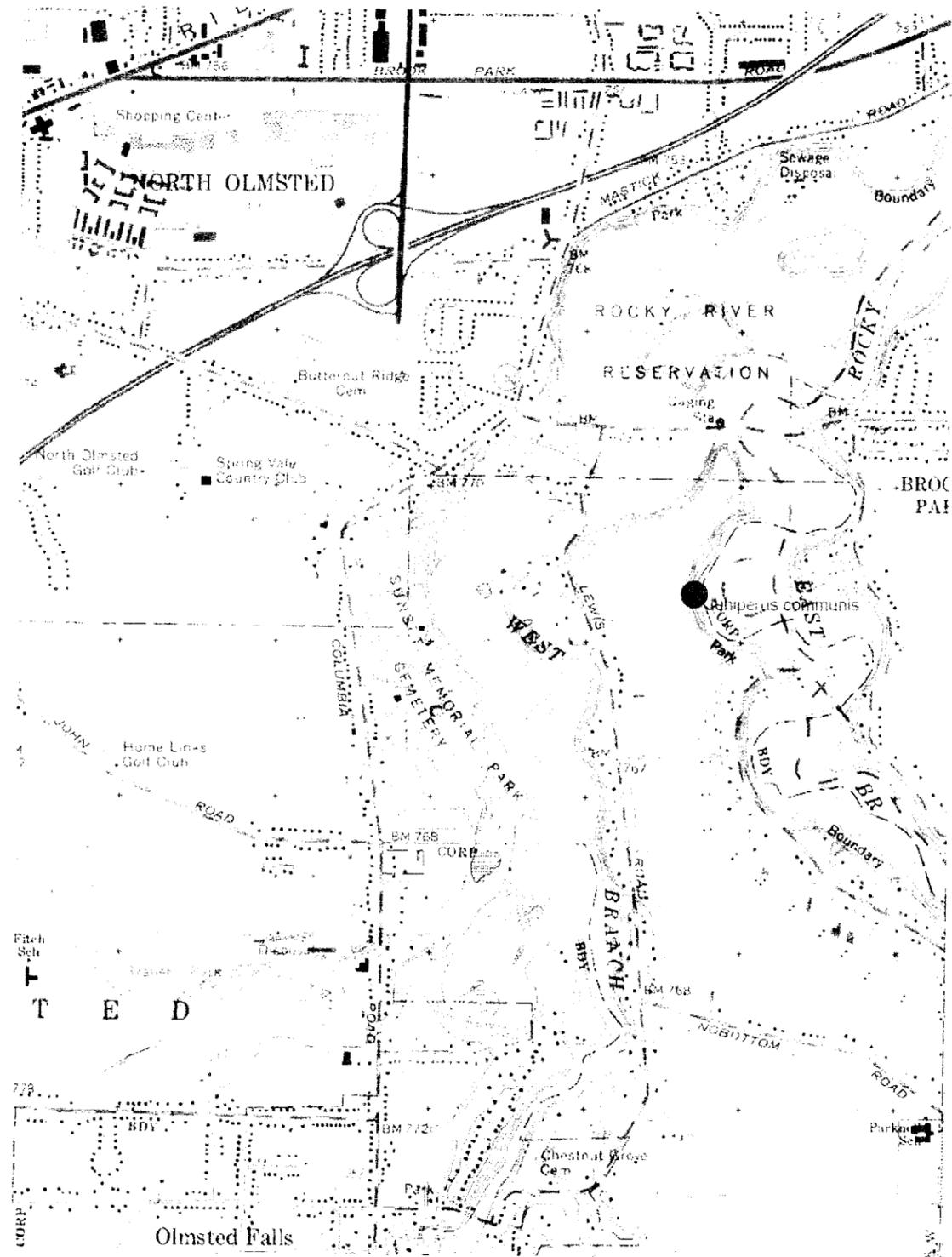


Figure 7.5. Rocky River Reservation, North Olmsted Quad.

VIII. LAKE COUNTY COAST (Figures 8.1-8.5)

The narrow Lake County Lake Plain is under terrific pressure from development as the Cleveland suburbs expand eastward. In presettlement times, the coastline contained beach communities and associated coastal marshes. Ancient sand ridges from an earlier stage of Lake Erie supported sand barrens and oak woodlands. Swamp forests occurred on flat terrain and mixed mesophytic forests were situated in areas with adequate drainage. Today, most of the original plant communities have been altered, although several areas of ecological significance remain. The Arcola Creek Estuary is located in Lake County on the Ashtabula County border, but is discussed in Section IX with western Ashtabula County.

Sand Beaches and Associated Marshes: The Mentor Headlands and Marsh was a spectacular area of marsh and beach communities before settlement. Mentor Marsh itself extends for about four and one half miles from the Grand River to the east and westward to Mentor Harbor (Isard 1966). An extensive beach community occurred in the Mentor Headlands, a narrow area sandwiched between the marsh and Lake Erie. However, this area has been greatly altered by human activities. The once diverse Mentor Marsh, now a State Nature Preserve, has been largely overrun with giant reed grass (*Phragmites australis*) which has significantly reduced the biotic diversity of this once extremely significant marsh. There are currently no known endangered or threatened species in the marsh. Even though the coastline has been changed dramatically from its original condition, there are several areas with sand beaches including two with significant plant communities:

Headlands Dunes State Nature Preserve - Beach-dune community: Headlands Dunes is one of three sites in Ohio with a significant dune-grass association. The natural beach occupies about 16 acres mostly dominated by coastal little bluestem (*Schizachyrium scoparium* var. *littorale*), switch grass (*Panicum virgatum*) and American beach grass (*Ammophila breviligulata*). A small zone of a cottonwood woodland is also present. The site has an excellent diversity of beach plants. A small, wet swale was created in 1989 in an attempt to recreate the type of interdunal wetlands that were formerly present along Ohio's Lake Erie beaches.

Mentor Lagoons Beach - Beach-dune community: The Mentor Lagoons site contains 174 acres of forest, beach and marsh (Van Natta 1990). The beach itself is about one mile long and only about 50-75 feet wide. The beach has one of the most significant dune-grass associations in Ohio, with an impressive population of the threatened American beach grass (*Ammophila breviligulata*).

The beaches and associated small marshes in this area have important populations of threatened and endangered plant species:

Ammophila breviligulata (T): American beach grass, which occurs in Ohio only along the Lake Erie Coast, is an abundant, dominant species at the Headland Dunes State Nature Preserve and the Mentor Lagoons beach. This plant is perhaps the most important species in the dune-grass association in Ohio's beach-dune plant community. The only other site in Ohio where it is still abundant is at Walnut Beach in Ashtabula.

Carex aquatilis (T): A small population of leafy tussock sedge was discovered in 1998 in the wet swale area at the Headlands Dunes State Nature Preserve. A very small population of the species was discovered in 1997 in a small marsh at the Mentor Lagoons. A third population was reported in 1986 in a small estuary marsh on land owned by the Mentor Yacht Club.

Lathyrus japonicus (T): A large population of over 5000 plants of inland beach-pea was reported in 1997 at the Headlands Dunes State Nature Preserve. The species was reported in 1986 on a small beach in the Mentor Yacht Club. This population could not be relocated in 1997. The species is also abundant on the Mentor Lagoons Beach.

Lipocarpa micrantha (T): A small population of dwarf bulrush was located in 1989 in moist soil at the Headlands Dunes State Nature Preserve.

Oenothera oakesiana (E): A small population of Oakes' evening-primrose was discovered in 1997 at the Headlands Dunes State Nature Preserve.

Potentilla paradoxa (T): A very small population of eight plants of bushy cinquefoil was confirmed at the Headlands Dunes State Nature Preserve in 1997.

Schizachyrium scoparium var. *littorale* (T): Coastal little bluestem is one of the co-dominant species along with American beach grass at the Headlands Dunes State Nature Preserve. The species was also reported at the Mentor Yacht Club Beach in 1986 and at the Mentor Lagoons Beach in 1993.

