

FLORISTIC ANALYSIS AND VASCULAR PLANT SUCCESSION
OF DREDGE MATERIAL IN NAVIGATION POOL 8 ON
THE UPPER MISSISSIPPI RIVER
WITH RESPECT TO AGE AND ELEVATION

A Thesis

Submitted to the Faculty

of

University of Wisconsin - La Crosse
La Crosse, Wisconsin 54601

by

Sarlyn R. Ziegler

In Partial Fulfillment of the
Requirements for the Degree

of

Master of Science in Biology

December 1976

UNIVERSITY OF WISCONSIN - LA CROSSE

La Crosse, Wisconsin 54601

COLLEGE OF ARTS, LETTERS, AND SCIENCES

Candidate: Sarlyn R. Ziegler

We recommend acceptance of this thesis to the College of Arts, Letters, and Sciences in partial fulfillment of this candidate's requirements for the degree Master of Science in Biology. The candidate has completed her oral defense of the thesis.

Seymour H. Schner

Thesis Committee Chairperson

11 January 1977

Date

James H. Warren

Thesis Committee Member

11 January 1977

Date

Thomas C. Mallin

Thesis Committee Member

11 January 1977

Date

C. Hosley, Jr.

Thesis Committee Member

11 Jan 1977

Date

This thesis is approved for the College of Arts, Letters, and Sciences

R. [Signature]

Dean, College of Arts, Letters, and Sciences

1/14/77

Date

ABSTRACT

To maintain the channel depth necessary for the transportation of heavy, high volume commodities by barges and towboats, dredging of the Mississippi River is conducted by the Department of the Army, Corps of Engineers. The material dredged from the channel is placed on islands in the river and along the shoreline resulting in the destruction of most of the vegetation previously growing on the site. With the support of the Waterways Experiment Station at Vicksburg, Mississippi the flora of the dredge material deposition sites in Navigation Pool 8 of the upper Mississippi River was determined. By utilizing the ages of the sites, their elevations above mean sea level, and community associations of the specimens collected, a determination was made of the primary colonizers of the various habitats found on dredge material.

A preliminary survey of the dredge material vegetation was conducted during the summer of 1974 on ten different sites. During the following summer a more extensive study was undertaken of 23 dredge material sites. This included the ten areas previously surveyed. Nearly every site was visited three times during the summer of 1975 in an effort to obtain all the spring-, summer-, and fall-flowering species. Specimens were randomly collected in the different habitats found on these sites. During the two growing seasons nearly 3,000 collections, each consisting of one to five specimens, were obtained. A total of 304 species representing 64 families were found on these dredge material sites. The largest families were the Cyperaceae (5 genera, 29 species), Gramineae (25 genera, 48 species), and Compositae (20 genera, 42 species).

Two grasses, Sporobolus cryptandrus (Torr.) Gray and Triplasis purpurea (Walt.) Chapm., the sedge, Cyperus schweinitzii Torr., and a chenopodiaceous tumbleweed, Cycloloma atriplicifolium (Spreng.) Coult., were the pioneer herbaceous species of the dry, exposed dredge material sites in Navigation Pool 8. The invasion of these elevated sites by woody species does not occur readily, so the pioneers dominate the areas for long periods of time. Eventually, vines and shrubs such as Vitis riparia Michx. (riverbank grape), Toxicodendron rydbergii Greene (poison ivy), and Rubus occidentalis L. (black raspberry) encroach on these exposed areas from the fringes of the surrounding alluvial forests.

ACKNOWLEDGMENTS

I wish to express my gratitude to Dr. S. H. Sohmer for his guidance in bringing this study to completion. I also appreciate the assistance provided by the other members of my thesis committee: Dr. James H. Warner, Dr. Thomas O. Claflin, and Dr. Charles F. Hosler. Support, principally in the form of a University of Wisconsin-La Crosse River Studies Center Fellowship, provided by the Waterways Experiment Station of Vicksburg, Mississippi, enabled me to undertake a thorough survey of the flora of the dredge material sites in Navigation Pool 8. The following individuals are thanked for annotating the vascular plant material of the groups in which they are expert: Dr. G. W. Argus, National Herbarium of Canada, Ottawa, Ontario; Dr. C. J. Burk, Smith College, Northampton, Massachusetts; Dr. P. H. Raven, Missouri Botanical Garden, St. Louis; Dr. R. G. Koch, University of Wisconsin-Superior; Dr. R. W. Freckmann, University of Wisconsin-Stevens Point; Dr. S. W. Ballou, CDM/Limnatics, Milwaukee, Wisconsin; Dr. P. J. Salamun, University of Wisconsin-Milwaukee; Dr. F. W. Gould, Texas A. & M. University, College Station, Texas; Dr. J. H. Zimmerman, 2114 Van Hise Avenue, Madison, Wisconsin. I also wish to thank those individuals involved with the River Studies Center of the University of Wisconsin-La Crosse in providing transportation to the various sites on the river. A special thanks goes to Ms. Mary F. Leykom and Mrs. Donna F. Sefton for their assistance in the field during the summer and autumn of 1975.

TABLE OF CONTENTS

	<u>PAGE</u>
LIST OF TABLES	vi
LIST OF FIGURES	vii
INTRODUCTION	1
LITERATURE REVIEW	7
MISSISSIPPI RIVER HISTORY	11
MATERIALS AND METHODS	15
SPECIES COMPOSITION AT VARIOUS ELEVATION LEVELS OF DREDGE MATERIAL	19
Herbaceous Species of Elevation Level 1	21
Herbaceous Species of Elevation Level 2	22
Herbaceous Species of Elevation Level 3	23
Herbaceous Species of Elevation Levels 1 & 2	24
Herbaceous Species of Elevation Levels 2 & 3	26
Herbaceous Species of Elevation Levels 1, 2, & 3	28
SPECIES COMPOSITION ON VARIOUS AGES OF DREDGE MATERIAL	32
Age Class 1 (1 year old)	34
Age Class 2 (2-3 years old)	35
Age Class 3 (4-6 years old)	37
Age Class 4 (7-10 years old)	41
Age Class 5 (11-13 years old)	43
Age Class 6 (20 years old or older)	46
DISCUSSION	49
SUMMARY AND CONCLUSIONS	52
LITERATURE CITED	53
APPENDIX I	
Introduction to the Vascular Flora	58
Vascular Flora of Dredge Material Sites	
Mississippi River-Navigation Pool 8	59
Equisetophyta	59
Coniferophyta	59
Magnoliophyta	59
Liliatae	59
Magnoliatae	76
Statistical Summary	117
Index to the Families	118

PAGE

APPENDIX II

Introduction to Dredge Material Sites	120
Locations of Dredge Material Sites	121

LIST OF TABLES

TABLEPAGE

1. Summary of herbaceous species found at various elevations of dredge material 29
2. Summary of species occurring on different age classes of dredge material 48

LIST OF FIGURES

<u>FIGURE</u>		<u>PAGE</u>
1.	Aerial photograph showing political boundaries adjacent to Navigation Pool 8, Mississippi River	2
2.	Aerial photograph of Navigation Pool 8, Mississippi River, showing dredge material sites	16
3.	Total number of species present in each of three elevation levels of dredge material in Navigation Pool 8	30
4.	Number of species restricted to elevation levels of dredge material in Navigation Pool 8	31

APPENDIX
FIGURE

5.	Dredge material Islands 1, 2, and 3	127
6.	Dredge material Islands 4 and 5	128
7.	Dredge material Islands 6 and 7	129
8.	Dredge material Island 8	130
9.	Dredge material Island 9	131
10.	Dredge material Island 10	132
11.	Dredge material Island 11	133
12.	Dredge material Islands 12 and 13	134
13.	Dredge material Islands 14, 15, and 16	135
14.	Dredge material Island 17	136
15.	Dredge material Island 18	137
16.	Dredge material Island 19	138
17.	Dredge material Islands 20 and 21	139
18.	Dredge material Island 22	140
19.	Dredge material Island 23	141

INTRODUCTION

The impoundment of the Mississippi River by the system of locks and dams has produced a series of artificial lakes or pools. Navigation Pool 8, stretching 23.3 miles, is the third longest pool of the 13 pools in the St. Paul District. It extends from Lock & Dam No. 7 near Dresbach, Minnesota, 702.5 river miles above the mouth of the Ohio River, to Lock & Dam No. 8, river mile 679.2, at Genoa, Wisconsin (Fig. 1). The southwestern Wisconsin counties of La Crosse and Vernon border the river on the east, while it is bordered by the Minnesota counties of Houston and Winona to the west.

Dredging activities in Navigation Pool 8 of the Mississippi River have resulted in the formation of numerous islands. This study was initiated to determine the flora of these sites. Incorporated with this information are the ages of these deposits and the elevations of the collection sites above mean sea level. By comparing similar environments on dredge material sites of different ages an insight into plant succession in these floodplain communities was gained. Major emphasis was placed on the early stages of plant succession since most sites were covered by recent dredge material. The greatest representation was of the five year age class. Of the 23 sites, only nine were ten years of age or older. The oldest of these sites remained undisturbed by additional

Fig. 1. Aerial photograph showing political boundaries adjacent to Navigation Pool 8, Mississippi River.

mi. 702.5

L & D 7

Winona Co.
Houston Co.

La Crosse Co.
Vernon Co.

MINNESOTA

WISCONSIN

mi. 679.2

L & D 8



deposition for a period of 23 years.

The climax community, the final or stable community in a sere, is influenced by the prevailing regional climate. The climate of this area, designated as humid-continental, is expressed by hot summers and very cold winters (Strahler, 1969). Located in the middle latitudes of the central North American continent, this area is influenced by arctic, subtropical, and continental air masses. Their relative duration and the frequency of their shifts control the weather. Seasonal contrasts are strong. High temperatures prevail in summer when subtropical air masses dominate the area. During the winter much colder weather prevails due to the dominance of the cold, dry, polar air masses. Along the Mississippi River at La Crosse the average July temperature is 22.7°C (72.8°F), while the average temperature for January is -8.8°C (16.1°F) (U. S. Department of Agriculture, 1941). Extreme temperatures of 42.2°C (108°F) in July, 1936 and -41.7°C (-43°F) in January, 1873 have been recorded (Waite, 1974).

The length of the normal growing season in this area of Wisconsin is 164 days (Wang, 1957). The normal growing season is usually defined as the number of days between the last killing frost in spring and the first killing frost in autumn (Finley, 1965). In this case 0°C (32°F) is determined to be the killing frost temperature. This is not necessarily the same as the growing season for cultivated crops or for native plants. A temperature of -2.2°C (28°F) or below

serves as a guideline for killing frost with regard to native plants (Wang, 1957). In this area a growing season of 183 days has been determined for native plants. The growing season for cultivated crops, with a killing frost temperature set at 4.4°C (40°F) or below, is 124 days (Wang, 1957).

Because this region lies in a frontal zone, sufficient precipitation is received throughout the year. Increases are noted during the summer months due to the invading maritime subtropical air masses. About 30 inches of precipitation is received annually and nearly 60 per cent of this is acquired between the warm months of May and September (Finley, 1965). The majority of the rainfall in the northern Midwest results from the contact of subtropical and arctic air masses. When these two air masses meet, the warm, moist subtropical air rises. As this air cools the moisture contained within it is released as rain. The interaction of these two air masses with the dry, continental air determines where rainfall will occur. When continental air masses are strong, drought conditions prevail on the plains and in the upper Mississippi and Ohio River valleys (Borchert, 1950). These westerlies inhibit contact between the arctic and subtropical air masses until they advance further east. During periods when the westerlies are weak or lacking, the arctic and subtropical air masses meet over the plains or the upper Mississippi River valley resulting in rain.

The climatic climax of the southwestern half of Wisconsin, designated by Curtis and McIntosh (1951) as the

prairie-forest province, is likely to be a hardwood forest. Where topography, soil, or water modify the effects of the prevailing regional climate, edaphic climaxes are reached in succession (Odum, 1954). In this region terrestrial areas of abundant moisture, as in river floodplains, may come to be dominated by willow, cottonwood, American elm, or silver maple. Sugar maple and basswood may dominate well-drained mesic sites, while a series of oak species develops on progressively drier sites (Curtis, 1974).

During the course of a revegetation project, conducted by the River Studies Center of the University of Wisconsin-La Crosse, data on various weather parameters and on physical and chemical properties of recently deposited dredge material were collected. The primary purpose of this study was to record the conditions affecting the survival of three grass species and two species of legumes after planting. Provided that the survival and growth of these five species were adequate, the stabilization of the sand from wind and water erosion could be accomplished.

The results of the various soil analyses obtained during the summer of 1974 showed the soil to be porous, subject to large fluctuations in temperature, and very nutrient poor. The one year old dredge material, slightly alkaline in nature with an average pH of 7.6, contained low levels of nitrate-nitrogen, potassium, and phosphorus. Throughout the summer the average levels of these nutrients remained below ten ppm. Moisture retention capacity of this substrate averaged 23.8

per cent. Soil temperature surveys were conducted three times each day during the summer. Surface temperatures during early morning were as low as 10°C (50°F). However, the surface soil temperatures often reached 50°C (122°F) during the afternoon. The results of the Revegetation Project have demonstrated that dredge material provides a very rigorous, unstable environment. The purpose of studying the flora of these sites was to determine the species capable of colonizing this environment. A complete listing of the species that were obtained from dredge material in Navigation Pool 8 can be found in the Appendix.

LITERATURE REVIEW

Several floristic studies have been conducted on dredge material deposits in the past. The earliest study was conducted in the floodplain of the Mississippi River between Minneapolis and St. Paul, Minnesota (George, 1924). In this work, the pioneer stage of plant succession was emphasized. Lakela (1939) undertook a four year study of the pioneers on dredging deposits near Duluth, Minnesota. Three decades later a floristic resurvey of this area was conducted by Bernard and Davidson (1969). Dredge material deposition along the Hudson River in eastern New York provided McVaugh (1947, 1957) with a suitable area for the study of plant succession over two decades. His first published report covered the period 1935 to 1945, while the second report described the vegetational changes occurring between 1945 and 1955.

Other floristic and successional surveys have resulted following construction activities. In two cases research was undertaken on river levees. The earlier one conducted by Turner (1931) involved plant succession in the Illinois River valley. Montz (1972) made a seasonal study of vegetation on levees along the Mississippi River near New Orleans, Louisiana. A revegetation study of an area was begun by Conrad (1913) following the construction of a railroad bed

near Cold Spring Harbor, Long Island. In straightening, widening, and changing the grade of the roadbed, large volumes of coarse sand and fine gravel were cut from the hillside and deposited downhill to produce a wide ledge. In the process large areas were newly exposed.

A number of studies have been accomplished on the floodplain of the Missouri River. They include: Hanson (1918), Johnson (1950), Johnson et al. (1976), Keammerer et al. (1975), Van Bruggen (1961), and Wilson (1970). Floristic studies were also conducted on the Wabash and Tippecanoe Rivers of Indiana by Petty (1958), Van Asdall (1958), and Lindsey et al. (1961). The White River also in Indiana was the subject of an ecological study (Lee, 1945). Brief surveys were made of vegetational changes on islands in the Ohio and Mississippi Rivers by Kennedy and Mohlenbrock (1963) and Shull (1944), respectively. Vegetational changes on a river dune was the subject of a short publication by Gleason (1910a).

The sand dunes of Lake Michigan have been the subject of significant ecological research by Cowles (1899, 1901), in particular, and by Gates (1912). Snow (1913) investigated the vegetational changes of sand dunes along the Delaware coast. A comprehensive study of inland sand deposits was made by Gleason (1910). His thorough survey of the vegetation was conducted on sites found in the northern half of Illinois.

Various manuals and monographs were employed to obtain accurate identifications of the species present on dredge material. Those keys used to the greatest extent were

Gray's Manual of Botany, 8th edition (Fernald, 1970) and The New Britton & Brown Illustrated Flora of the Northeastern United States and Adjacent Canada (Gleason, 1963). The Preliminary Reports on the Flora of Wisconsin were very helpful in the identifications of the members of some families. This series was begun by Norman C. Fassett and his students in 1929. The publication of these keys has continued to the present time. The reports for the following taxa were utilized: Caryophyllaceae (Schlising and Iltis, 1961), Compositae III-the genus Solidago (Salamun, 1963), Cruciferae (Patman and Iltis, 1961), Cyperaceae II-the genus Cyperus (Marcks, 1974), Labiatae (Koeppen, 1957), Polygonaceae (Mahony, 1932), and Salicaceae (Argus, 1964). A recent monograph of the genus Rorippa, a member of the Cruciferae family, was written by Stuckey (1972). The name determined for poison ivy was based on the treatment by Gillis (1971). Shinnars (1941) treatment of the genus Aster was also utilized. A Manual of Aquatic Plants (Fassett, 1972) was beneficial in the identification of the genus Bidens in the Compositae family. Another manual written by Fassett (1951), Grasses of Wisconsin, was utilized in the initial identifications of the Gramineae. Manual of the Grasses of the United States (Hitchcock, 1935) was consulted briefly in making a few determinations. Hartley's (1966) catalogue of the vascular plants of the Driftless Area was utilized to check the identifications of the dredge material flora. When discrepancies in nomenclature arose, Gray's Manual of Botany, 8th

edition (Fernald, 1970) was accepted as the final authority. In addition, as explained below, complicated groups were sent to appropriate experts for identification.

MISSISSIPPI RIVER HISTORY

Messipi was the name given by Claud Allouez, a Jesuit missionary assigned to Wisconsin in the 1660's, to the river now known as the Mississippi (Bunnell, 1897). Although he never saw the river, Indians from that area described it to him. The name was derived from the Algonquian language that was spoken by the Chippewa Indians (Lewis, 1967). "Sepe" or "sipi" in French orthography meant water. It was a common form in the Indian language and was used to express the idea of a river or lake. The prefix "messe" or "missi", denoting great, formed many Indian proper names (Lewis, 1967). Therefore, "Great River" is the literal translation of Mississippi, the river that extends approximately 2,400 miles from northern Minnesota to the Gulf of Mexico. The river and its tributaries extend through 31 states and drain an area of 1,243,700 square miles.

In the vicinity of La Crosse, Wisconsin the bluffs bordering the Mississippi River rise 500 feet above the water's surface. Only a small part of the four to six mile wide valley is occupied by the navigation channel. This gorge existed prior to the Pleistocene ice age, which began one million years ago. For nearly 300 miles from Hastings, Minnesota to Clinton, Iowa the course of the preglacial valley is followed by the Mississippi River (Leverett, 1895). Although the

section of the river involved in this study flows through the Driftless Area, a region not glaciated during the Pleistocene epoch, glaciation indirectly affected the area. This period was marked by numerous glacial advances and retreats and by interglacial periods. The deep preglacial gorges were filled with the large quantities of sand and gravel released by retreating glaciers. The enormous volume of water produced by the melting glaciers transported the debris great distances downstream. During periods of glacial advance, the rivers, carrying reduced stream loads, resumed their cutting action in the alluvial deposits. These cycles of deposition and erosion continued until the end of the Pleistocene, between 5,000 and 9,000 years ago.

The Mississippi River and its tributaries have played an integral part in the development of the region. For the Indians and fur traders it served as a major transportation route. Louis Joliet and Father Jacques Marquette explored the upper Mississippi River in 1673. Early explorers found the upper Mississippi River shallow; a depth of three feet was common during the low water period. Navigation was possible as far north as St. Paul, Minnesota only during high river stages. Early commercial traffic consisted primarily of small packet boats and log rafts moving timber.

Actual settlement of the upper Mississippi River started after the War of 1812. Major Stephen H. Long, a member of the Corps of Engineers, was commissioned by Congress in 1817 to explore the upper Mississippi River valley to the Minnesota

River (U. S. Army Engineer Division, North Central, 1970a).

In his reports from 1817 to 1823 he stated the importance of the rivers for future trade and travel. The invention of the steamboat in the early nineteenth century revolutionized river commerce. Improvement of the river for navigation was undertaken by the United States Congress. In 1824 the Corps of Engineers was authorized to remove snags and wrecks from the river to allow for the movement of commercial vessels (U. S. Army Engineer Division, North Central, 1970b). The first major development of the river was instituted by Congress with the Act of June 18, 1878 (U. S. Army Engineer Division, North Central, 1970b). The Corps of Engineers was directed to develop a channel with a minimum depth of 4.5 feet between St. Paul, Minnesota and the Missouri River. This was accomplished by dredging the river bed, building rock and brush wing dams, and constructing closing dams to reduce the flow of water into sloughs and secondary channels (U. S. Army Engineer Division, North Central, 1970a). With these dams the flow levels were confined to the main river channel and the meandering tendency of the river was reduced. River commerce thrived until the end of the nineteenth century. Due to the lack of channel improvements and the increasing competition of the railroads, the river traffic declined. It was becoming uneconomical to ship freight by river because steamers on the shallow upper Mississippi River had to be small and carry only light loads. In 1907 Congress authorized the development of a six-foot channel depth from St. Louis to

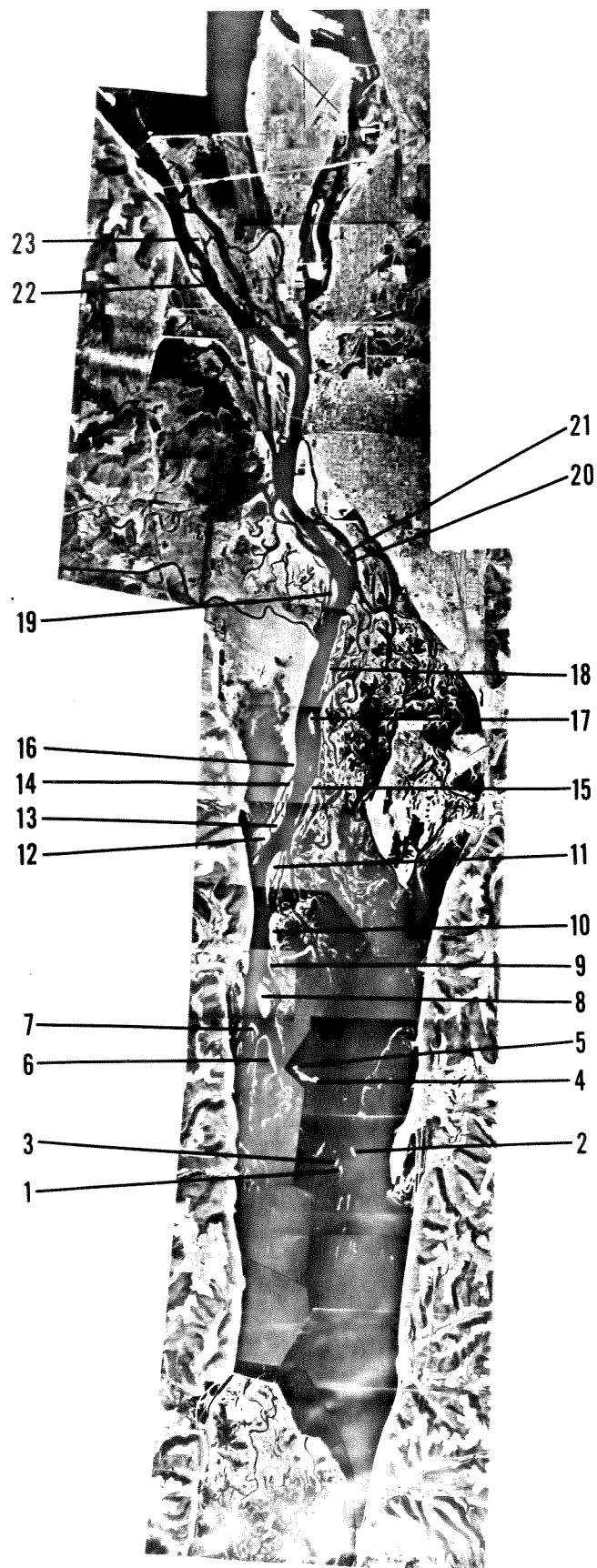
St. Paul (U. S. Army Engineer Division, North Central, 1970a). Further improvements for navigation were authorized by Congress on July 3, 1930. A nine-foot channel depth was instituted by the construction of a series of 28 locks and dams between the mouth of the Missouri and Minneapolis, Minnesota (U. S. Army Engineer Division, North Central, 1970a). By 1940 construction was completed. At that time the newly developed diesel-powered towboats, capable of pushing a dozen or more heavily loaded steel barges, were able to use the upper Mississippi River. To maintain the necessary channel depth for these barges and the earlier commercial craft, dredging of the navigation channel has been conducted through the years.

