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OPERABLE UNIT 9, ECOLOGICAL CHARACTERIZATION REPORT

MOUND PLANT
MIAMISBURG, OHIO

March 1994

Technical Memorandum
(Revision 0)

U.S. Department of Energy
Albuquerque Operations Office

Prepared by
Roy F. Weston, Inc. for
EG&G Mound Applied Technologies

ENVIRONMENTAL RESTORATION PROGRAM

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MOUND PLANT
MONTGOMERY COUNTY, OHIO

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U.S. DEPARTMENT OF ENERGY
ALBUQUERQUE OPERATIONS OFFICE

ENVIRONMENTAL RESTORATION PROGRAM
EG&G MOUND APPLIED TECHNOLOGIES

TECHNICAL MEMORANDUM
(REVISION 0)

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- Terrestrial flora: **Paul Durr** and Jim Negus;
- Birds: **Gerry Dinkins**, Ronald Wagner, and Paul Stodola;
- Mammals: **Jeffrey Murphy** and Mark Hughes;
- Reptiles and Amphibians: **Pat Myer**, **Gerry Dinkins**, Michael Etnier, Paul Durr, and Andy Haines;
- Fish and Macroinvertebrates: **Greg Kauffman**, **Gerry Dinkins**, Chris Skelton, Steve Brodman, and Ron Wagner

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ACRONYMS

AP	Asphalt Pond
BB	Benner Branch
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeter
DBH	diameter at breast height
DELT	deformities, eroded fins, lesions, and external tumors
DOE	U.S. Department of Energy
EF	East Fork
EPA	U.S. Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FFA	Federal Facility Agreement
FS	feasibility study
FSP	Field Sampling Plan
g	gram
ha	hectare
IBI	Index of Biotic Integrity
ICI	Invertebrate Community Index
LANL	Los Alamos National Laboratory
m	meter
MCD	Miami Conservancy District
mm	millimeter
mph	miles per hour
MWH	modified warmwater habitat
NPL	National Priorities List
ODNAP	Ohio Department of Natural Resources - Division of Natural Areas and Preserves
OEPA	Ohio Environmental Protection Agency
OU	operable unit
PS	percent similarity
PVC	polyvinyl chloride
QHEI	Qualitative Habitat Evaluation Index
RI	remedial investigation
RTE	rare, threatened, and endangered
SI	species index
sq mi	square miles
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WP	Work Plan

EXECUTIVE SUMMARY

Operable Unit (OU) 9 is designated for site-wide studies that provide the framework for the reme investigation/feasibility study. Investigations that are best conducted for the entire Mound Plant i its regional setting are included in OU 9. The ecological assessment at the Mound Plant (or site) being performed in a phased approach. Phase I, the ecological field assessment, is aimed at obtain general and specific information on the ecological features associated with the site. The results Phase I, along with data from surface water, soil, and sediment investigations, will be used to perfo Phase II, the ecological risk assessment. Phase II will provide information on the nature and extent contamination and the potential for site contaminants to leave the site via the flora and fauna. T approach for Phase II is presented in Operable Unit 9, Site-Wide Work Plan (DOE 1992); however, th approach may be refined based on the preliminary and/or final results of Phase I.

This report is a technical memorandum of work conducted in accordance with the OU 9 Site-Wid Work Plan (DOE 1992). It presents the results of the ecological field assessments that were designe to address the following principal components:

- Identification of the flora and fauna in and around the site,
- Identification of sensitive environments in and around the site (e.g., wetlands, floodplains wildlife breeding areas, etc.), and
- Identification of endangered species and their habitats in and around the site.

This report includes an annotated checklist of terrestrial flora, mammals, reptiles and amphibians (herptiles), birds, fish, and macroinvertebrates; a map of the major vegetative habitats; and a discussion of the relative sensitivity and importance of the Mound Plant environments based on species diversity, endangered species occurrence, and the presence of regulated habitats (e.g., wetlands, waterways, and floodplains).

This report does not address identification of those species consumed by humans or found in human food chains, or bioaccumulation data on food chain organisms. These will be part of the subsequent phases of the ecological characterization studies. This report also does not address the jurisdictional determination of wetlands, waterways, and floodplains. These were identified and reported as part of a separate field effort (DOE 1994).

ES.1. SUMMARY OF TERRESTRIAL SURVEYS

The initial field effort for this terrestrial flora and fauna investigation consisted of a pre-investigation site reconnaissance, conducted on May 20, 1992. At this reconnaissance, representatives from the U.S. Environmental Protection Agency (EPA) and the Ohio Environmental Protection Agency (OEPA) met with representatives from EG&G and field personnel from WESTON to establish the location of each ecological sampling area. Field investigations began 1 week later. Fieldwork for the terrestrial flora and fauna investigations was completed in May 1993. Field efforts consisted of seasonal surveys of plants, birds, small and large mammals, and herptiles.

In all, 376 species of plants, 17 species of mammals, 10 species of herptiles, and 81 species of birds were documented at the Mound Plant. These species were identified as occurring in seven distinct habitat types or communities (Figure ES.1, Table ES.1). To determine the relative importance of each of these habitat types in relation to the Mound Plant as a whole, the known number of plant, bird, herptile and mammal taxa within each habitat type was divided by the areal coverage of that habitat. This process led to the following findings:

- North-facing slope forests have the lowest biotic diversity of any of the major terrestrial communities investigated.
- South-facing slope forests possess habitat attributes comparable to the north-facing slopes.
- Riparian forests are restricted to the extreme western portion of the site adjacent to the Miami-Erie Canal and along the Overflow Creek. A total of 105 plant species and ten mammal species was found in this habitat.
- Scrub/shrub communities represent a transitional stage between herb-dominated pioneer communities and later successional types dominated, to a great extent, by woody species.
- The subxeric grassland type exhibits rather high plant diversity but is low in faunal diversity.
- Mesic grasslands, by virtue of a better soil moisture regime, were found capable of supporting a greater array of plant species than the subxeric grasslands, even though the area occupied by the mesic grasslands was only one-tenth as large.
- Wetlands and waterways represent the smallest area of any of the habitats, but are found to support the second-highest diversity index and consistently possess the highest percentage of unique (within Mound habitats) species, regardless of the biotic group considered.

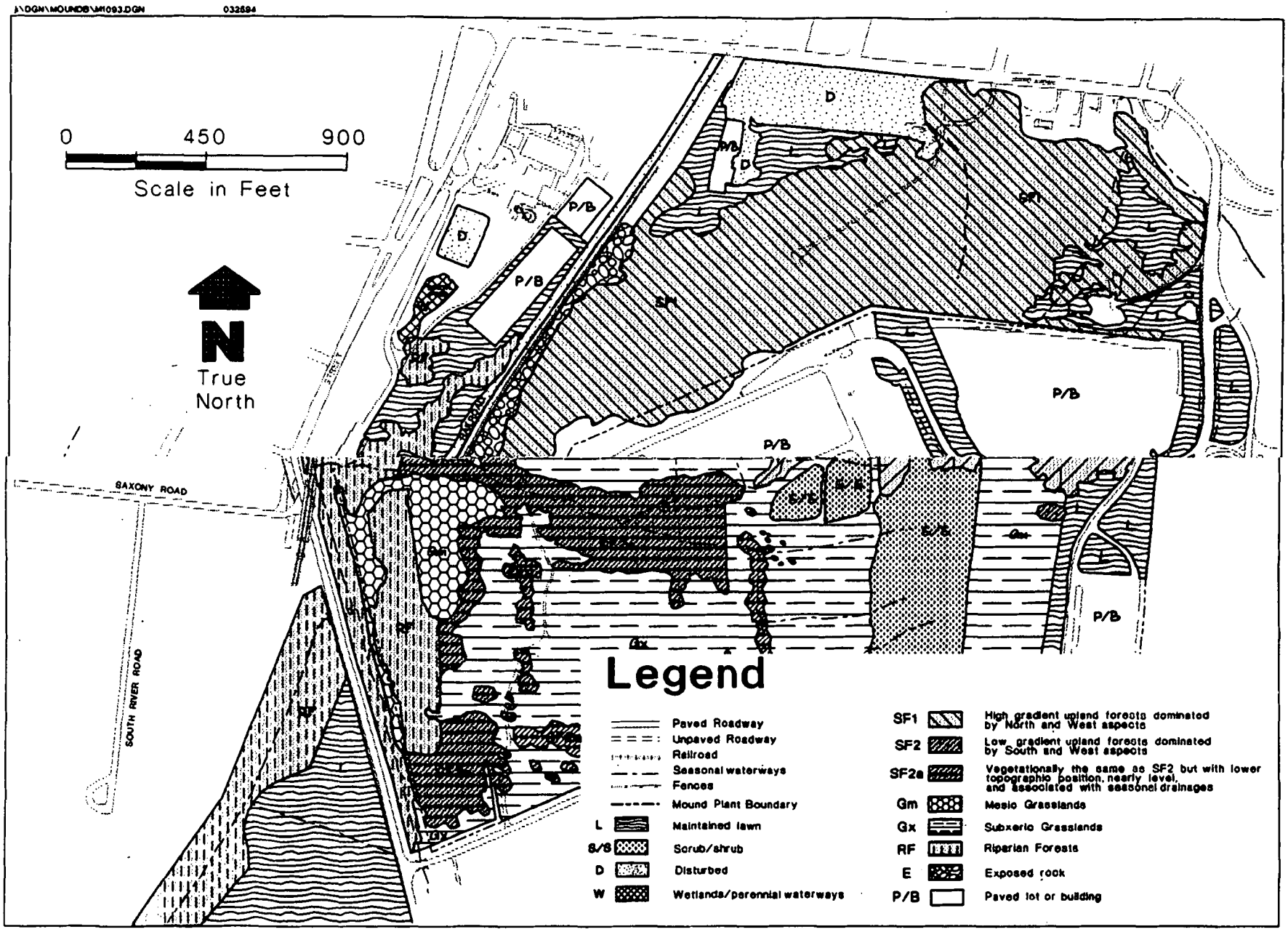


Figure ES.1. Habitats of the Mound Plant

Table ES.1. Species Occurrence Within Major Habitats and Derivation of Species Index Values

BIOTIC GROUP	COMMUNITY TYPE							
	North-Facing Slope Forest	South-Facing Slope Forest	Riparian Forest	Scrub/Shrub Community	Subxeric Grassland	Mesic Grassland	Industrial & Maintained Areas	Wetlands & Waterways
VASCULAR PLANTS								
• Total Species within Community Type	51	43	105	114	111	136	156	57
• Total Species Unique to Community Type	13	2	32	22	13	16	42	24
• Unique Species as Percent of Community Total	25.5	4.7	30.5	19.3	11.7	11.8	26.7	42.1
BIRDS								
• Total Species within Community Type	41	51	35	45	36	39	28	19
• Total Species Unique to Community Type	0	6	2	5	0	1	0	4
• Unique Species as Percent of Community Total	0.0	11.8	5.7	11.1	0.0	2.6	0.0	21.1
MAMMALS								
• Total Species within Community Type	6	9	12	6	7	6	5	8
• Total Species Unique to Community Type	0	0	2	0	0	0	0	1
• Unique Species as Percent of Community Total	0.0	0.0	16.7	0.0	0.0	0.0	0.0	12.5
HERPTILES								
• Total Species within Community Type	4	5	4	1	0	0	0	5
• Total Species Unique to Community Type	0	1	1	0				3
• Unique Species as Percent of Community Total	0.0	20.0	25.0	0.0				60.0
Total Species for all Biotic Groups	102	108	156	166	154	181	189	89
Community Area (ha)	21.6	17.2	11.1	8.6	20.7	2.7	34.9	1.5
Species Index	**4.7**	**6.3**	**14.1**	**19.3**	**7.4**	**67.0**	**5.4**	**59.3**

ES.2. SUMMARY OF AQUATIC SURVEYS

Aquatic sampling for fish and macroinvertebrates was conducted in streams and ponds in the spring of 1992 and the fall of 1993. Stream locations were as described in the OU 9 Work Plan and Field Sampling Plan (DOE 1992). These were located in the Overflow Creek, Miami-Erie Canal, Plant Drainage Ditch, and on two intermittent streams on the South Property. Pond locations sampled during the aquatic surveys included the Overflow Pond, Retention Basins, Asphalt Pond, and the South Pond in the Miamisburg Municipal Park. In the permanent and intermittent streams, a total of 1497 fish (representing 17 species and one hybrid) and 19,189 macroinvertebrates (representing 135 species of aquatic macroinvertebrates) was collected. In the ponds, a total of 43 fish (representing four species), and 32,004 macroinvertebrates (representing 123 taxa) was collected.

OEPA's method for evaluating aquatic habitats (Qualitative Habitat Evaluation Index [QHEI]) was applied to the stream sampling locations. This method revealed that all stream locations produced QHEI values within the upper 25 percent of QHEI values developed by the OEPA for channelized headwaters. The Index of Biotic Integrity (IBI) was used to evaluate the fish data from the stream surveys. Sampling for fish in the streams and ponds at the Mound Plant led to the following conclusions:

- There is a greater diversity of fish in the Overflow Creek compared to upstream in the Miami-Erie Canal and Plant Drainage Ditch. This was attributed to the weirs that block upstream fish migration from the river and Overflow Creek into upstream areas.

- In the Overflow Creek, IBI values exceeded the OEPA criterion for headwaters three of the four times this area was sampled.

- In the Miami-Erie Canal and the Plant Drainage Ditch, IBI values met the criterion for headwaters four of the eight times this area was sampled. The IBI criterion for headwaters may not be applicable to the Mound drainage, since the criterion may only apply to drainages larger than 1 sq mi. The Mound drainage is less than 1 sq mi.

- IBI values were lower during the spring sampling effort, primarily because of a higher incidence of deformities, eroded fins, lesions, and tumors (DELT anomalies). Six times more fish were collected during the spring effort from the streams. Many of these fish were badly emaciated. DELT anomalies are often associated with overcrowding and improper diet.

- There are no fish in the Asphalt Pond. The South Pond has fewer fish, but more species, than the Overflow Pond and Settling Basins.

- There were fewer and smaller fish in the Overflow Pond and Settling Basins during the fall survey, apparently because of a fish kill associated with oxygen depletion that occurred subsequent to the spring sampling effort.

- DELT anomalies, emaciation, and parasites were common in fish from the Overflow Pond and Settling Basins during the spring survey, but not during the fall survey.

The Invertebrate Community Index (ICI) was used to evaluate the macroinvertebrates in both the intermittent and permanent streams at the Mound Plant. There are no OEPA guidelines for assessing aquatic macroinvertebrate community data from ponds. For this reason, standard statistical methods were applied to the pond data. The following conclusions were drawn from the macroinvertebrate data:

- Seasonal differences in the macroinvertebrate communities of the intermittent streams on the South Property were typical for such habitats.
- ICI values were generally lower in the fall, especially in the intermittent streams.
- OEPA's criterion was developed for drainages greater than 10 sq mi and, as such, may not be applicable to the Mound data because of the small drainage size of the study area (less than 1 sq mi). Also, OEPA's criterion was developed using five artificial substrates. Only three artificial substrates were used in the Mound Plant study.
- Seasonal changes in the macroinvertebrate communities in the Overflow Pond and Settling Basins appeared to be related to naturally occurring changes in the dissolved-oxygen content of the sediment.
- Seasonal changes in the Asphalt Pond community appeared to be the result of a natural proliferation of certain taxa.

ES.3. RARE, THREATENED AND ENDANGERED SPECIES

In spite of intensive field efforts, no federal threatened or endangered species were documented and none is expected to occur. Two state protected species were found, but one of these (dark-eyed junco) is a common winter visitor throughout most of the eastern US; the other (inland rush) is apparently a casual waif that is not expected to be a permanent part of the Mound Plant flora.

ES.4. IMPORTANT AND SENSITIVE ENVIRONMENTS

For the purposes of the current investigation, sensitive environments are considered to be those areas that are sensitive because of their regulatory status (e.g., wetlands and waterways) or those areas that may be sensitive or important from a biological standpoint. While the phrase "biologically important" can connote a variety of meanings, the significance here is related to the relative ability of a particular habitat to support rare and unique entities or a highly diverse assemblage of species. From these data, it is concluded that the Mound Plant has diverse flora and fauna. Based on a strict interpretation of

the language presented in Attachment 1 of the CERCLA 120 agreement, most of the Mound Plant and adjacent properties could be considered to contain sensitive environments. For example, wetlands were found on the North Property and along the Miami-Erie Canal and Overflow Creek, and indications of wildlife breeding were observed throughout the site. Even so, the main conclusion of the ecological study was that the habitat and species composition of the Mound Plant is neither unique nor even of local importance. This conclusion was based on these findings:

1) No federal threatened or endangered species occur on the Mound Plant.

2) Two species listed by the state of Ohio as endangered were found, the dark-eyed junco and the inland rush. Neither are permanent, year-round components of the Mound Plant biota.

3) The majority of the Mound Plant flora consists of exotic species. The remainder is comprised of locally common species.

4) All of the various species of terrestrial fauna at the Mound Plant are locally common or typical seasonal visitors to southeastern Ohio.

5) Waterways associated with the site contain species of fish and macroinvertebrates that are common to the area around the Mound Plant and southeastern Ohio.