Significant Forested Plant Communities: Two additional forested sites contain high quality plant communities, but no threatened or endangered species.

Red Mill Valley MetroPark - White pine-red maple swamp: Until recently, the White Pine Bog Forest in Geauga County had been prized as the only remaining white pine-red maple forest community in Ohio. However, the Red Mill Valley site was only recently

recognized as the same plant community type. The low-lying areas are fed with springs. Organic detritus forms a thick layer of muck. Much of the herbaceous layer is comprised of skunk-cabbage (*Symplocarpus foetidus*). The dominant trees in the wettest areas are white pine (*Pinus strobus*) and red maple (*Acer rubrum*). Hemlock (*Tsuga canadensis*) is common on the higher ground. This site contains one of the more unique tree associations in Ohio.

Perry Nuclear Woods - Mixed mesophytic forest: This site, which is owned by the Perry Nuclear Power facility, contains approximately 275 acres of contiguous forest. The woods are fairly immature with the largest trees just reaching 60 cm dbh. The most common species are sugar maple (*Acer saccharum*) and red maple (*Acer rubrum*). Beech (*Fagus grandifolia*), black cherry (*Prunus serotina*) and red oak (*Quercus rubra*) are common. The site also contains yellow birch (*Betula alleghaniensis*), cucumber magnolia (*Magnolia acuminata*) and hemlock (*Tsuga canadensis*). This site is significant for its size and as one of the few remaining, large Lake Plain forests.

Additional Isolated Rare Species Populations:

Eleocharis parvula (E): Least spike-rush was discovered in 1993 on the edge of a pond at Veteran's Memorial Park. This population apparently represents the only natural occurrence of the species in Ohio.

Carex lupuliformis (T): False hop sedge was discovered in 1998 in a swamp forest at Erie Shores Metropark. This is a new addition to the modern coastal flora.

Dryopteris celsa (no status): A population of about 70 clumps of log fern was discovered by James Bissell in 1998 in a swamp forest at Erie Shores Metropark. This is a new addition to the flora of Ohio. The species will most likely be listed as endangered after the next meeting of the Ohio Rare Plant Advisory Committee in the year 2000.

Lathyrus japonicus (T): Three plants of inland beach-pea were located on a small beach east of Camp Roosevelt in 1995. A small population was observed in 1997 at the Lakeshore Reservation. The population had recently been much larger, but was damaged by high lake levels in early 1997.

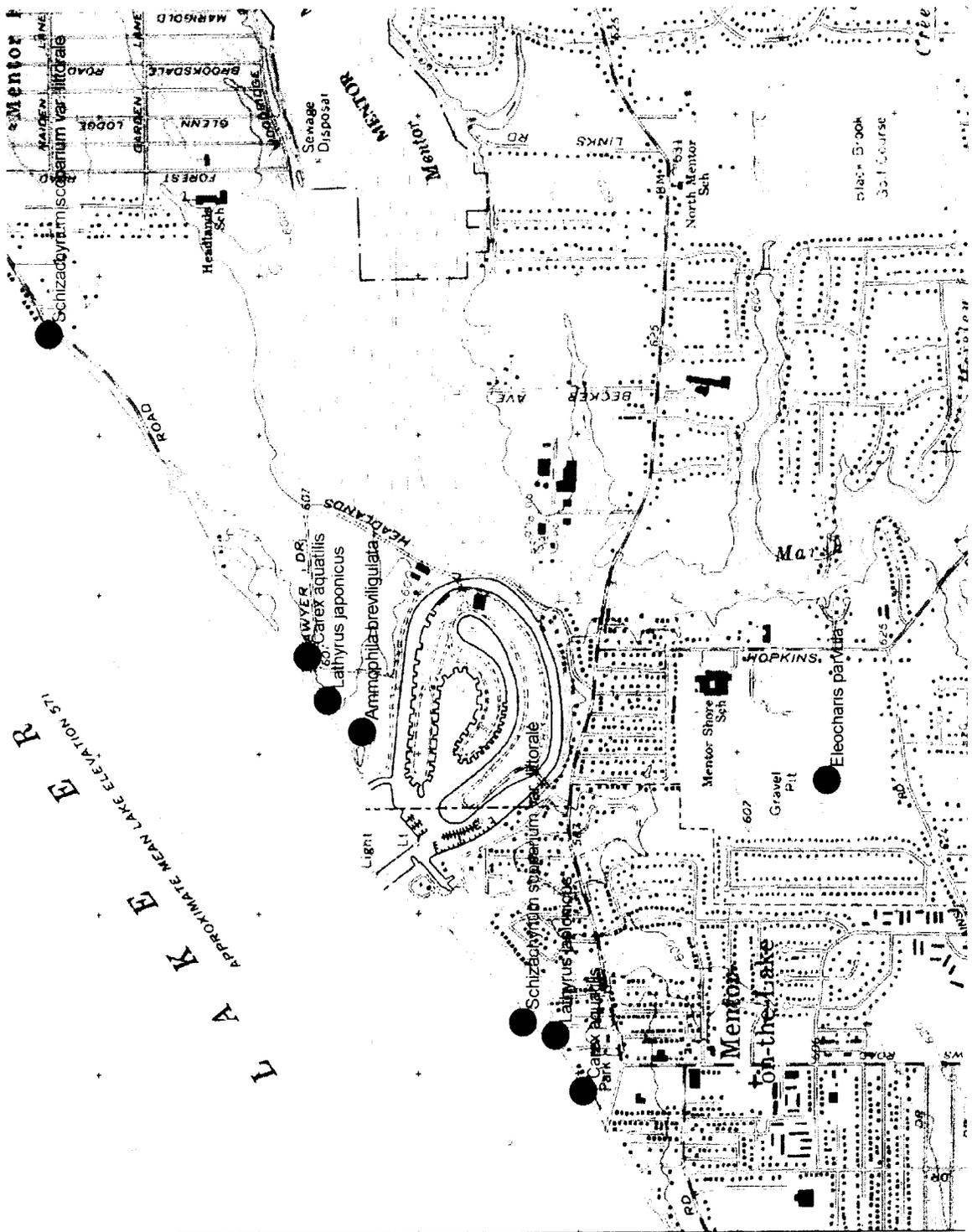


Figure 8.2. Mentor Lagoons and Mentor Yacht Club, Mentor Quad.