MATERIALS AND METHODS

The dredge material sites that were studied are designated in the aerial photograph of Navigation Pool 8 (Fig. 2). The locations and ages of the sites were originally determined from Volume 2 of the Final Environmental Impact Statement (U. S. Army Corps of Engineers, St. Paul District, 1974) concerning the Upper Mississippi River nine-foot navigation channel. Exhibit 40, a map of Navigation Pool 8 showing the locations of dredge material emplacement, was based on detailed records from the period 1956 to 1972. In Exhibit 53 of this statement, the location, volume, and frequency of channel dredging in Navigation Pool 8 were summarized for each year from 1934 to 1972. However, the precise locations of dredge material deposition for a specific year were not established by this information. Verification was obtained from dredging maps supplied by the St. Paul District, Corps of Engineers. Deposition sites were outlined on these maps along with other information, including the exact date of the activity. Using this source, dredge material deposition data was also obtained for the years 1973 and 1974.

The collection of specimens occurred during two growing seasons. During the summer of 1974 ten sites were briefly investigated. Nearly 700 specimens were collected. The

Fig. 2. Aerial photograph of Navigation Pool 8,
Mississippi River, showing dredge material sites.



next season 13 additional dredge material sites were covered in the survey. This time a more intensive study was conducted. Most of the 23 sites were visited three times during the summer of 1975 to obtain all spring-, summer-, and fall-flowering species. During this period approximately 2,300 collections were gathered. A collection consisted of one to five specimens from an individual or clonal population. With the aid of an assistant this intensive survey was accomplished. A random method of collection was carried out in the different habitats present on these sites. After a morning of field work, the plants were brought into the laboratory at the University of Wisconsin-La Crosse to be pressed. After drying was completed, the pressed specimens were stored in the herbarium of the University for later identification.

When the collection of specimens was completed in early autumn of 1975, a survey of elevations in various habitats was conducted. With the aid of an abney level and tape measure, the height of these areas above the pool's surface was determined. During this survey notes were made concerning the vegetation present. The St. Paul District, Corps of Engineers was able to supply the pool's elevation above mean sea level at several locations for those days the survey was conducted. This information was combined with that obtained from the field work to produce the elevations above sea level that were useful in the analysis of these dredge material sites.

The identifications, based on the nomenclature of Gray's Manual of Botany, 8th edition (Fernald, 1970), were carried out during the following months and completed by June, 1976. Difficult genera were sent to appropriate experts for annotation. Those genera sent out included: Salix (willow) to Dr. George W. Argus, Quercus (oak) to Dr. C. John Burk, Oenothera (evening primrose) to Dr. Peter H. Raven, Aster to Dr. Robert W. Freckmann, Bidens (stick-tight) to Dr. R. G. Koch, Erigeron (daisy fleabane) to Dr. Stephen W. Ballou, Solidago (goldenrod) to Dr. Peter J. Salamun, Echinochloa (barnyard grass) to Dr. F. W. Gould, Panicum (panic grass) to Dr. Robert W. Freckmann, and Carex (sedge) to Dr. James H. Zimmerman.

All specimens are accompanied by three labels. In addition to the descriptive label, an aerial photograph of Navigation Pool 8 is attached. On this label the location of the appropriate dredge material site is designated. Also included with each specimen is an enlarged outline of the dredge material site designating the location where the specimen was collected. After proper processing one set of specimens will be permanently preserved in the herbarium of the University of Wisconsin-La Crosse. The remaining sets will be distributed to other herbaria.

SPECIES COMPOSITION AT VARIOUS ELEVATION LEVELS OF DREDGE MATERIAL

An analysis was conducted of the relationship between herbaceous species and the elevation of the dredge material from which these species were obtained. Woody species were excluded from this analysis since the deposited dredge material covers a portion of their trunks giving a false impression of the elevation at which they grow. Additional dredge material usually does not destroy them once they have become well established. The analysis was also limited to those species for which a minimum of five collections from different sites were obtained. In this way the reporting of more precise results is achieved.

Three dredge material elevation categories were recognized. The elevation of Navigation Pool 8 is 631 feet above mean sea level. This is the elevation of the water's surface and is the level maintained for commercial navigation by Lock & Dam No. 8 at Genoa, Wisconsin. Elevation Level 1 was determined to be between 631 feet and 634 feet. These dredge material areas usually consist of moist sand and are found along slough and main channel shorelines. The second elevation category ranges from 634 feet to 637 feet or about three to six feet above the pool's surface. This and Elevation Level 3, from 637 feet to 650 feet, are much drier.

The following lists were prepared from the results of the floristic study. Under each category are recorded the species, including their family designation, generally found in those elevation ranges. A numerical summary of this information is presented in Table 1 for each level. Totals of 71, 103, and 45 species occupy Elevation Levels 1, 2, and 3, respectively. These totals include the species that were found in two or all three groups. This information is presented graphically in Fig. 3. In producing Fig. 4, those species that grow at more than one elevation level were eliminated. Therefore, Fig. 4 represents only those species restricted to one of the three levels. Nineteen species were found in Elevation Level 1, while 25 species and 4 species were present in Elevation Levels 2 and 3, respectively. As seen in Table 1, a considerable number of herbaceous species could not readily be placed in any single category. Thirty-seven species were commonly found in both Elevation Levels 1 and 2, while another 26 species inhabited both Elevation Levels 2 and 3. An additional 15 species were found in all three levels.

Herbaceous Species of Elevation Level 1
(631 to 634 feet)

Cyperaceae

Carex cristatella Britt.

Carex stipata Muhl.

Cyperus odoratus L.

Cyperus strigosus L.

Eleocharis calva Torr.

Scirpus validus Vahl

Gramineae

Leersia oryzoides (L.) Sw.

Asclepiadaceae

Asclepias incarnata L.

Balsaminaceae

Impatiens biflora Walt.

Compositae

Bidens connata Muhl. var. petiolata (Nutt.) Farw.

Cruciferae

Cardamine pensylvanica Muhl.

Labiatae

Physostegia formosior Lunell

Scutellaria lateriflora L.

Ranunculaceae

Ranunculus pensylvanicus L. f.

Rosaceae

Potentilla norvegica L.

Scrophulariaceae

Gerardia tenuifolia Vahl

Lindernia dubia (L.) Pennell

Mimulus ringens L.

Urticaceae

Boehmeria cylindrica (L.) Sw.

Herbaceous Species of Elevation Level 2

(634 to 637 feet)

Equisetaceae

Equisetum arvense L.

Gramineae

Agropyron repens (L.) Beauv.

Agrostis scabra Willd.

Cenchrus longispinus (Hack.) Fern.

Elymus virginicus L.

Muhlenbergia frondosa (Poir.) Fern.

Poa pratensis L.

Caryophyllaceae

Lychnis alba Mill.

Myosoton aquaticum (L.) Moench

Saponaria officinalis L.

Compositae

Achillea millefolium L.

Aster simplex Willd.

Cirsium arvense (L.) Scop.

Cirsium vulgare (Savi) Tenore

Erechtites hieracifolia (L.) Raf.

Solidago altissima L.

Convolvulaceae

Convolvulus sepium L.

Cucurbitaceae

Echinocystis lobata (Michx.) T. & G.

Sicyos angulatus L.

Euphorbiaceae

Euphorbia maculata L.

Leguminosae

Strophostyles helvola (L.) Ell.

Trifolium repens L.

Oxalidaceae

Oxalis stricta L.

Polygonaceae

Rumex acetosella L.

Ranunculaceae

Ranunculus abortivus L.

Herbaceous Species of Elevation Level 3

(637 to 650 feet)

Cyperaceae

Cyperus lupulinus (Spreng.) Marcks ssp. lupulinus X

Cyperus schweinitzii Torr.

Compositae

Tragopogon dubius Scop.

Labiatae

Monarda punctata L.

Scrophulariaceae

Verbascum thapsus L.

Herbaceous Species of Elevation Levels 1 & 2

Cyperaceae

Carex tribuloides Wahlenb.

Cyperus erythrorhizos Muhl.

Cyperus esculentus L.

Gramineae

Agrostis perennans var. aestivalis Vasey

Echinochloa muricata (Beauv.) Fern. var. microstachya

Wiegand

Echinochloa muricata (Beauv.) Fern. var. muricata

Echinochloa walteri (Pursh) Heller

Eragrostis hypnoides (Lam.) BSP.

Eragrostis pectinacea (Michx.) Nees.

Leersia virginica Willd.

Phalaris arundinacea L.

Amaranthaceae

Amaranthus tamariscinus Nutt.

Amaranthus tuberculatus (Moq.) Sauer

Compositae

Aster ontarionis Wieg.

Bidens cernua L.

Bidens frondosa L.

Erigeron annuus (L.) Pers.

Eupatorium maculatum L.

Eupatorium perfoliatum L.

Cruciferae

Barbarea vulgaris R. Br.

Brassica nigra (L.) Koch

Rorippa palustris (L.) Bess. subsp. glabra (O. E. Schulz)

Stuckey var. fernaldiana (Butt. & Abbe) Stuckey

Labiatae

Lycopus americanus Muhl.

Mentha arvensis L.

Stachys hispida Pursh

Polygonaceae

Polygonum lapathifolium L.

Polygonum pensylvanicum L.

Rumex crispus L.

Rosaceae

Geum laciniatum Murr.

Rubiaceae

Galium obtusum Bigel.

Scrophulariaceae

Veronica peregrina L. var. peregrina

Veronica peregrina L. var. xalapensis (HBK) Pennell

Solanaceae

Solanum nigrum L.

Urticaceae

Laportea canadensis (L.) Wedd.

Pilea pumila (L.) Gray

Urtica dioica L.

Verbenaceae

Verbena hastata L.

Herbaceous Species of Elevation Levels 2 & 3

Cyperaceae

Cyperus schweinitzii Torr.

Gramineae

Bromus tectorum L.

Panicum virgatum L.

Setaria glauca (L.) Beauv.

Sporobolus cryptandrus (Torr.) Gray

Triplasis purpurea (Walt.) Chapm.

Smilacaceae

Smilax hispida Muhl.

Asclepiadaceae

Asclepias syriaca L.

Capparidaceae

Polanisia graveolens Raf.

Chenopodiaceae

Cycloloma atriplicifolium (Spreng.) Coult.

Salsola kali L. var. tenuifolia G. F. W. Meyer

Compositae

Ambrosia artemisiifolia L.

Eupatorium rugosum Houtt.

Lactuca canadensis L.

Lactuca scariola L.

Solidago gigantea Ait. var. gigantea

Solidago gigantea Ait. appr. var. gigantea

Solidago gigantea Ait. var. serotina (Kuntze) Cron.

Cruciferae

Lepidium densiflorum Schrad.

Lepidium virginicum L.

Erysimum cheiranthoides L.

Labiatae

Teucrium canadense L. var. virginicum (L.) Eat.

Leguminosae

Melilotus alba Desr.

Melilotus officinalis (L.) Lam.

Nyctaginaceae

Mirabilis nyctaginea (Michx.) MacM.

Oxalidaceae

Oxalis europaea Jord.

Polygonaceae

Polygonum scandens L.

Herbaceous Species of Elevation Levels 1, 2, & 3

Cyperaceae

Carex laeviconica Dew.

Gramineae

Panicum capillare L.

Setaria viridis (L.) Beauv.

Sphenopholis intermedia Rydb.

Aizoaceae

Mollugo verticillata L.

Chenopodiaceae

Chenopodium album L.

Compositae

Erigeron canadensis L.

Erigeron strigosus Muhl.

Helenium autumnale L.

Taraxacum officinale Weber

Xanthium strumarium L.

Euphorbiaceae

Euphorbia supina Raf.

Onagraceae

Oenothera biennis L. subsp. caeciarum Munz.

Scrophulariaceae

Linaria vulgaris Hill

Solanaceae

Solanum dulcamara L.

Table 1. Summary of herbaceous species
found at various elevations of dredge material.

Elevation Level*	Total # Species	Total # Monocots	Total # Dicots
1 (only)	19	7	12
2 (only)	25	6	18
3 (only)	4	1	3
1 & 2	37	11	26
2 & 3	26	7	19
1, 2, & 3	15	4	11

* Dredge material from 631 to 634 feet, 634 to 637 feet, and 637 to 650 feet above mean sea level comprise Elevation Levels 1, 2, and 3, respectively.

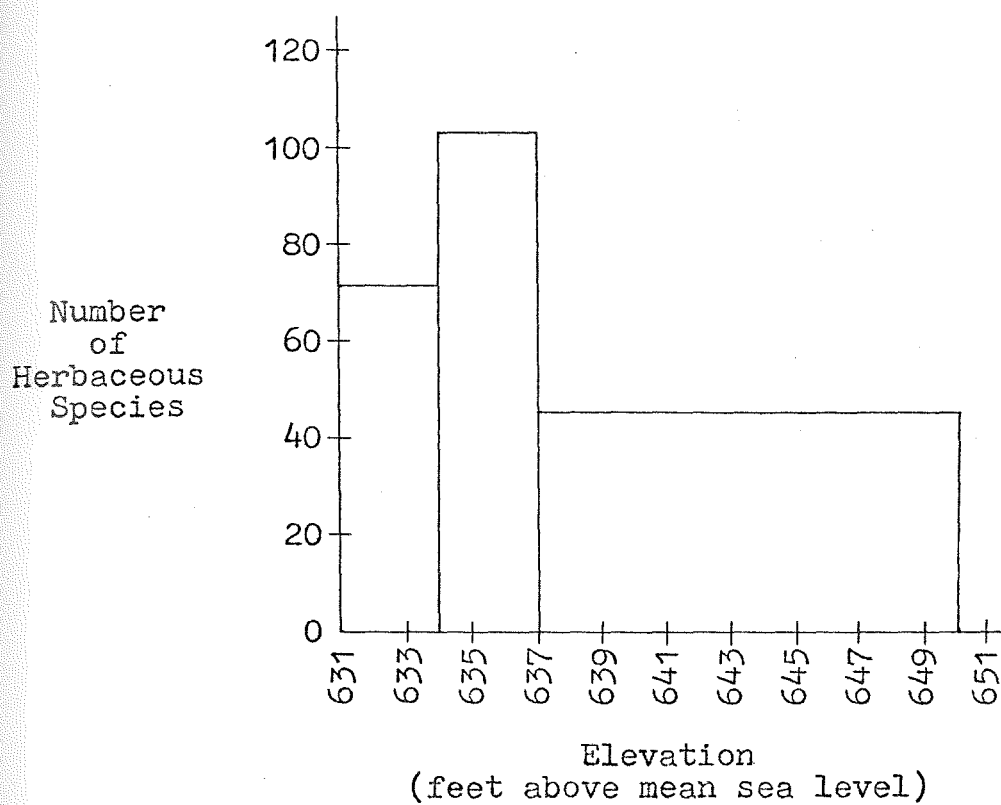


Fig. 3. Total number of species present in each of three elevation levels of dredge material in Navigation Pool 8.

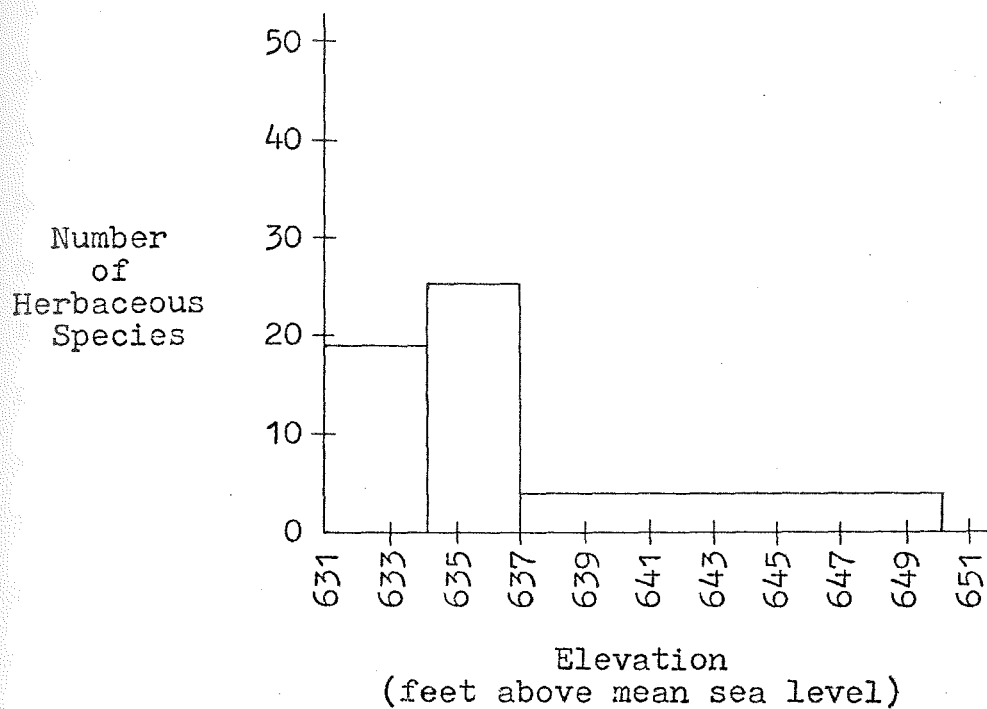


Fig. 4. Number of species restricted to elevation levels of dredge material in Navigation Pool 8.

SPECIES COMPOSITION ON VARIOUS AGES
OF DREDGE MATERIAL

In addition to the summary that was prepared concerning the herbaceous species found at various elevations, the following summary was prepared for those species present on different ages of dredge material. The dry, exposed dredge material sites that were included in this summary had minimum elevations of 636 feet above mean sea level. They ranged in age from one year to slightly over 20 years. Six different age categories of dry, exposed dredge material were delineated. The following periods of time represent the six age classes: 1 year, 2-3 years, 4-6 years, 7-10 years, 11-13 years, and over 20 years. The 4-6 year age class is represented by the greatest number of sites. Ten islands contained dredge material of this age. Dredge material of the 11-13 year and 2-3 year age classes was only present on three islands and two islands, respectively. The remaining three time periods, 1 year, 7-10 years, and over 20 years, were represented by one site each. There were no usable sites with dredge material of 14-19 years of age.

In the following discussions, the vascular plant species that were collected from those dry, exposed sites are listed for each of the six periods. The species are listed alphabetically within their appropriate families and are

vouched for by specimens possessing those particular collection numbers. Certain species are acknowledged separately in the discussions. These are the species which were most abundant on those sites since they were readily observed over the majority of the area. The islands where the collections were obtained are also specifically identified. A numerical summary of this information is presented in Table 2.

Age Class 1
(1 year old)

The colonizers of dry, exposed dredge material are Cyperus schweinitzii Torr., Sporobolus cryptandrus (Torr.) Gray, Triplasis purpurea (Walt.) Chapm., and Cycloloma atriplicifolium (Spreng.) Coult. These species, listed below, are vouched for by their respective collection numbers. Only a few specimens were present on this site of the other four species that are recorded below. Only one site, Island 11, contained dredge material of Age Class 1.

Cyperaceae

Cyperus schweinitzii Torr. 1752,2882

Gramineae

Panicum capillare L. 421

Sporobolus cryptandrus (Torr.) Gray 428,2879

Triplasis purpurea (Walt.) Chapm. 2880

Capparidaceae

Polanisia graveolens Raf. 287

Chenopodiaceae

Chenopodium album L. 437

Cycloloma atriplicifolium (Spreng.) Coult. 242,1751

Leguminosae

Melilotus alba Desr. 170

Age Class 2
(2-3 years old)

A considerably greater number of species were obtained from the 2-3 year old dredge material sites. Both Islands 8 and 15 represent this age class, but most specimens were collected from two large areas on Island 8. The four principal colonizers, listed previously, particularly Sporobolus cryptandrus (Torr.) Gray, dominated these areas. Other abundant species were Bromus tectorum L., Mollugo verticillata L., Erigeron canadensis L., both species of Lepidium, and Melilotus alba Desr. The following species were collected:

Cyperaceae

Cyperus schweinitzii Torr. 675,680,1586,2411

Gramineae

Agropyron repens (L.) Beauv. 1081

Bromus tectorum L. 1069,1083,1248

Elymus virginicus L. 679,2402

Panicum capillare L. 692,2405,2418

Poa pratensis L. 1070

Setaria viridis (L.) Beauv. 693,2424

Sporobolus cryptandrus (Torr.) Gray 678,2421

Triplasis purpurea (Walt.) Chapm. 694,2415

Aizoaceae

Mollugo verticillata L. 691

Asclepiadaceae

Asclepias syriaca L. 1585

Capparidaceae

Polanisia graveolens Raf. 2404

Caryophyllaceae

Saponaria officinalis L. 669,2414

Chenopodiaceae

Chenopodium album L. 2401

Cycloloma atriplicifolium (Spreng.) Coult. 673,1587

Salsola kali L. var. tenuifolia G. F. W. Meyer 670

Compositae

Ambrosia artemisiifolia L. 2403

Erigeron canadensis L. 674,2406

Erigeron strigosus Muhl. 688

Lactuca scariola L. 676,2407,2423

Solidago gigantea Ait. var. serotina (Kuntze) Cron. 2416

Tragopogon dubius Scop. 1090,2408

Xanthium strumarium L. 704,2420

Cruciferae

Lepidium densiflorum Schrad. 1082

Lepidium virginicum L. 672,695

Euphorbiaceae

Euphorbia supina Raf. 696

Labiatae

Teucrium canadense L. var. virginicum (L.) Eat. 2417

Leguminosae

Melilotus alba Desr. 677

Onagraceae

Oenothera biennis L. subsp. caeciarum Munz. 2413

Polygonaceae

Polygonum scandens L. 690,2412

Age Class 3

(4-6 years old)

Ten islands in Navigation Pool 8 contained dredge material of Age Class 3. By far this is the age class that is represented by the greatest number of sites. The four primary colonizers, Sporobolus cryptandrus (Torr.) Gray, Triplasis purpurea (Walt.) Chapm., Cyperus schweinitzii Torr., and Cycloloma atriplicifolium (Spreng.) Coult., remain the dominant species. However, the abundance of Oenothera biennis L. subsp. caeciarum Munz. increases considerably. This was especially noticeable on Island 13. Other abundant species were Bromus tectorum L., Mollugo verticillata L., Erigeron canadensis L., Lepidium densiflorum Schrad., Lepidium virginicum L., Melilotus alba Desr., Polanisia graveolens Raf., Mirabilis nyctaginea (Michx.) MacM., and Polygonum scandens L. Islands 8, 9, 10, 12, 13, 16, 19, 20, 21, and 22 contained suitable sites from which the following collections were obtained.