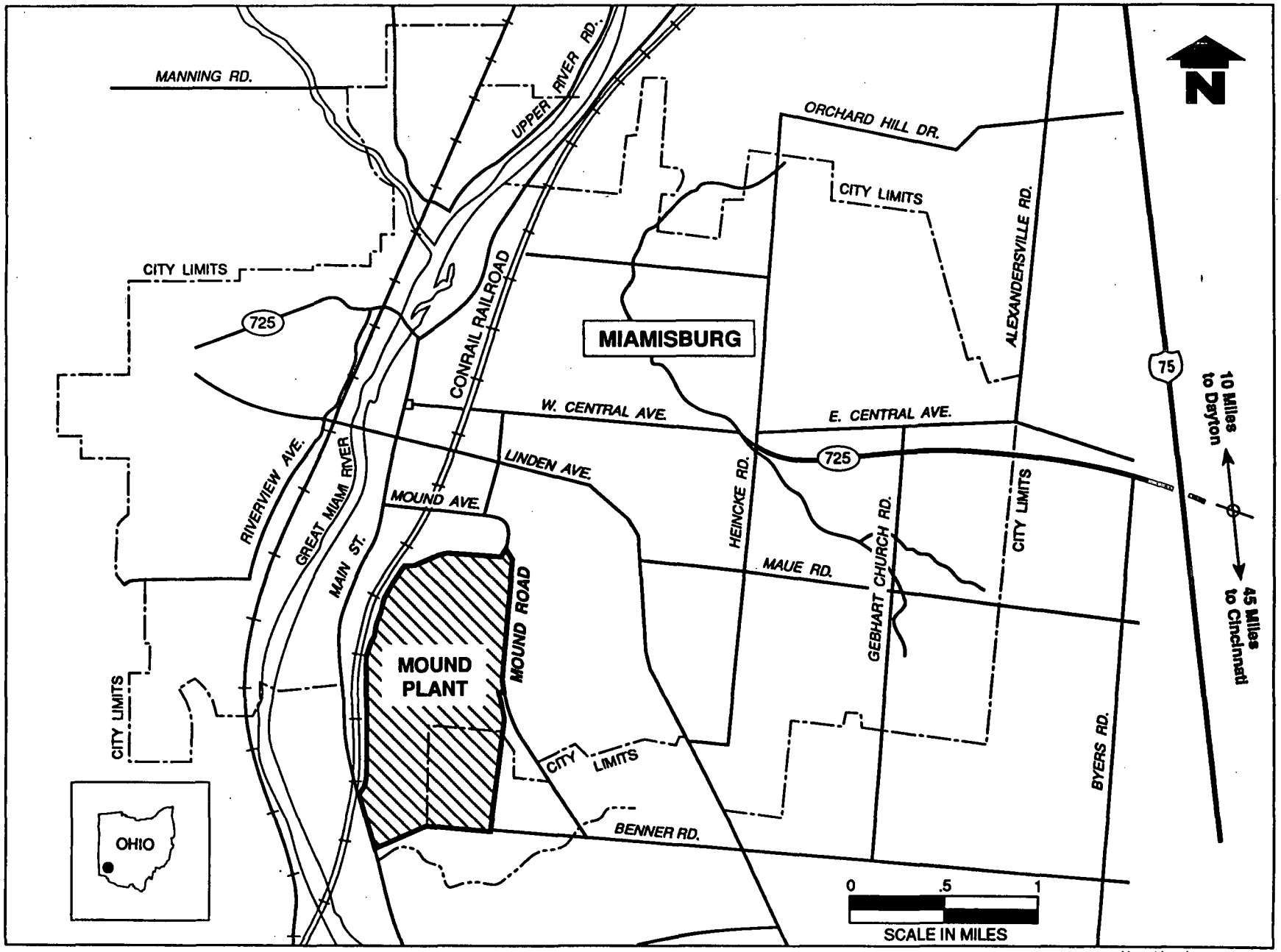
1. INTRODUCTION

The Mound Plant in Miamisburg, Ohio (Figure 1.1) is operated for the U.S. Department of Energy (DOE) by EG&G Mound Applied Technologies. The plant started operation in 1949 and is an integrated research, development, and production facility that operates in support of the DOE weapons and energy programs (DOE 1993).

The Mound Plant was placed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, also known as Superfund) National Priorities List (NPL) on November 21, 1989, (54 Federal Register 48184). The facility was added to the NPL as a consequence of historic disposal practices and releases of contaminants to the environment. Pursuant to its NPL status, DOE signed a CERCLA Section 120 Federal Facility Agreement (FFA) with the U.S. Environmental Protection Agency (EPA) that became effective October 11, 1990 (Administrative Docket #VW-'90-C-075). The Ohio Environmental Protection Agency (OEPA) became a signatory to the agreement in July 1993. The terms of the FFA require that DOE develop and implement remedial investigations (RIs) and feasibility studies (FSs) and conduct interim remedial actions to ensure that environmental impacts associated with past and present activities at the site are thoroughly investigated and appropriate action is taken to protect the public health and welfare and the environment.

Due to the number of potential release sites (more than 300) and the overall complexity of the RI/FS, the site is divided into nine operable units (OUs) to facilitate program management (DOE 1992). Currently, six OUs remain; the others have been closed and the sites reassigned. Operable Unit 9 is designated for site-wide studies that provide the framework for the RI/FS. Investigations that are best conducted for the entire Mound Plant and its regional setting are included in OU 9. As described in the OU 9 Site-Wide Work Plan (DOE 1992), the objective of the ecological characterization at the Mound Plant is to provide ecological information for the RI/FS. Specifically, Attachment 1 of the CERCLA 120 Agreement for this site requires that the ecological characterization includes, but is not limited to, these principal components:

- Identification of the flora and fauna in and around the site;
- Identification of sensitive environments in and around the site (e.g., wetlands, floodplains, wildlife breeding areas, etc.);
- Identification of endangered species and their habitats in and around the site;
- Identification of those species consumed by humans or found in human food chains; and
- Bioaccumulation data on food chain organisms, such as aquatic invertebrates and fish.



Mound location map/7-26-93

Figure 1.1. Location of Mound Plant, Miamisburg, Ohio.

To meet the first three objectives of the CERCLA 120 agreement (identification of flora and fauna, sensitive environments, and endangered species and their habitats), a detailed ecological assessment of the site is required. Although general information concerning the flora and fauna common to the site region (Miami Valley) has been presented in the Final Environmental Impact Statement (DOE 1979), additional data are required to meet the first three objectives of the CERCLA 120 Agreement. Additional data are also required to better understand the possible effects of site contaminants to humans and wildlife. Toward this end, the ecological characterization of the site is being performed in a phased approach. Phase I, the ecological field assessments, is aimed at obtaining general and specific information on the ecological features associated with the site. To that end, qualitative and, where possible, quantitative ecological data were collected. Although detailed population density information is not included as one of the principal components of the CERCLA 120 Agreement, estimates of relative abundance can be extrapolated for some biotic groups.

The results of Phase I, along with data from the surface water, soil, and sediment investigations, will be used to perform Phase II, an ecological risk assessment. Phase II will, among other things, provide information on the nature and extent of contamination and the potential for site contaminants to leave the site via the flora and fauna. Based on the results of the ecological risk assessment, recommendations will be made for Phase III. Phase III will be designed to fill significant data gaps, and quantify assessment and measurement endpoints. Examples of assessment and measurement endpoints that will be considered for Phase III include acute and chronic toxicity testing of various media, biomarkers of exposure and sublethal stress, offsite sampling of ecological communities for comparison to onsite results, and tissue sampling for chemical and radiological constituents. Thus, the fourth and fifth objectives of the CERCLA 120 Agreement (identification of species consumed by humans and collection of bioaccumulation data) will be addressed during Phase III of the ecological characterization program.

1.1. SCOPE OF REPORT

This technical memorandum of investigative work was developed as part of the OU 9 ecological characterization in accordance with the OU 9 Site-Wide Work Plan (DOE 1992). It presents the results of the ecological field assessments that were designed, in part, to address the following principal components of the CERCLA 120 Agreement:

- Identification of the flora and fauna in and around the site.
- Identification of sensitive environments in and around the site (e.g., wetlands, floodplains, wildlife breeding areas, etc.).
- Identification of endangered species and their habitats in and around the site.

An annotated checklist of terrestrial flora, mammals, reptiles and amphibians, birds, and fish is included in this report. A map of the major vegetative habitats and a discussion of the relative sensitivity and importance of the Mound Plant environments based on species diversity, endangered species occurrence, and presence of regulated habitats are also presented.

While one of the objectives of this report is to identify sensitive environments in and around the site, it is not within the scope of this study to determine the jurisdictional boundaries of wetlands and floodplains at the Mound Plant; these were identified and reported separately (DOE 1994). A jurisdictional determination is pending at this writing. As part of the delineation effort, vegetational attributes were examined to determine if wetland plant communities were present. In the present study, wetlands and waterways were again examined, but this time to determine their relative importance or sensitivity compared to other habitat entities on the site. They were also examined as part of the aquatic (fish and macroinvertebrate) sampling effort to determine if rare, threatened, or endangered species are present.

This report does not address the fourth and fifth components of the CERCLA 120 Agreement, namely:

- Identification of those species consumed by humans or found in human food chains; and
- Bioaccumulation data on food chain organisms, such as aquatic invertebrates and fish.

These two components will be addressed during Phases II and III of the ecological characterization, respectively.

This report is separated into four sections. Section 1 provides background information on the Mound Plant and the ecological characterization; Section 2 describes the methods used to characterize the site's flora and fauna; Section 3 provides the results of the ecological characterization; and Section 4 addresses sensitive environments and rare, threatened, and endangered species.

1.2 SAMPLING OBJECTIVES

The OU 9 Site-Wide Work Plan (DOE 1992) provides the basic guidelines for all ecological assessment activities. The Work Plan identified the core biotic groups to be studied, the seasons in which studies were to be performed, and the general approach used to investigate each group. Except for the aquatic fauna, sampling areas were not specifically addressed. The Work Plan stipulated, however,

that a thorough site reconnaissance would be undertaken as a priority task to finalize the overall sampling strategy and to determine precise sampling locations.

As a supplement to the Work Plan, a Field Sampling Plan (FSP) was developed that provided the specific field methodologies to be used in the ecological assessment. Detailed standard operating procedures for conducting terrestrial flora, terrestrial fauna, and aquatic fauna surveys were included as an appendix to that document.

The locations and, in some instances, the position, orientation, and size or length of sampling plots, transects, etc., were finalized on May 20, 1992, during the pre-investigation site reconnaissance. This reconnaissance involved the Remedial Project Manager, biologists from the EPA and OEPA, the Site Coordinator from the OEPA, EG&Gs OU 9 Manager, WESTON's OU 9 Manager, WESTON's ecological team leader, and two of the WESTON field biologists assigned to the Mound Plant project. Sampling areas were selected based on site attributes such as slope, aspect, vegetative cover, and proximity to operable units where contamination was either known or suspected to occur. At the time of the pre-investigation reconnaissance, pollutant source characterization had not been completed for all OUs. It was understood, therefore, that each sampling area would not correspond with a pollutant source. Prior to the initiation of fieldwork, numerous refinements were made to the approach used to characterize the terrestrial flora and fauna. These modifications were documented in internal field change logs. Some of these changes represented an increase in the level of effort described in the FSP (e.g., evening avian surveys).

1.3. OVERVIEW OF PLANT SETTING AND PHYSICAL CHARACTERISTICS

The Mound Plant was established in 1946 on a 728,000 square-meter (m^2) (182-acre) untillable portion of a farm consisting of two large hills (now referred to as the Main Hill and the SM/PP Hill), with a northeast-southwest trending valley separating them. The Mound Plant is located in the Eastern Deciduous Forest Province in the transition zone between the beech-maple forest and oak-hickory forest plant associations (Bailey 1978). Much of the original farm property has been altered through construction and use; however, small tracts of forest and scrub-shrub vegetative communities occur on the slope of the SM/PP Hill and in the valley separating the two hills. Nearly all of the Main Hill has been developed with buildings or parking lots, or is frequently mown as part of routine facilities maintenance.

Land use in the areas to the north, east, and west of the Mound Plant is largely residential with relatively low population density. Agricultural tracts similar in size and vegetative composition to the undeveloped area immediately to the south of the Mound Plant are common.

In 1981, DOE purchased the undeveloped tract of land to the south, now known as the South Property. Since that time, access to the 501,828 m^2 (124-acre) South Property has been restricted. The only notable disturbances are periodic mowing of the grasslands by facilities maintenance and occasional field training exercises by the Mound Plant security force.

2. METHODS

2.1. FLORISTIC INVESTIGATIONS

The basic approach to vegetation sampling has been presented in pre-investigation documents such as the OU 9 site-wide WP and the FSP. Several modifications to those original sampling methods, however, were instituted prior to the initiation of field work and have been documented in internal field change logs (Contractor Change Control Nos. 1-10,12 and 13; July 1992). These changes were made to enhance both the quality and relevancy of field data and to improve data acquisition processes. None of these modifications, which were readily embraced by cooperating regulatory agencies, impacted either the cost or scheduling of the project.

Because sampling protocols employed during the course of floristic investigations differed from those presented in initial planning documents, a detailed description of the sampling approach and methods is provided below.

2.1.1. Fixed-Area Sampling

Past land use practices at the Mound facility and on the adjoining south property include industrial development, farming, and grazing. These activities have created a mosaic of seral communities that harbor species characteristic of pioneer, intermediate, and subclimax successional stages. Additionally, the Mound site is located within an area that is topographically diverse. The dissected nature of the terrain has produced an array of ecological habitats, ranging from well-drained uplands to perennially moist riparian terraces. The site factors associated with each habitat type likewise have had a marked influence on plant community structure and distribution.

Recognizing the relative heterogeneous nature of the vegetation, a sampling strategy was devised to provide quantitative information on each of the dominant community types present at Mound. Determination of dominant types was made during a walk-through reconnaissance of the site (conducted in May 1992 by WESTON's ecological characterization team leader and biologists from the OEPA and EPA). Fine-scale aerial photography and U.S. Geological Survey (USGS) 1:24,000 topographic maps also proved useful in this effort. Community types identified include North-Facing Slope Forests, South-Facing Slope Forests, Riparian Forests, Early Successional Scrub/Shrub Areas, Mesic Grasslands, and Subxeric Grasslands.

Forest and Scrub/Shrub Communities

In early June and early July 1992, paired 100-meter-squared (m^2) fixed-area sampling plots were randomly located within each representative forest and scrub/shrub community type. Approximate locations are depicted in Plate 2. Individual plots were laid out using a Jacob staff and compass. Slope correction procedures were implemented to standardize plot sampling area and to allow for data comparability within and among types. During the installation phase, plot midpoints and corners were consistently monumented with color-coded pin flagging.

All live and dead trees (≥ 5 centimeter [cm] diameter at breast height [DBH]) occurring on the plots were identified by species and measured to the nearest 0.1 cm with a diameter tape for DBH. In the current study, the diameter point for all DBH measurements was defined as that point on the bole 1.37 m above ground level as determined from the uphill side of the tree. Additionally, four randomly selected dominant and codominant trees per plot were cored for age and measured with a clinometer for total height, using standard mensurational procedures.

Vegetation data on shrub and sapling class individuals (< 5 cm DBH and ≥ 1.37 m tall) were obtained from single 10-m^2 subplots nested within the 100-m^2 primary sampling units. Live and dead woody stems were identified by species, then measured with a caliper to determine basal diameter. Basal diameter measurements were taken at 15 cm high on the stem to avoid the confounding influence of ground-level root collar swelling. Data precision was to the nearest 0.01 cm. Live stems were also measured to the nearest centimeter for major and minor crown width. These parameters were used to establish the extent of foliar cover.

At each sampling location, woody seedlings (< 1.37 m tall), herbs, and non-vegetated substrates were assessed within a series of five 1-m^2 plots. Plot boundaries were circumscribed through the use of a polyvinyl chloride (PVC) sampling frame. All woody stems falling within the perimeter of the frame were counted, by species, and recorded in one of five age-size categories. A subjective estimate of the percent cover occupied by each woody and herbaceous taxon was also made. The remaining portion of the plot was similarly evaluated for percent cover of nonvegetated substrates, such as bare soil, bare rock, leaf litter, and the like. To prevent cover estimates from exceeding 100 percent, three-dimensional tallies were avoided. Only that portion of the vegetation or substrate clearly visible from a vantage point 1 m above plot was considered. Underlying portions occluded from view were not included in the estimate. It should be further noted that all 1-m^2 plots were positioned at random around the immediate periphery of the 100-m^2 primary sampling units. The decision to place these plots outside of the primary sampling area was made to preserve the integrity of fragile herbaceous

taxa. These elements would have been subject to inadvertent trampling during tree, sapling, and shrub inventories had they been situated otherwise.

Unlike dominant woody species, whose demographic parameters do not change appreciably during the course of a single growing season, herbaceous plants are generally far more phenologically dynamic. Certain herbs, for example, are extremely short-lived and may be identifiable for only a few weeks out of the year. Those same plants may dominate the herb stratum for a time before being replaced by an entirely different cohort of species. To capture this dynamism, cover estimates were made within the 1-m^2 plots four times throughout the growing season at approximately 1-month intervals. The insertion of pin flags into the ground at opposing corners of the sampling frame during the initial phase of sampling facilitated precise relocation of plots during subsequent sampling efforts.

Grassland Communities

Grasslands, by definition, contain little, if any, arborescent vegetation and are composed almost entirely of herbaceous plants. Consequently, the sampling methodologies used to inventory such communities typically are not the same as those employed in forested or semi-forested areas. In the current study, grassland inventories were configured around a systematic random design. A hand compass and tape were first used to lay out a 50 by 50-m grid covering the entire representative community type. A pair of 1-m^2 fixed-area plots delineated, with a PVC sampling frame, was then installed 2 m apart at each sampling location. Within plots, the percent coverage of non-vegetated substrates and of each individual species was subjectively estimated. As with the herbaceous stratum within forested and scrub/shrub areas, herbs within grasslands were inventoried four times throughout the growing season to capture their full range of speciation and dynamic growth patterns. Again, conspicuous monumentation permitted precise plot relocation. Plate 2 shows the approximate ground location of all grassland plots.

For the convenience of the reader, Table II.1 has been included to summarize the fixed-area sampling protocols used in each vegetation stratum within the various community types. A synopsis of data products associated with each phase of the inventory is also included.

2.1.2. Systematic Walk-Through Surveys

While fixed-area methods are useful in gaining an understanding of community structure through the interpretation of quantitative parameters such as species density, frequency, and coverage, the information can be best applied only within a limited geographic area and only within those community parcels considered "representative." To meet the larger sampling objectives presented in the FSP, supplementary information from site-wide vegetation surveys was necessary. To satisfy this

Table II.1. Bird Transect Descriptions

			Plant Communities[a]															
Transect	Location	Length (m)	XG	SS	MG	UG	ML	SA	OW	SF	UF	CC	RC1	RC2	RC3	RC4	RC5	RC6
1A	Lower South Property, east/west from fence along gravel road near eastern boundary to western boundary fence at Miami-Erie Canal; parallel to Benner Road	652	X	X	X								X					
1B	Lower South Property, east/west from fence along gravel road near eastern boundary to western boundary fence at Miami-Erie Canal; parallel to Benner Road	622	X	X	X								X					
2A	Middle South Property, east/west from fence along gravel road near eastern boundary to western boundary fence near confluence of unnamed, intermittent stream and Miami-Erie Canal	591	X	X	X										X		X	
2B	Middle South Property, east/west from fence along gravel road near eastern boundary to western boundary fence near confluence of unnamed intermittent stream and Miami-Erie Canal	591	X	X	X									X	X			

Table II.1. (page 2 of 3)

			Plant Communities*															
Transect	Location	Length (m)	XG	SS	MG	UG	ML	SA	OW	SF	UF	CC	RC1	RC2	RC3	RC4	RC5	RC6
3X	Upper South Property, east/west along woodland edge from fence corner at Post 8 to fence near production wells, parallel to North/South Property fence	610									X	X						
4A	Along Conrail railroad tracks, from Plant Drainage Ditch culvert to flagged stake approximately halfway between drainage ditch and railroad bridge over Dayton-Cincinnati Pike	387														X		
4B	Along Dayton-Cincinnati Pike, from confluence of Plant Drainage Ditch and Miami-Erie Canal to flagged stake approximately halfway between drainage ditch and railroad bridge over Dayton-Cincinnati Pike	424														X		
5A	North Property, around Overflow Pond and south side of Plant Drainage Ditch upstream to Building 22	372					X		X									X

Table II.1. (page 3 of 3)

			Plant Communities*															
Transect	Location	Length (m)	XG	SS	MG	UG	ML	SA	OW	SF	UF	CC	RC1	RC2	RC3	RC4	RC5	RC6
5B	North Property, from retention basins along north side of Plant Drainage Ditch to base of Main Hill adjacent to Building 22	372					X	X										X
6X	North Property, from rear of Building 22 to crest of SM/PP Hill	405				X				X								
7X	North Property, along crest of SM/PP Hill	466				X				X								

*Plant Communities (Dominant Species)

XG = subxeric grassland
SS = early successional scrub/shrub (hawthorn)
MG = mesic grassland
UG = unmaintained grassland corridor (meadow fescue)
ML = maintained lawn (meadow fescue, Kentucky bluegrass)
SA = seepage area (cattail, sandbar willow)
OW = open water
SF = slope forest (hackberry, elm, ash)
UF = upland forest
CC = closed canopy (hawthorn)
RC1 = riparian corridor (locust)
RC2 = riparian corridor (hackberry, elm)
RC3 = riparian corridor (hackberry, elm, boxelder)
RC4 = riparian corridor (hackberry, elm, locust, boxelder)
RC5 = riparian corridor (burr oak, sugar maple)
RC6 = riparian corridor (hackberry, cottonwood, bitternut hickory)

requirement, and to gain as thorough an understanding of the site-wide occurrence and distribution of as many plant species as possible, systematic walk-through investigations were implemented. These were carried out on four separate occasions during the 1992 growing season.