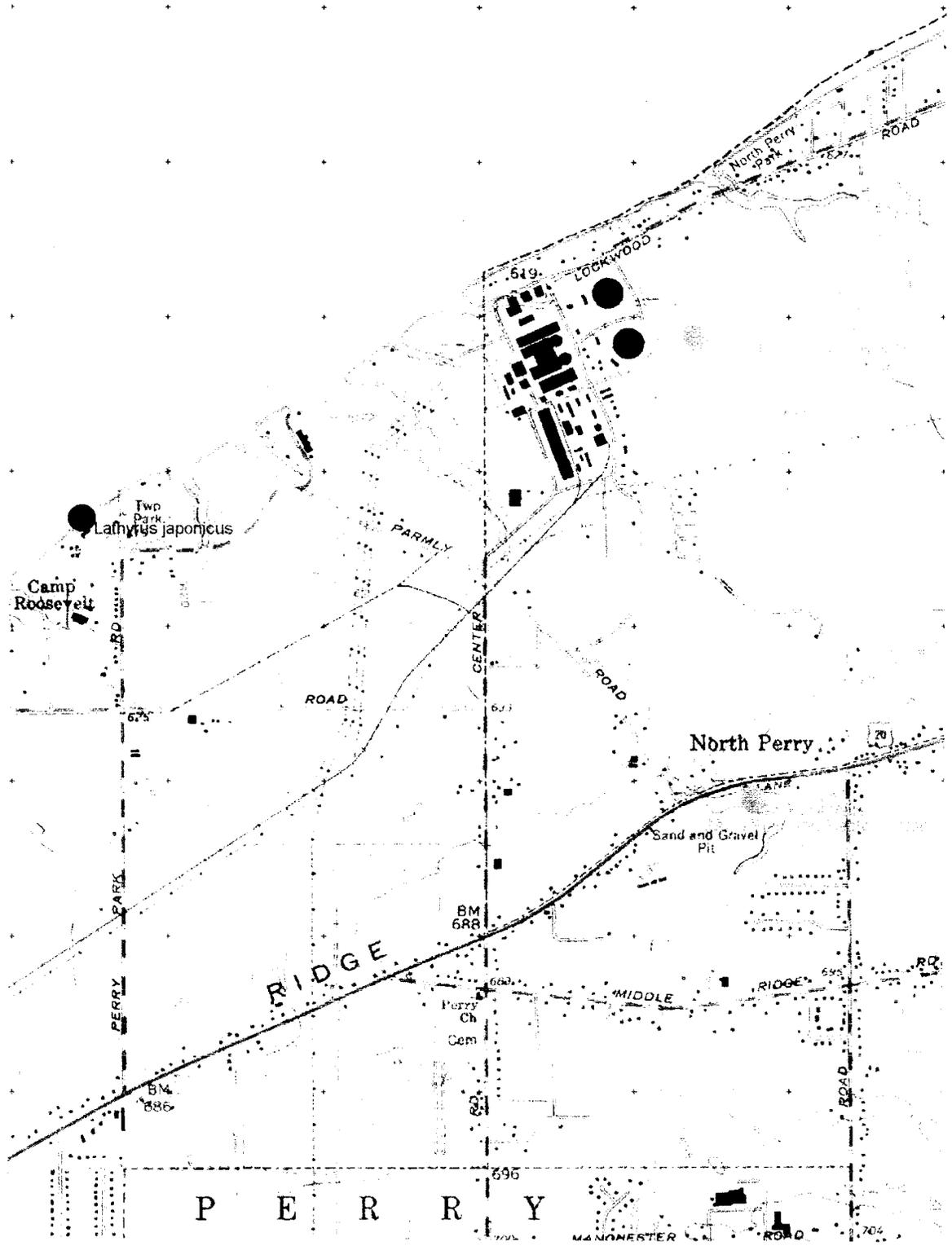


Figure 8.3. Red Mill Valley and Perry Nuclear Plant Woods, Perry Quad.



Figure 8.4. Lakeshore Reservation, Madison Quad.

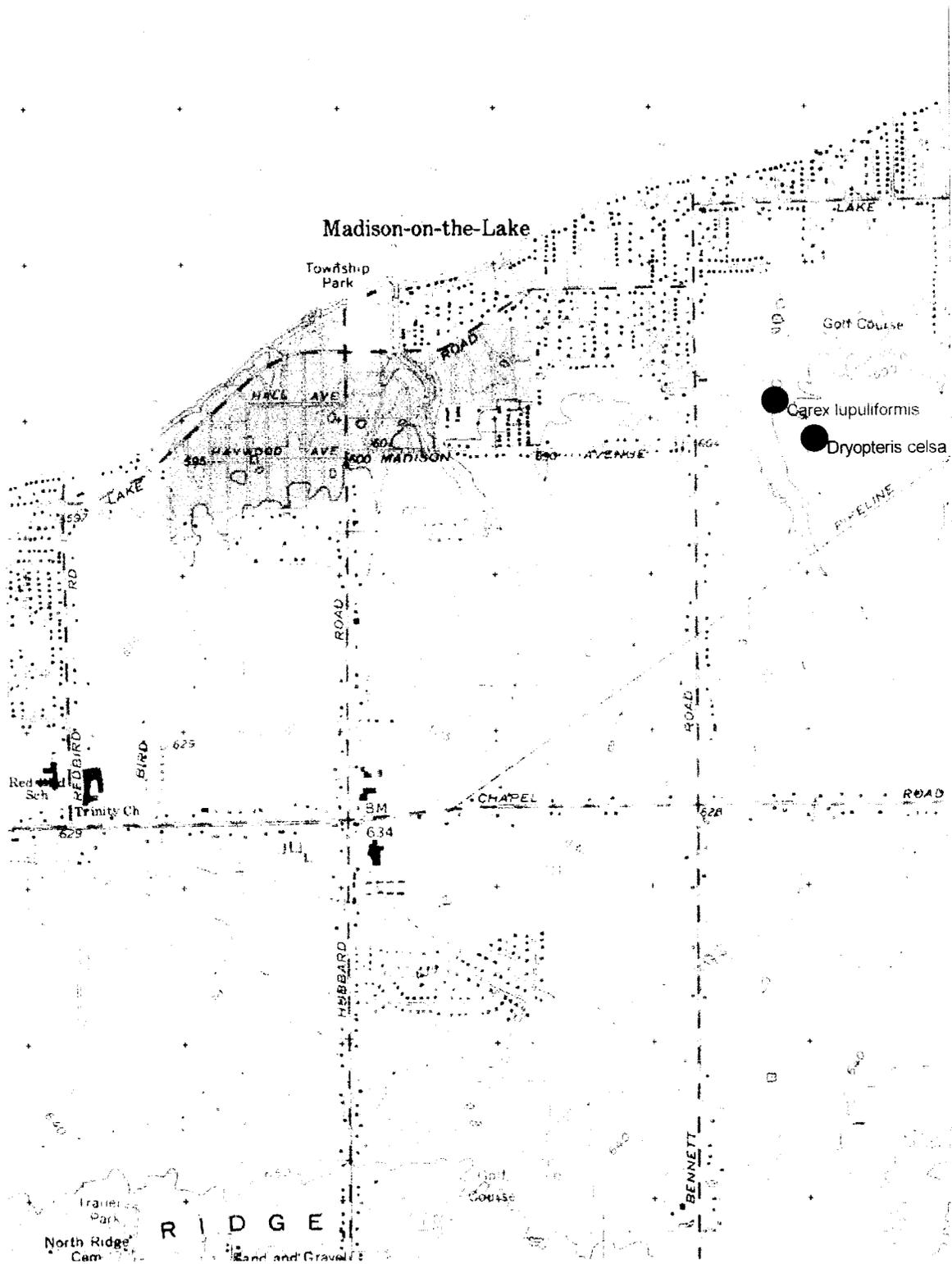


Figure 8.5. Erie Shore Metropark, Madison Quad.

IX. ARCOLA CREEK TO ASHTABULA (Figures 9.1-9.3)

This region extends from Arcola Creek on the Lake-Ashtabula County line to the City of Ashtabula. The most significant features of this section of the coast are the small estuary marshes that are located at the mouths of creeks as well as the beaches. All of the areas of interest are in the vicinity of Geneva-on-the-Lake with the exception of Walnut Beach in Ashtabula. Inland from the coast around Geneva are several large tracts of woods, much of which is swamp forest. Most of these appear to have been logged fairly recently and there are no recorded threatened or endangered plant species. However, this area is only lightly developed and represents some of the largest expanse of forested wetlands along the coast.

The area around Geneva was surveyed in the early 1930's by L. E. Hicks who briefly describes the area and lists the species he collected in his Ph. D. dissertation (Hicks 1933). He found interesting species along sand ridges (old beach ridges), sand beaches and marshes associated with Cowles Creek. Several species he collected are currently considered endangered or threatened and are no longer found in the area. These include:

Arabis drummondii (E): Drummond's rock-cress

Arabis lyrata (T): lyre-leaf rock-cress

Helianthus mollis (T): ashy sunflower

Hypericum gymnanthum (E): least St. John's-wort

Lipocarpa micrantha (T): dwarf bulrush

Sphenopholis obtusata var. *obtusata* (T): prairie wedgegrass

Hicks also collected the endangered two-leaved water-milfoil (*Myriophyllum heterophyllum*) near Geneva-on-the-Lake in 1932, a species which had been previously collected at Cowles Creek in 1886. A more recent botanical survey was conducted by James K. Bissell of the Cleveland Museum of Natural History who prepared a list of plant species and important natural areas in Geneva State Park in 1981 (Bissell 1981).