Equisetaceae

Equisetum arvense L. 1584

Cyperaceae

Carex laeviconica Dew. 1102

Cyperus lupulinus (Spreng.) Marcks ssp. lupulinus X

Cyperus schweinitzii Torr. 1953,2960

Cyperus schweinitzii Torr. 200,528,529,530,531,571,746,

747,1190,1211,1733,1865,1917,2525,2526

Gramineae

Agropyron repens (L.) Beauv. 199,455,1210,1263,1378,

1573,1576,1790

Agrostis perennans var. aestivalis Vasey 2929

Agrostis scabra Willd. 1301

Bromus tectorum L. 201,452,527,923,937,944,957,1107,

1256,1257,1307

Cenchrus longispinus (Hack.) Fern. 1789

Elymus virginicus L. 451,539,1904,1919,1942

Eragrostis pectinacea (Michx.) Nees. 1868,1948

Panicum capillare L. 458,2964

Panicum virgatum L. 1866

Poa pratensis L. 202,1098,1175,1310

Sphenopholis intermedia Rydb. 1561

Sporobolus cryptandrus (Torr.) Gray 467,544,1560,1730,

1869,1905,1914,2528,2631,2663,2926,2957,3018,3112

Triplasis purpurea (Walt.) Chapm. 750,2523,2632,2664,

2808,2818,2927,2958,3019,3054,3104,3111

Aizoaceae

Mollugo verticillata L. 522,1176,1221,1302,1564,1878,

1901,1921,1949

Asclepiadaceae

Asclepias syriaca L. 217,521,1563,1827,2186

Capparidaceae

Polanisia graveolens Raf. 456, 525, 1565, 1793, 2385

Caryophyllaceae

Lychnis alba Mill. 1571, 2173

Saponaria officinalis L. 1582, 1951

Chenopodiaceae

Chenopodium album L. 2530, 2630, 2810, 2817, 3042

Cycloloma atriplicifolium (Spreng.) Coult. 509, 524, 752,
1734, 1913, 2180

Salsola kali L. var. tenuifolia G. F. W. Meyer 523, 753,
1732, 2190, 2383, 2816

Compositae

Achillea millefolium L. 223, 1297, 1574, 1857

Ambrosia artemisiifolia L. 2639, 2928, 3015, 3107

Cirsium vulgare (Savi) Tenore 2531

Erigeron annuus (L.) Pers. 1295, 1871

Erigeron canadensis L. 460, 536, 1820, 1873, 1903, 1922, 1954,
2171, 2187, 2527, 2665

Erigeron strigosus Muhl. 225, 454, 1569

Eupatorium rugosum Houtt. 2637

Lactuca canadensis L. 2638, 2806, 3051

Lactuca scariola L. 543, 2191, 2811

Solidago altissima L. 3017a

Solidago gigantea Ait. var. gigantea 2940, 3017

Solidago gigantea Ait. appr. var. gigantea 3101

Solidago gigantea Ait. var. serotina (Kuntze) Cron. 472,
3053

Taraxacum officinale Weber 896,922

Tragopogon dubius Scop. 526,1181,1222,1879

Xanthium strumarium L. 2386,2962

Convolvulaceae

Convolvulus sepium L. 1570,1825

Cruciferae

Erysimum cheiranthoides L. 924,1791,1876

Lepidium densiflorum Schrad. 198,943,1106,1209,1305a,
1945

Lepidium virginicum L. 533,1305,1859

Euphorbiaceae

Euphorbia maculata L. 1918,2959,3016

Euphorbia supina Raf. 1875,1902

Labiatae

Monarda punctata L. 1863,1952,2172

Teucrium canadense L. var. virginicum (L.) Eat. 1826,
1864,2188

Leguminosae

Melilotus alba Desr. 220,538,1185,1187,1557

Melilotus officinalis (L.) Lam. 224,1374,1580

Nyctaginaceae

Mirabilis nyctaginea (Michx.) MacM. 218,468,1104,1108,
1180,1219,1308

Onagraceae

Oenothera biennis L. subsp. caeciarum Munz. 506,507,508,
542,765,2179,2384,2524,2660,2661,2807,2819,3043

Oxalidaceae

Oxalis stricta L. 1103, 1298, 1304, 1867

Polygonaceae

Polygonum scandens L. 466, 2193, 2636, 2809, 2965

Rumex crispus L. 1577, 1860

Scrophulariaceae

Linaria vulgaris Hill 1856, 1906

Verbascum thapsus L. 219, 520, 1568, 1748, 1824, 1855

Veronica peregrina L. var. xalapensis (HBK) Pennell 925,
1296

Solanaceae

Solanum dulcamara L. 1189

Age Class 4

(7-10 years old)

Only a small area on one dredge material site was suitable for study in this age class. This site, Island 17, was visited ten years after dredge material was deposited. The collections from the eight year old sites, Islands 6 and 8, were not included in these results. The eight year old deposition site on the northern end of Island 8 was of sufficient elevation but was unsuitable because it was almost entirely shaded by cottonwoods. Island 6 consisted of a large exposed deposition area, however, its elevation did not exceed 634 feet. Few species were obtained from Island 17. Those that were collected are contained in the following list. Island 17 was predominantly occupied by Sporobolus cryptandrus

(Torr.) Gray, Triplasis purpurea (Walt.) Chapm., Cycloloma atriplicifolium (Spreng.) Coult., Bromus tectorum L., Mollugo verticillata L., and Lepidium densiflorum Schrad.

Gramineae

Bromus tectorum L. 1341
Eragrostis pectinacea (Michx.) Nees. 2083
Muhlenbergia frondosa (Poir.) Fern. 2871
Panicum virgatum L. 261,2085
Poa pratensis L. 1343
Sphenopholis intermedia Rydb. 1387
Sporobolus cryptandrus (Torr.) Gray 2084,2872
Triplasis purpurea (Walt.) Chapm. 2873

Aizoaceae

Mollugo verticillata L. 1339

Chenopodiaceae

Cycloloma atriplicifolium (Spreng.) Coult. 2090

Compositae

Solidago gigantea Ait. var. serotina (Kuntze) Cron. 2870
Xanthium strumarium L. 2869,2875

Cruciferae

Erysimum cheiranthoides L. 263
Lepidium densiflorum Schrad. 262,1344

Onagraceae

Oenothera biennis L. subsp. caeciarum Munz. 265

Scrophulariaceae

Veronica peregrina L. var. xalapensis (HBK) Pennell 1342

Age Class 5

(11-13 years old)

The three sites, Islands 4, 5, and 10, contained exposed areas of sufficient elevation to study. Sporobolus cryptandrus (Torr.) Gray, Cyperus schweinitzii Torr., and Cycloloma atriplicifolium (Spreng.) Coult. were abundant on the 12 year old dredge material of Islands 4 and 5. Also abundant on Island 4 were Melilotus alba Desr. and Oenothera biennis L. subsp. caeciarum Munz. Where debris had been deposited by floods Mirabilis nyctaginea (Michx.) MacM., Polygonum scandens L., and Asclepias syriaca L. grew readily. The 13 year old deposition site on the northern end of Island 10 was carpeted by Panicum capillare L. Bromus tectorum L. and Sporobolus cryptandrus (Torr.) Gray were also abundant, while only a few specimens of Oenothera biennis L. subsp. caeciarum Munz. were seen. The collections from the 12 year old sites, Islands 1, 2, and 3, were not included in the following results since their maximum elevations were 634 feet above mean sea level. It was interesting to observe, though, that Sporobolus cryptandrus (Torr.) Gray, Oenothera biennis L. subsp. caeciarum Munz., Panicum capillare L., Polanisia graveolens Raf., and Xanthium strumarium L. were equally prominent on Islands 1 and 2. The following species were found on Islands 4, 5, and 10.

Equisetaceae

Equisetum arvense L. 1143

Cyperaceae

Cyperus lupulinus (Spreng.) Marcks ssp. lupulinus X

Cyperus schweinitzii Torr. 1531,2793

Cyperus schweinitzii Torr. 1489,1532,1555,2451,2466

Gramineae

Bromus tectorum L. 1137,1491

Elymus virginicus L. 2521

Muhlenbergia frondosa (Poir.) Fern. 2510

Panicum capillare L. 2507

Panicum virgatum L. 2514

Poa pratensis L. 1132

Sporobolus cryptandrus (Torr.) Gray 327,1490,1535,
2452,2513

Triplasis purpurea (Walt.) Chapm. 2467

Aizoaceae

Mollugo verticillata L. 322,1487

Asclepiadaceae

Asclepias syriaca L. 1545

Caryophyllaceae

Saponaria officinalis L. 1485,2516

Chenopodiaceae

Chenopodium album L. 2465

Cycloloma atriplicifolium (Spreng.) Coult. 320,1488,2470

Salsola kali L. var. tenuifolia G. F. W. Meyer 326,2789

Compositae

Ambrosia artemisiifolia L. 2515

Erigeron canadensis L. 323,2509

Eupatorium rugosum Houtt. 2520

Lactuca canadensis L. 2446,2790

Lactuca scariola L. 325,2791

Solidago canadensis L. var. hargeri Fern. 2511a

Solidago gigantea Ait. var. gigantea 2447,2511

Tragopogon dubius Scop. 1145

Convolvulaceae

Convolvulus sepium L. 1486

Cruciferae

Erysimum cheiranthoides L. 1134

Lepidium densiflorum Schrad. 1027,1139,1492

Euphorbiaceae

Euphorbia maculata L. 2794

Leguminosae

Melilotus alba Desr. 328,1543

Melilotus officinalis (L.) Lam. 1544

Nyctaginaceae

Mirabilis nyctaginea (Michx.) MacM. 1534

Onagraceae

Oenothera biennis L. subsp. caeciarum Munz. 2450,2471,2512

Polygonaceae

Rumex crispus L. 2518

Polygonum scandens L. 2519,2792

Scrophulariaceae

Linaria vulgaris Hill 2517

Verbascum thapsus L. 321

Veronica peregrina L. var. xalapensis (HBK) Pennell 1140

Solanaceae

Solanum dulcamara L. 1147, 1498

Age Class 6

(20 years old or older)

Island 23 was the oldest dredge material site that could be determined utilizing the available records. Although Sporobolus cryptandrus (Torr.) Gray, Cyperus schweinitzii Torr., Cycloloma atriplicifolium (Spreng.) Coult., and Triplasis purpurea (Walt.) Chapm. are still present, they do not dominate the area as on younger dredge material. Woody species are encroaching on the deposition site. The vines of Vitis riparia Michx. cover much of the area. Toxicodendron rydbergii Greene and Rubus occidentalis L. are also moving in from the fringes of the alluvial woods. Specimens that were collected on Island 23 included the following:

Cyperaceae

Cyperus lupulinus (Spreng.) Marcks ssp. lupulinus X

Cyperus schweinitzii Torr. 1831a, 1832, 1850

Cyperus schweinitzii Torr. 1831, 1849

Gramineae

Bromus tectorum L. 1835

Panicum virgatum L. 1848

Sporobolus cryptandrus (Torr.) Gray 1851

Triplasis purpurea (Walt.) Chapm. 3087

Aizoaceae

Mollugo verticillata L. 1837

Anacardiaceae

Toxicodendron rydbergii Greene 3081

Chenopodiaceae

Chenopodium album L. 3077

Cycloloma atriplicifolium (Spreng.) Coult. 1838

Compositae

Erigeron canadensis L. 3076

Lactuca canadensis L. 3085

Lactuca scariola L. 3085a

Labiatae

Monarda punctata L. 3073

Teucrium canadense L. var. virginicum (L.) Eat. 1842

Polygonaceae

Polygonum scandens L. 3075

Rosaceae

Rubus occidentalis L. 3098

Scrophulariaceae

Verbascum thapsus L. 1833

Solanaceae

Solanum dulcamara L. 1843

Vitaceae

Vitis riparia Michx. 1840

Table 2. Summary of species occurring
on different age classes of dredge material.

Age Class*	Total # Species	Total # Monocots	Total # Dicots
1	8	4	4
2	30	9	21
3	59	16	42
4	16	8	8
5	39	10	28
6	20	6	14

* Dredge material of 1 year, 2-3 years, 4-6 years, 7-10 years, 11-13 years, and over 20 years comprise Age Classes 1, 2, 3, 4, 5, and 6, respectively.

DISCUSSION

The results of this floristic study showed that two grasses, Sporobolus cryptandrus (Torr.) Gray and Triplasis purpurea (Walt.) Chapm., the sedge, Cyperus schweinitzii Torr., and a chenopodiaceous tumbleweed, Cycloloma atriplicifolium (Spreng.) Coult., were the pioneer herbaceous species of the dry, exposed dredge material sites in Navigation Pool 8. This supports, in part, McVaugh's (1947) results. He reported that Eragrostis pectinacea, Triplasis purpurea, and Cycloloma atriplicifolium were the predominant herbaceous species of recently deposited dredge material along the Hudson River. Unlike the other two species, Eragrostis pectinacea (Michx.) Nees. was only found in Navigation Pool 8 on dredge material of low elevation. The only other herbaceous species that were noted by McVaugh (1947) were Oenothera biennis, Xanthium sp., and Melilotus sp. George (1924), who conducted a study along the Mississippi River near St. Paul, Minnesota, reported the invasion of a bare gravel flat by Polanisia graveolens Raf., Oenothera biennis, Mollugo verticillata L., and Panicum capillare L. within a two year period. Comparable results were obtained in the Navigation Pool 8 study.

Ten years after his original survey, McVaugh (1947)

returned to note the changes that had occurred in the interim. Eragrostis pectinacea and Triplasis purpurea continued to form the scanty grass cover; no continuous or dense ground cover had developed. He recorded that Cycloloma atriplicifolium had practically disappeared and few new herbaceous species were found. In Navigation Pool 8 within five years the primary colonizers, Sporobolus cryptandrus (Torr.) Gray, Triplasis purpurea (Walt.) Chapm., Cyperus schweinitzii Torr., and Cycloloma atriplicifolium (Spreng.) Coult., were well established. Oenothera biennis L. subsp. caeciarum Munz., Melilotus alba Desr., Erigeron canadensis L., Bromus tectorum L., and Mollugo verticillata L. also formed part of the cover. However, McVaugh (1947) noted the prominence of several woody species. They included Robinia pseudo-acacia L. (black locust), Prunus serotina Ehrh. (wild black cherry), and Rhus typhina L. (staghorn sumac). In the Navigation Pool 8 study only five, four, and three collections were obtained of those species of Robinia, Prunus, and Rhus, respectively. Only six collections of another sumac, Rhus glabra L. (smooth sumac), were made. These species were present on the fringes of mature alluvial forests that are dominated by Ulmus americana L. (American elm) and Acer saccharinum (silver maple). These shrubs were established before the most recent dredge material was deposited and they were not destroyed by that activity. Therefore, their place in succession on these sites can not be determined. The same is true for other species McVaugh (1947) noted, such as Quercus velutina Lam. (black oak),

Rubus occidentalis L. (black raspberry), and Celastrus scandens L. (bittersweet). However, in a few instances oak saplings were collected on four and five year old dredge material in Navigation Pool 8. Both Quercus bicolor Willd., collections 1148, 1929, and 2802, and Quercus velutina Lam., collections 1200 and 2896, were obtained from these areas.

In Navigation Pool 8 the development of ground cover occurs slowly in dry, exposed areas of dredge material. This was also noted by McVaugh (1957). From his observations in 1955 he stated "there seems to have been little change, either in size or in plant-cover, in the open sandy stretches which were not occupied by trees" in 1945 (McVaugh, 1957). The dredge material was approximately 20 years old when this observation was made. He reported that Oenothera and Triplasis were abundant over the majority of the treeless sand flat. McVaugh (1957) also noted that Erigeron canadensis L. and Melilotus alba Desr. were moderately abundant. More dramatic changes occurred near wooded areas. McVaugh (1957) described these areas as being heavily overgrown by Vitis riparia Michx. (riverbank grape), Celastrus scandens L. (bittersweet), and Rhus radicans (poison ivy). These vines and shrubs were gradually spreading into the open areas. Much of the oldest deposition site in Navigation Pool 8 was also covered by these shrubs.

SUMMARY AND CONCLUSIONS

Plant succession is a slow process in the environment provided by dry, sandy dredge material. Since the sand is quite porous, low in nutrients, and subject to large fluctuations in temperature, it presents a very rigorous substrate for colonization by plants. The species capable of successfully colonizing these sites in Navigation Pool 8 of the upper Mississippi River were Sporobolus cryptandrus (Torr.) Gray, Cyperus schweinitzii Torr., Cycloloma atriplicifolium (Spreng.) Coult., and Triplasis purpurea (Walt.) Chapm. These were soon followed by Oenothera biennis L. subsp. caeciarum Munz., Melilotus alba Desr., Erigeron canadensis L., Bromus tectorum L., Mollugo verticillata L., Lepidium densiflorum Schrad., Lepidium virginicum L., and Polanisia graveolens Raf. Little change occurred in the species composition during the short 20 year time period. The most noticeable occurrence was the spread of Vitis riparia Michx. over much of the oldest deposition site. However, an indication of the climax community that would develop on dredge material was not readily apparent from the sites available in Navigation Pool 8. It is, however, exceedingly interesting that a total of 304 species of vascular plants were found on these sites, even though many of these species were present in very small numbers.

LITERATURE CITED

- Argus, G. W. 1964. Preliminary reports on the flora of Wisconsin, No. 51; Salicaceae. Trans. Wis. Acad. Sci. Arts Lett. 53:217-272.
- Bernard, J. M. and D. W. Davidson. 1969. A floristic resurvey of a landfill area 32 years after deposition: the Oatka Beach addition, Minnesota Point, Minnesota. Am. Midl. Nat. 82:559-563.
- Borchert, J. R. 1950. The climate of the central North American grassland. Annals Assoc. Amer. Geogr. 40:1-29.
- Bunnell, L. H. 1897. Winona and its environs on the Mississippi in ancient and modern days. Jones & Kroeger, Winona, Minn. 694 pp.
- Conrad, H. S. 1913. Revegetation of a denuded area. Bot. Gaz. 55:80-84.
- Cowles, H. C. 1899. The ecological relations of the vegetation on the sand dunes of Lake Michigan. Bot. Gaz. 27:95-117, 167-202, 281-308, 361-391.
- Cowles, H. C. 1901. The physiographic ecology of Chicago and vicinity. Bot. Gaz. 31:73-108, 145-182.
- Curtis, J. T. 1974. The vegetation of Wisconsin. The University of Wisconsin Press, Madison, Wis. 657 pp.
- Curtis, J. T. and R. P. McIntosh. 1951. An upland forest continuum in the prairie-forest border region of Wisconsin. Ecology 32:476-496.
- Fassett, N. C. 1951. Grasses of Wisconsin. The University of Wisconsin Press, Madison, Wis. 173 pp.
- Fassett, N. C. 1972. A manual of aquatic plants. The University of Wisconsin Press, Madison, Wis. 405 pp.
- Fernald, M. L. 1970. Gray's manual of botany, 8th ed. Van Nostrand Reinhold Co., New York. 1632 pp.
- Finley, R. W. 1965. Geography of Wisconsin-a content outline. College Printing & Typing Co., Inc., Madison, Wis. 228 pp.

- Gates, F. C. 1912. The vegetation of the beach area in northeastern Illinois and southwestern Wisconsin. Ill. State Lab. Nat. Hist. Bull. 9:255-372.
- George, H. 1924. The plant succession of the flood plain of the Mississippi River with special reference to the pioneer stage. M. A. Thesis. University of Minnesota. 91 pp.
- Gillis, W. T. 1971. The systematics and ecology of poison-ivy and the poison oaks (*Toxicodendron*, Anacardiaceae). Reprinted from *Rhodora* 73 (793, 794, 795, 796):72-159, 161-257, 370-443, 465-540, in one volume with funds provided by Mrs. Edward C. Sweeney, Coconut Grove, Fla.
- Gleason, H. A. 1910. The vegetation of the inland sand deposits of Illinois. Ill. State Lab. Nat. Hist. Bull. 9:23-174.
- Gleason, H. A. 1910a. The vegetational history of a river dune. Trans. Ill. State Acad. Sci. 2:19-26.
- Gleason, H. A. 1963. The new Britton & Brown illustrated flora of the northeastern United States and adjacent Canada. Hafner Publishing Co., Inc., New York. 3 vols.
- Hanson, H. C. 1918. The invasion of a Missouri River alluvial flood plain. Am. Midl. Nat. 5:196-201.
- Hartley, T. G. 1966. The flora of the "Driftless Area" in G. W. Martin, ed. The University of Iowa studies in natural history 21:1-174. University of Iowa Press, Iowa City, Iowa.
- Hitchcock, A. S. 1935. Manual of the grasses of the United States. U. S. Government Printing Office, Washington, D. C. 1040 pp.
- Johnson, D. F. 1950. Plant succession on the Missouri River floodplain near Vermillion, South Dakota. M. A. Thesis. University of South Dakota. 44 pp.
- Johnson, W. C., R. L. Burgess, and W. R. Keammerer. 1976. Forest overstory vegetation and environment on the Missouri River floodplain in North Dakota. Ecol. Monogr. 46:59-84.
- Keammerer, W. R., W. C. Johnson, and R. L. Burgess. 1975. Floristic analysis of the Missouri River bottomland forests in North Dakota. Can. Field Nat. 89:5-19.
- Kennedy, D. and R. H. Mohlenbrock. 1963. Botanical observations and collections on a sandbar in the Ohio

River. *Castanea* 28:58-62.

- Koeppen, R. C. 1957. Preliminary reports on the flora of Wisconsin, No. 41; Labiatae-mint family. *Trans. Wis. Acad. Sci. Arts Lett.* 46:115-140.
- Lakela, O. 1939. A floristic study of a developing plant community on Minnesota Point, Minnesota. *Ecology* 20: 544-552.
- Lee, M. B. 1945. An ecological study of the floodplain forest along the White River system of Indiana. *Butler Univ. Bot. Stud.* 7:155-175.
- Leverett, F. 1895. The preglacial valleys of the Mississippi and its tributaries. *J. Geol.* 3:740-763.
- Lewis, H. 1967. The valley of the Mississippi, illustrated. Minnesota Historical Society, St. Paul, Minn. 423 pp.
- Lindsey, A. A., R. O. Petty, D. K. Sterling, and W. Van Asdall. 1961. Vegetation and environment along the Wabash and Tippecanoe Rivers. *Ecol. Monogr.* 31:105-156.
- Mahony, K. L. 1932. Preliminary reports on the flora of Wisconsin, No. 15; Polygonaceae. *Trans. Wis. Acad. Sci. Arts Lett.* 27:207-225.
- Marcks, B. G. 1974. Preliminary reports on the flora of Wisconsin, No. 66; Cyperaceae II-sedge family II, the genus Cyperus-the umbrella sedges. *Trans. Wis. Acad. Sci. Arts Lett.* 62:261-284.
- McVaugh, R. 1947. Establishment of vegetation on sand-flats along the Hudson River, New York. *Ecology* 28:189-193.
- McVaugh, R. 1957. Establishment of vegetation on sand-flats along the Hudson River, New York.--II. The period 1945-1955. *Ecology* 38:23-29.
- Montz, G. N. 1972. A seasonal study of the vegetation on levees. *Castanea* 37:140-146.
- Odum, E. P. 1953. Fundamentals of ecology. W. B. Saunders Co., Philadelphia. 384 pp.
- Patman, J. P. and H. H. Iltis. 1961. Preliminary reports on the flora of Wisconsin, No. 44; Cruciferae-mustard family. *Trans. Wis. Acad. Sci. Arts Lett.* 50:17-72.
- Petty, R. O. 1958. Patterns of plant succession on the Tippecanoe and Wabash River flood plain. M. S. Thesis. Purdue University. 99 pp.