The initial phase of walk-through surveys involved the identification of virtually all major and minor community types. This was accomplished during a pre-implementation reconnaissance. Individual parcels were then covered by walking a series of parallel transect lines running generally in the direction of each tract's long axis. On herb-dominated fields and grasslands, a 50-m paced spacing between transect lines was used. In less diverse forested areas, the interval was increased to approximately 75 m. An estimated 2-m-wide corridor on either side of each transect was carefully scanned for species occurrences. As each new element was encountered, its identity was determined and the information recorded.

At the end of each parcel inventory, a species dominance code was subjectively assigned to the individual taxa. These codes, which take into account a plant's frequency of occurrence and areal coverage, range from "common" (characteristic and dominant) to "very rare" (a single locale with few individuals). These data were then pooled to derive not only a comprehensive species list, but also a subjective estimate of each taxon's relative dominance on a site-wide basis.

In addition to the community surveys described above, procedures were implemented to assess the potential occurrence of state and federal rare, threatened, and endangered species in and around the Mound facility. Lists of those sensitive species had been obtained from the Ohio Division of Natural Areas and Preserves prior to initiating ecological field work. Special habitats recognized as being capable of supporting the listed entities received a very high degree of scrutiny. Because such habitats tended to be limited, search corridors were intensified to cover all or nearly all of the land area involved. Habitats given the greatest consideration included wetlands, pond margins, seeps and springs, and riparian zones.

2.1.3. Species Identification and Archiving

While the identity of most plants could be directly ascertained in the field, certain taxa were collected for more detailed microscopic examination. Precise determinations were made using regional floristic manuals (Fernald 1950; Hitchcock 1950; Gleason 1952; Braun 1961, 1967; Cronquist 1980; and Gleason and Cronquist 1991). In cases where identities remained in doubt, botanical experts were consulted (Dr. Harold DeSelm, University of Tennessee, for Poaceae; Dr. Vernon McNeilus, University of Tennessee, for Cyperaceae). Herbarium searches at the University of Tennessee also proved useful in confirming species determinations.

Original operating procedures called for the archiving of each plant species identified during the ecological investigation. The practicality and utility of this requirement came into question, however, after the first few days of field work when over 100 species were encountered. Instead, only those taxa unidentifiable in the field were kept as voucher specimens. The problematic species have been archived at WESTON's Oak Ridge office and have been retained as a reference collection. Duplicate specimens have been mounted, labeled, and permanently reposited at the herbarium of the University of Tennessee, Knoxville (TENN).

2.2. FAUNAL INVESTIGATIONS

The basic approach to faunal sampling has been presented in the pre-investigation documents, such as the OU 9 site-Wide WP and the FSP. Several modifications to those original sampling methods, however, were instituted prior to the initiation of field work and have been documented in internal field change logs (Contractor Change Control Nos. 11, 14, and 15; July 1992). These changes were made in the interest of enhancing both the quality and relevancy of field data and improving data acquisition processes.

Biota groups characterized during the faunal investigations included birds, small and large mammals, and reptiles and amphibians (herptiles). Except for the changes described in the internal field change logs, the sampling strategy employed in the characterization of the Mound Plant terrestrial fauna was as defined in the WP and FSP. This approach is described below.

2.2.1. Avian Investigations

2.2.1.1. Transect Sampling

The primary method for determining the abundance and diversity of birds was transect sampling. In May 1992, WESTON investigators and representatives from the EPA and OEPA established a series of transects covering representative portions of each of the dominant plant community types present in and around the Mound facility. These community types are generally analogous with those described in Section 2.1 (Floristic Investigation). Plant communities were selected as the main stratification variable for the surveys since they provide critical habitat factors, such as food and cover, that determine species occurrence and distribution. No attempt was made to integrate sampling intensity with areal coverage of a given community type, however. Most floristic communities, regardless of areal extent, were sampled using two transects. This approach was considered valid because of the structural homogeneity within community types. The only exception was the slope forest community. This community was assessed using three transects to capture its broader range

of structural (successional) and topographic diversity. Table II.1 summarizes the relationship between the various transects, their general site location, and plant community/habitat type. Specific locational information is presented on Plate 2.

In all, 11 transects were established. Each transect was flagged to ensure that the same route was followed during each successive inventory effort. All transects were placed a minimum of 100 m apart to avoid duplication of individual bird observations within a given community type. Sampling was conducted during the spring, summer, and fall of 1992, and again in the winter of 1993. A detailed list of survey dates and times is presented in Table II.2.

Seasonal inventories were instituted to capture the full range of speciation, including summer nesters, winter visitors, seasonal migrants, and year-round residents. Sampling times were further divided into morning sessions, denoted as "AM" and afternoon sessions denoted as "PM." Morning sessions began 1/2-hour before sunrise and lasted until no later than 10:00 am. Afternoon surveys commenced at 3:00 pm and continued until dark. During the winter investigation, the timing of field surveys was modified somewhat to account for changes in the seasonal diurnal pattern. Because the birds were becoming active much later in the morning and began to roost earlier in the evening, the start of morning sampling was delayed until about 2 hours after sunrise; the afternoon effort was readjusted to begin at 2:00 pm. In all cases, however, the order in which the transects were sampled and their starting points were rotated daily to minimize time-of-day effects.

Avian surveys were always conducted on days with little or no precipitation and when the average wind speed was less than or equal to 15 miles per hour (mph). Each observer traveled along the entire length of the transect at a slow walk and scanned both sides of the route for avian species. When a bird was seen or heard, it was identified to species and sex (if possible), and its distance to the transect was estimated. Other details recorded on the data sheets specified whether the individual was in flight, perched, on water, or identified by song. In those instances where entire flocks of a given species were sighted in flight, bird counts were estimated.

2.2.1.2. Nocturnal Surveys

Because owls are near the top of the local food chain and are potential bioaccumulators of contaminants in the environment, the occurrence of these species was of particular interest. Accordingly, seasonal nocturnal surveys were instituted in an attempt to confirm the presence of owls at the Mound facility. During each sampling effort, recorded vocalizations of owls indigenous to Ohio were played between the hours of 10:00 pm and 2:00 am at established locations during the spotlight survey. Several calls were played at each stop, followed by a 30- to 60-second period of silence, and

Table II.2. Bird Survey Sampling Dates and Times Mound Plant, Montgomery County, Ohio

			Transect										
Season	Date	Time of Day	1A	1B	2A	2B	3X	4A	4B	5A	5B	6X	7X
Spring	05/27/92	AM	x	x	x	x	x						
		PM						x	x	x	x	x	x
	05/28/92	AM						x	x	x	x	x	x
		PM						x	x	x	x	x	x
	05/29/92	AM	x	x	x	x	x						
		PM											
	06/15/92	AM											
		PM	x	x	x	x	x						
Summer	08/27/92	AM	x	x	x	x	x						
		PM											
	08/28/92	AM						x	x	x	x	x	x
		PM	x	x	x	x	x						
	08/29/92	AM	x	x	x	x		x	x			x	x
		PM					x	x	x	x	x	x	x
	08/30/92	AM	x	x	x	x	x	x	x				
		PM											
	08/31/92	AM								x		x	x
		PM											

Table II.2. (page 2 of 2)

			Transect										
Season	Date	Time of Day	1A	1B	2A	2B	3X	4A	4B	5A	5B	6X	7X
Fall	10/13/92	AM	x	x	x	x	x	x	x				
		PM					x	x	x	x	x	x	x
	10/14/92	AM					x	x	x	x	x	x	x
		PM	x	x	x	x	x	x	x				
	10/15/92	AM	x	x	x	x	x	x	x	x	x	x	x
		PM											
	12/9/92	AM	x	x	x	x				x	x	x	x
		PM											
Winter	01/25/93	AM	x	x	x	x	x						
		PM					x	x	x	x	x	x	x
	01/26/93	AM	x	x	x	x				x	x	x	x
		PM					x	x	x	x	x	x	x
	01/27/93	AM	x	x	x	x	x	x	x				
		PM	x	x	x	x	x			x	x	x	x
	01/28/93	AM						x	x	x	x	x	x
		PM											

then followed again by the vocalization sequence. Investigators remained at each stop for 10 minutes, and all owls responding to calls were recorded by species, stop number, and direction of vocalization.

2.2.1.3. Random Encounters

To make the avian investigation as comprehensive as possible, casual sighting of all new bird species encountered during any phase of ecological sampling was recorded. Not only did this consist of birds directly associated with the site and a given habitat type, but also those species flying over the property (e.g., buteo hawks, migrating waterfowl). The rationale behind these latter tallies was that, although the birds might not have stopped at the site at the time of observation, there exists at least the possibility that they may have used it in the past or may use it at some point in the future.

2.2.2. Mammal Investigations

2.2.2.1. Small Mammals

The small mammal fauna at the Mound Plant site was examined during the spring, summer, and fall of 1992 using Sherman live traps arranged along transects in large and small grids. Each transect was 36 m in length and contained 10 traps spaced at approximately 4-m intervals (Figures C-1, C-2, and C-3). The large and small grids had four equal sides, each measuring 40 m and 8 m, respectively (Appendix C, Figures C-4 to C-9). The large grids were divided into five rows and five columns placed at 10-m intervals. The small grids were divided into three rows and three columns placed at 4-m intervals. The intersection of each column and row in the large and small grids was defined as the center of a station. A Sherman live trap was placed within 1 ft of the center of each station.

The location of each transect and grid is depicted on Plate 2. One transect was established on the South Property, one along the Miami-Erie Canal, and one on the North Property along the plant drainage ditch at the base of the Main Hill (Transects BB, ME, and DD, respectively). Three small grids were established on the North Property (Grids MH, PP, and SS); one small grid was established on the northern slope of the Main Hill on property owned by the city of Miamisburg (Grid NS). Two large grids were established on the South Property (Grids SW and SC).

During a site reconnaissance, the location of each transect and grid was agreed to by representatives of the EPA, OEPA, and the principal investigator. Each sampling area was then identified with a wooden stake placed at the end of a transect or corner of a grid. Upon initiation of the spring 1992 sampling effort, the small mammal sampling team used these stakes as a reference for each sampling area. Transects and grids were positioned so that every major plant community was sampled.

During the initial small mammal sampling effort conducted in the spring of 1992, the small mammal team laid out the grids using a 100-m measuring tape and marking each station with a fluorescent orange pin flag. Pin flags and stakes were labeled with permanent marker in code to identify the station and sampling area. Pin flags and stakes were left in place throughout the three sampling seasons.

Both large grids were established on the South Property because this area of the site had the largest expanses of homogenous vegetation types. Both large grids were chosen to cover meadow, woodland, and transitional zones; both overlapped the same intermittent creek. Conversely, the North Property was better suited for deployment of the small grids because the area's steep topography and developed nature resulted in smaller vegetative areas.

The final placement of a Sherman trap at each station was at the discretion of the small mammal team leader. The goal of individual trap placement was optimal trapping success for each trap. To that end, traps were placed near runways, burrows, dens, nests, logs, etc. Once the location of a trap was determined within a station, that location was not altered during the course of the sampling season.

At the beginning of each trapping period, the traps were deployed unbaited with the trap doors locked in an open position for 24 hours. At the end of this familiarization period, each trap was provided with a small amount of polyester "stuffing" (intended as bedding to reduce potential stress to the trapped animal), baited with a 50/50 mixture of oatmeal and peanut butter, and set for capture. Traps were checked and reset three times each day. In the evening, traps were set at least 1/2-hour before sunset, but never more than 3 hours before sunset. Traps were checked the following morning, beginning at least 1/2-hour after sunrise and completed within 4 hours after sunrise. Traps were checked and rebaited as needed during the noon hour. All sampling areas were sampled for a minimum of 5 consecutive days during the spring, summer, and fall sampling periods.

Captured animals were gently removed from the trap and placed in a clear ziplock plastic bag perforated with reinforced holes to avoid asphyxiation. Each animal was identified to genus (or species when possible), and its sex and age class were determined. Almost all of the small mammals captured were either eastern chipmunk (*Tamias stratus*), white-footed mouse (*Peromyscus leucopus*), or deer mouse (*Peromyscus maniculatus*). The investigators were not always able to distinguish *P. leucopus* from *P. maniculatus*. Consequently, all *Peromyscus* were grouped as a single taxon.

All animals were weighed to the nearest gram (g), using a 0 - 50 g or a 0 - 500 g Pesola scale. Observations of tumors, pelage condition, malformed growth, etc., were recorded on the field data sheet. Captured animals were marked with indelible ink in an effort to determine the recapture rate.

Pen markings were placed under the base of the tail for *Peromyscus* and on the white undercoat of all chipmunks. In many cases, the investigators were not able to accurately identify recaptured individuals; thus, no quantitative estimate of population size was calculated. When recaptured individuals could be positively identified, their length and weight were recorded but the resulting data were not used in the calculation of average weight and the associated standard deviation. Therefore, for some species, the total number of animals captured is different from the total number of individuals used to determine average weight and standard deviation.

2.2.2.2. Medium and Large Mammals

Surveys for medium and large mammals were conducted at night from four-wheel drive vehicles along established routes on both the North Property and South property (Plate 2). The routes were oriented so that each meadow or grassy opening could be examined with a spotlight (200,000 candlepower). While the principal objective of the nighttime surveys was to estimate the white-tail deer herd population on the Mound Plant site, other wildlife species were also tallied when seen (e.g., opossum, grey fox).

Nighttime surveys were conducted in the spring, summer, and fall of 1992, and winter and spring of 1993 by spotlighting from paved and unpaved roads in the direction of fields, forest edges, and openings (Plate 3, Table II.3). In general, surveys were begun soon after sunset and were concluded before midnight. The survey vehicle proceeded along roads or tracks at a speed of approximately 5 mph until wildlife was encountered. Observers would then make separate tallies for each wildlife species seen. If the observers differed in their count, the average was recorded in the field notes. At the beginning of each survey, weather conditions and ambient air temperature were recorded. Data variables documented at the time of each wildlife encounter included species, location, time, and, if discernible, sex and general age (i.e., adult or juvenile).

2.2.3. Herptile Investigations

Reptile and amphibian (herptile) surveys were performed in the summer of 1992 and the mid- and late spring of 1993. The WP and FSP stated that herptile surveys were to be performed during the spring, summer, and fall. The justification for this change was documented in an ER Program Planned Change Notification (Change No. 14). As described in this change notification, summer sampling for herptiles was conducted in late August 1992 under funding by Los Alamos National Laboratory (LANL). Prior to the onset of fall sampling, LANL funding of the ecological assessment ended and negotiations with EG&G for continuation of the ecological assessment began. In early December 1992, funding for the remainder of the ecological assessment became available from EG&G. However, while there were

Table II.3. Spotlight Survey Conditions

Date	Time Start	Time Stop	Weather/Wind (mph)	Temp(F°)	Survey Description	Comments
6/11/92	2230	2304	Clear	ND	North Property loop	
6/11/92	2315	0001	Clear	ND	South Property loop	
6/13/92	2212	2252	Partly cloudy	ND	North Property loop	Moon nearly full.
6/13/92	2254	2335	Partly cloudy	ND	Western half of South Property loop	Moon nearly full.
6/14/92	2202	2236	Mostly clear	ND	North Property loop	Full moon.
6/14/92	2250	2345	Mostly clear	ND	South Property loop	Full moon. Partial lunar eclipse at 2322.
6/15/92	2250	2315	Clear/0-2	ND	North Property loop	
6/15/92	2319	2357	Clear/0-2	ND	South Property loop	
8/28/92	2145	2220	Overcast/0-2	60	North Property loop[a]	Owl tapes played at Overflow Pond.
8/28/92	2210	2300	Overcast/0-2	60	South Property near entrance	Owl tapes played near stream crossing.
8/29/92	2140	2226	Clear/0-2	55-60	North Property loop	
8/29/92	2230	2320	Clear/0-2	55-60	South Property	Examined fields along Benner Road and in vicinity of intermittent stream in center of South Property. Owl tapes played near intermittent stream.
8/30/92	2050	2130	Mostly clear/0-2	55-60	South Property loop[b]	
12/10/92	2100	2120	Overcast/0-2	ND[b]	North Property loop	
12/10/92	2127	2147	Overcast/0-2	ND	South Property loop	
12/12/92	2200	2300	Overcast/0	35	North Property loop	
12/2/92	2300	2330	Overcast/0	32	South Property loop	

Table II.3. (page 2 of 2)

Date	Time Start	Time Stop	Weather/Wind (mph)	Temp(F°)	Survey Description	Comments
1/26/93	2200	2233	Clear/5	low 30s	North Property loop	Owl tapes played near Deep Wells.
1/26/93	2238	2328	Clear/0-2	low 30s	South Property loop	Owl tapes played at gravel road near Post 8.
1/27/93	2220	2254	Clear/0-2	30°	North Property loop	
1/27/93	2305	2350	Clear/0-2	30°	South Property loop	
1/28/93	2235	2308	Overcast/10-15	30°	North Property loop	
1/28/93	2315	2341	Overcast/10-15	30°	South Property loop	
4/6/93	2222	2317	Clear/0-5	60°	North Property loop	
4/6/93	2322	2358	Clear/0-5	60°	South Property loop	

[a]See Plate 3.
[b]ND = No data.

3 weeks remaining in the fall season, cold weather typically associated with late fall in Ohio had set in, and sampling for reptiles and amphibians became logistically and technically impractical. Further compounding this problem was the lack of an offsite access agreement with the city of Miamisburg for areas where herptile sampling was to have been performed, according to a verbal agreement reached with biologists from the EPA and OEPA during the preparatory stages of the ecological assessment (see Section 1). After reviewing the results of the summer quadrat and drift fence sampling effort and conferring with a University of Tennessee herpetologist involved with the ecological assessment, it was determined that the fall 1992 sampling effort that was missed could be replaced with one in early spring 1993.

2.2.3.1. Quadrat Searches

Quadrat searches were performed at three locations, representing a northwest-facing slope forest (North Slope and North Property) and a southwest-facing slope forest (South Property) (Plate 2). In each area, a 50-m by 50-m quadrat was established with the aid of a compass and metric tape. The four corners of the quadrat were located and permanently marked with a flagged stake. Nylon string was used to delineate the quadrat boundaries. Generally, each quadrat was searched by several biologists positioned side-by-side and moving in unison from one end of the quadrat to the other. Several passes were necessary to cover the entire area within the quadrat. The quadrate search schedule for the three plots is presented in Table II.4.