Estuary Marshes: Small estuary marshes occur at the mouths of Arcola Creek in Lake County, Wheeler Creek, Cowles Creek and a third, unnamed stream within Geneva State Park in Ashtabula County as well as Indian Creek also in Ashtabula County on the east side of Geneva-on-the-Lake. Of these marshes, the best are at Arcola Creek and the unnamed creek. The latter has been affected by the construction of the adjacent marina which has eliminated any buffer the marsh formerly had. Arcola Creek is considered to be a significant plant community:

Arcola Creek Estuary Marsh - Mixed emergent marsh: This marsh is the largest and

most diverse of the estuary marshes along this section of the coast and one of the largest natural marshes along the entire Ohio coast. It consists of both an emergent and an extensive floating-leaved zones.

Several threatened and endangered species are associated with these estuary marshes:

Carex aquatilis (T): Leafy tussock sedge was relocated at Wheeler Creek and Arcola Creek in 1998 where it is very abundant. It was collected in the unnamed Creek at Geneva State Park in 1981, but could not be relocated in 1998.

Callitriche verna (T): Water-starwort was collected in Geneva State Park in the unnamed Creek in 1981, but was not relocated in 1998. This is a diminutive, aquatic species which could easily be overlooked.

Sagittaria rigida (T): Deer's-tongue arrowhead was collected in Cowles Creek in 1981, but was not relocated in 1997. The marsh community of the west bank of the estuary has been severely overgrown with giant reed grass (*Phragmites australis*).

Sand Beaches: Small beaches are associated with several of the estuary marshes, although only Indian Creek's beach is reasonably unaltered by human activity or recent high lake levels. Breakwater Beach at Geneva State Park, which was greatly expanded by the addition of sand, exhibits a narrow strip of native beach vegetation which represents the only significant natural beach vegetation left in Geneva State Park. Most of the natural beach in the area was destroyed by the high water of the 1970's and by development at the park. However, several threatened and endangered species have been reported on these beaches since 1980:

Ammophila breviligulata (T): American beach grass was discovered during this study in 1997 on the beach at the mouth of Indian Creek. Bissell (1981) reports that the species was planted in the 1970's at the Skin's Beach at Geneva State Park, but the species was not relocated in the park in 1997 or 1998. The last vestige of Skin's Beach was destroyed by marina construction since Bissell's report.

Lathyrus japonicus (T): Inland beach-pea was collected at Wheeler Creek Beach in 1988, but was no longer present in 1997, or 1998. The species was also collected in 1991 at Arcola Creek Beach, but was not relocated in 1998. Most of the sand beach has washed away in the high water of 1997-1998. The species was still present at the Indian Creek Beach and at the Breakwater Beach in the Geneva State Park in 1998.

Oenothera oakesiana (E): Oakes' evening-primrose was discovered in 1997 on the small

beach at the mouth of Indian Creek.

Schizachyrium scoparium var. *littorale* (E): Coastal little bluestem, a variety of the more common prairie species, occurs in one small population on the swimming beach (Breakwater Beach) at Geneva State Park where it was confirmed in 1997.

Toxicodendron rydbergii (E): Northern poison-ivy is known from only two sites in Ohio, both in this area. It was reported in 1995 at a Geneva Township Park in Geneva-on-the-Lake and in the same year on the sand beach at the mouth of Arcola Creek.

At Ashtabula, Walnut Beach represents one of the three very high quality Beach-dune communities in the State of Ohio:

Walnut Beach Park - Beach-dune community: Walnut Beach is one of two sites in Ohio with a well-developed dune-grass association. It consists of about 10 acres mostly dominated by American beach grass (*Ammophila breviligulata*), along with switch grass (*Panicum virgatum*) and Canada wild rye (*Elymus canadensis*). Despite the fact that the site is heavily used and has many non-native species, it still has an excellent diversity of beach plants, including two threatened beach species and one threatened marsh species:

Ammophila breviligulata (T): American beach grass is extremely abundant at Walnut Beach. It is the dominant species over much of the natural portions of the beach. It was confirmed to be present in 1997.

Lathyrus japonicus (T): Inland beach-pea was relocated in 1997 on Walnut beach. However, the species was very uncommon.

Sagittaria rigida (T): Deer's-tongue arrowhead was reported in 1991 in the marsh on the east end of Walnut Beach, but the species is no longer present. This marsh has been almost completely overrun with giant reed grass (*Phragmites australis*).

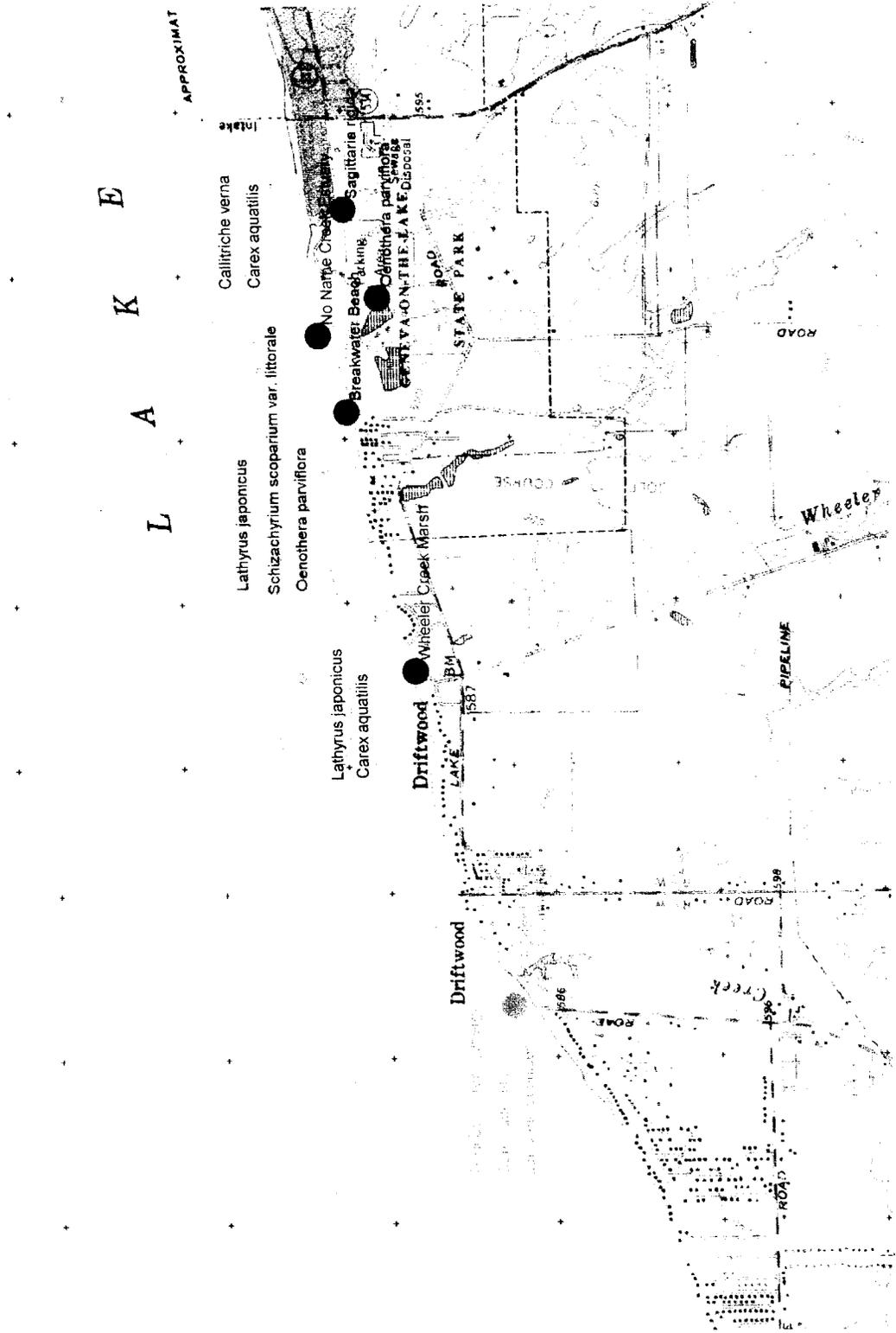


Figure 9.1. Arcola Creek Metropark and Geneva State Park, Madison Quad and Geneva Quad.