- Salamun, P. J. 1963. Preliminary reports on the flora of Wisconsin, No. 50; Compositae III-Compositae family III, the genus Solidago-goldenrod. Trans. Wis. Acad. Sci. Arts Lett. 52:353-382.
- Schlising, R. A. and H. H. Iltis. 1961. Preliminary reports on the flora of Wisconsin, No. 46; Caryophyllaceae-pink family. Trans. Wis. Acad. Sci. Arts Lett. 50:89-139.
- Shinners, L. H. 1941. The genus Aster in Wisconsin. Am. Midl. Nat. 26:398-420.
- Shull, C. A. 1944. Observations of general vegetational changes on a river island in the Mississippi River. Am. Midl. Nat. 32:771-776.
- Snow, L. M. 1913. Progressive and retrogressive changes in the plant associations of the Delaware coast. Bot. Gaz. 55:45-55.
- Strahler, A. N. 1969. Physical geography, 3rd ed. John Wiley and Sons, Inc., New York. 733 pp.
- Stuckey, R. L. 1972. Taxonomy and distribution of the genus Rorippa (Cruciferae) in North America. SIDA 4:279-430.
- Turner, L. M. 1931. Plant succession on levees in the Illinois River valley. Trans. Ill. State Acad. Sci. 24:94-102.
- U. S. Army Corps of Engineers, St. Paul District. 1974. Final environmental impact statement; operation and maintenance 9-foot navigation channel, upper Mississippi River, head of navigation to Guttenberg, Iowa; Vol. 2, exhibits. St. Paul, Minn. 585 pp.
- U. S. Army Engineer Division, North Central. 1970a. Upper Mississippi River comprehensive basin study; Vol. II, Appendix A-history of investigation. pp. 5-15.
- U. S. Army Engineer Division, North Central. 1970b. Upper Mississippi River comprehensive basin study; Vol. V, Appendix J-navigation. pp. 4-6.
- U. S. Department of Agriculture. 1941. Yearbook of agriculture; climate and man. U. S. Government Printing Office, Washington, D. C. 1248 pp.
- Van Asdall, W. 1958. Flood plain edaphic conditions. M. S. Thesis. Purdue University. 75 pp.
- Van Bruggen, T. 1961. An ecologic and taxonomic study of a

sand dune and flood plain area adjacent to the Missouri River. Proc. S. D. Acad. Sci. 40:132-141.

Waite, P. J. 1974. The climate of Wisconsin. Pages 437-452 in U. S. Dep. of Commerce, Climates of the states-Vol. 1, eastern states. Water Information Center, Inc., Port Washington, N. Y.

Wang, J. Y. and V. E. Suomi. 1957. The phyto-climate of Wisconsin, 1; the growing season. Wis. Agric. Exp. Stn. Res. Rep. 1. University of Wisconsin, Madison, Wis. 22 pp.

Wilson, R. E. 1970. Succession in stands of Populus deltoides along the Missouri River in southeastern South Dakota. Am. Midl. Nat. 83:330-342.

APPENDIX I

INTRODUCTION TO THE VASCULAR FLORA

The following species were obtained from the 23 dredge material sites investigated in Navigation Pool 8 of the upper Mississippi River. The families are listed alphabetically within their major classification groups, and the genera within each family are also listed alphabetically as are the species. Each species is accompanied by its common name, the numbers of the sites where it was collected, my collection numbers, as well as a commentary. In this commentary the habitat types and the elevations of the collection areas are stated. Since the surface of the water in Navigation Pool 8 is maintained for commercial traffic at an elevation of 631 feet above mean sea level, it can be determined whether these species grow in moist areas within a few feet of the pool's surface or on more elevated sites. A statistical summary of the composition of the dredge material flora in Navigation Pool 8 is provided at the end of the species list. Of those genera that were sent for annotation, the determinations for Erigeron have not been returned at the present time.

VASCULAR FLORA OF DREDGE MATERIAL SITES
MISSISSIPPI RIVER-NAVIGATION POOL 8

Division Equisetophyta

Equisetaceae (Horsetail Family)

Equisetum arvense L.

Common Horsetail

Weedy borders of alluvial forests; 634 feet

Islands: 4,5,6,8,9,10,11,16,18

Collections: 108,124,132,155,308,487,699,1094,1113,1143,
1283,1359,1439,1502,1526,1584,1781

Equisetum hyemale L.

Scouring-rush

Edge of weedy borders along alluvial forests; 637 feet

Islands: 4,8

Collections: 319,1096,1537,2449

Division Coniferophyta

Cupressaceae (Cypress Family)

Juniperus communis L.

Common Juniper

Dry open areas; 640 feet

Islands: 8,12

Collections: 1075,1212,1583

Division Magnoliophyta

Class Liliatae

Alismataceae (Water-plantain Family)

Alisma subcordatum Raf.

Water-plantain

Moist alluvial woods; 634 feet

Islands: 4,20,21

Collections: 2057,2461,3041

Araceae (Arum Family)

Arisaema dracontium (L.) Schott Green-dragon

Small Phalaris meadows in alluvial woods; 633 feet

Islands: 9,10,15

Collections: 503,1138,2135

Commelinaceae (Spiderwort Family)

Tradescantia ohiensis Raf. Spiderwort

Dry open area; 637 feet

Island: 4

Collection: 1026

Cyperaceae (Sedge Family)

Carex brevior (Dew.) Mackenz. Sedge

Dry open area and edge of Salix community bordering slough;
632 to 638 feet

Islands: 8,16,21

Collections: 1099,1319,1382

Carex cristatella Britt. Sedge

Moist sand in Salix community; 633 feet

Islands: 6,7,10,11,12,17,21

Collections: 189,251,1389,1428,1443,1456,1738,1808,1975

Carex emoryi Dew. Sedge

Moist sand in Salix community; 633 feet

Islands: 1,2,12,20

Collections: 209,959,992,2065

Carex hystericina Muhl.

Sedge

Moist sand in Salix community; 632 feet

Island: 7

Collections: 1060,1427

Carex laeviconica Dew.

Sedge

Open areas; 634 feet

Islands: 1,2,4,5,8

Collections: 1017,1102,1505,1529,1634,1678

Carex lanuginosa Michx.

Sedge

Open areas; 634 feet

Islands: 3,5,8

Collections: 976,1504,1562,1661

Carex muhlenbergii Schkuhr.

Sedge

Dry open area; 644 feet

Island: 13

Collection: 1179

Carex muskingumensis Schwein.

Sedge

Moist sand bordering slough, in Salix community; 634 feet

Islands: 9,21

Collections: 1974,2672

Carex stipata Muhl.

Sedge

Moist sand; 633 feet

Islands: 4,7,8,11

Collections: 119,1009,1062,1085,1420

Carex tenera Dew. or

Sedge

Carex tenera Dew. X Carex normalis Mackenz.

Moist sand of Salix community; dry weedy border of alluvial woods; 632 feet to 638 feet

Islands: 2,10,19,22

Collections: 926,939,993,1154

Carex tribuloides Wahlenb.

Sedge

Moist sand bordering slough, in Salix community; 634 feet

Islands: 8,9,17,20,21

Collections: 275,1078,1322,1333,1762,2054

Carex typhina Michx.

Sedge

Dry open area; 638 feet

Island: 10

Collection: 1731

Carex vulpinoidea Michx.

Sedge

Moist sand bordering Salix community; 632 feet

Islands: 6,9

Collections: 1129,1451,1762a,1764

Cyperus aristatus Rottb.

Awed Cyperus

(Cyperus inflexus Muhl.)

Moist sand bordering sloughs; 633 feet

Islands: 3,4,6,7,9,11,14,15,18,20,21

Collections: 434,489,1429,1481,1550,1666,1778,1786,1994,
2013,2069,2128,2143,2158,2332,2998,3033

Cyperus erythrorhizos Muhl.

Red-rooted Cyperus

Moist sand bordering river and sloughs; 633 feet

Islands: 1,3,4,10,16,18

Collections: 596,1548b,1723,2603,2621,2997

Cyperus esculentus L.

Yellow Nut-grass,

Moist sand bordering sloughs; 633 feet

Chufa

Islands: 1,2,6,9,10,11,14,18,19,20,21,22

Collections: 461,1457,1599,1679,1727,1755,1894,2001,2015,
2073,2156,2950,3006,3034

Cyperus lupulinus (Spreng.) Marcks

Slender-stemmed

ssp. lupulinus

Cyperus

Dry open areas; 642 feet

Islands: 8,12

Collections: 1823,2409,2410

Cyperus lupulinus (Spreng.) Marcks

Umbrella Sedge

ssp. lupulinus X Cyperus schweinitzii Torr.

Dry open areas; 642 feet

Islands: 4,19,20,21,23

Collections: 1531,1831a,1832,1850,1928,1953,2034,2793,2960

Cyperus odoratus L.

Coarse Cyperus

Moist sand bordering river and sloughs; 633 feet

Islands: 1,2,3,4,6,9,10,13,14,18,19,20

Collections: 515,516,517,563,564,1474a,1548,1549a,1599b,
1665,1674,1739,1765,1777,2000,2072,2533a,2688,2841,2949,
2996

Cyperus rivularis Kunth

Shining or Brook

Moist sand in Salix community; 632 feet

Cyperus

Island: 7

Collection: 2321

Cyperus schweinitzii Torr.

Schweinitz's Cyperus

Dry open areas; 635 to 650 feet

Islands: 1,2,3,4,5,7,8,10,11,12,13,19,20,22,23

Collections: 175,200,379,528,529,530,531,571,657,675,680,
 746,747,1164,1190,1211,1489,1532,1555,1586,1633,1660,1712,
 1733,1752,1799,1831,1849,1865,1917,2033,2333,2411,2451,2466,
 2525,2526,2554,2882

Cyperus strigosus L.

Straw-colored Cyperus

Moist sand bordering river and sloughs; 633 feet

Islands: 1,4,6,7,8,9,10,17,21

Collections: 256,332,514,1437,1474,1548a,1549,1554,1599a,
 1739a,1956,2117,2311,2378,2478,2479,2533,2570

Eleocharis acicularis (L.) R. & S.

Spike-rush

Moist sand along slough; 632 feet

Islands: 1,17,20,21

Collections: 1321,1594,2082,2107

Eleocharis calva Torr.

Spike-rush

Moist sand along slough; 632 feet

Islands: 1,4,5,6,7,8,10,11,17,18,21

Collections: 104,273,958,1022,1061,1084,1153,1320,1425,1462,
 1507,1542,1593,3010

Eleocharis obtusa (Willd.) Schult.

Spike-rush

Moist sand along slough; 633 feet

Islands: 18,20

Collections: 2022,2077

Hemicarpha micrantha (Vahl) Pax

--

Moist sand bordering river and sloughs; 634 feet

Islands: 7,9,18

Collections: 1774,1785,2014,2347,3013

Scirpus atrovirens Willd.

Bulrush

Moist sand to mud; 632 feet

Islands: 7,9

Collections: 1433,1761

Scirpus cyperinus (L.) Kunth

Bulrush

Moist sand bordering marsh; 632 feet

Islands: 1,9,10,11

Collections: 435,519,713,2575

Scirpus validus Vahl

Great or Soft-stem

Moist sand bordering marsh; 632 feet

Bulrush

Islands: 1,2,7,8,9,10,11,17,18

Collections: 135,286,390,512,963,1059,1087,1155,1698,1766,
2027

Gramineae (Grass Family)

Agropyron repens (L.) Beauv.

Witch or Quack Grass

Dry open areas; 635 feet

Islands: 2,7,8,9,11,12,13,16

Collections: 158,199,370,455,1039,1081,1172,1210,1263,1378,
1573,1576,1677,1687,1790

Agrostis gigantea Roth.

Redtop

Open areas, 636 feet

Islands: 3,17

Collections: 255,1658,2087

Agrostis hyemalis (Walt.) BSP.

Ticklegrass, Hairgrass

Open area, 636 feet

Island: 3

Collection: 1646

Agrostis perennans var. aestivalis Vasey Thingrass

Alluvial woods; 634 feet

Islands: 4,7,18,19,20,21

Collections: 2314,2464,2929,2978,3040,3044,3071

Agrostis scabra Willd.

Hairgrass, Fly-away

Open areas; 634 feet

Grass, Ticklegrass

Islands: 1,3,4,5,19,20,21

Collections: 1301,1506,1528,1627,1652,1927,2031

Bromus kalmii Gray

Brome Grass

Open area; 636 feet

Island: 12

Collection: 2742

Bromus tectorum L.

Brome Grass

Dry open areas; 634 to 646 feet

Islands: 1,3,5,6,7,8,9,10,11,12,13,15,17,19,21,22,23

Collections: 145,157,201,369,382,452,527,923,937,944,957,
968,1041,1069,1083,1107,1137,1166,1201,1248,1256,1257,1307,
1341,1472,1491,1610,1645,1835

Calamagrostis inexpansa Gray

Reed-Bentgrass

var. brevior (Vasey) Stebbins

Alluvial woods; 636 feet

Island: 16

Collection: 1384

Cenchrus longispinus (Hack.) Fern. Sandbur

Open areas; 634 feet

Islands: 1,2,4,7,8,9,10,20

Collections: 749,1567,1630,1693,1789,2035,2318,2437,2541,
2593,2692,2761

Digitaria ischaemum (Schreb.) Muhl. Crab Grass

Moist sand in Salix community; 633 feet

Island: 17

Collection: 2089

Digitaria sanguinalis (L.) Scop. Crab Grass

Moist sand of river shoreline; 633 feet

Island: 9

Collection: 2701

Echinochloa crusgalli (L.) Beauv. Barnyard Grass

var. crusgalli

Moist sand of river shoreline and Phalaris meadow; 633 feet

Islands: 7,20

Collections: 2079a,2342

Echinochloa muricata (Beauv.) Fern. Barnyard Grass

var. microstachya Wiegand

Moist sand of slough and river shorelines; 632 to 636 feet

Islands: 1,8,9,10,11,14,15,17,21,22

Collections: 432,740,2134,2380,2602,2657,2700,2838,2877,
3025,3038,3123

Echinochloa muricata (Beauv.) Fern. Barnyard Grass

var. muricata

Moist sand of slough and river shorelines; 632 to 636 feet

Islands: 1,3,6,7,9,10,12,15,16,18,20,21,22

Collections: 453,1973,1998,2016,2078,2337,2502,2582,2623,
2650,2728,2848,2849,2922,3009,3031,3116

Echinochloa walteri (Pursh) Heller Barnyard Grass

Moist sand of slough and river shorelines; 632 to 636 feet

Islands: 1,4,15,18,20

Collections: 1997,1999,2079,2133,2440,2462,2578

Elymus canadensis L. Wild Rye

Dry open areas; 636 feet

Islands: 2,12,13

Collections: 532,1701,1822,2185

Elymus virginicus L. Terrell Grass

Alluvial woods and open areas; 634 feet

Islands: 2,4,6,7,8,9,10,12,13,14,15,16,18,19,20,21,22,23

Collections: 294,350,381,451,539,638,658,679,736,1729,1795,
1904,1919,1926,1942,2029,2088,2150,2163,2167,2194,2202,
2329,2360,2390,2402,2475,2503,2521,2567,2644,2681,2853,
2979,3084,3114

Eragrostis frankii C. A. Mey. Lovegrass

Moist sand along slough; 632 feet

Island: 13

Collection: 2815

Eragrostis hypnoides (Lam.) BSP. Lovegrass

Moist sand; 634 feet

Islands: 9,15,17,18,20,21,23

Collections: 562, 599, 1776, 1976, 1993, 2019, 2068, 2123, 2878,
2995, 3094

Eragrostis pectinacea (Michx.) Nees. Lovegrass

Moist sand along shores; dry open areas; 632 to 636 feet

Islands: 1, 2, 3, 4, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22

Collections: 250, 252, 459, 490, 1410, 1522, 1611, 1624, 1647, 1663,
1676, 1680, 1686, 1737, 1744, 1769, 1811, 1868, 1891, 1948, 1992,
2002, 2024, 2066, 2083, 2113, 2126, 2141, 2203, 2305, 2532, 2605,
2612, 2697, 2744, 2820, 2921, 2945, 2990, 3008, 3035, 3121

Eragrostis spectabilis (Pursh) Steud. Tumblegrass,

Dry open area; 638 feet Petticoat Climber

Island: 19

Collection: 2930

Festuca octoflora (Walt.) Fescue

(Vulpia octoflora (Walt.) Rydb. var. tenella (Willd.) Fern.

Dry open areas; 636 to 646 feet

Islands: 21, 22

Collections: 897, 1303, 1877

Glyceria grandis S. Wats. Reed Meadow Grass

Moist sand bordering marshy area; 632 feet

Islands: 7, 11

Collections: 394, 433, 1421

Leersia lenticularis Michx. Catchfly Grass

Moist sand of alluvial woods; 636 feet

Island: 23

Collection: 3092

Leersia oryzoides (L.) Sw.

Rice Cutgrass

Moist sand bordering marshy area; 633 feet

Islands: 1,2,3,4,7,9,10,11,18,20,21

Collections: 732,2336,2460,2558,2579,2622,2649,2658,2674,
3007,3029,3070

Leersia virginica Willd.

Whitegrass

Alluvial woods; 634 feet

Islands: 15,16,18,19,22,23

Collections: 2855,2904,2956,2980,2993,3088,3091,3115

Leptoloma cognatum (Schultes) Chase

Fall Witch Grass

Dry open areas; 636 to 646 feet

Islands: 20,22,23

Collections: 1834,1870,2028,3078

Muhlenbergia frondosa (Poir.) Fern.

Muhly

Weedy margins and alluvial woods; 634 feet

Islands: 2,4,7,9,10,15,16,17,18,19,21,23

Collections: 616,762,2315,2369,2443,2454,2510,2547,2671,
2710,2784,2844,2864,2871,2899,2938,2977,3027,3083

Muhlenbergia racemosa (Michx.) BSP.

Muhly

Weedy margins and alluvial woods; 635 feet, 640 feet

Islands: 4,22

Collections: 2453,3109

Panicum capillare L.

Old Witch Grass

Open areas; 632 to 648 feet

Islands: 1,2,3,4,6,7,8,9,10,11,12,14,16,17,18,19,20

Collections: 421,458,586,692,754,1912,2004,2074,2112,2146,
2306,2308,2355,2396,2405,2418,2432,2444,2507,2549,2580,

2615,2673,2694,2725,2735,2766,2823,2829,2842,2891,2906,
2944,2964,2991,3061

Panicum dichotomiflorum Michx.

Panic Grass

Open areas; 635 feet

Islands: 4,14

Collections: 2768,2829a

Panicum lanuginosum Ell.

Panic Grass

var. implicatum (Scribn.) Fern.

Open area; 637 feet

Island: 4

Collection: 1530

Panicum lanuginosum Ell.

Panic Grass

var. septentrionale Fern.

Open area; 633 feet

Island: 3

Collection: 1656

Panicum oligosanthos Schultes

Panic Grass

var. scribnerianum (Nash) Fern.

Open areas; 636 feet

Islands: 4,12

Collections: 1202,1533

Panicum virgatum L.

Switchgrass

Open areas; 634 to 650 feet

Islands: 10,11,13,14,17,20,21,22,23

Collections: 261,548,1848,1866,2032,2085,2181,2514,2656,
2839,3036

Paspalum ciliatifolium --var. stramineum (Nash) Fern.

Open area; 634 feet

Island: 20

Collection: 2030

Phalaris arundinacea L.

Reed Canary Grass

Moist sand of slough and river shorelines; 633 feet

Islands: 4,6,7,8,9,10,11,12,13,14,15,16,17,18,20,21

Collections: 111,133,138,276,304,491,565,604,605,748,1063,

1088,1111,1156,1163,1198,1205,1227,1243,1281,1327,1337,

1358,1384a,1455,2067

Phleum pratense L.

Common Timothy

Dry open area; 636 feet

Island: 12

Collection: 203

Phragmites communis Trin.

Reed

Moist sand bordering marshy areas; 632 feet

Islands: 2,7,10

Collections: 705,2338,2560

Poa compressa L.

Canada Bluegrass

Dry open areas; 636 feet

Islands: 8,13

Collections: 1100,1262,1572,1575

Poa palustris L.

Fowl Meadow Grass

Open area; 636 feet

Island: 21

Collection: 1947

Poa pratensis L.

Kentucky Bluegrass

Dry open areas; 636 feet

Islands: 1,2,6,7,8,9,10,11,12,13,17,18,19,21

Collections: 163,202,941,960,991,1037,1070,1098,1121,1132,
1169,1175,1207,1288,1310,1323,1343,1469Setaria glauca (L.) Beauv.

Foxtail

Dry open areas; 634 to 648 feet

Islands: 6,10,11,17,18

Collections: 2505,2647a,2655,2862,2976

Setaria viridis (L.) Beauv.

Green Foxtail

Dry open areas; 633 to 646 feet

Islands: 1,2,7,8,9,10,11,12,16

Collections: 693,721,1690,1812,1819,2331,2357,2424,2583,
2647,2653,2684,2738,2885,2886,2924Spartina pectinata Link

Fresh-water Cord Grass,

Moist sand along shores; 633 feet

Slough Grass

Islands: 4,8,17

Collections: 2372,2780,2876

Sphenopholis intermedia Rydb.

Wedgegrass

Open areas; 632 to 640 feet

Islands: 1,6,7,8,17

Collections: 1387,1411,1419,1453,1484,1561,1600

Sporobolus cryptandrus (Torr.) Gray

Sand Drop-seed

Dry open areas; 634 to 650 feet

Islands: 1,2,4,5,7,8,9,10,11,12,13,16,17,18,19,21,22,23

Collections: 327,383,428,467,544,606,659,678,725,1490,1535,
1560,1631,1730,1800,1851,1869,1905,1914,2084,2421,2452,

2513, 2528, 2548, 2598, 2604, 2631, 2663, 2693, 2762, 2872, 2879,
2926, 2957, 2981, 3018, 3112

Triplasis purpurea (Walt.) Chapm. Sand Grass

Dry open areas; 634 to 650 feet

Islands: 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 22, 23

Collections: 694, 750, 2345, 2397, 2415, 2467, 2488, 2523, 2546,
2619, 2632, 2654, 2664, 2695, 2726, 2763, 2808, 2818, 2873, 2880,
2927, 2958, 2982, 3019, 3054, 3087, 3104, 3111

Iridaceae (Iris Family)

Iris virginica L. Blue Flag

var. shrevei (Small) E. Anders.

Moist sand along river shoreline; 632 feet

Island: 6

Collection: 1435

Juncaceae (Rush Family)

Juncus dudleyi Wieg. Rush

Moist sand bordering marshy area; 632 feet

Islands: 4, 6, 7

Collections: 1422, 1449, 1552

Juncus effusus L. Soft Rush

Moist sand bordering marshy area; 632 feet

Islands: 1, 7

Collections: 1432, 1592

Juncus nodosus L. Rush

Moist sand bordering marshy area; 632 feet

Islands: 6, 7

Collections: 395,1431,1461,2320,2367

Liliaceae (Lily Family)

Asparagus officinalis L.

Garden Asparagus

Alluvial woods and weedy borders; 634 feet, 646 feet

Islands: 10,20,23

Collections: 719,2041,3079

Polygonatum canaliculatum (Muhl.) Pursh Solomon's Seal

Alluvial woods; 636 feet

Island: 20

Collection: 2052

Smilacina racemosa (L.) Desf.

False Solomon's Seal

Alluvial woods; 636 feet

Island: 12

Collection: 230

Smilacina stellata (L.) Desf.

False Solomon's Seal

Moist sand in Salix community; 632 feet

Island: 19

Collection: 951

Smilacaceae (Greenbrier Family)

Smilax hispida Muhl.