2.2.3.2. Drift Fences

Drift fences were constructed of aluminum flashing (50-cm wide and 30-m long) placed in a 10-cm trench with galvanized metal stakes set at each end of the flashing. Pitfall traps were buried flush with the soil surface at each end of the fence. A plywood cover (1 to 2 inches above the surface) was placed over all traps to provide shade and to attract animals (Appendix C, Figure C-10). All traps were checked daily. Drift fences were deployed at three locations at the Mound Plant (North Slope, Miami-Erie Canal, and the South Property) (Plate 2). Because of topographical constraints, the configuration of each drift fence differed. The North Slope location was selected because of the presence of Seep 607 and the habitat the North Slope presents for amphibians. This woodland slope has moderate to strong shading with significant drops in temperature below the canopy. Although there is little leaf litter on the ground, there are large numbers of downed trees and rocks for cover. The surface moisture was variable but adequate for amphibians. The North Slope drift fence was constructed in a three wing "T" formation with four pitfalls (Appendix C, Figure C-11). Two in-line wings were placed across the gradient while the remaining wing went down the slope. The downhill wing was parallel to the run-off from Seep 607. One of the in-line wings crossed the seepage channel approximately 45 m downhill from the source.

Table II.4. Herpetological Quadrat Search Schedule for Mound Ecological Assessment

Quadrat	Date/Time	Number of Person(s) Searching
North Slope	8-26-92/1230-1430	2
	4-7-93/1005-1200	2
	5-20-93/1100-1330	2
South Property	8-26-92/1615-1720	6
	4-7-93/1535-1655	2
	5-19-93/1616-1820	2
North Property	8-27-92/0900-1100	2
	4-8-93/0935-1110	2
	5-19-93/1200-1330	2

The Miami-Erie Canal drift fence site was unique in that it was located in an ecotonal area between a steep wooded slope and the Miami-Erie canal. The fence was placed on an artificial secondary terrace parallel to the canal and across the slope in a linear formation, with two wings and three shaded pitfalls (Appendix C, Figure C-12). A secondary fence was formed by the railroad tracks above the slope and parallel to the canal.

The South Property drift fence locality contained open woodlands, an intermittent stream bed, and tree falls. The fence formation included four wings with five shaded bucket pitfalls (Appendix C, Figure C-13). One of the wings was situated in a thicket; one wing went parallel to the stream bed; another was located in a moderately shaded woodland; and the fourth wing ran down a moderately steep woodland slope with dense shading. Therefore, several distinct, adjacent micro-habitats were sampled by the South Property drift fence.

The traps were checked at least twice a day to prevent desiccation or starvation. The drift fence set-up and monitoring schedule is presented in Table II.5. Animals captured in the roving searches, quadrat searches, or drift fences were identified, measured, weighed, sexed (if possible), and released. A few specimens of *Plethodon cinereus* were preserved in 10 percent formalin for later confirmation of identification.

2.2.3.3. Roving Searches

Herptiles were sampled by roving searches across all available habitats. Locations covered during each roving search are described in Table II.6. Several recorded sightings of amphibians and reptiles were made by the aquatic sampling team, the mammal team, the bird team, and the vegetation team. These sightings were classified as roving observations. No identifications of frogs were made exclusively from their calls.

2.3. AQUATIC INVESTIGATIONS

The basic approach to aquatic sampling has been presented in the pre-investigation documents such as the WP and the FSP. Twelve locations were identified for aquatic sampling in Section 12.3.2.4 of the WP and Section 10.3.3 of the FSP. Six of the sampling locations are located on Mound Plant property (onsite) and six of the locations are located on property owned by either the Miamisburg Conservancy District (MCD), city of Miamisburg, or both (offsite). With only minor adjustments to the precise location of each sampling area, the spring sampling effort was performed in June and July of 1992. Prior to the fall sampling effort, the offsite aquatic sampling was postponed until written

Table II.5. Herpetological Drift Fence Monitoring Schedule at the Mound Plant, Montgomery County, Ohio

Drift Fence	Set Date/Time	Monitoring Dates/Times	Last Check Closing Date/Time
North Slope	8-27-92/0900	8-28-92/0650,1315,1700 8-29-92/0745,1245 8-30-92/0700,1335	8-31-92/1015
	4-7-93/1000	4-8-93/0920	4-8-93/1600
	5-18-93/0940	5-18-93/1900 5-19-93/1000,1800 5-20-93/0930	5-20-93/1620
Miami-Erie Canal	8-27-92/1200	8-28-92/0800,1345,1720 8-29-92/0900,1300 8-30-92/0830,1400	8-31-92/1305
	4-7-93/0930	4-8-93/0845	4-8-93/1615
	5-18-93/0815	5-19-93/1045,1700 5-20-93/0900	5-20-93/1615
South Property	8-28-92/1415	8-29-92/1000,1400 8-30-92/0925,1400	8-31-92/1125
	4-7-93/0900	4-8-93/0845	4-8-93/1550
	5-18-93/1125	5-19-93/1047,1630 5-20-93/0950	5-20-93/1700

Table II.6. Roving Search Schedule For Herpetological survey at the Mound Plant, Montgomery County, Ohio

Date	Time Range	Location(s) Covered
8-28-92	2030-2200	Overflow Pond and Plant Drainage Ditch
8-28-92	2200-2300	Miami-Erie Canal
8-29-92	0815-1145	All habitats between north slope along railroad tracks to canal drift fence and then to South Property drift fence
8-29-92	1245-1540	All habitats between north slope along railroad tracks to canal drift fence and then to South Property drift fence
8-30-92	0700-0830	North slope site adjacent to railroad tracks
8-30-92	0900-1030	South Property
5-18-93	1900-2130	Peripheral roads around the site
5-18-93	2130-2245	Miami-Erie Canal
5-18-93	2245-0015 (5-19)	Overflow Pond and adjacent reach of Plant Drainage Ditch
5-19-93	1630-1700	Miami-Erie Canal
5-19-93	1720-1800	Park pond east of north slope in Miamisburg
5-19-93	1800-1830	Miami-Erie Canal
5-20-93	1700-1830	North Property roads and offsite peripheral roads

permission to access their properties was given by the MCD and the city of Miamisburg. A temporary access agreement that allowed sampling to proceed in the offsite areas was not issued until February 25, 1993. By that time, the 1992 fall season had passed. Although not explicitly stated as such, a consecutive spring-fall effort is implied in the WP and FSP. The EPA and OEPA decided to have aquatic sampling performed in the fall of 1993 to complement the spring 1992 effort. The EPA and OEPA also stated that they might require further sampling in the fall of 1994, should the aquatic data be problematic as a result of the extended hiatus between the spring and fall sampling efforts.

Fish and macroinvertebrates were the two biota groups characterized during the aquatic investigations. Aquatic macroinvertebrates are animals that are large enough to be seen by the unaided eye, can be retained by a U.S. Standard No. 30 sieve (28 meshes per inch, 0.595 mm openings), and live at least part of their life cycles within or upon available substrates in a body of water or water transport system. Observations of other biota groups, such as birds and amphibians, were made during aquatic sampling and were reported to the appropriate sampling teams.

Aquatic sampling was conducted in two distinct habitat types: streams and ponds. Table II.7 presents a description of the stream and pond locations and the type(s) of aquatic samples collected at each.

Physical habitats of the streams at the Mound Plant were evaluated and quantified using the Qualitative Habitat Evaluation Index (QHEI). A discussion of the QHEI is presented in Appendix G.

2.3.1. Fish Investigations

2.3.1.1. Field Procedures

Fish were collected at the stream and pond locations (identified in Table II.7) using either a stream-side or boat-mounted electroshocker equipped with cables and dipnets, or a backpack electroshocker and a seine net. Electroshocking with a stream-side generator was used during the spring effort. A backpack shocker did not effectively stun fish during the fall effort. Therefore, seining was used to collect fish during the fall effort. The length of time spent collecting fish at each location is presented in Table II.8. Prior to sampling, each stream location was isolated with block nets. Each stream location was then sampled with an upstream and a downstream pass, in accordance with OEPA standard methods (OEPA 1989). Fish collected in each pass were processed separately. Sampling in ponds was conducted until no new species were encountered and the team leader determined that an adequate representation of the fish community had been obtained. Fish were not found during the spring 1992 sampling effort in the Asphalt Pond (AP) or in the intermittent streams on the South Property (Benner Branch [BB] and East Fork [EF]); therefore, subsequent fish sampling efforts were not repeated at those locations during the fall survey.

Table II.7. Aquatic Sampling Effort at the Mound Plant, Summary of Sample Types Collected

Location Description	WP/FSP Location #	New Location #	Spring 1992					Fall 1993				
			Fish	H-D	Surber	Eckman	Qual.	Fish	H-D	Surber	Eckman	Qual.
Permanent Streams												
Miami-Erie Canal (south section), just downstream of the confluence with the plant drainage ditch.	1	MEI	X	X			X	X	X			X
Miami-Erie Canal (south section), in the vicinity of the confluence with the Overflow Creek.	2	ME2	X	X			X	X	X			X
Overflow Creek below the confluence with the south canal.	3	OC1	X	X			X	X	X			X
Overflow Creek near its mouth.	11	OC2	X	X			X	X	X			X
Plant Drainage Ditch, upstream of the retention basins.	5	DD1	X	X			X	X	X			X
Plant Drainage Ditch, downstream of the retention basins.	4	DD2	X	X			X	X	X			X
Intermittent Streams												
Unnamed stream on the South (new) Property near Mound Road.	6	EF	[b]		X		X			X		[c]
Unnamed stream on the South Property near the Western Property boundary[a]	7	BB	[b]		X		X			X		[c]
Ponds												
South Pond in the Miamisburg Municipal Park.	8	SP	X			X	X	X			X	X
Overflow Pond	9	OP	X			X	X	X			X	X
Retention Basins	10	RB	X			X	X	X			X	X
Asphalt-lined Pond	12	AP	[b]			X	X				X	X

[a]This location was moved upstream near Benner Road.
[b]Fish not present.
[c]During the fall sampling effort, Benner Branch and East Fork did not have sufficient flow to support qualitative sampling.

Table II.8. Length of Time, in Minutes, Spent Collecting Fish at the Mound Plant Aquatic Sampling Locations

Station	Spring 1992			Fall 1993		
	Pass 1	Pass 2	Total	Pass 1	Pass 2	Total
ME1	34	12	46	15	15	30
ME2	15	11	26	15	15	30
OC1	45	29	74	20	15	35
OC2	14	15	29	10	10	20
DD1	10	10	20	10	10	20
DD2	14	10	24	20	20	40
EF	-	-	-	-	-	-
BB	-	-	-	-	-	-
SP	-	-	37	-	-	25
OP	-	-	15	-	-	25
RB	-	-	25	-	-	26
AP	-	-	-	-	-	-
	Total Spring Effort = 296 minutes			Total Fall Effort = 251 minutes		

Fish collected in each pass through the streams or ponds were kept in 5-gallon buckets filled with water from the sampling location, and held until sample processing was completed. All fish were identified to species, counted, weighed to the nearest 0.01 g, and measured for both standard and total length to the nearest mm. Each fish was examined for symptoms of parasitism, disease, malformation, and tumors. In addition to these external signs, the general physical condition of each fish was recorded in the field databook. Representative samples of each fish species were preserved in 10 percent buffered formalin and retained as voucher specimens. All fish not retained as vouchers were returned unharmed to the streams or ponds at the location of capture.

2.3.1.2. Laboratory Procedures

Fish sampling results were analyzed through the calculation of the Index of Biotic Integrity (IBI) (OEPA 1988; Addendum 1989). The IBI incorporates 12 community metrics (Table II.9). The value of each metric is determined by fishing approximately 300 m of stream length. These values are compared to values predicted for a site where human influence has been minimal. Predictions are based on collections from many reference sites. Ratings of 5, 3, or 1 are assigned to each metric based on comparisons to predictions. For metrics 1 through 5, 8, 10, and 11, high values compared to predictions are awarded ratings of 5, values somewhat lower than predictions are awarded ratings of 3, and values considerably lower than predictions are awarded ratings of 1. For metrics 6, 7, 9, and 12, high values are rated lower than low values. This index is appropriate for watersheds of less than 20 sq mi (headwater sites). Criteria for headwater sites have been developed by the OEPA from samples collected from streams with watersheds ranging from 1 to 20 sq mi. These criteria may not apply to streams with watersheds less than 1 sq mi. Generally, drainage from waterheds less than 1 sq mi is intermittent and does not provide fish habitat. The Mound watershed is less than 1 sq mi. Flow from the Mound watershed is maintained artificially by release from the facility. No comparable location could be found for this unique Mound situation. Comparison of data from the Mound stream locations to OEPA criteria established from many locations, although all with larger watersheds, was considered to be the best possible alternative. A list of the metrics used to evaluate the IBI in headwater stream sites is presented in Table II.10.

IBI calculations were compared to QHEI habitat evaluations and to the Ohio Water Quality Standards for Modified Warmwater streams (OEPA 1988; Addendum 1989). The category of Modified Warmwater Habitat (MWH) includes channelized streams. All stream locations on or around the Mound site sampled for fish during this investigation were channelized.

There is no category in the Ohio Water Quality Standards for ponds, nor is it suggested by the OEPA that pond data be analyzed through IBI calculations. Therefore, pond fish data were analyzed only by inspection.

Table II.9. Index of Biotic Integrity Metrics Used to Evaluate Headwaters Stream Sites

IBI Metric	Headwaters Sites[a]
1. Total Number of Species[b]	X
2. Number of Darter and Sculpin Species	X
3. Number of Headwaters Species	X
4. Number of Minnow Species	X
5. Number of Sensitive Species	X
6. Percent Tolerant Species	X
7. Percent Omnivores	X
8. Percent Insectivorous Species	X
9. Percent Pioneering Species	X
10. Number of Individuals[c]	X
11. Number of Simple Lithophilic Species	X
12. Percent DELT Anomalies[d]	X

[a]Applies to sites with drainage areas between 1 and 20 sq mi.
[b]Excludes exotic species.
[c]Excludes species designated as tolerant, hybrids, and exotics.
[d]Includes deformities, eroded fins, lesions, and external tumors (DELT).

Table II.10. Physical and Chemical Parameters and Habitat Variables Characterized During the Aquatic Investigations at the Mound Plant

Parameter/Habitat Variable	Method of Quantification
pH	Fisher Scientific pH meter
Specific conductance	YSI meter, Model 33
Air temperature	Thermometer
Water temperature	Thermometer
Dissolved oxygen	YSI meter, Model 51B
Stream velocity	Marsh McBirney current meter, Model 201
Channel depth	Carpenter's rule
Channel width	Tape measure
Flow volume	Calculated using velocity, channel depth, channel width, and observed construction of channel
Bottom condition	Visually characterized
Substrate rock size	Visually characterized and measured
Embeddedness of rocks in fine matrix of gravel, sand, or silt	Visually estimated
Sediment conditions (i.e., odors, sheens, deposits)	Visually characterized
Aquatic vegetation	Visually characterized
Watershed coverage	Calculated from USGS quad map
Floodplain coverage	Visually characterized
Bank structure	Visually characterized

2.3.2. Macroinvertebrate Investigations

2.3.2.1. Field Procedures for Macroinvertebrates

Aquatic macroinvertebrates were collected using sampling devices and techniques appropriate for the habitats encountered (Table II.7). Benthic macroinvertebrates were collected from permanent streams with Hester-Dendy artificial substrates (OEPA 1988). Three individual substrates were deployed at each permanent stream location for 6 weeks during each sampling effort: June 14 to July 25, 1992, and September 22 to November 3, 1993. Criteria have been established by the OEPA from benthic samples collected between June 15 and September 30 (OEPA 1989). It is not clear if these dates refer to the deployment of artificial substrates, their retrieval 6 weeks later, or both. To ensure comparability to OEPA criteria, Hester-Dendy artificial substrates were deployed on or about June 15 as the earliest possible date, although organisms emerging before July 25 would be missed by this schedule.

Part of the objective of this study was to discern and describe natural seasonal changes. If the OEPA time frame applies to both deployment and retrieval dates and two sample groups were deployed withing that time frame, only 3 weeks would separate retrieval of the first group and deployment of the second. Seasonal changes over that short interval may not be dsicernable. To improve the chance of observing seasonal changes, fall samples were retrieved outside the OEPA time frame with the understanding that results from that group may not be comparable to OEPA criteria.

At the end of these intervals, qualitative samples were also collected at the permanent stream locations, using standard methods and equipment (OEPA 1989). A qualitative sample is defined as one in which two collectors spent at least 30 minutes each collecting aquatic macroinvertebrates from all available habitats and substrates in the stream reach where the quantitative samples were collected. Qualitative collections were continued until no new taxa were evident in gross examinations. Locations where the combination of Hester-Dendy and qualitative sampling was conducted are described in Table II.7.

At two locations on the South Property EF and BB, the stream was too small to allow normal Hester-Dendy deployment. Also, the temporary nature of the streams at those locations may have exposed the artificial substrates to air before conclusion of the required deployment interval, destroying the sample's usefulness. In lieu of Hester-Dendy sampling, three 1-ft^2 samples were collected at the two South Property locations during each sampling effort, using a Surber sampler with 500-micron mesh netting. Qualitative sampling was only conducted at these intermittent stream locations in the spring of 1992. A more complete discussion of the stream locations and deployment of the artificial substrates is presented in Appendix H. In the fall of 1993, EF and BB did not have continuous flow

and were present as small, isolated pools. Each pool was barely large enough to accommodate the 1-ft^2 frame of the Surber sampler. Because there was no current, all rocks and sediments within the ft^2 frame were collected. For this reason, qualitative sampling was not performed in the intermittent streams during the fall survey. This method has been used successfully by WESTON previously and was approved verbally by OEPA prior to sampling.

Benthic communities in ponds were sampled with a standard Ekman dredge. Three 0.25-ft^2 dredge samples and a qualitative sample were collected from each of four ponds during June 1992 and November 1993 sampling efforts.

Physical and chemical variables and habitat variables were characterized at each aquatic sampling location (Table II.10). QHEI forms were completed, using these data and other field observations (OEPA 1989).

2.3.2.2. Laboratory Procedures

Material collected using the various benthic collection methods was placed in labeled plastic containers, preserved with formaldehyde, and shipped to the Pennington and Associates, Inc., laboratory in Cookeville, Tennessee, for identification and enumeration. Benthic macroinvertebrate community analyses included the following statistical and index methods and treatments:

- ICI (streams) (OEPA 1988; Addendum 1989).
- Statistical comparisons of the number of individuals (ponds).
- Statistical comparison of the number of taxa (ponds).
- Shannon Diversity Index (ponds).
- Hilsenhoff Biotic Index (ponds).
- Percent similarity index (ponds).

A list of the metrics and criteria used to calculate ICI scores is presented in Table II.11.

For statistical tests, Bartlett's test for homogeneity of variances was used to determine if the fourth root of x ($\sqrt[4]{x}$) transformation was required. For more detailed descriptions of statistical tests and indices, see Appendix I.