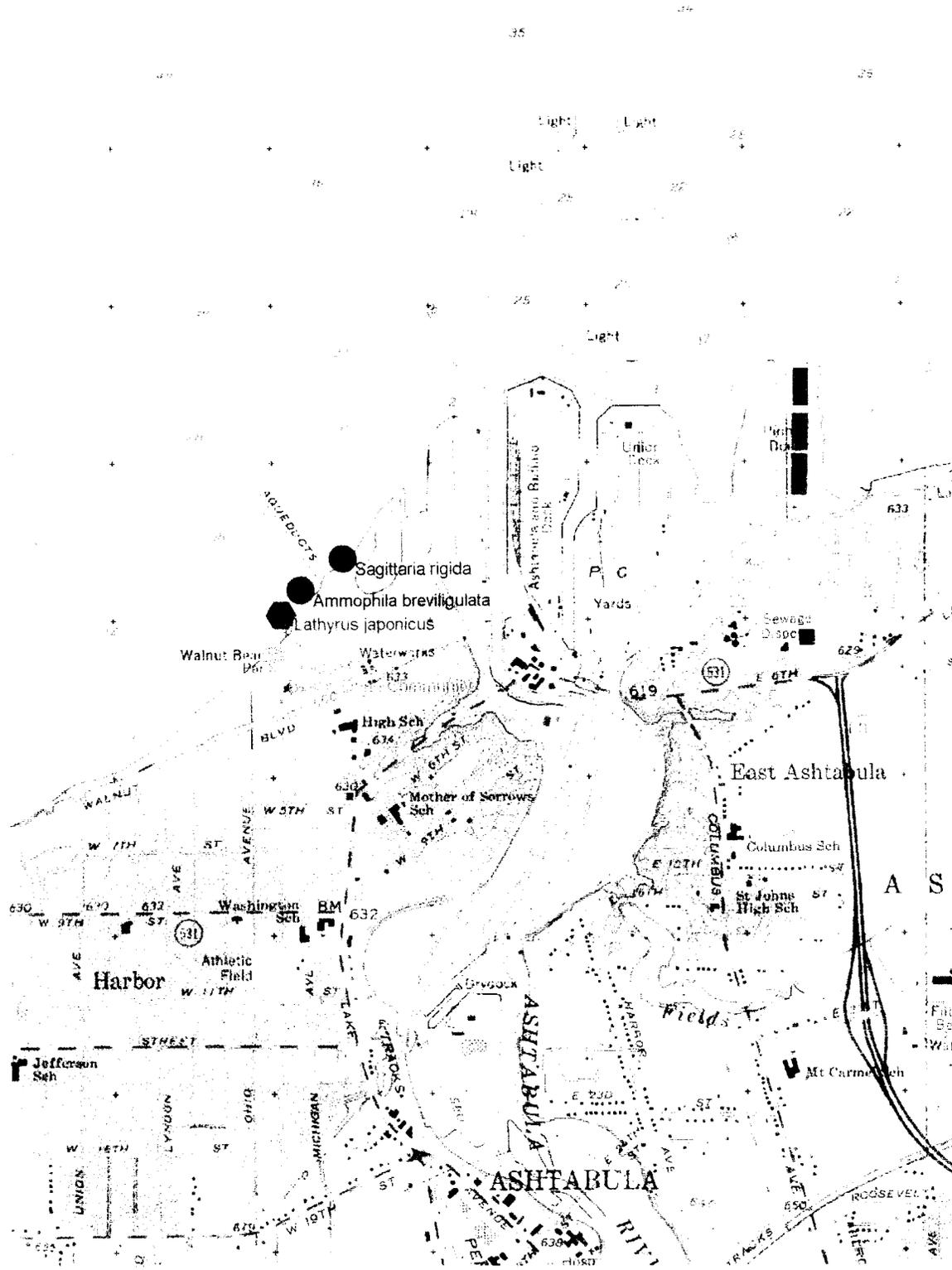


Figure 9.3. Walnut Beach, Ashtabula North Quad.

X. EASTERN ASHTABULA COUNTY (Figures 10.1-10.3)

The section of the coast from North Kingsville to the Pennsylvania line contains some of the least developed areas along Ohio's portion of the Lake Erie coast. This area contains Ohio's only remaining Lake Plain hemlock-hardwood swamps, the only remaining sand barrens community in the coastal region, a sand beach and mesic hardwood forests.

Hemlock-Hardwood Swamps: Hemlock-hardwood swamps only occur in Ashtabula County in northeastern Ohio (Schneider and Cochrane 1997). Some of these communities occur on the Lake Plain where they are associated with seeps along the base of ancient beach ridges. In other parts of Ashtabula County, they occur in association with swamp forest complexes. These communities usually exhibit a hummock and hollow topography with the hemlock (*Tsuga canadensis*) almost exclusively on hummocks. The dominant species in these communities are typically hemlock and red maple (*Acer rubrum*). These sites also support mesic tree species such as beech (*Fagus grandifolia*), black cherry (*Prunus serotina*), tuliptree (*Liriodendron tulipifera*), cucumber magnolia (*Magnolia acuminata*), yellow birch (*Betula alleghaniensis*), red oak (*Quercus rubra*) and sugar maple (*Acer saccharum*). In addition, striped maple (*Acer pensylvanicum*), an endangered species confined to Ashtabula County, is usually present. The hemlock-hardwood swamps that remain are small and usually have been altered from their natural state. They often occur within a larger wet forest complex and the hemlock stands are usually quite small. The beach ridges with which they are usually associated on the Lake Plain have been built upon and quarried away. There continues to be tremendous pressure from development along the entire Lake Plain. Hemlock-hardwood swamps have become much reduced in size and increasingly isolated. There are several sites in this area where significant hemlock-hardwood swamp communities occur:

Armstrong Hemlock Grove - Hemlock-hardwood swamp: Hemlock (*Tsuga canadensis*) is the dominant species in this 5-acre woodlot. Red maple (*Acer rubrum*), yellow birch (*Betula alleghaniensis*) and black cherry (*Prunus serotina*) are common. Most trees are under 50 cm dbh. This site is only moderately significant as a rare community type because of its small size and relative immaturity.

Cathedral Woods - Hemlock-hardwood swamp: The community comprises about 10 acres of a 45-acre woods. Hemlock (*Tsuga canadensis*), red maple (*Acer rubrum*) and tuliptree (*Liriodendron tulipifera*) are the dominant species. Wetter areas are dominated by green ash (*Fraxinus pensylvanica*) and pumpkin ash (*Fraxinus tomentosa*). The trees are mature second growth. Though small, this site is highly significant as a rare example

of intact Lake Plain hemlock-hardwood swamp.

Harmon Road Hemlock Swamp - Hemlock-hardwood swamp: The site contains about 5 acres of hemlock-hardwood swamp within about 90 acres of woods. Hemlock (*Tsuga canadensis*), beech (*Fagus grandifolia*) and tuliptree (*Liriodendron tulipifera*) dominate the 5-acre area. Yellow birch (*Betula alleghaniensis*) and green ash (*Fraxinus pennsylvanica*) are also common. The surrounding forest consists mostly of red maple (*Acer rubrum*). The site is significant for its size, although it is very immature.

North Kingsville Sand Barrens Swamp - Hemlock-hardwood swamp: This site contains about 25 acres of hemlock-hardwood swamp fed by a series of springs from the base of an ancient beach ridge. Hemlock (*Tsuga canadensis*), tuliptree (*Liriodendron tulipifera*) and red maple (*Acer rubrum*) are the dominant species. The trees are mature and the site has excellent diversity. The site is very significant as one of the last remaining hemlock-hardwood swamps associated with these beach ridges. It is also adjacent to an excellent sand barren community.