Greenbrier, Catbrier

Alluvial woods; 634 to 648 feet

Islands: 10,12,13,15,16,23

Collections: 614,2629,2754,2814,2856,2898,3082

Class Magnoliatae

Aceraceae (Maple Family)

Acer negundo L.

Box-elder

Alluvial woods

Islands: 4,5,6,7,8,9,10,11,13,15,17,18,21,22

Collections: 17,112,122,134,176,268,343,580,685,880,888,
1035,1047,1066,1127,1150,1183,1240,1279,1328,1355,1397,
1470,1497,1981,2100Acer saccharinum L.

Silver Maple

Alluvial woods

Islands: 2,3,4,6,7,8,9,10,11,12,13,15,16,17,18,19,21,22

Collections: 109,151,192,282,302,482,558,642,687,700,760,
879,889,911,945,987,999,1014,1043,1077,1116,1161,1237,1284,
1335,1354,1366,1447,2099Acer sp. (seedlings)

Maple

Moist sand in alluvial woods and Salix community; 634 feet

Islands: 9,15,18,19,22

Collections: 1245,1246,1889,1930,1991,2683

Aizoaceae (Carpetweed Family)

Mollugo verticillata L.

Carpetweed

Open areas; 633 to 646 feet

Islands: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,17,18,19,20,
21,22,23Collections: 322,423,488,522,691,734,1176,1221,1302,1318,
1339,1409,1467,1487,1521,1564,1617,1643,1659,1673,1681,
1775,1806,1837,1878,1892,1901,1921,1923,1949,1990,2017,

2070, 2109, 2119, 2125, 2142

Amaranthaceae (Amaranth Family)

Amaranthus retroflexus L.

Green Amaranth,

Open area; 634 feet

Pigweed

Island: 18

Collection: 1986

Amaranthus tamariscinus Nutt.

Water-hemp

(Acnida tamariscina (Nutt.) Wood)

Moist sand of slough and river shorelines; 634 feet

Islands: 1, 2, 3, 4, 7, 8, 11, 15, 17, 18, 19, 22

Collections: 2086, 2131, 2330, 2422, 2552, 2601, 2625, 2795, 2884,
2947a, 3005, 3124

Amaranthus tuberculatus (Moq.) Sauer

Water-hemp

(Acnida altissima Riddell)

Moist sand of slough and river shorelines; 634 feet

Islands: 1, 2, 3, 6, 9, 10, 11, 12, 13, 14, 15, 18, 19, 20, 21, 22

Collections: 419, 424, 425, 426, 427, 429, 430, 431, 436, 547, 560,
561, 1632, 1654, 1691, 1692, 1697, 1768, 1960, 1984, 1985, 2025, 2130,
2144, 2145, 2152, 2499, 2535, 2538, 2686, 2708, 2715, 2729, 2821,
2837, 2946, 2947, 2988, 3004, 3028, 3058, 3124a

Froelichia floridana (Nutt.) Moq.

Cottonweed

Dry weedy area; 636 feet

Island: 13

Collection: 2192

Anacardiaceae (Cashew Family)

Rhus glabra L.

Smooth Sumac

Dry open area bordering woods; 638 feet

Islands: 4,8,11,13

Collections: 245,305,324,582,2189,2425

Rhus typhina L.

Staghorn Sumac

Dry open area bordering woods; 638 feet

Islands: 4,7,22

Collections: 402,927,1525

Toxicodendron rydbergii Greene

Poison Ivy

Alluvial woods and dry open areas; 634 to 650 feet

Islands: 3,8,9,10,11,12,13,15,16,17,18,19,20,21,22,23

Collections: 182,239,480,626,668,1648,1804,2627,2682,2805,
2858,2908,2939,2967,2971,3021,3052,3081,3113

Apocynaceae (Dogbane Family)

Apocynum cannabinum L.

Indian Hemp

Moist sand bordering Salix community; 633 feet

Dry open area; 646 feet

Islands: 3,4,10,23

Collections: 1551,1637,1844,2537

Asclepiadaceae (Milkweed Family)

Asclepias incarnata L.

Swamp Milkweed

Moist sand along shorelines; 633 feet

Islands: 1,2,3,4,5,7,9,10,11,13,17,19,21

Collections: 254,258,351,376,504,585,716,1513,1591,1635,
1672,1718,1767,1939,1961,2092,2196,2299

Asclepias syriaca L.

Common Milkweed

Dry open areas; 634 to 650 feet

Islands: 1,2,3,4,7,8,11,12,13

Collections: 217,244,349,388,521,667,1545,1563,1585,1619,
1636,1682,1684,1750,1827,2186Asclepias verticillata L.

Whorled Milkweed

Dry weedy borders; 634 feet

Islands: 10,13

Collections: 568,2184,2508

Balsaminaceae (Touch-me-not Family)

Impatiens biflora Walt.

Touch-me-not

Moist sand to mud of alluvial woods; 632 feet

Islands: 2,4,7,9,16

Collections: 501,609,2363,2459,2559,2704,2705

Betulaceae (Birch Family)

Betula nigra L.

River or Red Birch

Alluvial woods and shorelines

Islands: 1,3,5,8,9,10,11,12,13,15,18,19,21,22

Collections: 168,227,579,682,684,890,971,984,1074,1110,
1159,1193,1235,1286,1331,1510,1933

Bignoniaceae (Bignonia Family)

Catalpa speciosa Warder

Catalpa

Moist to dry woods and weedy borders; 634 feet, 638 feet

Islands: 17,19,22

Collections: 280,1887,1900

Boraginaceae (Borage Family)

Hackelia virginiana (L.) I. M. Johnston Stickseed

Alluvial woods and thickets; 635 feet

Islands: 7,16

Collections: 357,622

Campanulaceae (Bluebell Family)

Campanula americana L.

Tall Bellflower

Alluvial woods; 635 feet

Island: 16

Collections: 625,627

Lobelia cardinalis L.

Cardinal Flower

Moist sand of Salix communities and Phalaris meadows;
633 feet

Islands: 7,11,15,20

Collections: 2055,2136,2322,2659

Lobelia siphilitica L.

Great Lobelia

Moist sand bordering Salix community; 633 feet

Islands: 6,7

Collections: 2323,2371,2485

Cannabinaceae (Hemp Family)

Cannabis sativa L.

Hemp, Marijuana

Dry wooded area; 638 feet

Island: 20

Collection: 3065

Capparidaceae (Caper Family)

Polanisia graveolens Raf.

Clammyweed

Dry open areas; 634 to 650 feet

Islands: 1,2,7,8,9,11,12,13,16,22

Collections: 287,371,456,525,594,648,1565,1614,1696,1706,
1793,1798,1895,2385,2404,2431

Caprifoliaceae (Honeysuckle Family)

Lonicera X bella Zabel

Honeysuckle

Dry wooded area; 638 feet

Islands: 11,17,19,22

Collections: 174,906,907,912,914,936,1395,1885

Lonicera tatarica L.

Tartarian Honeysuckle

Dry wooded area; 638 feet

Islands: 19,20,21,23

Collections: 933,1315,1852,2043

Sambucus canadensis L.

Common Elder

Moist sand of shorelines and alluvial woods; 634 feet

Islands: 3,4,6,16,18,20,21

Collections: 620,1468,1640,1944,1980,2045,2788

Caryophyllaceae (Pink Family)

Cerastium vulgatum L.

Common Mouse-ear

Weedy border of Salix community; 635 feet Chickweed

Islands: 4,16

Collections: 348,628

Lychnis alba Mill.

White Cockle, White

Dry open areas; 636 feet

Campion

Islands: 1,4,5,8,12,16

Collections: 235,306,608,1500,1571,1626,2173

Myosoton aquaticum (L.) Moench

Giant Chickweed

(Stellaria aquatica (L.) Scop.)

Moist alluvial woods and borders; 634 feet

Islands: 3,11,14,18,21,22

Collections: 172,1653,1754,1893,1969,1995,2834

Saponaria officinalis L.

Bouncing Bet, Soapwort

Dry open areas; 636 feet

Islands: 4,5,6,8,10,20,21

Collections: 303,669,720,1485,1515,1582,1724,1951,2053,2414,
2489,2516,2777

Silene antirrhina L.

Sleepy Catchfly

Dry open areas; 638 feet

Islands: 8,10

Collections: 1579,2635

Silene cserei Baumg.

Catchfly, Campion

Dry open areas; 640 feet

Islands: 8,21,22

Collections: 671,1299,1858

Stellaria media (L.) Cyrillo

Common Chickweed

Alluvial woods; 635 feet

Island: 16

Collection: 615

Celastraceae (Staff Tree Family)

Celastrus scandens L.

Bittersweet

Dry woods and borders; 636 to 650 feet

Islands: 10,12,13,16,20,23

Collections: 231,1223,1254,1747,2628,2749,2750,2813,2901,
3062,3100

Chenopodiaceae (Goosefoot Family)

Chenopodium album L.

Lamb's-quarters

Weedy areas; 633 to 650 feet

Islands: 1,2,3,4,6,8,9,10,11,12,13,14,15,16,18,19,20,21,23

Collections: 290,437,473,595,633,717,2401,2426,2465,2476,
2530,2550,2590,2596,2610,2630,2679,2707,2736,2743,2767,
2782,2810,2817,2828,2852,2883,2913,2923,2943,2987,3042,
3064,3077

Cycloloma atriplicifolium (Spreng.) Coult. Winged Pigweed

Dry open areas; 634 to 650 feet

Islands: 1,2,3,4,5,7,8,9,10,11,13,17,19,23

Collections: 242,320,344,373,509,524,649,673,752,1488,1587,
1616,1662,1683,1734,1751,1771,1838,1913,2090,2180,2395,2470

Salsola kali L.

Russian-thistle

var. tenuifolia G. F. W. Meyer

Dry open areas; 636 to 650 feet

Islands: 4,8,10,13

Collections: 326,342,523,670,753,1732,2190,2383,2391,2648,
2789,2816

Compositae (Composite Family)

Achillea millefolium L.

Yarrow

Weedy borders; 634 feet

Islands: 1,3,6,7,8,12,13,19,21,22

Collections: 223,380,570,1297,1413,1480,1574,1612,1649,1857,
1911,2183

Ambrosia artemisiifolia L.

Common Ragweed

Open areas; 634 to 650 feet

Islands: 1,2,4,6,8,10,11,16,19,21,22

Collections: 2403,2435,2487,2515,2553,2591,2639,2764,2881,
2903,2928,3015,3050,3107

Ambrosia trifida L.

Great Ragweed

Weedy areas; 633 feet

Islands: 2,6

Collections: 2496,2563

Artemisia biennis Willd.

Wormwood

Border of Salix community, Phalaris meadow; 634 feet

Islands: 14,16

Collections: 2827,2916

Artemisia ludoviciana Nutt.

Western Mugwort,

Dry open area; 636 feet

White Sage

Island: 22

Collection: 3106

Artemisia serrata Nutt.

Wormwood

Dry open area; 634 feet

Island: 1

Collection: 2589

Aster ericoides L.

Aster

Weedy area; 633 feet

Island: 6

Collection: 2482

Aster novae-angliae L.

New England Aster

Dry sandy bank bordering thicket; 636 feet

Island: 22

Collection: 3108

Aster ontarionis Wieg.

Aster

Moist to dry alluvial woods and open areas; 632 to 636 feet

Islands: 6,7,9,10,13,14,15,16,17,19,20,21,23

Collections: 611,2349,2642,2698,2721,2801,2833,2857,2868,
2900,2937,3024a,3055,3096

Aster simplex Willd.

Aster

Open area; 636 feet

Island: 19

Collection: 2963

Aster simplex Willd. var. simplex

Aster

Moist sand of shorelines; 634 feet

Islands: 1,6,9,18

Collections: 2484,2597,2669,2972

Bidens cernua L.

Stick-tight

Moist sand of shorelines and marshy areas; 632 to 636 feet

Islands: 1,2,3,4,6,9,10,12,14,16,18,20,21,22,23

Collections: 733,2438,2463,2536,2557,2574,2606,2611,2667,
2689,2716,2717,2720,2756,2758,2796,2825,2911b,2999,3046,
3056,3093,3119

Bidens comosa (Gray) Wieg.

Beggar-ticks,

Border of Salix community, 636 feet

Stick-tights

Island: 14

Collection: 2825a

Bidens connata Muhl. var.

Beggar-ticks,

petiolata (Nutt.) Farw.

Stick-tights

Moist sand of shorelines and marshy areas; 633 feet

Islands: 2,6,9,10,15,16

Collections: 737,2539,2557a,2689a,2720a,2851,2911a

Bidens frondosa L.

Beggar-ticks

Moist sand of shorelines and marshy areas; 632 to 636 feet

Islands: 2,3,4,7,8,13,14,16,18,19,20,21

Collections: 537,2365,2382,2556,2613,2798,2836,2911,2961,

2994,3045,3059

Bidens vulgata Greene

Beggar-ticks,

Border of Salix community; 636 feet

Stick-tights

Island: 14

Collection: 2836a

Cirsium arvense (L.) Scop.

Canadian Thistle

Open areas and weedy borders; 634 feet

Islands: 1,2,4,7,14

Collections: 1540,1625,1688,2151,2350

Cirsium vulgare (Savi) Tenore

Bull Thistle

Open areas, weedy borders, and alluvial woods; 636 feet

Islands: 7,9,10,13,16

Collections: 378,478,567,647,2159,2170,2531,2894

Erechtites hieracifolia (L.) Raf.

Filewort

Alluvial woods; 634 feet

Islands: 3,9,12,16,17,21

Collections: 2607,2709,2755,2859,2897,3047

Erigeron annuus (L.) Pers.

Daisy Fleabane

Moist to dry weedy borders and open areas; 632 to 636 feet

Islands: 1,2,3,4,5,6,10,11,12,13,17,19,20,21,22

Collections: 188,211,269,573,1196,1295,1459,1501,1604,1651,
1700,1719,1818,1871,1925,2051,2723,2753,2770,3024,3026Erigeron canadensis L.

Horseweed

(Conyza canadensis (L.) Cron.)

Weedy borders and dry open areas; 632 to 646 feet

Islands: 1,2,3,4,6,7,8,9,10,11,12,13,14,15,16,17,18,19,21,
22,23Collections: 323,341,368,386,410,422,460,536,607,651,674,
1772,1820,1873,1903,1922,1954,2114,2171,2187,2309,2394,
2406,2429,2442,2509,2527,2544,2595,2614,2665,2718,2773,
2822,2847,2887,2942,2975,3076Erigeron philadelphicus L.

Fleabane

Alluvial woods; 632 to 635 feet

Islands: 7,11,18

Collections: 185,1267,1270,1415

Erigeron strigosus Muhl.

Daisy Fleabane

Weedy borders and dry open areas; 633 to 642 feet

Islands: 4,7,8,9,10,12

Collections: 225,338,403,454,688,711,1516,1569,1809

Eupatorium maculatum L.

Joe-pye-weed

Moist alluvial woods and borders; 633 to 635 feet

Islands: 4,7,9,16

Collections: 438,439,612,2169,2325,2474

Eupatorium perfoliatum L.

Boneset

Moist sand of marshy areas and Salix borders; 633 to 635 feet

Islands: 1,3,6,7,9,14

Collections: 372,511,2153,2324,2493,2584,2616

Eupatorium rugosum Houtt.

White Snakeroot

Alluvial woods; 634 to 646 feet

Islands: 8,9,10,12,16,17,19,20,22,23

Collections: 618,624,655,722,2427,2520,2637,2643,2662,2745,
2865,2895,2935,3066,3074,3102Galinsoga ciliata (Raf.) Blake

--

Moist sand of Salix community and Phalaris meadow; 634 feet

Island: 20

Collection: 2060

Gnaphalium obtusifolium L.

Catfoot

Dry open area; 640 feet

Island: 22

Collection: 3105

Helenium autumnale L.

Sneezeweed

Borders of alluvial woods and Salix communities; 633 to 638
feet

Islands: 1,4,6,7,10,17,18,19,20,21

Collections: 708,2317,2581,2719,2759,2866,2931,2973,3023,
3068Heliopsis helianthoides (L.) Sweet

Ox-eye

Dry sand of Salix community; 636 feet

Island: 13

Collection: 2195

Lactuca biennis (Moench) Fern.

Wild Lettuce

Alluvial woods; 635 feet

Island: 16

Collection: 621

Lactuca canadensis L.

Wild Lettuce

Dry weedy borders and open areas; 635 to 640 feet

Islands: 4,7,10,12,13,16,17,20,22,23

Collections: 637,2046,2351,2446,2638,2748,2787,2790,2806,
2968,3051,3085,3103Lactuca scariola L.

Prickly Lettuce

Dry weedy borders and open areas; 634 to 648 feet

Islands: 2,4,7,8,9,10,12,13,16,23

Collections: 325,385,543,676,723,2191,2407,2423,2562,2677,
2731,2746,2791,2811,2902,3085aRudbeckia laciniata L.

Coneflower

Alluvial woods; 635 feet

Island: 16

Collections: 617,2168,2909

Solidago altissima L.

Goldenrod

(Solidago canadensis L. var. scabra (Muhl.) T. & G.)

Open areas and weedy borders; 634 feet

Islands: 1,2,3,4,10,21

Collections: 2564,2600,2617,2641,2760,3017a

Solidago canadensis L. var. hageri Fern. Goldenrod

Open area; 636 feet

Island: 10

Collection: 2511a

Solidago gigantea Ait. var. gigantea Goldenrod

Open areas and weedy borders; 634 to 640 feet

Islands: 4,6,8,10,18,19,21

Collections: 2379,2447,2492,2511,2940,2974,3017

Solidago gigantea Ait. Goldenrod

appr. var. gigantea

Open areas and weedy borders; 634 to 640 feet

Islands: 1,10,22

Collections: 726,2600a,3101

Solidago gigantea Ait. Goldenrod

var. serotina (Kuntze) Cron.

Open areas and weedy borders; 634 to 640 feet

Islands: 4,7,8,9,10,12,17,20,23

Collections: 289,384,472,660,698,2300,2416,2428,2651,2676,
2734,2760a,2870,3053,3097

Tanacetum vulgare L. Tansy

Weedy area at edge of Salix community; 633 feet

Island: 6

Collection: 2498

Taraxacum officinale Weber Common Dandelion

Moist to dry shorelines and open areas; 632 to 646 feet

Islands: 2,3,4,7,8,11,13,16,19,22

Collections: 92,93,94,95,96,101,102,103,896,922,940,978,995,
1018,1029,1064,1105,1194,1372

Tragopogon dubius Scop. Goat's-beard

Dry open areas; 642 feet

Islands: 8,10,11,12,13,22

Xanthium strumarium L.

Cocklebur

Dry open areas; 633 to 642 feet

Islands: 1,2,4,6,7,8,9,12,13,14,17,18,19,21,22

Collections: 704,2297,2358,2386,2420,2504,2551,2594,2711,
2757,2799,2804,2831,2869,2875,2934,2962,3003,3039,3120

Convolvulaceae (Convolvulus Family)

Convolvulus sepium L.

Hedge Bindweed, Wild

Open areas; 634 feet

Morning-glory

Islands: 1,3,4,5,6,8,9,11,12,15,16,18,19

Collections: 241,474,597,1476,1486,1539,1570,1629,1642,
1825,1937,1996,2124

Cornaceae (Dogwood Family)

Cornus obliqua Raf.

Silky Dogwood

Shorelines and borders of alluvial woods; 633 feet

Islands: 4,5,6,7,8,9,10,11,12,16

Collections: 152,169,221,317,358,497,686,764,1383,1402,
1442,1512Cornus rugosa Lam.

Round-leaved Dogwood

Alluvial woods; 638 feet

Island: 8

Collection: 1101

Cornus stolonifera Michx.

Red Osier

Shorelines and borders of alluvial woods; 633 feet

Islands: 1,3,4,12,13,15,17

Collections: 576,969,982,1030,1241,1396,1519,1608,1671,1803

Crassulaceae (Orpine Family)

Sedum sarmentosum Bunge

Stonecrop

Open area; 634 feet

Island: 21

Collection: 1316

Cruciferae (Mustard Family)

Barbarea vulgaris R. Br.

Yellow Rocket

Moist sand of slough and river shorelines; 632 to 635 feet

Islands: 1,2,4,5,9,11,12,18,19,21

Collections: 120,140,141,234,292,942,966,989,1019,1036,1109,
1268,1313,1503Berteroa incana (L.) DC.

Hoary Alyssum

Dry open area; 636 feet

Island: 8

Collection: 1556

Brassica nigra (L.) Koch

Black Mustard

Moist sand of shorelines and open areas; 632 to 634 feet

Islands: 1,6,10,11,14,16

Collections: 215,1605,1736,2154,2166,2494

Capsella bursa-pastoris (L.) Medic.

Shepherd's-purse

Moist sand along slough; 632 feet

Island: 11

Collection: 100

Cardamine pensylvanica Muhl.

Bitter Cress

Moist sand of shorelines and alluvial woods; 633 feet

Islands: 1,3,11,12,15,17,18,21

Collections: 99, 144, 961, 975, 1244, 1272, 1293, 1312, 1338, 1596,
1668, 1810

Erysimum cheiranthoides L.

Wormseed Mustard

Weedy open areas; 634 to 642 feet

Islands: 4, 6, 7, 8, 9, 10, 11, 17, 19, 22, 23

Collections: 162, 186, 263, 288, 363, 653, 718, 924, 950, 1052, 1134,
1392, 1477, 1478, 1726, 1791, 1829, 1876, 1881, 1910, 2116, 2495

Lepidium densiflorum Schrad.

Peppergrass

Dry open areas; 634 to 646 feet

Islands: 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 17, 19, 21, 23

Collections: 148, 198, 262, 505, 943, 1027, 1082, 1106, 1139, 1168,
1192, 1209, 1305a, 1344, 1412, 1492, 1655, 1817, 1836, 1924, 1945

Lepidium virginicum L.

Poor Man's Pepper

Dry open areas; 634 to 646 feet

Islands: 1, 4, 6, 7, 8, 9, 10, 13, 17, 21, 22

Collections: 301, 340, 366, 367, 533, 650, 672, 695, 724, 1195, 1305,
1408, 1466, 1613, 1859, 2111, 2389, 2680

Rorippa palustris (L.) Bess.

Yellow Cress

subsp. glabra (O. E. Schulz) Stuckey

var. fernaldiana (Butt. & Abbe) Stuckey

Moist sand of shorelines; 632 to 634 feet

Islands: 1, 2, 6, 7, 8, 10, 11, 12, 13, 14, 16, 17, 18, 21

Collections: 118, 143, 213, 391, 534, 602, 1086, 1158, 1233, 1292,
1340, 1381, 1414, 1460, 1602, 1694, 1756, 1805, 1966, 1989, 2021, 2115,
3011

Sisymbrium altissimum L.

Tumbling Mustard

Dry open area; 636 feet

Island: 7

Collection: 1038

Cucurbitaceae (Gourd Family)

Echinocystis lobata (Michx.) T. & G. Wild or Prickly

Alluvial woods and borders; 634 feet Cucumber

Islands: 4,6,15,16,18,20,21

Collections: 592,1987,2040,2448,2501,2776,2843,2919,2986,
3049

Sicyos angulatus L.

Bur-cucumber

Alluvial woods and borders; 634 feet

Islands: 4,6,9,12,14,16,19,20,22,23

Collections: 311,631,2165,2472,2500,2712,2730,2772,2835,
2893,2920,2953,3060,3099,3117

Cuscutaceae (Dodder Family)

Cuscuta sp.

Dodder

On various herbs and shrubs-Solidago, Lycopus, Salix

Islands: 1,2,4,7,9,17,18

Collections: 2303,2327,2328,2473,2568,2587,2588,2713,2779,
2969,2992

Euphorbiaceae (Spurge Family)

Acalypha rhomboidea Raf.