Table II.11. Macroinvertebrate Community Metrics and Criteria for Calculating the Invertebrate Community Index (ICI) and ICI Scores for Evaluating Biological Condition

Metric	Score			
	0	2	4	6
1. Total number of taxa	Varies with drainage area			
2. Total number of Mayfly taxa	Varies with drainage area			
3. Total number of Caddisfly taxa	Varies with drainage area			
4. Total number of Dipteran taxa	Varies with drainage area			
5. Percent Mayfly composition	0	>0,≤10	>10,≤25	>25
6. Percent Caddisfly composition	Varies with drainage area			
7. Percent Tribe Tanytarsini Midge composition	0	>0,≤10	>10,≤25	>25
8. Percent other Dipteran and non-Insect Composition	Varies with drainage area			
9. Percent tolerant organisms	Varies with drainage area			
10. Total number of qualitative EPT taxa	Varies with drainage area			

3. RESULTS AND DISCUSSION

3.1. FLORISTIC INVESTIGATIONS

The Mound site falls within what Schaffner has called the Miami Phytogeographic Region (1932). This region incorporates a large portion of the western Ohio glacial till plain and is underlain primarily by Ordovician limestones and shales (Stout 1943). Descriptions from early property surveys, botanical expeditions, and existing remnants of natural vegetation suggest that, prior to European settlement, the area around present-day Miamisburg was dominated by the oak-sugar maple forest association (Sears 1925; Gordon 1966, 1969). Well-drained upland sites contained a high percentage of both white and northern red oak, as well as white ash and shagbark hickory. More mesophytic species (such as elm, basswood, black walnut, sugar maple, black maple, and bitternut hickory) tended to be dominant on the moist lower slopes and ravines.

Today, nearly all of the original hardwood forests and attending herbaceous vegetation has been severely impacted by man's activities (Braun 1961). The former oak-sugar maple forest association of south-central Montgomery County has been replaced by small, second-growth woodlands interspersed among farmlands and vast areas of urban development. Most extant stands are now comprised of small diameter, early- and mid-successional species such as hackberry, American elm, honeylocust, blue ash, and eastern redbud. The vegetational composition of the area has been further impacted by purposeful and accidental introduction of numerous exotic species. Some of these Asiatic and European species have thrived and are now aggressively supplanting the native flora.

The intent of the following subsection is to describe both the composition and distribution of vegetation at the Mound facility as it currently exists. A characterization of dominant communities based on fixed-area sampling methods is presented first. This is followed by a discussion of site-wide vegetation occurrences derived from systematic walk-through surveys.

3.1.1. Fixed-Area Sampling

North-Facing Slope Forests

North-facing slope forests occur primarily on the SM/PP Hill and on offsite areas associated with the Main Hill. As the type name indicates, these forests are characteristically found on upland topographic positions. Elevations range from about 720 to 870 ft. Degree of slope within the type is steep and, in certain locations, may exceed 30 percent. Because of their generally north-facing orientation or

aspect, these habitats tend to receive the least amount of direct sunlight. Consequently, in Northern Temperate zones, these sites have the potential for being cooler and moister than sites on different slope aspects. Plants colonizing such areas are often adapted to these special conditions and are normally the least tolerant of evapotranspirational stress (Spurr and Barnes 1973).

Soils within north-facing slope forests are moderately eroded Ritchey, Hennepin, and Miami silt loams or silty clay loams of the Fairmount Series. Each of these soils is derived from calcareous glacial till or from residuum of thin-bedded limestone and clay-shale bedrock (Davis et al. 1976). Steep relief causes soil profiles to be rather shallow and poorly developed, with parent material at or close to the surface. Despite the potential for favorable moisture regimes related to northern aspects, water retention is only fair; rapid percolation carries soil nutrients downhill and away from the rooting zone.

Overstory

Table III.1 summarizes the fixed-area sampling protocols used in each vegetation stratum within the various community types. The table also includes a synopsis of data products associated with each phase of the inventory.

Examination of plot data from a representative north-facing stand on the SM/PP Hill indicates the most dominant overstory trees are hackberry, the Asiatic white mulberry, and white ash (Table III.2). Hackberry has been particularly successful in capturing the site and currently accounts for 20 percent of the average relative density and nearly 24 percent of average relative cover (Table III.3). White mulberry, while not as prevalent as either hackberry or white ash in terms of stem density or frequency, has a marked influence on stand structure by virtue of its ability to achieve superior diameter growth.

An apparent elevated soil pH has allowed for the addition of several obligate and facultative calciphytes to the canopy. These include species such as eastern redbud, Ohio buckeye, and blue ash. Both redbud and blue ash are equally frequent constituents within the stand, occurring at an average density of 200 stems/hectare (ha). The basal area coverage of redbud, however, is five times that of blue ash, indicating larger stem diameters. Ohio buckeye contributes approximately the same amount of basal area coverage to the site as does redbud, but it only occurs at the rate of 100 stems/ha.

When analyzed from the stand level perspective, fixed-area plot data show a mean basal area coverage of 26.70 m^2/ha and an average density of 1,500 stems/ha for all species combined (Table III.2). Stem diameters were found to range from 5.0 to 40.4 cm, but averaged only 12.87 cm. This information suggests that the area is moderately stocked with mostly small-diameter stems. Overstory height,

Table III.1. Floristic Investigations: Summary of Fixed-Area Sampling Protocols and Data Products Associated with Each

Community Type	Sampling Unit	Stratum[a]	Measurement/ Measurement Interval	Data Product[b]
North-Facing Slope Forest South-Facing Slope Forest Riparian Forest Scrub-Shrub Area	100 m^2 (10 x 10 m)	Tree	Stem Count by Species (1 time)	- Average Density (stems/ha) - Average Relative Density (%) - Average Frequency (%) - Average Relative Frequency (%)
North-Facing Slope Forest South-Facing Slope Forest Riparian Forest Scrub-Shrub Area	100 m^2	Tree	Stem Diameter by Species (1 time)	- Average Basal Area Coverage (m^2/ha) - Average Relative Basal Area Coverage (%) - Importance Value - Importance Rank
North-Facing Slope Forest South-Facing Slope Forest Riparian Forest Scrub-Shrub Area	100 m^2	Dominant and Codominant Trees (four per plot)	Total Height (1 time)	- Average Canopy Height (m) (not species specific)
North-Facing Slope Forest South-Facing Slope Forest Riparian Forest Scrub-Shrub Area	100 m^2	Dominant and Codominant Trees (four per plot)	Total Age (1 time)	- Average Stand Age (years) (not species specific)
North-Facing Slope Forest South-Facing Slope Forest Riparian Forest Scrub-Shrub Area	10 m^2 (3.16 x 3.16 m)	Shrub/Sapling	Stem Count by Species (1 time)	- Average Density (stems/ha) - Average Relative Density (%) - Average Frequency (%) - Average Relative Frequency (%)
North-Facing Slope Forest South-Facing Slope Forest Riparian Forest Scrub-Shrub Area	10 m^2	Shrub/Sapling	Stem Based Diameter (1 time)	- Average Basal Area Coverage (m^2/ha) - Average Relative Basal Area Coverage (%) - Importance Value - Importance Rank
North-Facing Slope Forest South-Facing Slope Forest Riparian Forest Scrub-Shrub Area	1 m^2 (1 x 1m)	Woody Seedling	Stem Count by Species (1 time)	- Average Density (stems/ha) - Average Relative Density (%) - Average Frequency (%) - Average Relative Frequency (%)

Table III.1. (page 2 of 2)

Community Type	Sampling Unit	Stratum[a]	Measurement/ Measurement Interval	Data Product[b]
North-Facing Slope Forest South-Facing Slope Forest Riparian Forest Scrub-Shrub Area Subxeric Grassland Mesic Grassland	1 m^2	Woody Seedling Herbs (in part)	Cover Estimation[c] by Species (4 times)	- Average Foliar Coverage (%) - Average Relative Foliar Coverage (%) - Importance Value - Importance Rank - Cover Change (%) from Previous Sample - Frequency Change (%) from Previous Sample

[a]See text for definition of various vegetation stata.
[b]Data products are on a by-species basis unless otherwise noted. Mathematical formulas used to compute data products are presented in the FSP.
[c]Derivation of importance value and ranking for woody seedlings is based on a one-time, early season estimation of cover. Importance values are relevant only to non-grassland areas.

Table III.2. North-Facing Slope Forest: Summary of Overstory Tree Parameters

Species	Average Density (stems/ha)	Average Frequency (%)	Average[a] Basal Area Coverage (m^2/ha)
American elm (L)	150	50	1.99
American elm (D)	100	50	1.25
Blue ash (L)	200	50	0.58
Boxelder (L)[b]	50	50	0.15
Hackberry (L)	300	100	6.40
Ohio buckeye (L)	100	50	3.65
Redbud (L)	200	50	3.11
White ash (L)	250	100	0.98
White ash (D)[c]	50	50	0.10
White mulberry (L)	100	50	8.49
TOTALS	1,500	-	26.70
	L = 90.00%		L = 94.94%
	D = 10.00%		D = 5.06%

[a]Average cover values are derived from DBH measurements taken in fixed-area plots during the June 1992 inventory.
[b]L = Live stems.
[c]D = Dead stems.

Table III.3. North-Facing Slope Forest: Relativized Overstory Tree Parameters and Derivation of Species Importance Values

Species	(A) Average Relative Density (%)	(B) Average Relative Frequency (%)	(C) Average[a] Relative Cover (%)	Importance Value (A) + (B) + (C)	Importance Rank
American elm (L)	10.00	8.33	7.45	25.78	6
American elm (D)	6.67	8.33	4.68	19.68	8
Blue ash (L)	13.33	8.33	2.17	23.83	7
Boxelder (L)[b]	3.33	8.33	0.56	12.22	9
Hackberry (L)	20.00	16.67	23.97	60.64	1
Ohio buckeye (L)	6.67	8.33	13.67	28.67	5
Redbud (L)	13.33	8.33	11.65	33.31	4
White ash (L)	16.67	16.67	3.67	37.01	3
White ash (D)[c]	3.33	8.33	0.38	12.04	9
White mulberry (L)	6.67	8.33	31.80	46.80	2
TOTALS	100.00	100.00	100.00	300.00	-

[a]Average relative cover values are derived from DBH measurements taken in fixed-area plots during the June 1992 inventory.
[b]L = Live stems.
[c]D = Dead stems.

determined by sampling representative individuals from dominant and codominant canopy positions, averaged 12.96 m, further documenting the rather diminutive nature of the overstory trees.

Average stand age provides additional information regarding forest structure and dynamics. Dominant and codominant trees averaged only 40.13 years. This correlates well with the relatively small stature of the overstory trees described previously. Additionally, the standard deviation associated with overstory age was only 4.55 years, strongly indicating an even-aged stand condition. This implies that the trees now comprising the overstory all germinated at approximately the same time. Synchronous germination of this kind commonly takes place in highly disturbed habitats where propagules are exposed to full sunlight, as might be the case in old field succession. Indeed, anecdotal information from a long-time employee at Mound confirms that, at the time of the facility's construction in the late 1940s, the SM/PP Hill was an abandoned pasture containing only scattered trees and honeysuckle shrubs (Thomas 1992).

Middlestory

Within the shrub and sapling stratum, Amur honeysuckle populations are extremely well developed. Crown diameter measurements of live stems indicate that this species alone contributes, on a per hectare basis, 9,390 m^2 of foliar cover. This suggests nearly complete middlestory closure. Combined live and dead average density was found to be correspondingly high at 10,500 stems/ha (Table III.4). This is equivalent to 87.5 percent of total middlestory density (Table III.5). On well-drained calcareous situations, this introduced Asiatic species apparently has such a competitive advantage that it has precluded the establishment of all other arborescent taxa except blue ash. Although blue ash is also known to thrive in upland limestone habitats, it has only been able to maintain itself in areas where Amur honeysuckle thins out or where it has succeed in raising its crown above the level of the honeysuckle.

Understory

Undoubtedly the extreme density and coverage associated with Amur honeysuckle is responsible for preventing the survival and, hence, recruitment of woody tree species into the upper canopy levels. Inventory data from the understory stratum show that small hackberry and blue ash seedlings will persist for a time, but ultimately cannot compete with the honeysuckle in the struggle for light and nutrients. In the 0.26- to 1-m height category, both species occur at the rate of 1,000 stems/ha, but no arborescent taxa, not even the hardy blue ash, lived long enough to persist in the 1.01- to 1.36-m category (Table III.6).

Table III.4. North-Facing Slope Forest: Summary of Shrub and Sapling Parameters

Species	Average Density (stems/ha)	Average Frequency (%)	Average[a] Basal Area Coverage (m^2/ha)
Amur honeysuckle (L)	8,000	100	1.80
Amur honeysuckle (D)[c]	2,500	100	0.48
Blue ash (L)[b]	1,500	100	2.32
TOTALS	12,000		4.60
	L = 79.17%		L = 89.56%
	D = 20.83%		D = 10.44%

[a]Average cover values are derived from basal diameter measurements taken in fixed-area plots during the June 1992 inventory.
[b]L = Live stems.
[c]D = Dead stems.

Table III.5. North-Facing Slope Forest: Relativized Shrub and Sapling Parameters and Derivation of Species Importance Values

	(A)	(B)	(C)		
Species	Average Relative Density (%)	Average Relative Frequency (%)	Average[a] Relative Cover (%)	Importance Value (A) + (B) + (C)	Importance Rank
Amur honeysuckle (L)	66.67	33.33	39.13	139.13	1
Amur honeysuckle (D)[c]	20.83	33.33	10.43	64.59	3
Blue ash (L)[b]	12.50	33.33	50.44	96.27	2
TOTALS	100.00	100.00	100.00	300.00	-

[a]Average cover values are derived from basal diameter measurements taken in fixed-area plots during the June 1992 inventory.
[b]L = Live stems.
[c]D = Dead stems.

Table III.6. North-Facing Slope Forest: Summary of Woody Seedling Parameters

Species	Size/Age Class: Average Density (Stems/ha)				Average Frequency (%)	Average[a] Foliar Coverage (% Sample Area)
	Germinal	1 yr - 0.25 m	0.26 m - 1.00 m	1.01 m - 1.36 m		
American elm (L)	0	1,000	0	0	10	0.10
Amur honeysuckle (L)	•	206,000	7,000	3,000	100	4.90
Amur honeysuckle (D)	•	0	1,000	1,000	20	0.00
Blue ash (L)	0	0	1,000	0	10	0.30
Blue ash (D)[c]	0	0	0	1,000	10	0.00
Frost grape (L)	19,000	1,000	0	0	80	0.70
Hackberry (L)[b]	15,000	5,000	1,000	0	80	0.90
Multiflora rose (L)	0	1,000	0	0	10	0.10
Redbud (L)	15,000	0	0	0	40	0.40
TOTALS	49,000	214,000	10,000	4,000	--	7.40
	L = 98.19%					
	D = 1.81%					

[a]Average cover values are based on subjective estimates of the percent of ground area within sample units occupied by woody seedlings. Data are derived from June 1992 fixed-area plot inventory.
[b]L = Live stems.
[c]D = Dead stems.
•Germinal and 1 year - 0.25m seedlings pooled.

Field data also suggest that extreme Amur honeysuckle density (Tables III.6 and III.7) may even act to interfere with its own long-term seed regeneration mechanisms. While initial germination is very high, averaging 206,000 seedlings/ha, the extremely dense shading afforded by the parent plants deters the persistence of the propagules. At least within the north-facing stands, the only stems that could be found in the 1.01- to 1.36-m size class were those which had arisen as basal offshoots or vegetative root sprouts from dominant mature individuals.

Since Amur honeysuckle exhibits notable seed regeneration problems within closed stands, it is puzzling how the species manages to maintain itself in such high numbers over a relatively long period of time. This is especially true when it is realized that supplemental stem age samples showed that the largest individuals (in terms of height and basal diameter) averaged only 9.88 years. A plausible explanation is that, once honeysuckle has formed a relatively unbroken shrub layer, it must then rely solely on vegetative propagation. As older individuals senesce and begin to die, adventitious buds located at the top of the root collar become active and begin to sprout. Because the sprouts have a readily available supply of water and nutrients from pre-existing root systems of the parent plants, their growth is rapid. Competition among sprouts of a single individual is intense; only those reaching the top of the shrub layer survive. After the surviving stems persist for a period of perhaps a decade, the process is repeated. Though turnover is continuous, this process ensures the species continued dominance in the lower forest strata.

Herbs and Non-Vegetated Substrates

It would appear that extremely low light intensity beneath nearly unbroken stands of Amur honeysuckle is displacing native herbaceous species, just as it does with middle and understory woody taxa. Examination of Figure 3.1 and Tables A.1 and A.2 in Appendix A shows that the only herbaceous plant of significance occurring in understory plots is the very shade-tolerant garlic mustard. Even at that, this weedy European entity succeeds in capturing, at best, only 3.3 percent of the forest floor. The vast majority of the forest floor area is occupied by leaf litter and bare soil. Depending on the time of the growing season, the combined occurrence of these substrate types ranges from 77.6 to 81.2 percent. Not surprisingly, the two are also inversely related. In the beginning and at the end of the growing season, when leaf litter is at its highest, the amount of bare soil decreases. This corresponding decrease is a direct result of soils being overlain with leafy detritus.

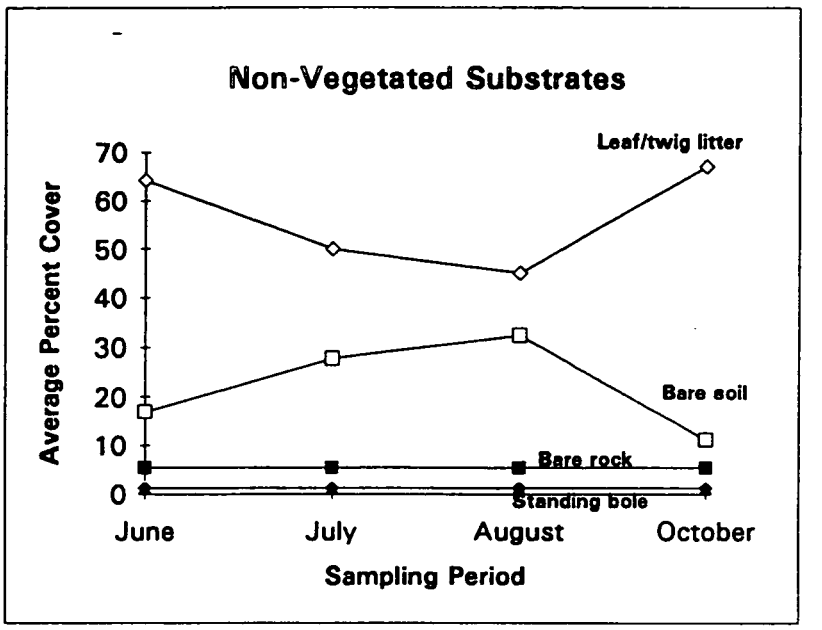
South-Facing Slope Forests

This forest type is restricted to the South Property on the southern flank of the SM/PP Hill. Topography is gently to moderately sloping; elevations range from about 750 to 860 ft. Soils in the

Table III.7. North-Facing Slope Forest: Relativized Woody Seedling Parameters and Derivation of Species Importance Values

Species	(A) Average Relative Density (%)	(B) Average Relative Frequency (%)	(C) Average[a] Relative Cover (%)	Importance Value (A) + (B) + (C)	Importance Rank
American elm (L)	0.36	2.78	1.35	4.49	7
Amur honeysuckle (L)	76.90	27.78	66.22	170.90	1
Amur honeysuckle (D)	1.44	5.56	0.00	7.00	6
Blue ash (L)	0.36	2.78	4.05	7.19	5
Blue ash (D)[c]	0.36	2.78	0.00	3.14	8
Frost grape (L)	7.22	22.22	9.46	38.90	3
Hackberry (L)[b]	7.59	22.22	12.16	41.97	2
Multiflora rose (L)	0.36	2.78	1.35	4.49	7
Redbud (L)	5.42	11.11	5.41	21.94	4
TOTALS	100.00	100.00	100.00	300.00	-

[a]Average relative cover valves are based on subjective estimates of the percent of ground area within sampling units occupied by woody seedlings. Areal coverage of substrates and herbaceous species has been omitted from the calculations. Data are derived from June 1992 fixed-area plot inventory.
[b]L = Live stems.
[c]D = Dead stems.