North Kingsville Swamp - Hemlock-hardwood swamp: This site contains at least 30 acres of hemlock-hardwood swamp within about 160 acres of forested swamp and shrub swamp. The hemlock-hardwood swamp is mostly dominated by hemlock (*Tsuga canadensis*), red maple (*Acer rubrum*), and yellow birch (*Betula alleghaniensis*). American elm (*Ulmus americana*), sour gum (*Nyssa sylvatica*) and silver maple (*Acer saccharinum*) are also common. The surrounding shrub swamp is dominated by buttonbush (*Cephalanthus occidentalis*), winter-berry holly (*Ilex verticillata*) and highbush blueberry (*Vaccinium corymbosum*).

Rzeszutek Woods - Hemlock-hardwood swamp: This community occurs in a seepage area within a 100-acre tract of woods. Hemlock (*Tsuga canadensis*), red maple (*Acer rubrum*) and tuliptree (*Liriodendron tulipifera*) are the dominant species. This site is very close to Cathedral Woods and was undoubtedly part of the same forest, before they were split by a road.

Thompson Road Woods - Hemlock-hardwood swamp: Hemlock (*Tsuga canadensis*) is the dominant species in a 5-acre hemlock-hardwood swamp within a 12-acre forest. The site is second-growth with trees reaching 50 cm dbh. Red maple (*Acer rubrum*), yellow birch (*Betula alleghaniensis*) and beech (*Fagus grandifolia*) are common. This site is only moderately significant as a rare community type because of its small size and relative immaturity.

Four threatened or endangered species occur in these hemlock-hardwood swamps:

Acer pensylvanicum (E): Striped maple is restricted in Ohio to the northeast corner of Ashtabula County. The species is usually associated with hemlock-hardwood forests and hemlock-hardwood swamps. In the Lake Plain swamps, it occurs in the North Kingsville Swamp, at the North Kingsville Sand Barrens Swamp, at Cathedral Woods and Rzeszutek Woods.

Carex albolutescens (T): Several hundred clumps of pale straw sedge were discovered on hummocks in 1993 at the North Kingsville Swamp.

Clintonia borealis (E): Bluebead-lily occurs in only three sites in Ohio and only one in the coastal region. A small population was seen in 1998 in the hemlock-hardwood swamp at the Cleveland Museum of Natural History's North Kingsville Sand Barrens Preserve.

Streptopus roseus (E): Rose twisted-stalk occurs in only three sites in Ohio. A small population was seen in 1997 in the hemlock-hardwood swamp at Cathedral Woods.

Sand Barrens: Sand ridges formed from beach dunes from earlier stages of Lake Erie are very obvious from the state line well into Lake County and westward (Forsyth 1959). These ridges were formerly occupied by sand barrens communities and oak woodlands. There are many old records of unusual plants that are associated with this habitat from locations in Ashtabula, Lake and Cuyahoga counties. However, these ridges have been extensively built upon and quarried away. They were often the first place where roads were built when the area was settled. Today, there is only one significant sand barrens community remaining in the coastal region:

North Kingsville Sand Barrens- Sand Barrens: This 10-acre site occurs on a long and narrow ancient sand ridge within about a mile of Lake Erie. The site supports several small openings within an oak woodland dominated by black oak (*Quercus velutina*) and chestnut oak (*Quercus prinus*). The openings in the woodland contain wild lupine (*Lupinus perennis*) and other dry sand species. Several mesic tree species occur on the north slope of the ridge as it grades into a hemlock-hardwood swamp. The understory is dense and the community may have formerly been maintained in a more open habitat by fire. Part of the site is owned by the Cleveland Museum of Natural History. It represents the only intact sand barrens community in the coastal region and one of the few remaining sites for wild lupine in northeastern Ohio. One threatened plant species occurs at this site:

Polygala polygama (T): Racemed milkwort is widely scattered throughout the sand barrens community, where it was seen in 1998. This species is locally common in the

Oak Openings region, but is very rare in the coastal region.

Sand Beaches: The contiguous Township and Lakeview Parks in the City of Conneaut contain a sand beach. The site was surveyed in 1931 by Hicks (1933). Several species which are now considered rare in Ohio were present at that time on the beach and in adjacent marshes including:

Apocynum sibiricum (E): clasping-leaf dogbane

Artemisia campestris (T): beach wormwood

Callitriche verna (T): water-starwort

Lechea villosa (T): hairy pinweed

Megalodonta beckii (X): water-marigold

Zizania aquatica (T): wild rice

The original marshes were completely destroyed and the natural beach community was severely altered. Only two threatened species have been located since 1980:

Potentilla paradoxa (T): A small population of bushy cinquefoil was reported in 1991 on Conneaut Beach in a wet swale, but the species could not be relocated in 1997.

Lathyrus japonicus (T): A small population of inland beach-pea was reported on Conneaut Beach in 1986, but was no longer present in 1997.

Mesic Hardwood Forests: Two significant upland hardwood forests are located in this region. One is a hemlock-hardwood forest and the other is a mixed mesophytic forest.

Dorman Hemlock Woods - Hemlock-hardwood forest: This forest contains approximately 30 acres of woods with varying densities of hemlock (*Tsuga canadensis*) from upper slopes to stream bottom. Upper slopes have a greater percentage of sugar maple (*Acer saccharum*) and beech (*Fagus grandifolia*) and less hemlock. Hemlock gradually increases to near 100% dominance towards the base of the slopes. The site contains one endangered species:

Acer pensylvanicum (E): A very small population of striped maple was reported at Dorman Hemlock Woods in 1982. However, this site was not revisited in 1997-1998.

Amboy Woods: This site contains about 32 acres of immature mixed mesophytic forest within 108 acres of contiguous forests. The dominant species are red oak (*Quercus rubra*), red maple (*Acer rubrum*) and tuliptree (*Liriodendron tulipifera*). The surrounding

forest was recently cut. The site is only moderately significant because of its small size and lack of maturity. However, this site was not revisited in 1997-1998.

Additional Isolated Rare Species Populations :

Acer pennsylvanica (E): Even though striped maple is endangered in Ohio, it is relatively common in this far northeastern corner of Ashtabula County. Two additional isolated populations are known to occur. One small population was reported in 1987 on steep bluffs overlooking Conneaut Creek near Creek Road Covered Bridge. The second population was found in 1987 in an open woodland adjacent to the bluffs over Lake Erie northeast of Cathedral Woods.

Carex pallescens (T): Two plants of pale sedge were located in 1993 in a open, disturbed area adjacent to a young woodlot just south of the bluffs overlooking Lake Erie.

Sagittaria rigida (T): A small population of deer's-tongue arrowhead was located in 1987 in a small riverine marsh in Conneaut Creek not far from its outlet into Lake Erie.



Figure 10.1. North Kingsville Sand Barrens and North Kingsville Swamp, North Kingsville Quad.