Three-seeded Mercury

Weedy areas; 633 to 638 feet

Islands: 6,14,20,22

Collections: 2486,2826,3069,3122

Euphorbia maculata L.

Eyebane

Dry open areas; 634 feet

Islands: 2,4,6,7,12,19,21

Collections: 346,1797,1918,2296,2361,2436,2483,2545,2727,
2794,2959,3016

Euphorbia supina Raf.

Milk-purslane

Open areas; 633 to 640 feet

Islands: 1,3,8,17,18,19,20,21,22

Collections: 696,1618,1644,1875,1902,1957,2010,2048,2110

Fagaceae (Beech Family)

Quercus bicolor Willd.

Swamp White Oak

Alluvial woods, Salix communities; 633 to 640 feet

Islands: 9,10,11,12,17,19

Collections: 229,243,481,727,1115,1148,1353,1398,1929,2096,
2633,2703,2739,2936,2970

Quercus velutina Lam.

Black Oak

Dry open areas and borders of alluvial woods; 636 to 648 feet

Islands: 11,12,13,16,19,20,21,22

Collections: 150,206,581,895,918,1200,2733,2802,2812,2896,
2952,3020,3063,3110

Geraniaceae (Geranium Family)

Geranium carolinianum L.

Cranesbill

Dry open area; 644 feet

Island: 13

Collections: 1177,1178

Juglandaceae (Walnut Family)

Juglans nigra L.

Black Walnut

Alluvial woods; 636 feet

Islands: 9,12

Collections: 238,1128,1802,2751

Labiatae (Mint Family)

Glechoma hederacea L.

Ground-ivy

var. parviflora Druce

Alluvial woods; 633 feet

Island: 11

Collection: 129

Hedeoma hispida Pursh

Mock Pennyroyal

Open areas; 638 feet

Islands: 21,22

Collections: 1294,1874,1955

Lycopus americanus Muhl.

Water-horehound

Salix communities and shorelines; 632 to 636 feet

Islands: 1,4,7,9,10,11,13,16,20,21

Collections: 247,352,374,406,464,572,729,1601,1721,1763,
1967,2059,2177,2197,2310,2326,2640Lycopus virginicus L.

Water-horehound,

Salix communities and shorelines;

Bugleweed

634 feet

Islands: 7,8,10,13

Collections: 709,2199,2298a,2375

Mentha arvensis L.

Mint

Salix communities and shorelines; 632 to 636 feet

Islands: 7,9,10,13,16,17,19,21

Collections: 281,387,411,413,444,445,446,552,553,731,1938,
1972,2104,2176,2198,2298

Monarda punctata L.

Dotted Monarda,

Dry open areas; 640 feet

Horsemint

Islands: 1,12,16,21,22,23

Collections: 1863,1952,2172,2592,2747,3073

Nepeta cataria L.

Catnip

Dry open areas; 634 feet, 640 feet

Islands: 7,10

Collections: 355,1749

Physostegia formosior Lunell

False Dragonhead

Salix communities and shorelines; 633 feet

Islands: 3,7,8,9,13,18,19

Collections: 495,569,2200,2354,2376,2624,2955,3000

Scutellaria galericulata L.

Common Skullcap

(Scutellaria epilobiifolia A. Hamilton)

Salix communities and shorelines; 633 feet

Islands: 6,7

Collections: 414,1434,2340

Scutellaria lateriflora L.

Mad-dog Skullcap

Salix communities and shorelines; 633 feet

Islands: 4,6,7,9,10,13,16,17,19

Collections: 414a,462,470,550,629,738,739,2105,2175,2204,
2304,2456,2668,2722,2954

Stachys hispida Pursh

Hedge-nettle

Salix communities and shorelines; 632 to 636 feet

Islands: 2,6,7,9,12,13,15,16,18,20,21

Collections: 408,442,443,463,551,630,1702,1796,1963,2007,
2081,2129,2140,2178,2490,2555Stachys tenuifolia Willd.

Hedge-nettle

Alluvial woods; 636 feet

Island: 10

Collection: 2646

Teucrium canadense L.

Germander, Wood-sage

var. virginicum (L.) Eat.Moist to dry sand of alluvial woods and weedy borders; 634
to 646 feet

Islands: 2,4,8,9,12,13,16,17,19,20,21,22,23

Collections: 283,334,336,1514,1695,1707,1784,1801,1826,
1828,1842,1864,1883,1896,1962,2042,2164,2188,2417

Leguminosae (Pulse Family)

Amorpha fruticosa L.

False or Bastard

Shorelines and borders of alluvial woods; 633 feet Indigo

Islands: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,21

Collections: 136,153,204,345,347,359,412,477,499,554,701,
714,967,986,994,1016,1049,1073,1095,1118,1146,1197,1214,
1224,1250,1309,1458,1511Apios americana Medic.

Wild Bean, Groundnut

Border of alluvial woods; 634 feet

Islands: 3,16

Collections: 2608,2910

Astragalus canadensis L.

Milk Vetch

Border of alluvial woods; 636 feet

Island: 9

Collection: 1792

Lathyrus palustris L.

Vetchling

Moist sand of Salix community; 632 feet

Island: 7

Collection: 1416

Medicago lupulina L.

Black Medick

Weedy areas bordering alluvial woods; 636 feet

Islands: 8,10,11,12

Collections: 171,232,1160,1578

Melilotus alba Desr.

White Sweet Clover

Dry open areas; 634 to 650 feet

Islands: 4,6,7,8,9,10,11,12,13,16,17,19

Collections: 170,187,220,284,328,415,510,538,635,654,677,
712,1187,1475,1543,1557,1722,1753,1907,2388

Melilotus officinalis (L.) Lam.

Yellow Sweet Clover

Dry open areas; 634 to 644 feet

Islands: 4,8,10,12,13,16

Collections: 190,224,1157,1185,1374,1544,1546,1580,1821

Robinia pseudo-acacia L.

Black Locust

Dry sand bordering alluvial woods; 638 feet

Islands: 4,8,11,16

Collections: 154,662,1093,1377,2783

Strophostyles helvola (L.) Ell. Wild Bean

Dry open areas; 634 to 637 feet

Islands: 2,4,8,19

Collections: 1897,2374,2469,2566,2781

Trifolium pratense L. Red Clover

Weedy area bordering alluvial woods; 636 feet

Island: 11

Collection: 159

Trifolium repens L. White Clover

Open areas; 635 feet

Islands: 4,7,10,11,18

Collections: 146,1289,1423,1547,1728,1757

Malvaceae (Mallow Family)

Abutilon theophrasti Medic. Velvet-leaf

Weedy borders of shores and alluvial woods; 634 feet

Islands: 9,14,16

Collections: 2706,2840,2925

Menispermaceae (Moonseed Family)

Menispermum canadense L. Moonseed

Alluvial woods; 636 feet

Islands: 9,12,13,23

Collections: 1259,2691,2752,3086

Moraceae (Mulberry Family)

Morus alba L. White Mulberry

Alluvial woods

Islands: 2,3,4,10,11,13,19,21,22

Collections: 161,299,583,742,908,913,919,920,983,1006,1024,
1258,1336,2966

Nyctaginaceae (Four-o'clock Family)

Mirabilis nyctaginea (Michx.) MacM. Four-o'clock

Dry open areas; 634 to 644 feet

Islands: 2,4,8,9,11,12,13,21

Collections: 164,181,218,295,468,1104,1108,1180,1219,1308,
1534,1711

Oleaceae (Olive Family)

Fraxinus pennsylvanica Marsh. Red or Green Ash

Alluvial woods

Islands: 1,2,3,4,5,6,7,8,9,10,11,12,13,15,16,17,19,20,21,
22,23

Collections: 123,165,207,226,361,500,556,640,681,757,878,
886,946,973,985,1007,1010,1028,1044,1092,1123,1174,1188,
1220,1234,1330,1352,1367,1471,1509,1845,2044

Onagraceae (Evening Primrose Family)

Epilobium glandulosum Lehm. Willow-herb, Fireweed

Moist sand of Salix community; 633 feet

Island: 7

Collections: 416,2352

Oenothera biennis L. Evening Primrose

subsp. caeciarum Munz.

Dry open areas and weedy borders of Salix communities and
alluvial woods; 633 to 650 feet

Islands: 1,2,3,4,6,7,8,9,10,11,12,13,16,17,18,19,20,21

Collections: 246,265,353,389,506,507,508,542,591,610,634,
656,765,2179,2301,2346,2368,2384,2413,2433,2450,2471,2491,
2497,2512,2524,2542,2561,2599,2618,2660,2661,2737,2765,
2807,2819,2860,2890,2917,2932,2984,3001,3043,3067

Oenothera rhombipetala Nutt.

Evening Primrose

Dry open area; 648 feet

Island: 19

Collection: 1916

Oxalidaceae (Wood Sorrel Family)

Oxalis europaea Jord.

Wood Sorrel, Lady's

Weedy areas bordering alluvial woods and Sorrel

Salix communities; 634 to 650 feet

Islands: 1,4,7,9,11,16,17,18,19,20,21,23

Collections: 177,300,449,1370,1390,1400,1527,1609,1854,1909,
1931,1946,1970,1983,2012,2036

Oxalis stricta L.

Wood Sorrel, Lady's

Weedy areas bordering alluvial woods and Sorrel

Salix communities; 634 to 636 feet

Islands: 3,8,14,18,21,22

Collections: 1103,1229,1274,1287,1298,1304,1667,1867

Plantaginaceae (Plantain Family)

Plantago major L.

Common Plantain

Moist sand of Salix communities; 633 feet

Islands: 7,11,14,17

Collections: 249,2106,2149,2344,2366

Plantago rugelii Dcne.

Plantain

Moist sand of Salix communities; 633 feet

Island: 13

Collection: 535

Polygonaceae (Buckwheat Family)

Polygonum aviculare L.

Knotweed

Dry open area; 634 feet

Island: 9

Collection: 457

Polygonum coccineum Muhl.

Smartweed

Moist sand bordering Phalaris meadow; 634 feet

Island: 16

Collection: 589

Polygonum erectum L.

Knotweed

Dry open areas; 634 to 640 feet

Islands: 4,10,13,16

Collections: 2529,2775,2800,2915

Polygonum hydropiper L.

Common Smartweed

Moist sand bordering Salix community; 633 feet

Islands: 4,10

Collections: 2652,2769

Polygonum lapathifolium L.

Smartweed

Moist sand along shorelines and marshy areas; 632 to 636 feet

Islands: 1,2,3,4,6,7,8,9,10,11,12,14,16,18,20,21,22

Collections: 253,392,465,486,603,689,735,1689,1742,2003,

2018,2075,2148,2157,2174,2302,2313,2341,2377,2419,2477,2534,

2543, 2569, 2577, 2626, 2666, 2690, 2696, 2741, 2797, 2824, 2888,
2912, 2989, 3030, 3118

Polygonum pensylvanicum L.

Pinkweed

Moist sand along shorelines and marshy areas; 632 to 636 feet

Islands: 1, 4, 7, 9, 12, 14, 15, 16, 19, 21, 22

Collections: 2148a, 2174a, 2302a, 2585, 2675, 2687, 2696a, 2740,
2774, 2850, 2907, 2918, 2948, 3030a, 3118a

Polygonum punctatum Ell.

Water Smartweed

Moist sand of alluvial woods and shorelines; 633 feet

Islands: 1, 4, 21, 23

Collections: 2455, 2572, 3037, 3090

Polygonum scandens L.

Climbing False

Dry open areas; 634 to 640 feet

Buckwheat

Islands: 2, 3, 4, 6, 8, 9, 10, 11, 12, 13, 16, 17, 19, 23

Collections: 466, 545, 546, 632, 690, 745, 2193, 2393, 2412, 2434,
2441, 2480, 2519, 2565, 2620, 2636, 2678, 2699, 2732, 2792, 2809, 2861,
2889, 2905, 2914, 2965, 3075

Rumex acetosella L.

Sheep-Sorrel

Open areas; 634 feet

Islands: 1, 2, 4, 6

Collections: 962, 990, 1473, 1623, 1710, 2468

Rumex crispus L.

Yellow or Curly Dock

Moist sand of slough and river shorelines; 632 to 636 feet

Islands: 2, 7, 8, 9, 10, 11, 12, 13, 17, 19, 22

Collections: 98, 139, 210, 398, 469, 540, 541, 1577, 1699, 1725, 1735,
1787, 1807, 1860, 1908, 2101, 2201, 2518

Rumex mexicanus Meisn.

Dock

Moist sand of river shoreline; 633 feet

Island: 9

Collection: 1788

Rumex orbiculatus Gray

Water Dock

Moist sand bordering slough; 632 feet

Island: 1

Collection: 2576

Rumex patientia L.

Patience Dock

Moist sand bordering Salix community; 634 feet

Island: 17

Collection: 257

Rumex verticillatus L.

Swamp Dock

Moist sand bordering shoreline; 633 feet

Islands: 11,20

Collections: 214,2056

Primulaceae (Primrose Family)

Lysimachia ciliata L.

Loosestrife

Alluvial woods; 636 feet

Islands: 4,12,19,23

Collections: 293,1794,1830,1898

Lysimachia hybrida Michx.

Loosestrife

Alluvial woods; 636 feet

Island: 21

Collection: 3048

Lysimachia terrestris (L.) BSP.

Swamp Loosestrife,

Moist sand of Salix community;

Swamp Candles

632 feet

Island: 1

Collection: 1621

Ranunculaceae (Crowfoot Family)

Anemone canadensis L.

Anemone

Salix community; 637 feet

Island: 18

Collection: 2011

Ranunculus abortivus L.

Kidneyleaf Buttercup

Alluvial woods; 636 feet

Islands: 11,12,13,22

Collections: 128,233,909,1165,1261

Ranunculus pensylvanicus L. f.

Bristly Crowfoot

Moist sand bordering marshy area; 633 feet

Islands: 1,7,9,12,17

Collections: 405,441,1603,1813,2102,2359

Rosaceae (Rose Family)

Geum laciniatum Murr.

Avens

Moist sand of alluvial woods and borders of Salix communities; 633 to 635 feet

Islands: 4,7,8,11,17

Collections: 184,297,313,1391,1406,1517,1559,2439

Potentilla argentea L.

Silvery Cinquefoil

Dry open area; 636 feet

Island: 21

Collection: 1306

Potentilla norvegica L.

Cinquefoil, Five-

Open areas; 632 to 634 feet

Finger

Islands: 1,2,3,4,6,7,9,10,11,13,17,22

Collections: 97,212,264,277,407,450,549,1417,1483,1520,1615,
1650,1705,1740,1770,1872,2362,2803

Prunus americana Marsh.

Wild Plum

Alluvial woods; 640 feet

Island: 11

Collection: 216

Prunus serotina Ehrh.

Wild or Black Cherry

Alluvial woods; 638 feet

Islands: 8,10,11,12

Collections: 149,1097,1213,1746

Prunus virginiana L.

Choke Cherry

Alluvial woods; 635 feet

Island: 4

Collection: 1025

Rosa acicularis Lindl.

Rose

Dry open area; 636 feet

Island: 21

Collection: 1314

Rosa blanda Ait.

Rose

Alluvial woods; 636 feet

Islands: 9,10,13

Collections: 475,1112,1136,1182

Rubus flagellaris L.

Northern Dewberry

Dry open area; 635 feet

Island: 3

Collections: 988, 1639

Rubus occidentalis L.

Black Raspberry

Weedy areas bordering alluvial woods; 636 feet

Islands: 2, 4, 5, 7, 8, 10, 11, 12, 19, 22, 23

Collections: 156, 205, 237, 298, 354, 661, 947, 1046, 1065, 1133,
1405, 1496, 1538, 1704, 1862, 3098

Rubiaceae (Madder Family)

Cephalanthus occidentalis L.

Buttonbush

Shorelines and borders of alluvial woods; 634 feet

Islands: 3, 4, 7, 9, 10, 12, 16, 19

Collections: 309, 356, 479, 1670, 1745, 1773, 1816, 1934, 2160

Galium aparine L.

Spring Cleavers

Moist sand of Salix communities and alluvial woods; 633 feet

Islands: 4, 11, 17, 19

Collections: 125, 131, 952, 1023, 1357

Galium obtusum Bigel.

Bedstraw, Cleavers

Moist sand of Salix communities and alluvial woods; 632 to
636 feet

Islands: 1, 4, 6, 7, 8, 11, 17, 21, 22

Collections: 183, 291, 1317, 1349, 1401, 1452, 1518, 1566, 1620, 1882

Galium tinctorium L.

Bedstraw, Cleavers

Moist sand of Salix community; 633 feet

Island: 7

Collections: 401,1430

Salicaceae (Willow Family)

Populus deltoides Marsh.

Cottonwood

Alluvial woods

Islands: 2,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,21,22

Collections: 113,166,197,228,270,296,315,365,575,665,741,

901,931,997,1032,1058,1068,1120,1149,1226,1251,1275,1334,

1380,1424,1479,1499,1536,2026

Salix amygdaloides Anderss.

Peach-leaved Willow

Shorelines and borders of alluvial woods

Islands: 2,4,7,8,10,11,12,13,15,17,19,21,22

Collections: 114,115,117,193,331,703,715,883,894,928,1004,

1033,1067,1151,1239,1252,1260,1332,1388,1426,1884

Salix fragilis L.

Crack Willow

Moist sand of shoreline

Island: 16

Collection: 1361

Salix interior Rowlee

Sandbar Willow

Shorelines and borders of alluvial woods

Islands: 2,4,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22

Collections: 18,116,137,259,260,333,409,484,559,590,763,885,

887,948,1003,1008,1011,1051,1054,1056,1057,1089,1124,1130,

1131,1135,1152,1171,1173,1191,1203,1206,1228,1230,1253,1255,

1269,1273,1277,1324,1325,1346,1347,1363,1375,1376,1463,1464,

1815,1915,2009,2061,2062,2097

Salix nigra Marsh.

Black Willow

Shorelines and borders of alluvial woods

Islands: 2,6,7,8,12,16,19,20

Collections: 191,644,664,953,1002,1055,1091,1362,1440,2063

Salix rigida Muhl.

Willow

Shorelines and borders of alluvial woods

Islands: 1,2,3,4,6,7,8,9,10,11,12,17

Collections: 121,178,271,339,476,702,743,759,965,974,980,
1000,1005,1021,1048,1122,1218,1348,1448,2098

Saxifragaceae (Saxifrage Family)

Penthorum sedoides L.

Ditch Stonecrop

Moist sand of Salix communities and alluvial woods; 633 feet

Islands: 4,7,20

Collections: 399,2058,2316,2348,2457

Ribes americanum Mill.

Wild Black Currant

Alluvial woods and weedy borders; 634 feet

Islands: 7,9,11,12,13,16,17,19,22

Collections: 110,126,236,266,496,574,619,882,900,902,904,
921,932,934,954,1053,1125,1356,1373,1404,2095

Scrophulariaceae (Figwort Family)

Gerardia tenuifolia Vahl

Gerardia

Moist sand along shorelines; 633 feet

Islands: 6,7,8,9,10

Collections: 710,2307,2364,2373,2481,2506,2540,2670

Linaria canadensis (L.) Dumont

Old-field Toadflax

Dry open areas; 646 feet

Islands: 19,22,23

Collections: 899,956,1839,1841,1861

Linaria vulgaris Hill

Butter-and-Eggs

Weedy areas bordering Salix communities and alluvial woods;
633 to 642 feet

Islands: 6,7,9,10,13,18,19,21,22

Collections: 375,1436,1783,1856,1906,1950,2182,2517,2983

Lindernia dubia (L.) Pennell

False Pimpernel

Moist sand along shorelines; 633 feet

Islands: 1,3,6,7,10,15,16,17,18,20,21

Collections: 393,600,1438,1597,1622,1669,1743,1968,2023,
2071,2108,2127

Mimulus ringens L.

Monkey Flower

Moist sand of Salix communities and shorelines; 633 feet

Islands: 1,7,10,11,12,15,17,19,20,21

Collections: 248,396,707,1598,1741,1814,1936,1941,1959,2037,
2103,2132

Scrophularia marilandica L.

Figwort

Alluvial woods; 635 feet

Islands: 4,16,23

Collections: 312,623,3095

Verbascum thapsus L.

Common Mullein

Dry open areas; 637 to 646 feet

Islands: 4,7,8,10,12,13,22,23

Collections: 219,321,400,520,1568,1748,1824,1833,1855

Veronica peregrina L. var. peregrina

Purslane Speedwell

Moist sand along shorelines; 632 to 635 feet

Islands: 6,11,13,14,18

Collections: 105, 1167, 1199a, 1231, 1285, 1482a

Veronica peregrina L.

Purslane Speedwell

var. xalapensis (HBK) Pennell

Moist sand along shorelines; 632 to 635 feet

Islands: 1, 4, 6, 8, 10, 11, 13, 17, 18, 19, 21, 22

Collections: 105a, 925, 955, 964, 1031, 1079, 1140, 1199, 1290, 1296,
1342, 1482

Solanaceae (Nightshade Family)

Solanum carolinense L.

Horse-nettle

Dry open areas; 636 feet

Islands: 4, 8

Collections: 1541, 1558, 1581

Solanum dulcamara L.

European Bittersweet,

Open areas, Salix communities,

Nightshade

and alluvial woods; 633 to 646 feet

Islands: 1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21,
23

Collections: 107, 142, 147, 194, 267, 335, 360, 502, 577, 593, 636,
652, 744, 938, 1034, 1050, 1071, 1117, 1147, 1170, 1189, 1208, 1225,
1249, 1271, 1329, 1345, 1360, 1465, 1498, 1595, 1843, 1940, 1971, 2008,
2080, 2118, 2392, 2685

Solanum nigrum L.

Black Nightshade

Moist sand of Salix communities and alluvial woods; 633 to
636 feet

Islands: 2, 3, 4, 8, 9, 10, 11, 14, 16, 17, 18, 19, 20, 21, 22

Collections: 420, 601, 751, 1657, 1675, 1779, 1880, 1965, 1982, 2020,

2038, 2091, 2147, 2430, 2609, 2778, 2830, 2863, 2933, 2941, 2985, 3032

Tiliaceae (Linden Family)

Tilia americana L.

Basswood, Linden

Alluvial woods

Islands: 7, 11

Collections: 180, 1403

Ulmaceae (Elm Family)

Celtis occidentalis L.

Hackberry

Alluvial woods

Islands: 5, 11, 16, 20, 22, 23

Collections: 179, 903, 1385, 1495, 1846, 2050, 3080

Ulmus americana L.

American Elm

Alluvial woods

Islands: 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22,
23

Collections: 130, 167, 195, 196, 279, 307, 310, 483, 498, 557, 578,
641, 643, 666, 755, 756, 881, 893, 905, 915, 916, 930, 949, 981, 1001,
1015, 1045, 1119, 1142, 1162, 1216, 1217, 1236, 1238, 1247, 1280, 1282,
1326, 1365, 1368, 1394, 1441, 1446, 1454, 1638, 1664, 1847, 1888, 1899,
1920, 2832, 2874

Umbelliferae (Parsley Family)

Cicuta bulbifera L.

Water Hemlock

Moist sand of marshy areas; 632 feet

Islands: 1, 7, 10

Collections: 730, 2339, 2571

Cryptotaenia canadensis (L.) DC.

Honewort

Alluvial woods; 635 feet

Island: 16

Collections: 613, 1369

Daucus carota L.

Queen Anne's Lace

Open weedy area; 636 feet

Island: 10

Collection: 2522

Sium suave Walt.

Water Parsnip

Moist sand bordering Salix community; 633 feet

Island: 17

Collection: 2867

Urticaceae (Nettle Family)

Boehmeria cylindrica (L.) Sw.