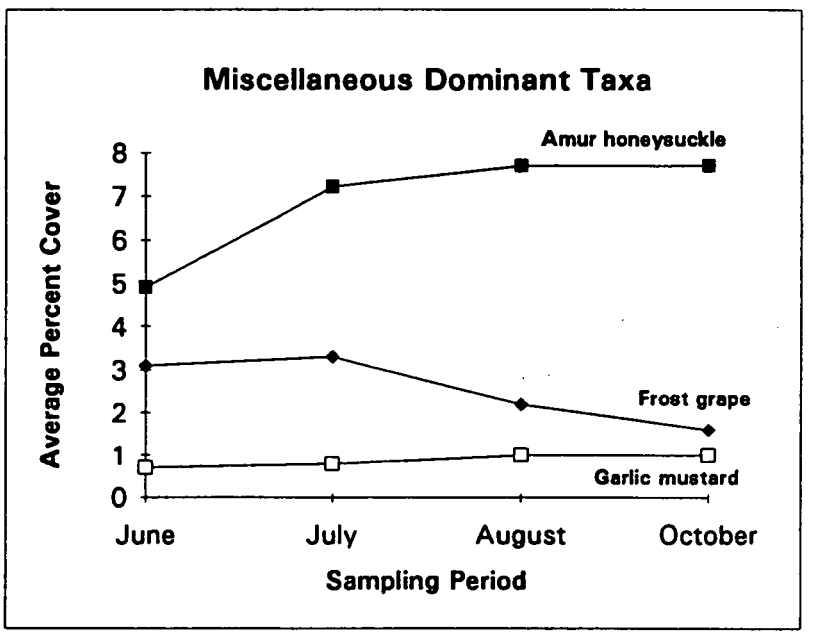


Figure 3.1. North-facing slope forest: Average percent cover of dominant non-vegetated substrates and of dominant plant species tracked throughout the growing season on ten 1-m^3 fixed-area plots (a)

(a) Dominants are considered to be those substrates and plant species contributing a minimum of 1 percent average cover at some point during the growing season.

area consist of Fairmont and Milton silty clay loams that are somewhat eroded (Davis et al. 1976). From an ecological perspective, south-facing forests receive a markedly higher amount of solar insolation than north-facing sites and, consequently, are under greater evaporational and transporational influence. This potential stress, however, is offset by more well-developed soils that offer a greater available moisture-holding capacity and a deeper rooting zone.

Overstory

Physiognomically, the south-facing forests are similar to their north-facing counterparts. Stands are comprised of relatively young, mixed deciduous species underlain with dense Amur honeysuckle. Apart from several widely scattered super-dominants, the overstory has an even-aged appearance. This suggests that this forest, like contiguous north-facing stands, originated in an abandoned pasture. Super-dominant trees, therefore, seem to represent old residual pasture trees that were present before the advent of secondary succession.

The forest canopy in this location averages 16.08 m high and is populated primarily by white ash and American elm. Hackberry, which was the principal constituent of the north-facing upland forest, is subordinate here (Tables III.8 and III.9). Stand density for all species combined averages 1,750 stems/ha, while basal area coverage averages 35.57 m^2/ha. This indicates that, at least in comparison with north-facing forests, south-aspect forests are better stocked and are composed of larger diameter trees ($\bar{x}$ = 14.5 cm). The stands too are slightly younger, averaging only 37.38 years (s = 4.93 years).

Overstory mortality appears somewhat elevated at 13.47 percent of standing basal area. Although some tree death can be equated with normal successional processes, most can be attributed to the impact that Dutch elm disease has had on American elm. Virtually all dead elms bore characteristic insect galleries made by the disease vector, the lesser European elm bark beetle. Field evidence indicates that Dutch elm disease, highly prevalent in the past 10 years, is currently in a quiescent state. Its former predominance in this location may be related to the insect's increased feeding and fecundity rates on warmer southern exposures.

Middlestory

Woody shrubs and sapling-size arborescent taxa are dominated by Amur honeysuckle and blue and white ash, respectively. Amur honeysuckle contributes well in excess of 65 percent of middlestory basal area ($\bar{x}$ = 3.55 m^2/ha), nearly 40 percent of average relative density (4,500 stems/ha) (Tables III.10 and III.11), and 75 percent of foliar cover (4,760 m^2/ha). Ash species seem to gain a foothold and compete successfully in microsites where Amur honeysuckle is sparse and in small sunny openings created by disturbances in the canopy.

Table III.8. South-Facing Slope Forest: Summary of Overstory Tree Parameters

Species	Average Density (stems/ha)	Average Frequency (%)	Average[a] Basal Area Coverage (m^2/ha)
American elm (L)	650	100	11.70
American elm (D)	300	100	4.53
Amur honeysuckle (L)	50	50	0.12
Hackberry (L)[b]	50	50	1.40
Soft hawthorne (L)	50	50	0.77
Soft hawthorne (D)[c]	50	50	0.26
White ash (L)	600	100	16.79
TOTALS	1,750	-	35.57
	L = 80.00%		L = 86.53%
	D = 20.00%		D = 13.47%

[a]Average cover values are derived from DBH measurements taken in fixed-area plots during the June 1992 inventory.
[b]L = Live stems.
[c]D = Dead stems.

Table III.9. South-Facing Slope Forest: Relativized Overstory Tree Parameters and Derivation of Species Importance Values

	(A)	(B)	(C)		
Species	Average Relative Density (%)	Average Relative Frequency (%)	Average[a] Relative Cover (%)	Importance Value (A) + (B) + (C)	Importance Rank
American elm (L)	37.14	20.00	32.89	90.03	2
American elm (D)	17.14	20.00	12.74	49.88	3
Amur honeysuckle (L)	2.86	10.00	0.34	13.20	7
Hackberry (L)[b]	2.86	10.00	3.94	16.80	4
Soft hawthorne (D)[c]	2.86	10.00	0.73	13.59	6
Soft hawthorne (L)	2.86	10.00	2.16	15.02	5
White ash (L)	34.28	20.00	47.20	101.48	1
TOTALS	100.00	100.00	100.00	300.00	-

[a]Average relative cover values are derived from DBH measurements taken in fixed-area plots during the June 1992 inventory.
[b]L = Live stems.
[c]D = Dead stems.

Table III.10. South-Facing Slope Forest: Summary of Shrub and Sapling Parameters

Species	Average Density (stems/ha)	Average Frequency (%)	Average[a] Basal Area Coverage (m^2/ha)
American ash (L)[b]	1,000	50	0.14
Amur honeysuckle (L)	1,500	100	0.66
Amur honeysuckle (D)	4,500	100	3.55
Blue ash (L)	3,500	50	0.80
Blue ash (D)[c]	1,000	50	
TOTALS	5,000		5.24
	L = 78.26%		L = 85.69%
	D = 21.74%		D = 14.31%

[a]Average cover valves are derived from basal diameter measurements taken in fixed-area plots during the July 1992 inventory.
[b]L = Live stems.
[c]D = Dead stems.

Table III.11. South-Facing Slope Forest: Relativized Shrub and Sapling Parameters and Derivation of Species Importance Values

	(A)	(B)	(C)		
Species	Average Relative Density (%)	Average Relative Frequency (%)	Average[a] Relative Cover (%)	Importance Value (A)+(B)+(C)	Importance Rank
Amur honeysuckle (L)	39.13	28.57	67.75	135.45	1
Amur honeysuckle (D)	13.04	28.57	12.59	54.20	3
Blue ash (L)	30.43	14.29	15.27	59.99	2
Blue ash (D)[c]	8.70	14.29	1.72	24.71	5
White ash (L)[b]	8.70	14.29	2.67	25.66	4
TOTALS	100.00	100.00	100.00	300.00	-

[a]Average cover valves are derived from basal diameter measurements taken in fixed-area plots during the July 1992 inventory.
[b]L = Live stems.
[c]D = Dead stems.

Understory

The same dynamics described under north-facing slope forests are repeated in the understory of south-facing forests. An extremely dense Amur honeysuckle shrub layer initially permits the germination of certain woody species, but ultimately precludes the long-term survivorship of most individuals. Only the honeysuckle itself produces significant numbers of stems that attain a height greater than 1 m. Most, however, are vegetative in nature, and many of these die in the dense shade of the parent plants (Tables III.12 and III.13).

Herbs and Non-Vegetated Substrates

Field data derived from replicated 1-m^2 plots again clearly show the repressive effect of Amur honeysuckle on the establishment of a herbaceous community. Despite being carried out over a significant part of the growing season, only two herb species were encountered. These include field garlic and garlic mustard (Tables A.3 and A.4 in Appendix A). Of the two, only garlic mustard succeeds in capturing greater than 1 percent of the plot area. The prevalence of non-colonized bare soil and leaf/twig litter substrates is indicative of inhospitable growing conditions associated with low light intensity. Combined average cover values for these span from 69.2 to 73.7 percent (Figure 3.2).

It is clear from the previous discussion that the introduced Amur honeysuckle is a highly tenacious species that, after becoming established, has the ability to out-compete native plants. Even though much of the suppressive effect is certainly attributable to the low light intensities found beneath well-established upland stands, additional competitive factors may be involved. Review of the literature indicates that several of the Asiatic shrub honeysuckles that are very closely related to Amur honeysuckle possess the ability to inhibit the growth of associated species through the release of metabolic by-products into the soil (Cottam 1984; Norby and Koslowski 1980; Zolotuckhin 1980-81). It is conceivable that these same allelopathic capabilities could be present in Amur honeysuckle. If present, such capabilities could strongly interfere with the reproductive success of many woody and herbaceous elements, particularly within sub-canopy levels on well-drained sites.

Riparian Forests

The riparian forest type occurs in areas falling within the historic 100-year flood plain of the Great Miami River. Such communities are most conspicuous adjacent to the Miami-Erie Canal and Overflow Creek system. Elevational gradients are slight and range from approximately 700 to 720 ft. Original soils were dominated by alluvial Ross silt loams, but are now partially intruded with unconsolidated fill material. Although the soils are considered well-drained, they exhibit high moisture and nutrient availability and offer a deep rooting zone during the growing season (Davis et al. 1976).

Table III.12. South-Facing Slope Forest: Summary Of Woody Seedling Parameters

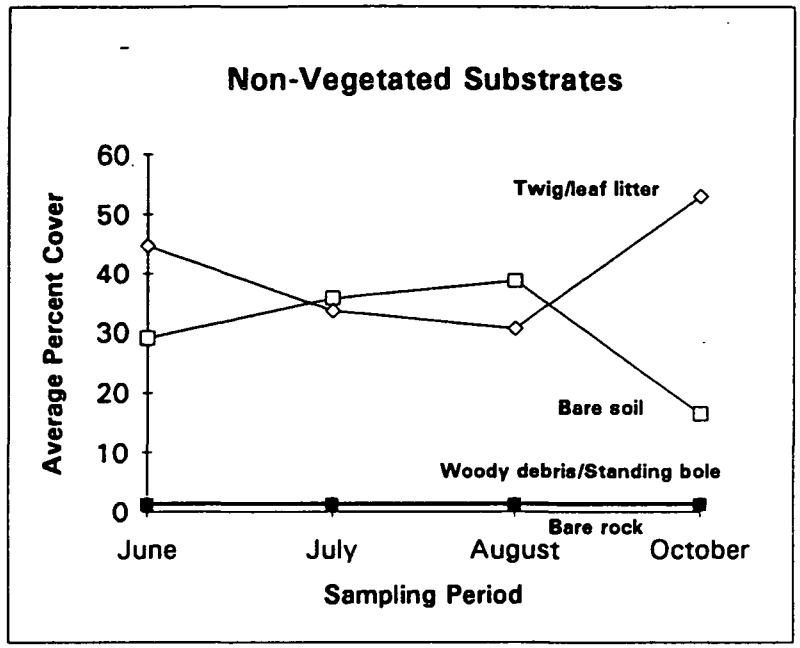
Species	Size/Age Class: Average Density (Stems/ha)				Average Frequency (%)	Average[a] Foliar Coverage (% Sample Area)
	Germinal	1 yr - 0.25 m	0.26 m - 1.00 m	1.01 m - 1.38 m		
Amur honeysuckle (L)	*	225,000	39,000	8,000	100	19.00
Amur honeysuckle (D)[c]	*	0	2,000	1,000	20	0.00
Blue ash (L)	0	0	1,000	0	10	1.20
Frost grape (L)	33,000	0	0	0	50	0.30
Hackberry (L)[b]	0	2,000	0	0	20	0.10
Poison ivy (L)	0	1,000	0	0	10	0.10
White ash (L)	0	1,000	1,000	0	20	0.50
TOTALS	33,000	229,000	43,000	9,000	--	21.20
	L = 99.04 %					
	D = 0.96 %					

[a]Average cover values are based on subjective estimates of the percent of ground area within sample units occupied by woody seedlings. Data are derived from June 1992 fixed-area plot inventory.
[b]L = Live stems.
[c]D = Dead stems.
*Germinal and 1 year - 0.25m seedlings pooled.

Table III.13. South-Facing Slope Forest: Relativized Woody Seedling Parameters and Derivation of Species Importance Values

Species	(A) Average Relative Density (%)	(B) Average Relative Frequency (%)	(C) Average[a] Relative Cover (%)	Importance Value (A) + (B) + (C)	Importance Rank
Amur honeysuckle (L)	86.62	43.48	89.62	220.00	1
Amur honeysuckle (D)[c]	0.96	8.70	0.00	9.66	6
Blue ash (L)	0.32	4.35	5.66	10.33	4
Frost grape (L)	10.51	21.74	1.42	33.70	2
Hackberry (L)[b]	0.64	8.70	0.47	9.81	5
Poison ivy (L)	0.32	4.35	0.47	5.14	7
White ash (L)	0.64	8.70	2.36	11.70	3
TOTALS	100.00	100.00	100.00	300.00	-

[a]Average relative cover valves are based on subjective estimates of the percent of ground area within sampling units occupied by woody seedlings. Areal coverage of substrates and herbaceous species have been omitted from the calculations. Data are derived from June 1992 fixed-area plot inventory.
[b]L = Live stems.
[c]D = Dead stems.



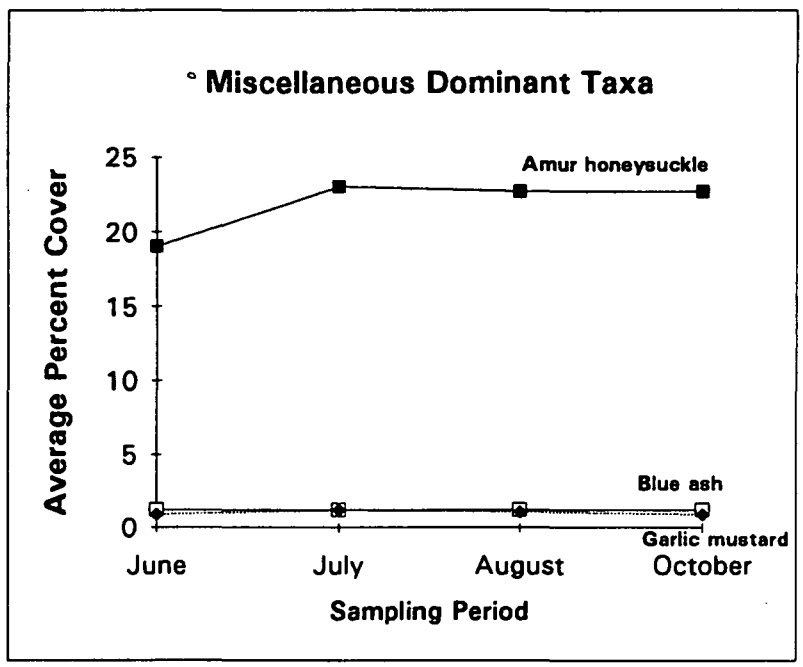


Figure 3.2. South-facing slope forest: Average percent cover of dominant non-vegetated substrates and of dominant plant species tracked throughout the growing season on ten 1-m^2 fixed-area plots (a)

(a) Dominants are considered to be those substrates and plant species contributing a minimum of 1 percent average cover at some point during the growing season.

For the purpose of quantitative studies, only those locations situated within the boundaries of the Mound property were considered. These sites occurred along the extreme western edge of the South Property near the canal. Although, from a broad-scale perspective, riparian corridor forests are homogeneous, local anomalies do occur. For this reason, the reader is cautioned that the data presented below may not be representative of the entire plant drainage system above the Great Miami River, particularly on offsite areas.

Overstory

The overstory contains typical riparian species, such as boxelder, in addition to taxa adapted to somewhat drier locales. Examples of these include American elm, hackberry, honeylocust, and white mulberry (Tables III.14 and III.15). When compared with upland forests, riparian stands are noticeably better stocked ($\bar{x}$ = 2,100 stems/ha). Although canopy individuals are generally comparable in height, averaging 15.4 m, stand age is only 22 years (s = 2.56 years). This is about half that of representative upland forests and suggests a rather productive site. Not unexpectedly for a young stand, mean tree diameter was only 10.42 cm. Corresponding average basal area coverage was calculated to be 19.41 m^2/ha. Such information strongly suggests that this forest originated as the result of farmland abandonment in the recent past.

Tree mortality averages nearly 10 percent of standing basal area. The bulk of the dead trees are American elm that succumbed to the Dutch elm disease fungus. Shade-intolerant boxelder was also found to be dying in reportable numbers (2.68 percent of total basal area), but these were all suppressed stems that were not able to compete for light levels adequate to ensure their survival.