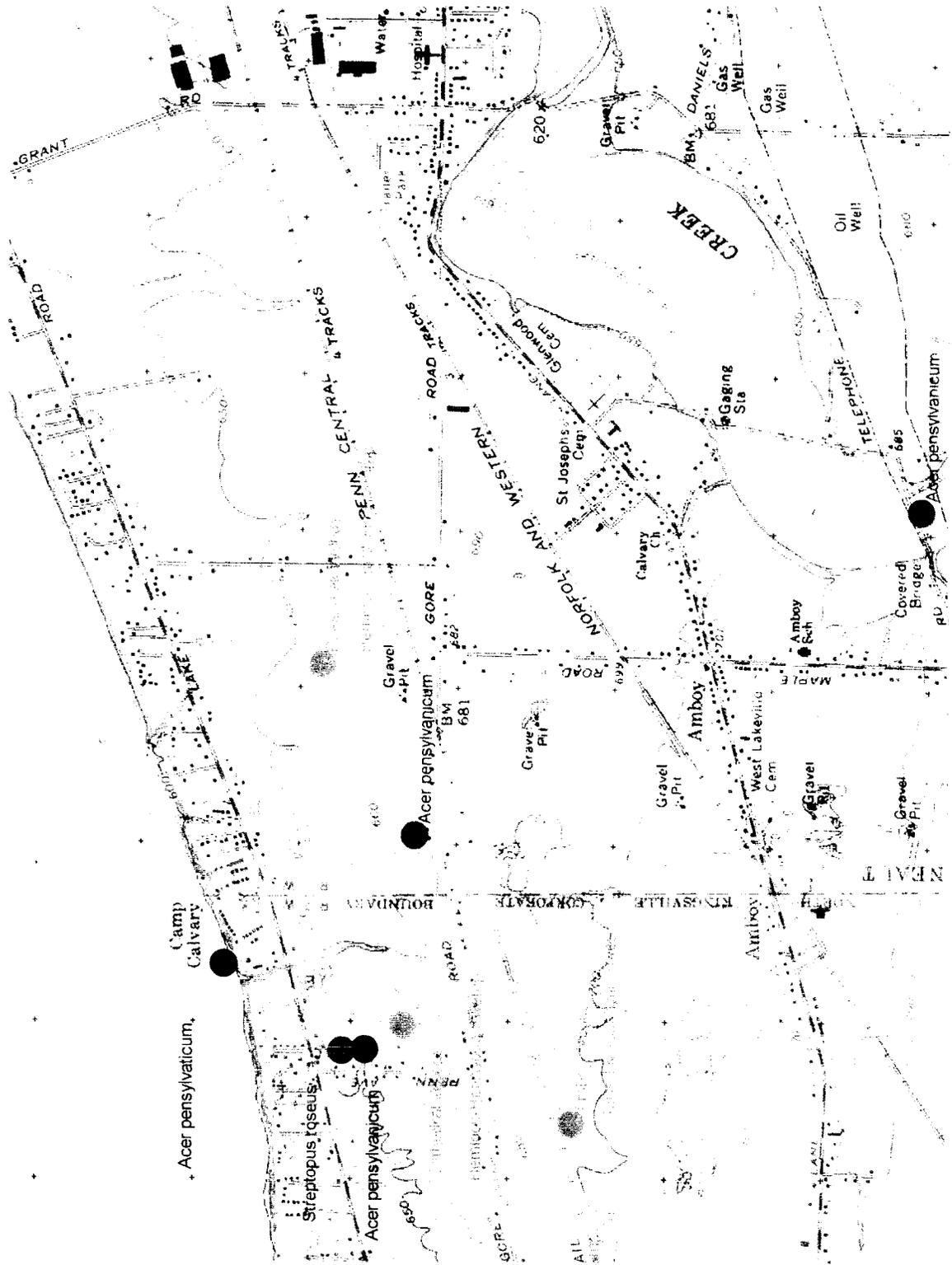


Figure 10.2. Amboy Woods, Cathedral Woods, Rzeszutek Woods, Conneaut Quad, North Kingsville Quad.

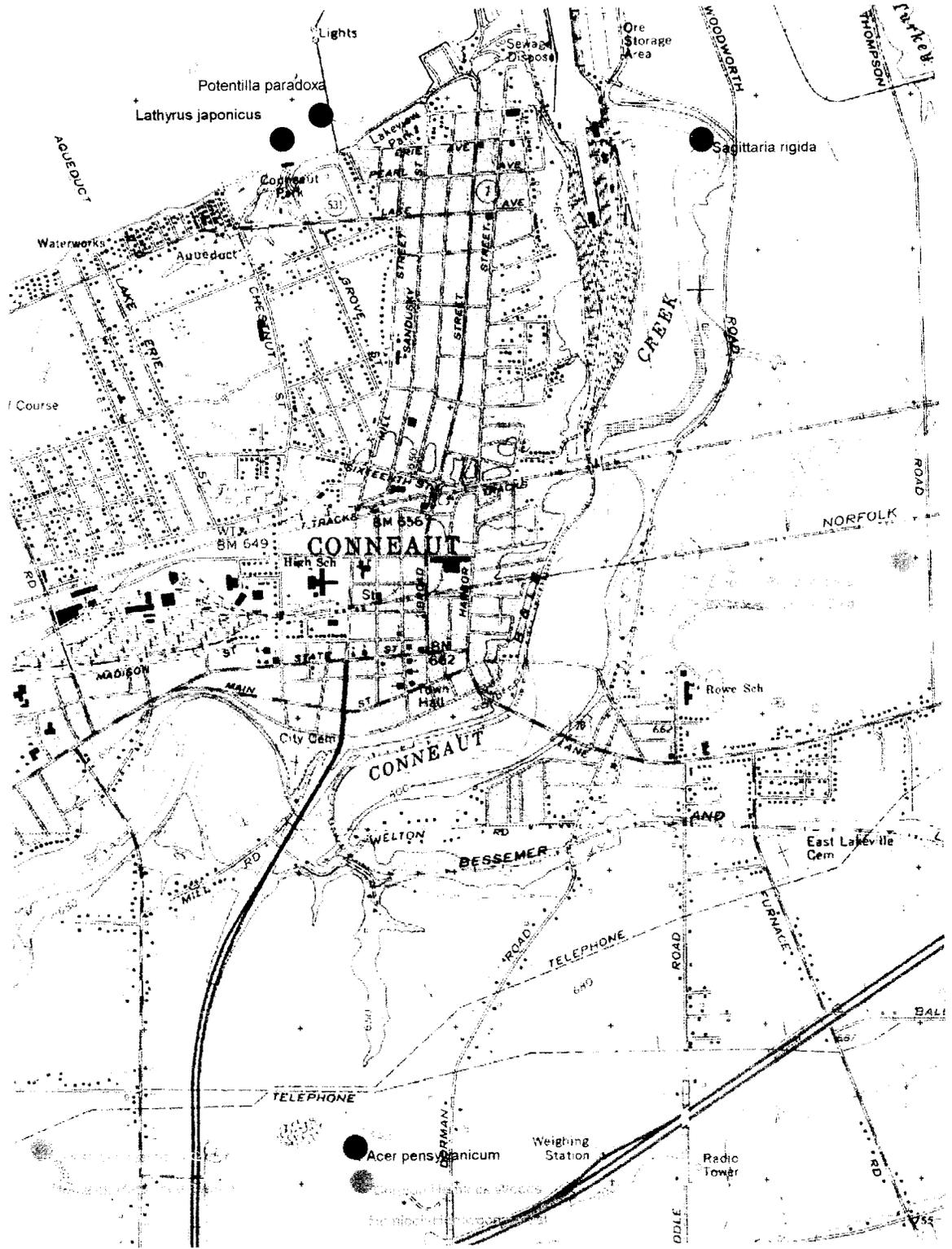


Figure 10.3. Conneaut, Conneaut Quad.

CONCLUSION

During the course of the 1997 and 1998 field seasons, I conducted botanical surveys of the Lake Erie coast 2-3 times per week. During these surveys, 81 new populations of state-listed plant species were located, including 11 endangered, 25 threatened and 45 potentially threatened plant populations. Thirty-seven older records for plant species were updated. Some of the more significant discoveries of new plant species populations include:

- Two new populations of the endangered wapato (*Sagittaria cuneata*) were discovered in the western Lake Erie coastal marshes at the Mallard Club State Wildlife Area and the Ottawa National Wildlife Refuge. These sites now represent by far the two largest known populations of this species in the state. Almost every other population known from 1960-1990 is no longer present.
- A new population of the federally and state threatened Eastern prairie fringed orchid (*Platanthera leucophaea*) was discovered in a sedge meadow near Maumee Bay. This population, though numbering only about 12 plants, occurs in the Mallard Club State Wildlife Area and can most likely be enhanced through management.
- The largest known population of the threatened deer's-tongue arrowhead (*Sagittaria rigida*) was discovered at the Ottawa National Wildlife Refuge. This population along with the Winous Point population, which was reconfirmed in 1996, represent the only two known sites for this species in the western coastal region. A few small populations occur along the eastern coast of Lake Erie.
- The first population of the endangered diffuse rush (*Juncus diffusissimus*) in northern Ohio was located at a newly discovered wetland in Erie County.
- The state's fifth known population of rock elm (*Ulmus thomasi*) was found on a trip to Green Island Wildlife Area. This site is one of the only places where the tree occurs in reasonable numbers in a natural setting.
- Two of Ohio's first three confirmed records for the endangered Oakes' evening-primrose (*Oenothera oakesiana*) were located on Indian Creek Beach in Ashtabula County and Magee Marsh Beach in Lucas County.
- Four new sites for the endangered narrow-leaved blue-eyed grass (*Sisyrinchium mucronatum*) were discovered. Two sites are within the Lafarge Quarry on the Marblehead Peninsula in Ottawa County, one is in an abandoned quarry in Kelleys Island State Park in Erie County and the fourth is at the Resthaven Wildlife Area.