False Nettle, Bog-hemp

Moist sand of alluvial woods; 633 feet

Islands: 1, 2, 3, 4, 7, 9, 10, 13, 15, 17, 19, 20, 21, 22, 23

Collections: 337, 485, 566, 1523, 1606, 1641, 1685, 1720, 1780, 1853,
1890, 1935, 1964, 2076, 2094, 2139, 2353, 2645, 2714, 2786

Laportea canadensis (L.) Wedd.

Wood Nettle

Alluvial woods; 633 to 636 feet

Islands: 4, 15, 16, 18

Collections: 316, 646, 1524, 2005, 2138, 2162, 2845

Parietaria pensylvanica Muhl.

Pellitory

Weedy areas; 636 feet

Islands: 20, 22

Collections: 1886, 2047

Pilea pumila (L.) Gray

Clearweed

Moist sand of alluvial woods; 632 to 636 feet

Islands: 1,4,16,18,20,23

Collections: 1988,2458,2573,2892,3057,3089

Urtica dioica L.

Stinging Nettle

Alluvial woods; 632 to 636 feet

Islands: 1,2,4,9,15,16,17,18,20,21

Collections: 278,318,492,587,645,1393,1523a,1607,1703,1782,
1943,1979,2039,2093,2137,2161,2586,2846

Verbenaceae (Vervain Family)

Lippia lanceolata Michx.

Frog-Fruit

(Phyla lanceolata (Michx.) Greene)

Moist sand of shorelines and alluvial woods; 633 feet

Islands: 5,10,18,21

Collections: 728,1508,1958,3012

Verbena hastata L.

Blue Vervain

Open areas; 633 to 636 feet

Islands: 1,2,4,6,7,8,9,11,18

Collections: 240,330,377,404,471,513,697,1553,1628,1709,
1758,1760,2006,2155,2312,2319,2343,2370a,2381,2702,2724,
2771,3002

Verbena stricta Vent.

Hoary Vervain

Dry open areas; 634 feet, 642 feet

Islands: 2,4,8

Collections: 1708,2387,2785

Verbena urticifolia L.

White Vervain

Moist sand of Salix community; 633 feet

Island: 7

Collection: 2370

Vitaceae (Vine Family)

Parthenocissus vitacea (Knerr) Hitchc. Virginia Creeper,

(Parthenocissus inserta (Kerner) K. Fritsch) Woodbine

Alluvial woods and bordering areas; 634 to 640 feet

Islands: 1,2,3,4,5,6,7,8,9,10,12,13,17,18,19,22

Collections: 222,285,314,362,494,584,683,761,892,935,972,
979,996,1013,1020,1042,1072,1126,1141,1184,1204,1276,1351,
1450,1494

Vitis riparia Michx.

Riverbank or Frost

Alluvial woods and bordering areas; 634 to Grape
640 feet

Islands: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,
20,21,22,23

Collections: 106,160,208,272,329,364,448,493,555,598,639,
663,758,884,891,917,929,970,977,998,1012,1040,1076,1114,
1144,1186,1215,1232,1242,1278,1291,1311,1350,1364,1444,1445,
1493,1840,2064

STATISTICAL SUMMARY

1. Systematic composition of dredge material flora

Taxon	# of Families	# of Genera	# of Species
Equisetophyta	1	1	2
Coniferophyta	1	1	1
Magnoliophyta			
Liliatae	9	39	89
Magnoliatae	53	136	212
Total	64	177	304

2. Largest families with the number of species in each

Gramineae	48	Labiatae	13
Compositae	42	Leguminosae	11
Cyperaceae	29	Cruciferae	10
Polygonaceae	14		

3. Largest genera with the number of species in each

<u>Carex</u>	13	<u>Panicum</u>	6
<u>Cyperus</u>	9	<u>Bidens</u>	5
<u>Polygonum</u>	8	<u>Salix</u>	5
<u>Rumex</u>	6		

INDEX TO THE FAMILIES

	<u>PAGE</u>		<u>PAGE</u>
Aceraceae	76	Crassulaceae	92
Aizoaceae	76	Cruciferae	92
Alismataceae	59	Cucurbitaceae	94
Amaranthaceae	77	Cupressaceae	59
Anacardiaceae	78	Cuscutaceae	94
Apocynaceae	78	Cyperaceae	60
Araceae	60	Equisetaceae	59
Asclepiadaceae	78	Euphorbiaceae	94
Balsaminaceae	79	Fagaceae	95
Betulaceae	79	Geraniaceae	95
Bignoniaceae	79	Gramineae	65
Boraginaceae	80	Iridaceae	74
Campanulaceae	80	Juglandaceae	96
Cannabinaceae	80	Juncaceae	74
Capparidaceae	81	Labiatae	96
Caprifoliaceae	81	Leguminosae	98
Caryophyllaceae	81	Liliaceae	75
Celastraceae	82	Malvaceae	100
Chenopodiaceae	83	Menispermaceae	100
Commelinaceae	60	Moraceae	100
Compositae	83	Nyctaginaceae	101
Convolvulaceae	91	Oleaceae	101
Cornaceae	91	Onagraceae	101

	<u>PAGE</u>
Oxalidaceae	102
Plantaginaceae	102
Polygonaceae	103
Primulaceae	105
Ranunculaceae	106
Rosaceae	106
Rubiaceae	108
Salicaceae	109
Saxifragaceae	110
Scrophulariaceae	110
Smilacaceae	75
Solanaceae	112
Tiliaceae	113
Ulmaceae	113
Umbelliferae	113
Urticaceae	114
Verbenaceae	115
Vitaceae	116

APPENDIX II

INTRODUCTION TO DREDGE MATERIAL SITES

Included in this section are the locations of the 23 dredge material sites that were studied in 1975. The age of the dredge material at the time of the survey is also given, as well as the year in which the deposition occurred. In addition, included in the descriptions are the maximum elevations in feet above mean sea level of the dredge material sites. As stated in previous sections, the elevation of the water's surface in the pool is maintained at 631 feet above mean sea level. With this information the elevation of the site above this level of the pool can be determined.

Line drawings of the dredge material sites accompany the location information. These figures were prepared from overlays of aerial photographs taken on July 10, 1973 by the St. Paul District, Corps of Engineers for the Upper Mississippi River Nine-Foot Channel Project. Several abbreviations are used in designating the types of ground cover present on the dredge material deposition sites. Sandy areas are designated by S. Forested areas dominated by Ulmus americana L. (American elm) and Acer saccharinum L. (silver maple) are designated by F. Rp and B denote areas covered primarily by Salix (willow).

LOCATIONS OF DREDGE MATERIAL SITES

Island 1 (Fig. 5), located in Vernon County, Wisconsin (T14N R7W Sec 32), lies along the west side of the main channel in the southern third of Navigation Pool 8 at river mile 685. The maximum elevation of the 12 year old dredge material, deposited in 1963, was 635 feet above mean sea level.

Island 2 (Fig. 5), located in Vernon County, Wisconsin (T14N R7W Sec 32), lies along the east side of the main channel in the southern third of Navigation Pool 8 at river mile 685.1. The maximum elevation of the 12 year old dredge material, deposited in 1963, was 635 feet above mean sea level.

Island 3 (Fig. 5), located in Vernon County, Wisconsin (T14N R7W Sec 32), lies along the west side of the main channel in the southern third of Navigation Pool 8 at river mile 685.1. The maximum elevation of the 12 year old dredge material, deposited in 1963, was 636 feet above mean sea level.

Island 4 (Fig. 6), located in Vernon County, Wisconsin (T14N R7W Sec 19), lies along the east side of the main channel in the southern third of Navigation Pool 8 at river mile 686.7. The maximum elevation of the 12 year old dredge material, deposited in 1963, was 640 feet above mean sea level.

Island 5 (Fig. 6), located in Vernon County, Wisconsin (T14N R7W Sec 19), lies along the east side of the main channel in the southern third of Navigation Pool 8 at river mile 686.7. The maximum elevation of the 12 year old dredge material, deposited in 1963, was 637 feet above mean sea level.

Island 6 (Fig. 7), located in Vernon County, Wisconsin (T14N R7W Sec 19), lies along the west side of the main channel in the southern third of Navigation Pool 8 at river mile 687.2. The maximum elevation of the eight year old dredge material, deposited in 1967, was 635 feet above mean sea level.

Island 7 (Fig. 7), located in Houston County, Minnesota (T103N R4W Sec 36), lies along the west side of the main channel in the middle third of Navigation Pool 8 at river mile 687.9. The maximum elevation of the five year old dredge material, deposited in 1970, was 636 feet above mean sea level.

Island 8 (Fig. 8), located in Vernon County, Wisconsin (T14N R7W Sec 18), lies along the east side of the main channel in the middle third of Navigation Pool 8 at river mile 688.4. The northern end of the island consisting of eight year old dredge material, deposited in 1967, was 640 feet above mean sea level. The two large open areas located south of this site contained dredge material that was deposited in 1972. The maximum elevation of these three year old areas was 642 feet above mean sea level. The remainder of the

island was composed of five year old dredge material, deposited in 1970. The areas were of similar elevation.

Island 9 (Fig. 9), located in Vernon County, Wisconsin (T14N R7W Sec 18), lies along the east side of the main channel in the middle third of Navigation Pool 8 at river mile 688.8. The maximum elevation of the five year old dredge material, deposited in 1970, was 638 feet above mean sea level.

Island 10 (Fig. 10), located in Vernon County, Wisconsin (T14N R7W Sec 7), lies along the east side of the main channel in the middle third of Navigation Pool 8 at river mile 689.2. The northern end of the island consisting of 13 year old dredge material, deposited in 1962, was 636 feet above sea level. The maximum elevation of the six year old dredge material, deposited in 1969, on the southern end of the island was 640 feet above mean sea level. The remainder of the island was composed of four year old dredge material, deposited in 1971. The maximum elevation of these areas was 644 feet above mean sea level.

Island 11 (Fig. 11), located in Vernon County, Wisconsin (T14N R7W Sec 6), lies along the east side of the main channel in the middle third of Navigation Pool 8 at river mile 690. The northern end of the island consisting of three year old dredge material, deposited in 1972, was 638 feet above sea level. One year old dredge material, deposited in 1974 south of this site, was 650 feet above mean sea level. The maximum elevation of the southern end of the island

consisting of two year old dredge material, deposited in 1973, was 650 feet above mean sea level.

Island 12 (Fig. 12), located in Houston County, Minnesota (T103N R4W Sec 13), lies along the west side of the main channel in the middle third of Navigation Pool 8 at river mile 690.5. The maximum elevation of the six year old dredge material, deposited in 1969, was 650 feet above mean sea level.

Island 13 (Fig. 12), located in Houston County, Minnesota (T103N R4W Sec 13), lies along the west side of the main channel in the middle third of Navigation Pool 8 at river mile 691. The maximum elevation of the five year old dredge material, deposited in 1970, was 650 feet above mean sea level.

Island 14 (Fig. 13), located in Houston County, Minnesota (T103N R4W Sec 13), lies along the west side of the main channel in the middle third of Navigation Pool 8 at river mile 691.6. The maximum elevation of the six year old dredge material, deposited in 1969, was 636 feet above mean sea level.

Island 15 (Fig. 13), located in La Crosse County, Wisconsin (T15N R7W Sec 31), lies along the east side of the main channel in the middle third of Navigation Pool 8 at river mile 691.6. The maximum elevation of the two year old dredge material, deposited in 1973, was 642 feet above mean sea level.

Island 16 (Fig. 13), located in Houston County, Minnesota

(T103N R4W Sec 12), lies along the west side of the main channel in the middle third of Navigation Pool 8 at river mile 691.6. The maximum elevation of the six year old dredge material, deposited in 1969, was 642 feet above mean sea level.

Island 17 (Fig. 14), located in La Crosse County, Wisconsin (T15N R7W Sec 30), lies along the east side of the main channel in the middle third of Navigation Pool 8 at river mile 692.5. The maximum elevation of the ten year old dredge material, deposited in 1965, was 646 feet above mean sea level.

Island 18 (Fig. 15), located in La Crosse County, Wisconsin (T15N R7W Sec 29), lies along the east side of the main channel in the middle third of Navigation Pool 8 at river mile 693.3. The maximum elevation of the 15 year old dredge material, deposited in 1960, was 636 feet above mean sea level.

Island 19 (Fig. 16), located in Houston County, Minnesota (T104N R3W Sec 31), lies along the west side of the main channel in the northern third of Navigation Pool 8 at river mile 694.6. The maximum elevation of the five year old dredge material, deposited in 1970, was 650 feet above mean sea level.

Island 20 (Fig. 17), located in La Crosse County, Wisconsin (T15N R7W Sec 17), lies along the east side of the main channel in the northern third of Navigation Pool 8 at river mile 695. The maximum elevation of the five year old

dredge material, deposited in 1970, was 640 feet above mean sea level.

Island 21 (Fig. 17), located in La Crosse County, Wisconsin (T15N R7W Sec 17), lies along the east side of the main channel in the northern third of Navigation Pool 8 at river mile 695. The maximum elevation of the five year old dredge material, deposited in 1970, was 640 feet above mean sea level.

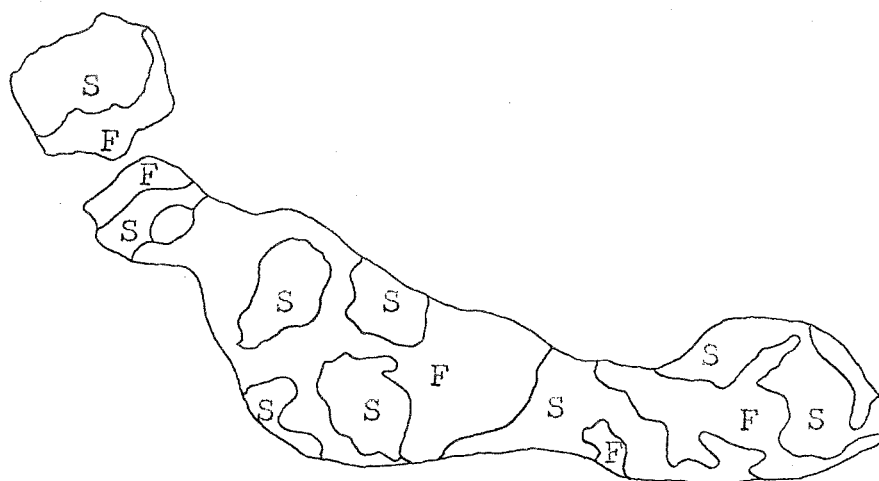
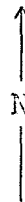
Island 22 (Fig. 18), located in Houston County, Minnesota (T104N R4W Sec 2), lies along the east side of the main channel in the northern third of Navigation Pool 8 at river mile 700. The maximum elevation of the five year old dredge material, deposited in 1970, was 646 feet above mean sea level.

Island 23 (Fig. 19), located in Houston County, Minnesota (T104N R4W Sec 2), lies along the east side of the main channel in the northern third of Navigation Pool 8 at river mile 700.7. The maximum elevation of the 23 year old dredge material, deposited in 1952, was 650 feet above mean sea level.



Scale
1 inch = 500 feet

Fig. 5. Dredge material Islands 1, 2, and 3.

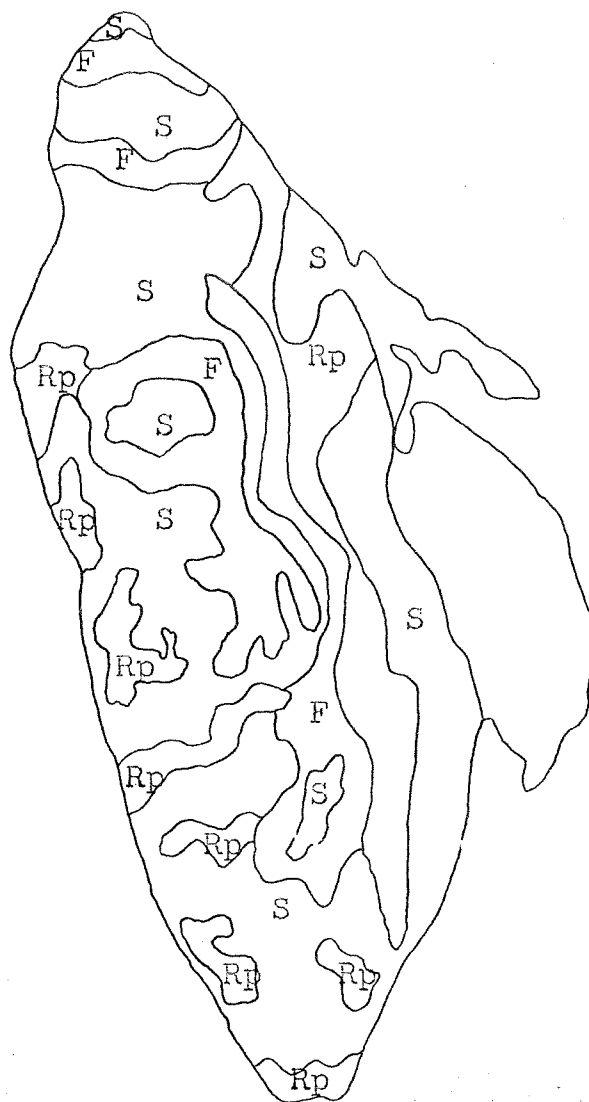
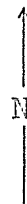


Scale
1 inch = 500 feet

Fig. 6. Dredge material Islands 4 and 5.

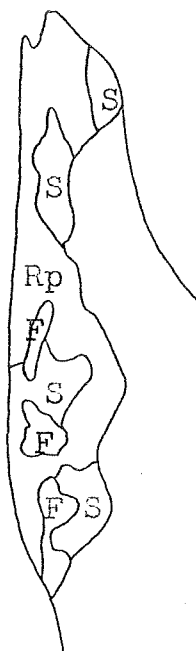
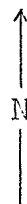


Fig. 7. Dredge material Islands 6 and 7.



Scale
1 inch = 500 feet

Fig. 8. Dredge material Island 8.



Scale
1 inch = 500 feet

Fig. 9. Dredge material Island 9.

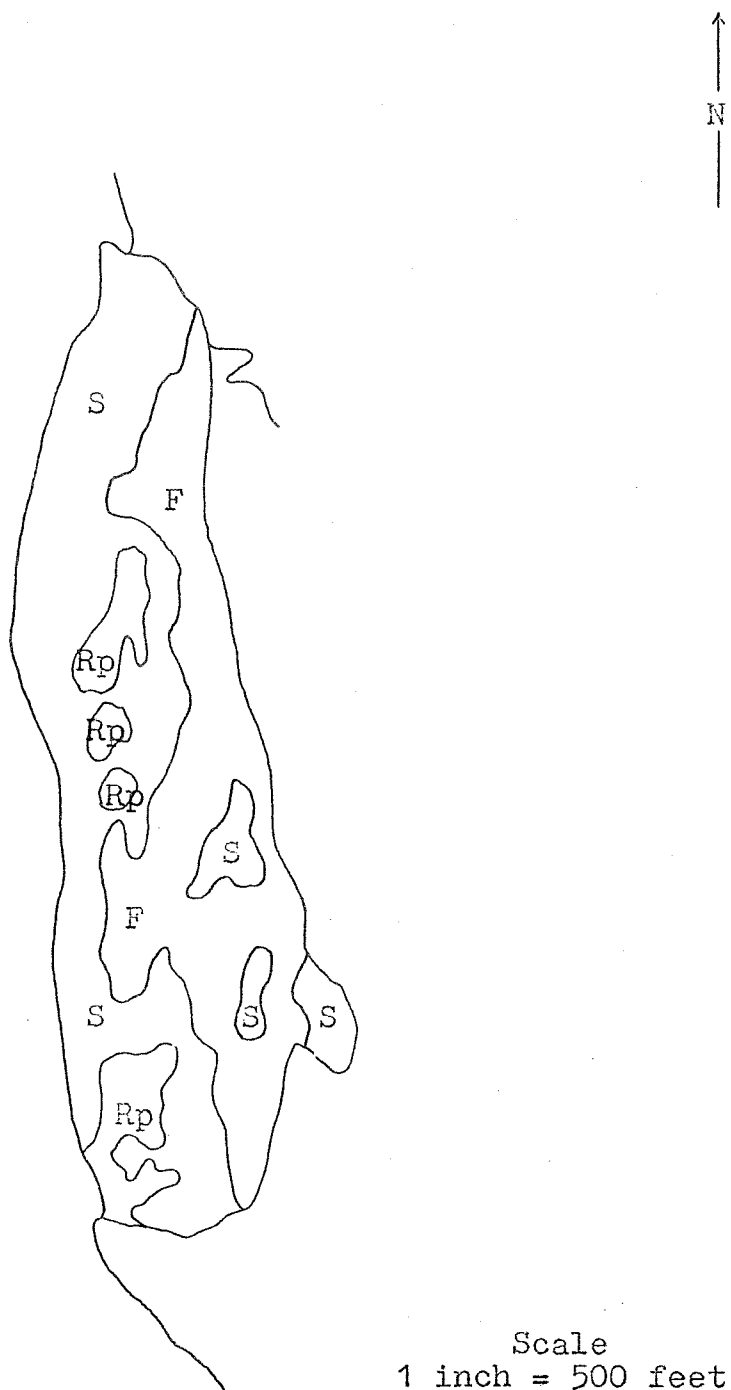


Fig. 10. Dredge material Island 10.