Middlestory

The shrub and sapling class vegetation within representative riparian forest stands is composed entirely by two species, Amur honeysuckle and boxelder. When compared to other forest types at the Mound site, subcanopy stocking density and coverage are relatively low. Combined average density for all species is 5,000 stems/ha, which is equivalent to only 1.45 m^2/ha mean basal area coverage (Table III.16). Although Amur honeysuckle constitutes 90 percent of average relative density and more than half of the average relative basal area coverage, populations are comparatively sparse (Table III.17). Foliar coverage also averaged only 3,070 m^2/ha. The honeysuckle's apparent lack of tenacity within riparian forests likely relates to its strong preference for better-drained sites. This is shown by the fact that it is only becoming aggressively established on raised secondary terraces and on elevated berms and fill piles. Boxelder saplings tend to be widely spaced, and the majority of individuals possess crown ratios of less than 25 percent. This indicates impending mortality due to

Table III.14. Riparian Forest: Summary of Overstory Tree Parameters

Species	Average Density (stems/ha)	Average Frequency (%)	Average[a] Basal Area Coverage (m^2/ha)
American elm (L)	850	100	9.52
American elm (D)	300	50	1.42
Boxelder (L)[b]	450	50	4.84
Boxelder (D)[c]	100	50	0.52
Hackberry (L)	200	100	1.39
Honeylocust (L)	100	50	0.99
White mulberry (L)	100	50	0.73
TOTALS	**2,100**	-	**19.41**
	L = 80.95%		L = 90.01%
	D = 19.05%		D = 9.99%

[a]Average cover values are derived from DBH measurements taken in fixed-area plots during the July 1992 inventory.
[b]L = Live stems.
[c]D = Dead stems.

Table III.15. Riparian Forest: Relativized Overstory Tree Parameters and Derivation of Species Importance Values

Species	(A) Average Relative Density (%)	(B) Average Relative Frequency (%)	(C) Average[a] Relative Cover (%)	Importance Value (A) + (B) + (C)	Importance Rank
American elm (L)	40.48	22.22	49.05	111.75	1
American elm (D)	14.29	11.11	7.31	32.71	4
Boxelder (L)[b]	21.43	11.11	24.94	57.48	2
Boxelder (D)[c]	4.76	11.11	2.68	18.55	7
Hackberry (L)	9.52	22.22	7.16	38.90	3
Honeylocust (L)	4.76	11.11	5.10	20.97	5
White mulberry (L)	4.76	11.11	3.76	19.63	6
TOTALS	100.00	100.00	100.00	300.00	-

[a]Average relative cover values are derived from DBH measurements taken in fixed-area plots during the July 1992 inventory.
[b]L = Live stems.
[c]D = Dead stems.

Table III.16. Riparian Forest: Summary of Shrub and Sapling Parameters

Species	Average Density (stems/ha)	Average Frequency (%)	Average[a] Basal Area Coverage (m^2/ha)
Amur honeysuckle (L)[b]	4,500	100	0.74
Boxelder (L)	500	50	0.71
TOTALS	5,000	--	1.45
	L = 100.00 %		L = 100.00 %

[a]Average cover valves are derived from basal diameter measurements taken in fixed-area plots during the July 1992 inventory.
[b]L = Live stems.
[c]D = Dead stems.

Table III.17. Riparian Forest: Relativized Shrub and Sapling Parameters and Derivation of Species Importance Values

	(A)	(B)	(C)		
Species	Average Relative Density (%)	Average Relative Frequency (%)	Average[a] Relative Cover (%)	Importance Value (A) + (B) + (C)	Importance Rank
Amur honeysuckle (L)[b]	90.00	66.67	51.03	207.70	1
Boxelder (L)	10.00	33.33	48.97	92.30	2
TOTALS	100.00	100.00	100.00	300.00	-

[a]Average cover valves are derived from basal diameter measurements taken in fixed-area plots during the July 1992 inventory.
[b]L = Live stems.
[c]D = Dead stems.

low light intensity from canopy closure. Other factors that might be responsible for poor middlestory development include periodic flooding of the Miami-Erie Canal and the lack of seed input opportunity from later successional, shade-tolerant species.

Understory

Woody seedling density for all species averages 205,000 stems/ha (Table III.18). The dominant taxa in the understory, as in the middlestory, are Amur honeysuckle with a relative density of nearly 47 percent (live and dead stems) and boxelder at about 28 percent (Table III.19). Notable is the fact that only 6.82 percent of the inventoried stems have attained a height greater than 1 m tall. This clearly indicates that conditions are favorable for germination and early seedling establishment, but long-term survivorship is thwarted by certain conditions in the understory environment. The same factors cited above are likely responsible for limiting understory density as well since, on the whole, the same species are involved.

Although unconfirmed, another factor that could be responsible for preventing the continued viability of seedlings is the occurrence of one of the powdery mildews. A fungus species in this group was observed freely colonizing the leaf surfaces of many woody seedlings during the month of June 1992. The outbreak appeared most concentrated in shaded, closed-canopy areas where soil moisture and ambient humidity levels were high. While the literature indicates that powder mildews rarely adversely impact mature trees, they can cause localized mortality in young stems. This is especially true where environmental conditions foster annually recurrent infections (Boyce 1961).

Herbs and Non-Vegetated Substrates

Owing partly to reduced competition from Amur honeysuckle, and partly to somewhat more favorable moisture regimes at the surface level, understory herbaceous communities are more fully developed in riparian forests than in any other closed-canopy forest type at the Mound Plant site. Dominant species consist entirely of moisture-loving, shade-tolerant elements that include white snakeroot, bedstraw, common chickweed, and the highly adaptable garlic mustard (Figure 3.3; Appendix A, Tables A-5 and A-6). Because the herbaceous community has greater success in capturing the forest floor, non-vegetated substrates are reduced incrementally. Average seasonal coverage for both leaf/twig litter and bare soil, for example, was found to be only 54.05 percent. Bare soil alone averaged a mere 7.42 percent.

Table III.18. Riparian Forest: Summary of Woody Seedling Parameters

Species	Size/Age Class: Average Density (Stems/ha)				Average Frequency (%)	Average[a] Foliar Coverage (% Sample Area)
	Germinal	1 yr - 0.25 m	0.26 m - 1.00 m	1.01 m - 1.36 m		
American elm (L)	0	20,000	0	0	90	0.90
Amur honeysuckle (L)	*	75,000	5,000	0	100	5.40
Amur honeysuckle (D)[c]	*	7,000	9,000	0	40	0.00
Boxelder (L)[b]	0	57,000	0	0	100	2.40
Black cherry (L)	0	4,000	0	0	30	0.30
Frost grape (L)	0	3,000	0	0	30	0.30
Hackberry (L)	2,000	17,000	0	0	50	0.90
Poison ivy (L)	0	6,000	0	0	30	0.30
TOTALS	2,000	189,000	14,000	0	-	10.50
	L = 92.19 %					
	D = 7.81 %					

[a]Average cover values are based on objective estimates of the percent of ground area occupied within sample units by woody seedlings. Data are derived from July 1992 fixed-area plot inventory.
[b]L = Live stems.
[c]D = Dead stems.
*Germinal and 1 year - 0.25m seedlings pooled.

Table III.19. Riparian Forest: Relativized Woody Seedling Parameters and Derivation of Species Importance Values

Species	(A) Average Relative Density (%)	(B) Average Relative Frequency (%)	(C) Average[a] Relative Cover (%)	Importance Value (A) + (B) + (C)	Importance Rank
American elm (L)[b]	9.76	19.57	8.57	37.90	3
Amur honeysuckle (L)	39.03	21.74	51.43	112.20	1
Amur honeysuckle (D)[c]	7.81	8.70	0.00	16.51	5
Black cherry (L)	1.95	6.52	2.86	11.33	6
Boxelder (L)	27.80	21.44	22.86	72.40	2
Frost grape (L)	1.46	6.52	2.86	10.84	7
Hackberry (L)	9.27	10.87	8.57	28.71	4
Poison ivy (L)	2.93	4.35	2.86	10.14	8
TOTALS	100.00	100.00	100.00	300.00	-

[a]Average relative cover valves are based on subjective estimates of the percent of ground area within sampling units occupied by woody seedlings. Areal coverage of substrates and herbaceous species have been omitted from the calculations. Data are derived from the July 1992 inventory.
[b]L = Live stems.
[c]D = Dead stems.

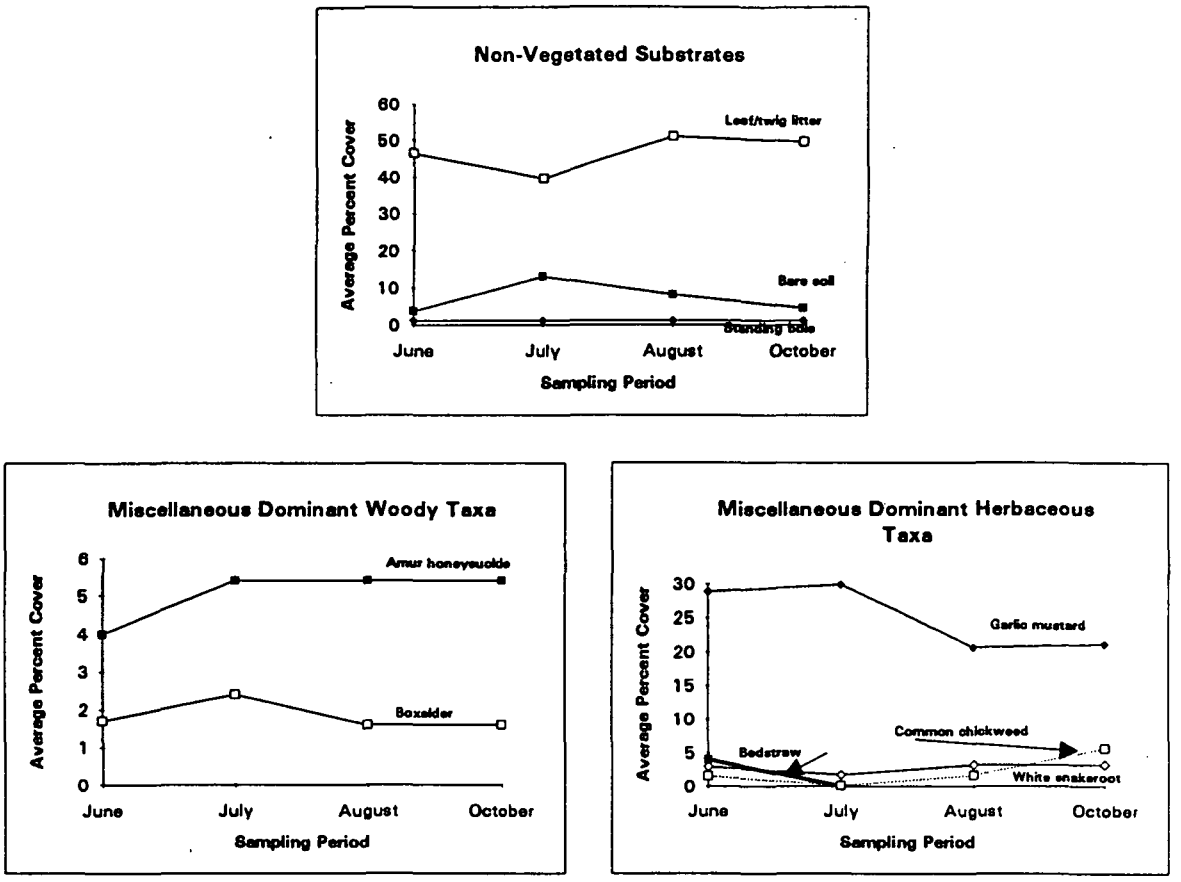


Figure 3.3. Riparian forest: Average percent cover of dominant non-vegetated substrates and of dominant plant species tracked throughout the growing season on ten 1-m^2 fixed-area plots (a,b)

(a) Dominants are considered to be those substrates and plant species contributing a minimum of 1 percent average cover at some point during the growing season.

(b) July, August, and October data collected in 1992; June data obtained in 1993.

Early Successional Scrub/Shrub Communities

For the purposes of the current study, scrub/shrub communities have been defined as grasslands, pastures, and other previously disturbed areas that have been abandoned for long enough periods of time to allow encroachment by shrubs and small trees. Since these areas are exposed to comparatively high levels of sunlight, herbaceous species diversity is much higher than in closed-canopy forest associations.

Scrub/shrub areas are widely scattered throughout the Mound site. On the North Property, most have originated as a result of industrial land clearing activities, while those on the South Property owe their existence to agricultural land abandonment. Because of their wide-ranging distribution, scrub/shrub associations occur on a variety of topographic positions and soil types. Most of the largest associations, however, are restricted to relatively dry upland situations at elevations between 770 and 900 ft. Soils in these locations are primarily moderately to severely eroded Milton, Fairmount, and Ritchey silty clay loams. Milton silt loams predominate in scrub/shrub types occupying the crest of the SM/PP Hill (Davis et al. 1976).

Overstory

While no overstory exists in the true sense of the term, several widely scattered small trees were present within the selected study area. The only species inventoried was black locust, which occurs at an average density of 50 stems/ha and has an average basal area coverage of 0.42 m^2/ha (Tables III.20 and III.21). Tree age and height were found to be 10 years and 6.51 m, respectively.

Middlestory

Shrub and sapling class stems consist entirely of hardy Amur honeysuckle. Average density is 10,500 stems/ha, with a corresponding mean basal area of 2.47 m^2/ha (Tables III.22 and III.23). This indicates the presence of numerous young, small-diameter plants. Aging techniques confirmed the juvenile nature of the honeysuckle, with stems averaging only 6.25 years of age. Despite their small diameter, middlestory foliar coverage averages 4,950 m^2/ha. This is equivalent to nearly 50 percent crown closure.

Understory

Although understory data appear to follow the same basic trends observed in closed-canopy areas, one notable exception is the extremely high regeneration rate of Amur honeysuckle. Seedlings less than

Table III.20. Early Successional Scrub/Shrub: Summary of Overstory Tree Parameters

Species	Average Density (stems/ha)	Average Frequency (%)	Average[a] Basal Area Coverage (m^2/ha)
Black locust (L)[b]	50	50	0.42
TOTALS	50	-	0.42
	L = 100.00%		L = 100.00%
	D[c] = 0.00%		D = 0.00%

[a]Average cover values are derived from DBH measurements taken in fixed-area plots during the July 1992 inventory.
[b]L = Live stems.
[c]D = Dead stems.

Table III.21. Early Successional Scrub/Shrub: Relativized Overstory Tree Parameters and Derivation of Species Importance Values

	(A)	(B)	(C)		
Species	Average Relative Density (%)	Average Relative Frequency (%)	Average[a] Relative Cover (%)	Importance Value (A)+(B)+(C)	Importance Rank
Black locust (L)[b]	100.00	100.00	100.00	300.00	1
TOTALS	100.00	100.00	100.00	300.00	-

[a]Average cover values are derived from DBH measurements taken in fixed-area plots during the July 1992 inventory.
[b]L = Live stems.
[c]D = Dead stems.

Table III.22. Early Successional Scrub/Shrub: Summary of Shrub and Sapling Parameters

Species	Average Density (stems/ha)	Average Frequency (%)	Average[a] Basal Area Coverage (m^2/ha)
Amur honeysuckle (L)[b]	10,500	100	2.47
TOTALS	10,500		2.47
	L = 100.00%		L = 100.00%
	D[c] = 0.00%		D = 0.00%

[a]Average cover valves are derived from basal diameter measurements taken in fixed-area plots during the July 1992 inventory.
[b]L = Live stems.
[c]D = Dead stems.

Table III.23. Early Successional Scrub/Shrub: Relativized Shrub and Sapling Parameters and Derivation of Species Importance Values

	(A)	(B)	(C)		
Species	Average Relative Density (%)	Average Relative Frequency (%)	Average[a] Relative Cover (%)	Importance Value (A) + (B) + (C)	Importance Rank
Amur honeysuckle (L)[b]	100.00	100.00	100.00	300.00	1
TOTALS	100.00	100.00	100.00	300.00	-

[a]Average cover valves are derived from basal diameter measurements taken in fixed-area plots during the July 1992 inventory.
[b]L = Live stems.
[c]D = Dead stems.

0.25 m tall were found to occur at densities in excess of 1,760,000 stems/ha (Table III.24). This constitutes 99.61 percent of the density and 97.10 percent of the cover for all woody species combined (Table III.25). The bulk of the young seedlings is concentrated directly under the parent plants where localized shading has killed highly competitive sod-forming grasses. Apparently, honeysuckle seedlings can only become effectively established in great numbers on bare mineral soil seedbeds. Though partially shaded, it is hypothesized the greater light availability in scrub/shrub sites, compared with closed-canopy stands, might be responsible for promoting such high rates of seed germination.

Other woody species also have difficulty gaining a foothold in open sod-dominated areas. The most effective of these are frost grape ($\bar{x}$ = 4,000 stems/ha), soft hawthorne ($\bar{x}$ = 2,000 stems/ha), and boxelder ($\bar{x}$ = 1,000 stems/ha). The long-term survival of the latter species is tenuous because of its preference for sites with more favorable moisture regimes.

Herbs and Non-Vegetated Substrates

In the sunlit environs of the scrub/shrub community, herbaceous plants flourish and dominate. More than 30 non-woody taxa were identified over the course of the field survey. By far the most conspicuous are early successional members of the grass, aster, and pea families. Figure 3.4 shows the seasonal cover trajectories for the most dominant contributors. Support data for these, as well for lesser taxa, are located in Appendix A, Tables A.7 and A.8.

Among the grasses, meadow fescue and Kentucky blue grass are by far the most prevalent. Both of these introduced forage grasses are encroaching into the representative study area from nearby lawns and maintained road shoulders. Meadow fescue exhibits a temporary mid-season growth depression after it sets its seed (Buta et al. 1987), but the blue grass retains a more consistent growth pattern. Downy aster and Canada goldenrod attain maximum cover values late in the growing season, which corresponds to their peak flowering period. This trend is characteristic for many aster family members across a broad spectrum of genera. Bitterweed and Canada thistle, on the other hand, show relatively flat trajectories.

The values presented in the graphics are representative of surface area dominance. They also correspond to the general phenological patterns expected for each individual species. Sometimes, however, when species of differing stature grow in close proximity, the total cover contribution of the more diminutive entity is obfuscated. For example, the mid-season growth depression observed in Queen Anne's lace is not due to a lessening of plant biomass as it was in meadow fescue, but is because it was partially hidden from view by the tremendous growth spurt put on by yellow sweet

Table III.24. Early Successional Scrub/Shrub: Summary of Woody Seedling Parameters

Species	Size/Age Class: Average Density (Stems/ha)				Average Frequency (%)	Average[a] Foliar Coverage (% Sample Area)
	Germinal	1 yr - 0.25 m	0.26 m - 1.00 m	1.01 m - 1.36 m		
Amur honeysuckle (L)	*	1,761,000	10,000	1,000	100	13.40
Boxelder (L)[b]	0	1,000	0	0	10	0.10
Frost grape (L)	0	4,000	0	0	20	0.20
Soft hawthorne (L)	0	2,000	0	0	10	0.10
TOTALS	0	1,768,000	10,000	1,000	--	13.80
	L = 100.00%					
	D[c] = 0.00%					

[a]Average cover values are based on subjective estimates of the percent of ground area within sample units occupied by woody seedlings. Data are derived from July 1992 fixed-area plot inventory.
[b]L = Live stems.
[c]D = Dead stems.
*Germinal and 1 year - 0.25m seedlings pooled.