These four new populations represent the second through the fifth known modern records for this species.

- Three new populations of the threatened Southern wapato (*Lophotocarpus calycinus*) were found in the Ottawa National Wildlife Refuge in Ottawa and Lucas counties. One of these, numbering in the thousands, represents the largest known population in the state.
- A new population of the threatened inland beach grass (*Ammophila breviligulata*) was discovered on the beach at the mouth of Indian Creek in Ashtabula County.
- Two new populations of the threatened leafy tussock sedge (*Carex aquatilis*) were discovered. The first was found in the Resthaven Wildlife Area in Erie County and the second at the Headlands Dunes State Nature Preserve in Lake County.
- A new site for the threatened American water-milfoil (*Myriophyllum sibiricum*) was found at the Rhexia Flats wetland in Erie County.
- The third population of the endangered least St. John's-wort (*Hypericum gymnanthum*) was discovered at the Rhexia Flats wetland in Erie County.
- A huge population of the threatened olivaceous spike-rush (*Eleocharis olivacea*) was found at the Rhexia Flats wetland in Erie County. After all the other records of these species in the coastal region proved to be erroneous, this population turns out to be the only known site for the region.
- A huge population of the threatened Great-Lakes goldenrod (*Euthamia remota*) was located at the Rhexia Flats wetland.
- A new record for the endangered coastal little bluestem (*Schizachyrium scoparium* var. *littorale*) was located at Geneva State Park in Ashtabula County.
- The Division of Natural Areas and Preserves has been working with the Lafarge Corporation to identify areas within their 2500-acre quarry on the Marblehead Peninsula that contain rare species. During surveys of the quarry from 1996-1998, additional populations for the endangered Lakeside daisy (*Hymenoxys herbacea*) and Garber's sedge (*Carex garberi*), as well as the threatened balsam squaw-weed (*Senecio pauperculus*), flat-stem spike-rush (*Eleocharis compressa*) and limestone savory (*Calamintha arkansana*) were located. The Division of Natural Areas and Preserves has been working with the Lafarge Corporation to develop a long-term protection plan for the Lakeside daisy (*Hymenoxys herbacea*) on quarry property.

Many plant community surveys in the Lake Erie Coastal Region were conducted in 1995 and 1996 as part of the Lake Erie Drainage plant community survey (Schneider and Cochrane 1997). Five additional high quality plant community sites were inventoried in 1997 and 1998, including:

Arcola Creek Marsh - Mixed emergent marsh
 Chance Creek - Hemlock-hardwood forest
 Edison Woods - Oak-ash-maple swamp
 North Ridgeville Reservation - Oak-ash-maple swamp
 Rzeszutek Woods - Hemlock-hardwood swamp

Botanists have been exploring the Lake Erie coast for at least one hundred years. However, until now no systematic survey of the entire coast had been conducted. Three interesting sites were surveyed that had apparently been previously overlooked by botanists:

- **Mallard Club Wildlife Area:** This site in Lucas County contains one of the few remnants of a coastal sedge meadow along with a large marsh. The sedge meadow contained two potentially threatened sedge species, Sartwell's sedge (*Carex sartwellii*) and wheat sedge (*Carex atherodes*) along with the threatened Eastern prairie fringed orchid (*Platanthera leucophaea*). The sedge meadow grades into the marsh which harbors an impressive population of the endangered wapato (*Sagittaria cuneata*).
- **Rhexia Flats:** This privately owned site in Erie County was first surveyed for rare plant species in 1997 and again in 1998. The site consists of a large artificial pond, created during the construction of the Ohio Turnpike, and a large, open area of wet soil and crushed shale. Despite its artificial nature, this site contains a tremendous number of native wetland and prairie species. A total of eleven state-listed plants were documented including the endangered diffuse rush (*Juncus diffusissimus*) and least St. John's-wort (*Hypericum gymnanthum*), as well as the threatened bushy aster (*Aster dumosus*), American water-milfoil (*Myriophyllum sibiricum*), olivaceous spike-rush (*Eleocharis olivacea*) and Great Lakes goldenrod (*Euthamia remota*). The site received the unofficial name of Rhexia Flats due to the huge number of Virginia meadow-beauty (*Rhexia virginica*) found in the area.
- **Ottawa National Wildlife Refuge:** Even though this area is well known to zoologists, there had been very few records of rare plant species documented from this area. During 1998, substantial populations of the endangered wapato (*Sagittaria cuneata*), as well as the threatened deer's-tongue arrowhead (*Sagittaria*

rigida) and southern wapato (*Lophotocarpus calycinus*) were located.

Rare plant species were also found in at least three areas along the coast that have been often surveyed in the past by botanists:

- Kelleys Island North Quarry: Three populations of rare plants not previously reported from anywhere on Kelleys Island were located. Two records were for potentially threatened plants and one was for the endangered narrow blue-eyed grass (*Sisyrinchium mucronatum*).
- Resthaven Wildlife Area: This area has been surveyed for plants by many researchers for many years. However, three new records for rare species were discovered including the endangered narrow blue-eyed grass (*Sisyrinchium mucronatum*), the threatened leafy tussock sedge (*Carex aquatilis*) and the potentially threatened little yellow sedge (*Carex cryptolepis*).

Unfortunately, at the same time many exciting new discoveries were being made, some populations of rare species and plant communities were confirmed lost:

- A large tract of mixed mesophytic forest in Ashtabula County which had been surveyed in 1981 and mapped as a significant plant community, had later been clear cut.
- The northeastern corner of Ashtabula County (and thereof of Ohio) consists of an area of about 700 uninhabited, forested acres. A small stream named Turkey Creek flows through this forested area. This site had been recommended as a potentially high quality plant community. The site was explored in 1997. Unfortunately it had just been heavily logged the previous winter.
- An unusual palustrine sand plain wetland in North Olmsted, Lorain County, where one of the state's largest populations of the threatened pale straw sedge (*Carex albolutescens*), as well as the potentially threatened lance-leaved violet (*Viola lanceolata*) and large cranberry (*Vaccinium macrocarpon*) were located in 1993, had been completely destroyed by a housing development by 1997.
- During the 1960's and 1970's, at least 10 populations of the endangered wapato (*Sagittaria cuneata*) were known from the western Lake Erie region. Only two of these populations had been reported at any time during the 1980's or 1990's. The only populations now known are the two discovered during this project and a third found in 1995.

The Division's Heritage Database was enhanced as a result of this project by the addition of 81 new records for plant species and 37 updates of older records as well as the five new plant community records. The Division receives numerous requests for data on rare plants and animals, significant plant communities and other natural features from environmental consultants, researchers and government, as well as non-government agencies. The Heritage Database is frequently used by the US Fish and Wildlife Service, the US Forest Service, the US EPA, the US Army Corp of Engineers, the Ohio Department of Transportation, the Ohio EPA, the Ohio Department of Agriculture and other Divisions of the Department of Natural Resources. The addition of new records and updating of old records is a critical part of maintaining the Database and providing accurate information to requesting parties.

Many of the sites inventoried during this project are owned by public and private organizations such as the Cleveland Museum of Natural History, US Fish and Wildlife Service, the ODNR Division of Wildlife and Division of Parks and Recreation, County and City Park Districts, as well as private hunting clubs. This report will be made available to any of these land managing agencies and organizations. It is our hope that this botanical survey of Ohio's Lake Erie coastal region will be useful to a variety of public and private entities to protect the few remaining significant natural areas in this region.

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