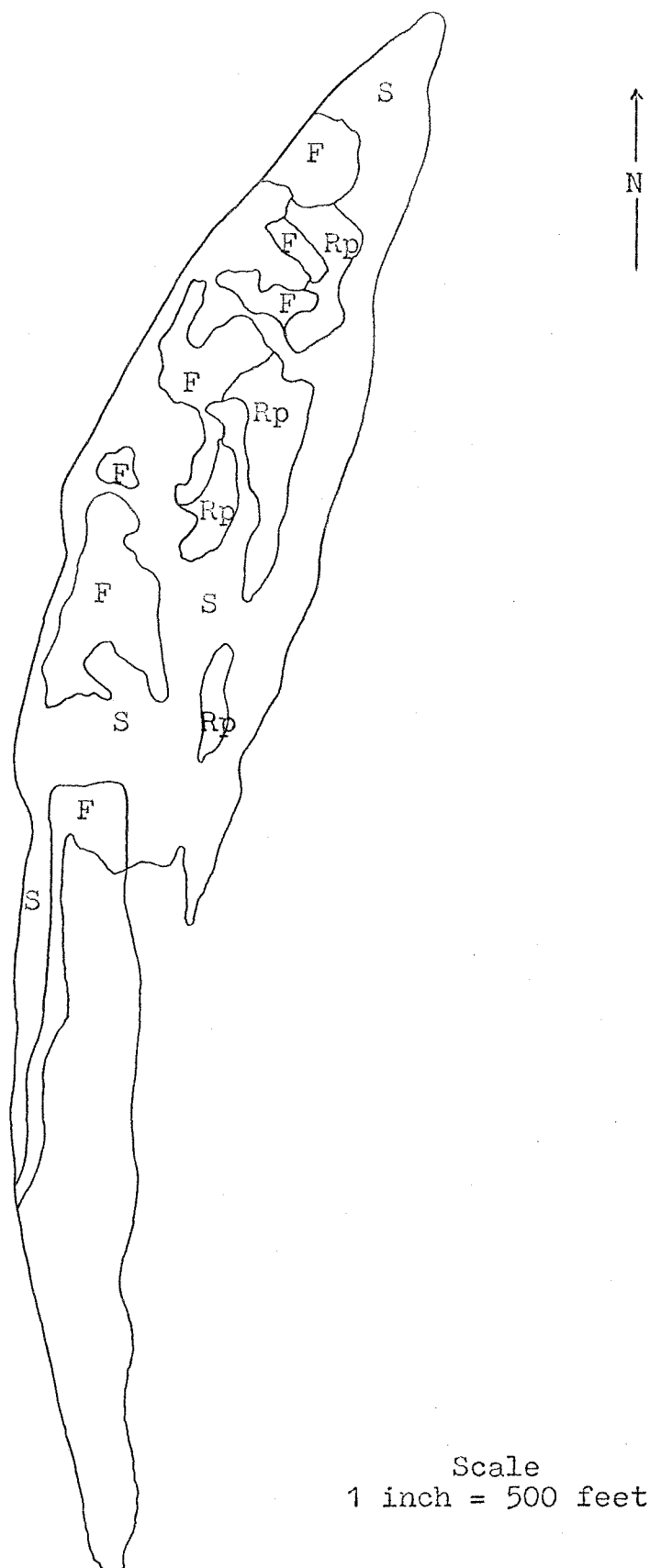
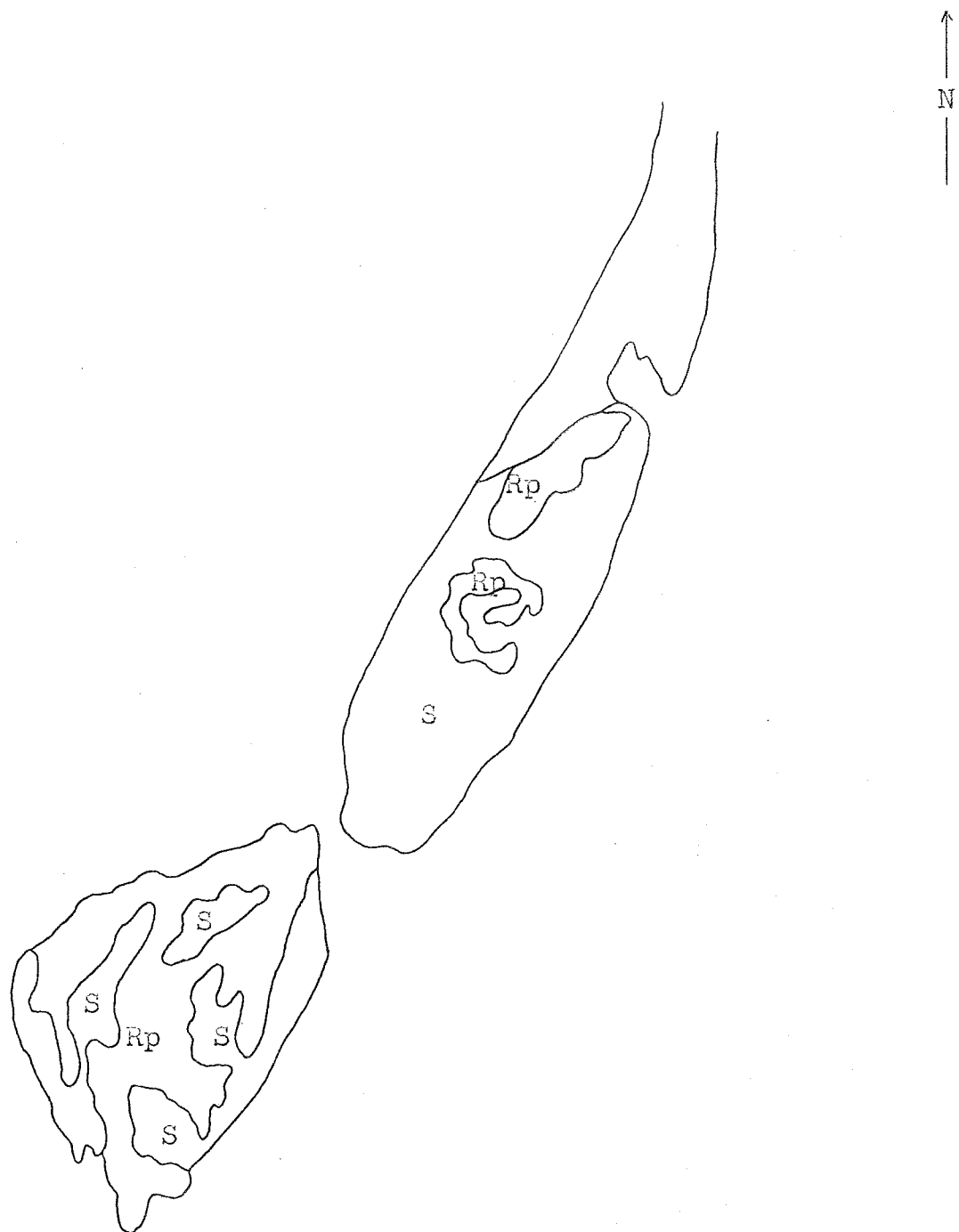


Fig. 11. Dredge material Island 11.



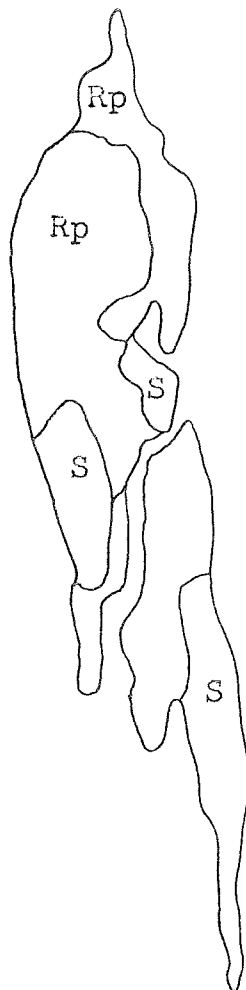
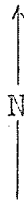
Scale
1 inch = 500 feet

Fig. 12. Dredge material Islands 12 and 13.



Scale
1 inch = 500 feet

Fig. 13. Dredge material Islands 14, 15, and 16.



Scale
1 inch = 500 feet

Fig. 14. Dredge material Island 17.

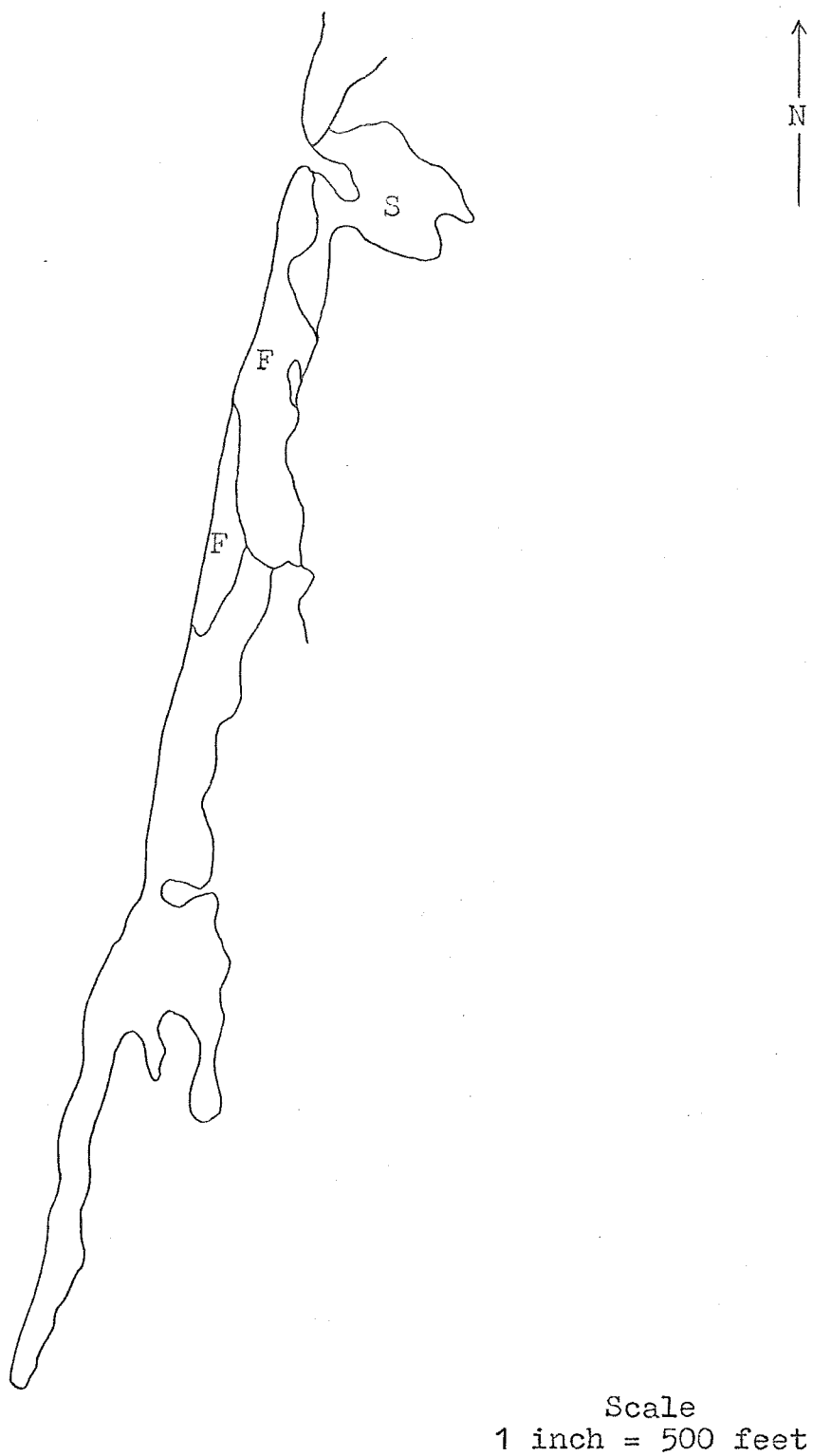


Fig. 15. Dredge material Island 18.

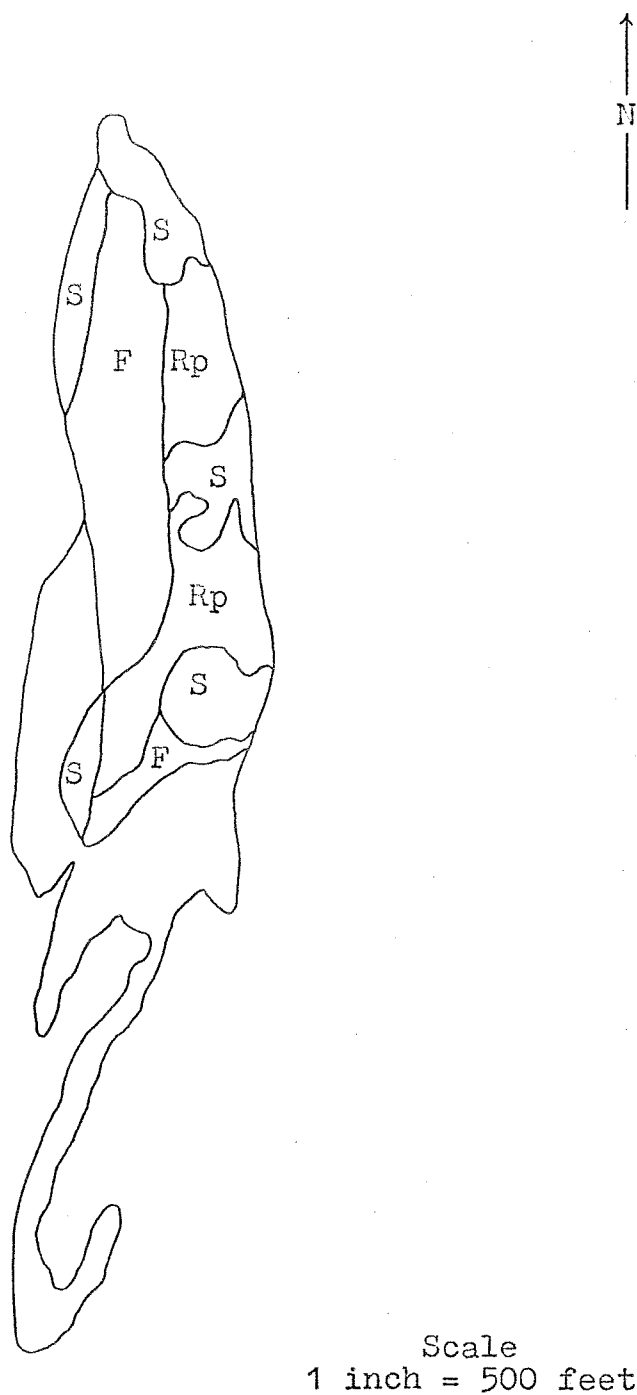


Fig. 16. Dredge material Island 19.

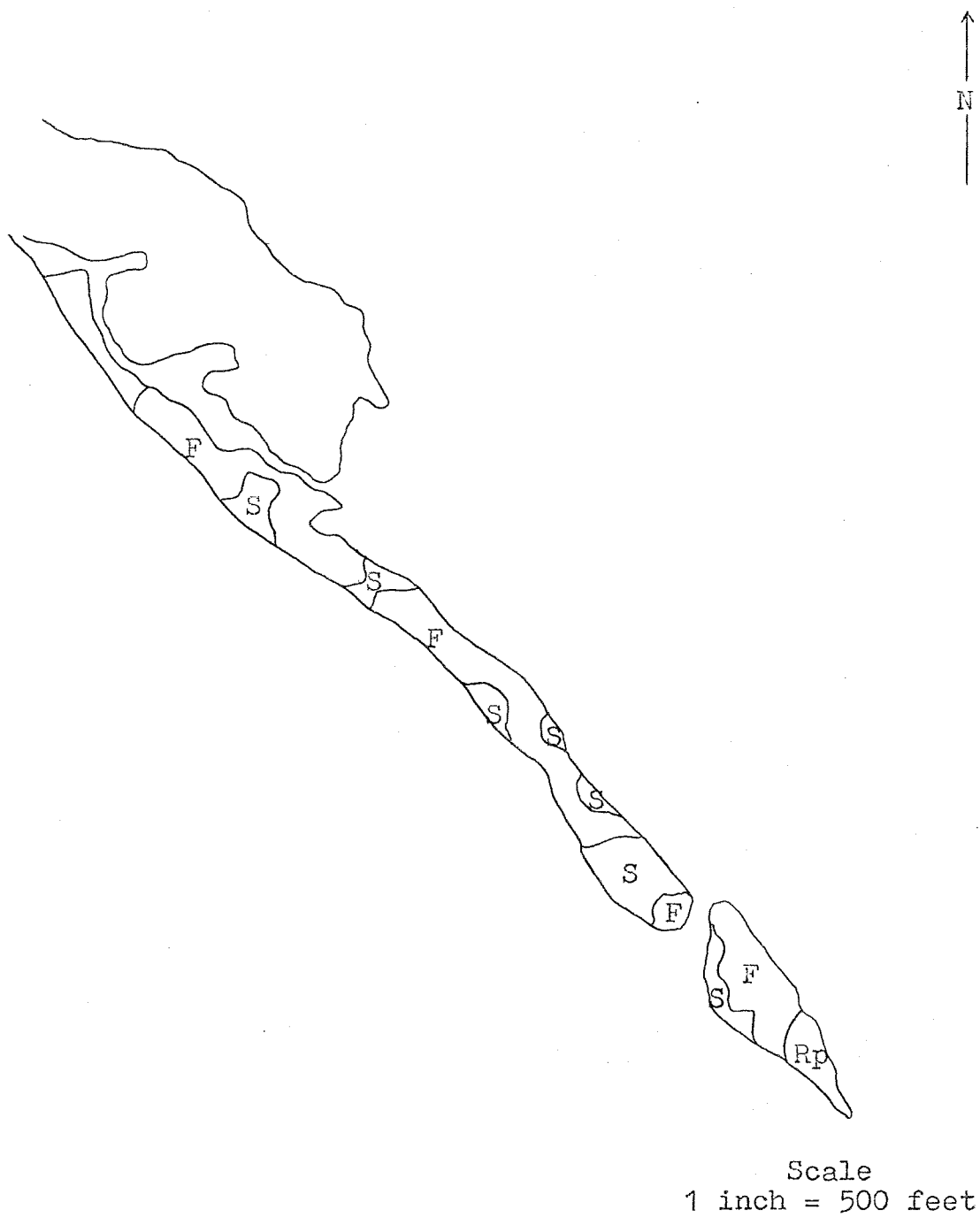
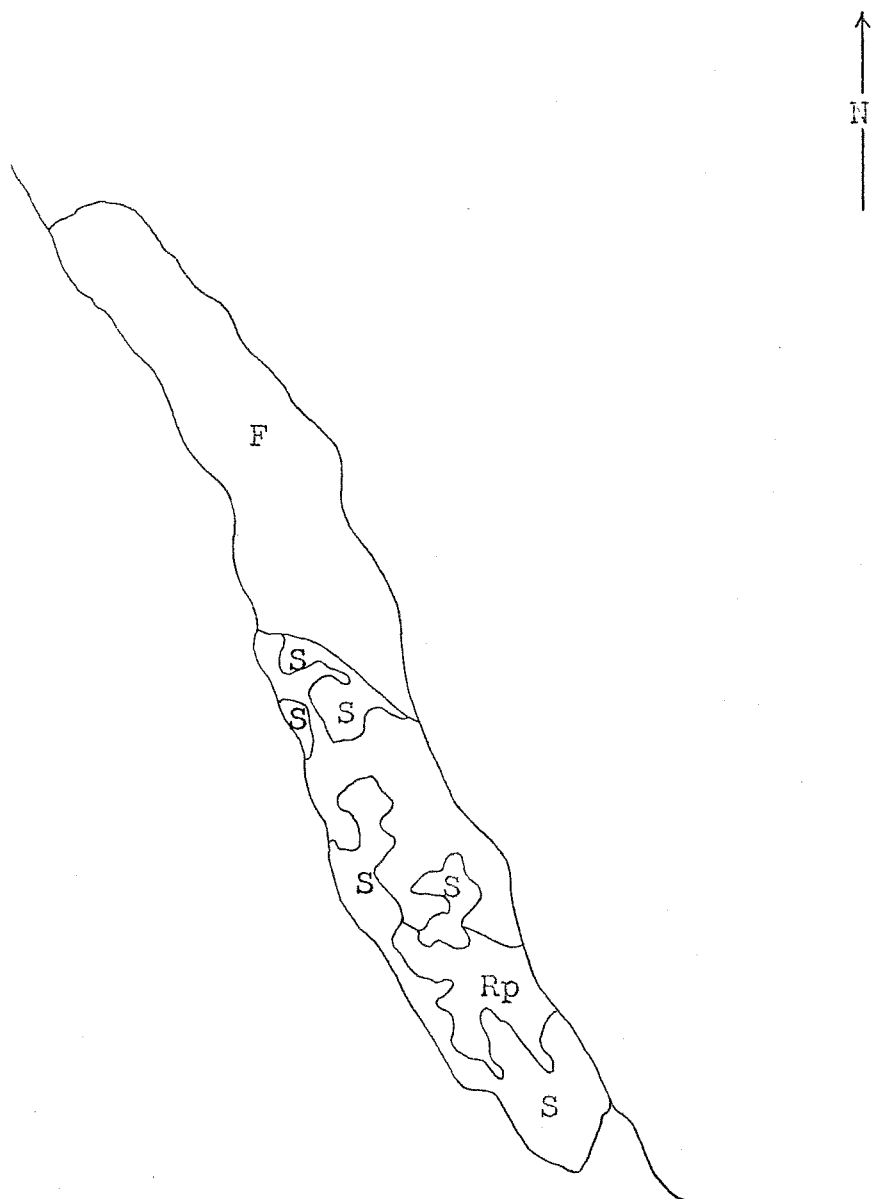


Fig. 17. Dredge material Islands 20 and 21.



Scale
1 inch = 500 feet

Fig. 18. Dredge material Island 22.

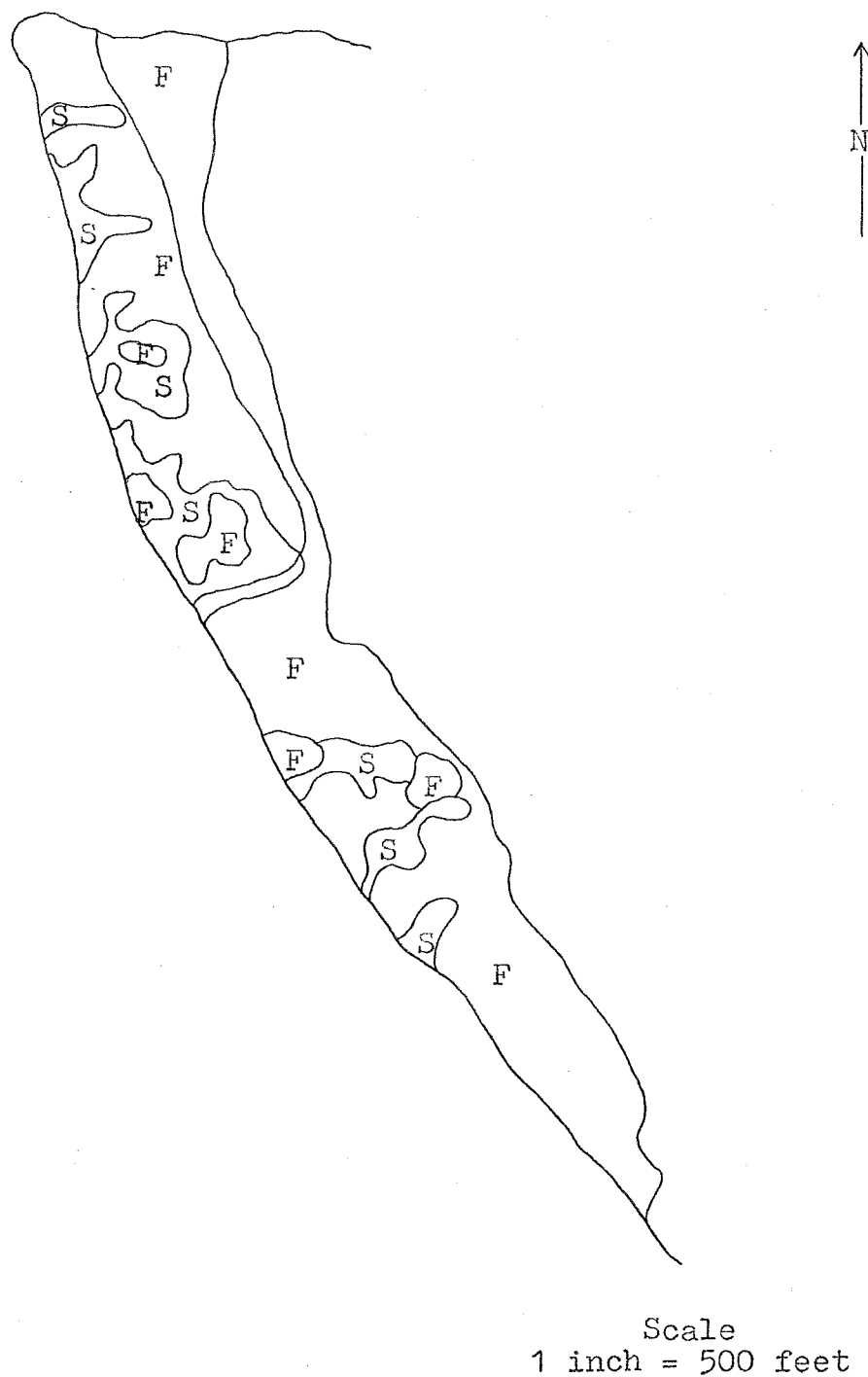


Fig. 19. Dredge material Island 23.