III.25. Early Successional Scrub/Shrub: Relativized Woody Seedling Parameters and Derivation of Species Importance Values

Species	(A) Average Relative Density (%)	(B) Average Relative Frequency (%)	(C) Average[a] Relative Cover (%)	Importance Value (A) + (B) + (C)	Importance Rank
Amur honeysuckle (L)	99.61	69.23	97.10	265.94	1
Boxelder (L)[b]	0.06	7.69	0.73	8.48	4
Frost grape (L)	0.23	15.39	1.45	17.07	2
Soft hawthorne (L)	0.11	7.69	0.73	8.53	3
TOTALS	100.00	100.00	100.00	300.00	-

[a]Average cover values are based on subjective estimates of the percent of ground area within sample units occupied by woody seedlings. Data are derived from July 1992 fixed-area plot inventory.
[b]L = Live stems.
[c]D = Dead stems.
*Germinal and 1 year - 0.25m seedlings pooled.

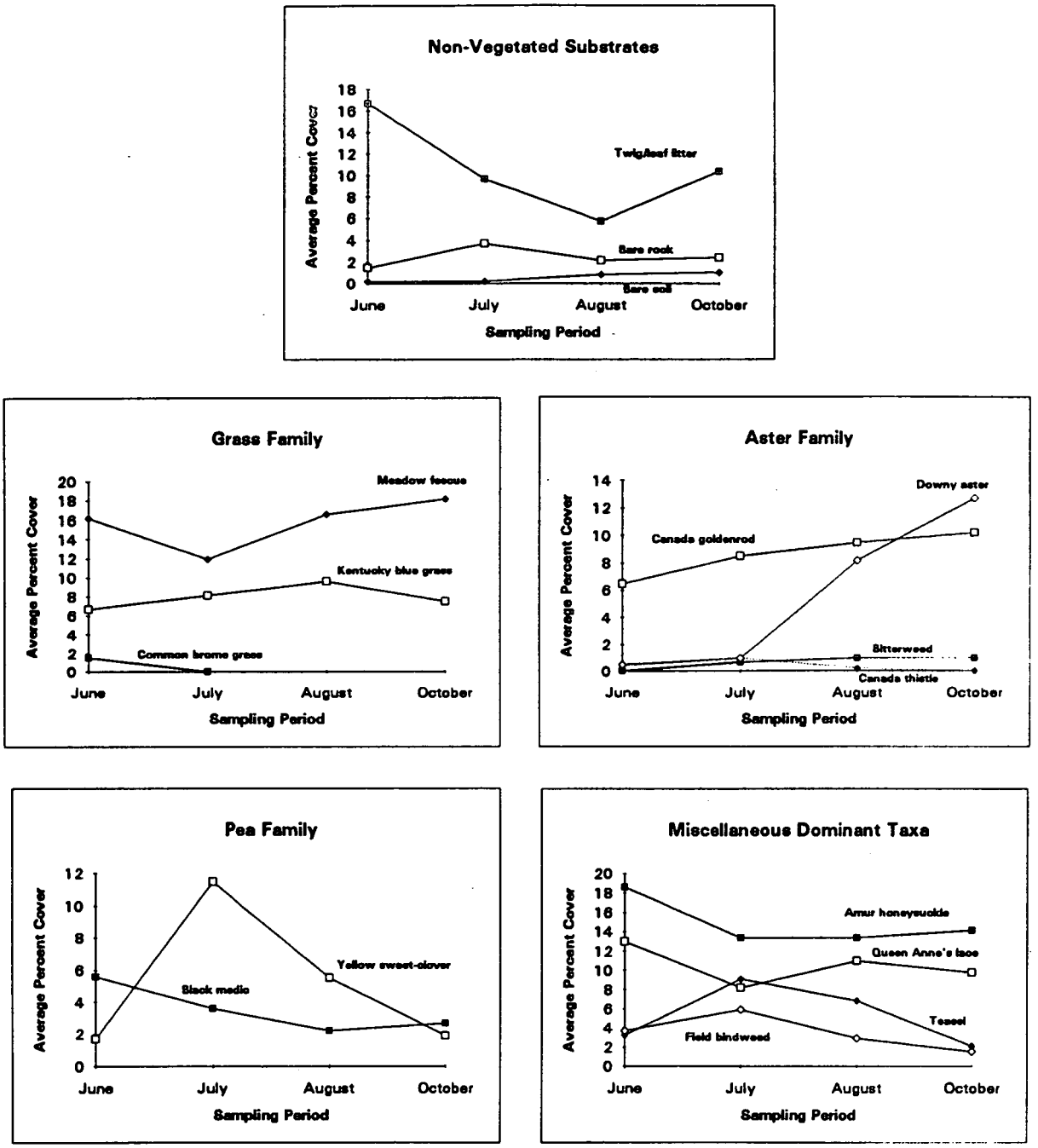


Figure 3.4. Early successional shrub/shrub: Average cover of dominant non-vegetated substrates and of dominant plant species tracked throughout the growing season on ten $1 = m^2$ fixed-area plots (a,b)

(a) Dominants are considered to be those substrates and plant species contributing a minimum of 1 percent average cover at some point during the growing season.

(b) Original vegetation plots were accidentally destroyed by geology assessment crews after the June 1992 sampling effort. Replacement plots were established in a new location in July of that year. July-October data, therefore, were acquired in 1992, while June data were obtained in 1993.

clover. A similar statement can be made about twig and leaf litter cover. While the amount of these substrates does actually decline in mid-summer due to decomposition and an abatement of leaf fall, part of this apparent decline is also because much of the substrate is occluded from view by overtopping plant matter.

Subxeric Grasslands

Subxeric grasslands occur almost exclusively on the south property. They are found in areas between 780 and 850 ft elevation (formerly upland pastures). Because of their upland topographic position they are well-drained and seasonally droughty. A system of tile drains further enhances this condition on selected sites that are under the influence of localized seeps. Soils are moderately to severely eroded silty clay loams of the Fairmount and Milton series (Davis et al. 1976).

Because the pastures have only recently been abandoned, no overstory, middlestory, or woody understory exists. Periodic mowing also helps to keep these areas in a primary successional stage. Although widely scattered shrub and tree seedlings do exist, vegetation is fundamentally herbaceous.

Herbs and Non-Vegetated Substrates

Seasonal cover estimates revealed the presence of 73 identifiable species on the representative sample area. Of these, 30 species (41.1 percent) are non-native (Appendix A, Tables A.9 and A.10). The most conspicuous floristic elements are drought-resistant sod formers such as meadow fescue, Kentucky blue grass, Canada blue grass, and rough dropseed. The fescue and blue grasses are non-native lawn and forage species that have maintained themselves since the time of farmland abandonment. Rough dropseed, the most dominant and most frequently occurring grass, is indigenous. It is highly aggressive on the driest situations and sometimes forms nearly pure stands up to nearly 1 ha in size. In the absence of significant competition from associated forbs, cover contribution of these grasses remained relatively constant over the sampling period. The combined average cover of the four taxa ranged from a low of 44.4 percent in June to high of 47.2 percent in August. Apart from a notable early season growth spurt from Kentucky blue grass and a late season decline in rough dropseed, cover trajectories are correspondingly level (Figure 3.5).

The remaining ground area is occupied mainly by grass litter and, to a far lesser extent, by various shade-intolerant herbs. Canada goldenrod, spotted knapweed, Queen Anne's lace, and English plantain all display upwardly sloping growth trends throughout the growing season. Amblystegium moss and black medic show a reverse tendency by reaching their maximum cover values in June. Species such as chickory, tall ironweed, and white sweet-clover exhibit highest cover values in mid- or late-summer, at a time coinciding with their peak flowering period.

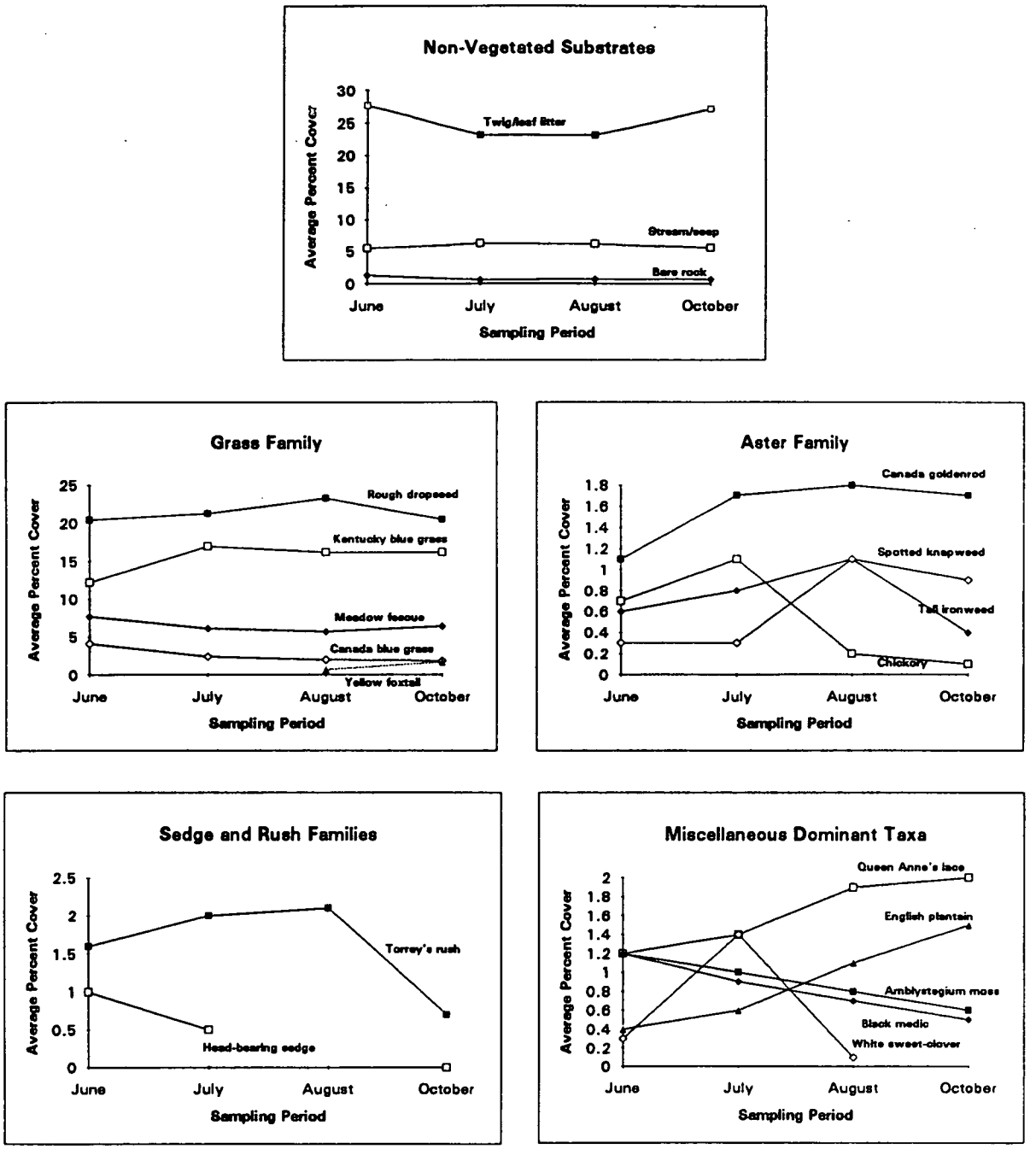


Figure 3.5. Subxeric grassland: Average percent cover of dominant non-vegetated substrates and of dominant plant species tracked throughout the growing season on 38 1-m^2 fixed-area plots (a,b)

(a) Domants are considered to be those substrates and plat species contributing a minimum of 1 percent average cover at some point during the growing season.

(b) A portion of the sample area was impacted by mowing after the June 1992 sampling effort. June data points, therefore, contain information obtained in June 1993 from 16 replacement plots plus 22 plots remaining intact from 1992.

Scattered within the study site are a series of small seepages. Flow volume of the seeps is low and they are subject to drying up during times of low rainfall. Seepage areas, though limited in areal extent, provide a unique habitat for sedges and rushes that require full sunlight for survival. Species found in such areas include green bulrush, lined bulrush, head-bearing sedge, fox sedge, Frank's sedge, Dudley's path rush, and Torrey's rush. One of these seeps is also the location of interior rush. This species is the only state endangered plant to be discovered at Mound during the ecological characterization.

Mesic Grasslands

Mesic grasslands and subxeric grasslands superficially resemble one another, but differing moisture regimes give rise to markedly different herbaceous communities. Whereas subxeric grasslands are located on topographic uplands, mesic grasslands are positioned on the more moist and fertile Ross soils of the Great Miami River's historic floodplain (Davis et al. 1976). Such sites are largely restricted to the western boundary of the south property and occupy approximately 10 percent of that tract's total land area. Elevation ranges from 700 to 710 ft.

In early August, midway through vegetation inventory effort, mesic grassland plots were inadvertently destroyed by mowing activities. Because this happened so late in the growing season, the installation of replacement plots was untenable. Therefore, the data presented below include only June and July 1992.

Herbs and Non-Vegetated Substrates

Within the mesic grassland, 49 total species were identified. Of these, nearly half are non-native. Despite an overall difference in the mix of herbaceous plants, both the mesic and subxeric types are dominated by grasses (45.0 and 47.4 percent average ground cover, respectively). Early season dominants include common brome grass, Japanese brome grass, meadow fescue, and Kentucky blue grass. By the end of July, Johnson grass gained predominance by capturing 22.5 percent of the sample area. Johnson grass, a non-native perennial, is capable of attaining heights in excess of 3 m on moist, fertile soils (Appendix A, Tables A.11 and A.12).

Among non-grass forbs, Canada thistle exhibits the greatest cover values. Average cover for this species ranges from 15.8 to 19.4 percent. Despite being highly colonial, it was found to be rather well distributed, occurring on 60 percent of the sample plots. Additional herbs of note are Indian hemp, poison hemlock, tall ironweed, and tall thoroughwort.

Trees and shrubs accounted for only 6 percent of the species mix. On an areal cover basis, they are also poorly represented, inhabiting a mere 0.75 percent of the study site. There is evidence, however, to suggest that boxelder is beginning to become established as an early successional woody species. In July, boxelder seedlings were located on 70 percent of the 1-m^2 plots. The seed source for these propagules is a nearly pure stand of mature trees in the adjacent Miami-Erie Canal riparian forest.

3.1.2. Systematic Walk-Through Surveys

Quantitative fixed-area plot surveys were coupled with qualitative walk-through investigations to gain an understanding of the site-wide occurrence and distribution of as many floristic elements as possible. Walk-through inventories were conducted four times throughout the 1992 growing season at approximately 1-month intervals. A major product of these efforts is a comprehensive annotated checklist of the native and naturalized vascular flora of the Mound site. This document is located in Appendix B. A summary of results from the checklist is presented below.

The checklist includes 81 families, 242 genera, and 376 species (Appendix B, Table B.1). Infraspecific taxa have not been recognized. Woody plants make up 73 species and account for 19.4 percent of the flora. Pteridophytes and gymnosperms are represented by five species and together comprise less than 2 percent of the total. Angiospermous taxa dominate with 92 monocots (24.5 percent) and 278 dicots (73.9 percent). Composites (*Asteraceae*) and grasses (*Poaceae*) are by far the most dominant families, together constituting more than a quarter of all species present.

The Mound site flora includes 150 species (39.9 percent) that are not native to Ohio (Appendix B, Tables B.2 and B.3). Only those exotics that have become naturalized through the processes of seed and/or vegetative propagation have been retained in the checklist. The percentage of the flora represented by exotics considerably exceeds the range cited for other eastern North American areas (approximately 10 to 30 percent; see Fernald 1950). However, given the land use history of the property and its close proximity to human population centers and major transportation corridors, this strong representation by non-native entities is not unexpected. While most occur as casual waifs, some species have flourished and, over time, have become aggressive invaders. Most notable are Amur honeysuckle, Japanese honeysuckle, and white mulberry. All three of these Asiatic ornamentals have seeds that are bird-disseminated and all strongly exhibit the capacity to supplant native vegetation. Several of the commonly introduced forage grasses such as meadow fescue, Kentucky blue grass, and yellow foxtail also appear well established and are aggressively spreading.

3.2. FAUNAL INVESTIGATIONS

3.2.1. Avian Investigations

3.2.1.1. Site-Wide Inventory

A total of 81 species of birds was documented at the Mound Plant during the transect sampling, nocturnal surveys, and random encounters (Table III.26). An annotated list of all bird species observed at the Mound Plant is presented in Appendix D. Of the 81 species observed at the Mound Plant, only 11 species were actually confirmed as nesting on the site. In addition to these 11 species, another 22 species were suspected to nest on the site based on observations of courting behavior, territoriality, gathering of nesting material, or simply their continuous occurrence on the site during the nesting season. A review of the ornithological literature dealing with birds found in the Dayton area showed that 61 of the bird species observed at the Mound Plant are known to nest in the Miamisburg vicinity. All of the bird species confirmed or suspected of nesting on the Mound Plant are known to nest in the general area.

3.2.1.2. Transects

A summary of the observations made during the transect surveys is presented in Appendix E (Table E-1). Table E-2 provides an analysis, by time of day, of the total and average number of individuals and species observed along each transect. Table E-3 presents the total and average number of individuals and species by transect and season. Table E-4 reflects the occurrence, by transect and season, of the ten most common birds observed during the transect surveys. Table E-5 shows the abundance of each species, by habitat and season. Table E-6 is a list of each raptor observation by transect. In all, a total of 4,682 birds representing 78 species were counted during the four season transect surveys. The greatest number of individuals observed along a transect during a single season occurred in the fall at transect 5A (N = 585, Table E-1). Of these 585 birds, American robins accounted for 525 of the individuals. Long lines of this species were observed on consecutive mornings as they left the crest of the wooded slope on the SM/PP Hill. One possible reason for the density of robins in this area might be that they were feeding on the berries of Amur honeysuckle (*Lonicera maackii*), a middle and understory shrub that occurs in extremely high densities throughout the Mound Plant and that retains its berries well into the colder months (see Section 3.1.1). Amur honeysuckle is known to be disseminated by birds, indicating that the berries are palatable. Robins may also have been taking advantage of the thermal protection afforded by the dense middle and understory provided by the Amur honeysuckle.

Table III.26. Seasonal Occurrence and Nesting Status of the Bird Fauna at the Mound Plant, Montgomery County, Ohio

Species	Season				Nesting Status		
	Sp[a]	Su[b]	Fa[c]	Wi[d]	KN[e]	SN[f]	AN[g]
Red-winged blackbird	x		x			x	x
Eastern bluebird	x						x
Indigo bunting	x					x	x
Northern cardinal	x	x	x	x	x		x
Gray catbird	x	x				x	x
Black-capped chickadee				x			
Carolina chickadee	x	x	x	x	x		x
Double-crested cormorant			x				
Brown-headed cowbird	x						x
Brown creeper				x			
American crow	x	x	x	x			x
Yellow-billed cuckoo	x						x
Mourning dove	x	x	x	x		x	x
Rock dove	x	x	x	x		x	x
House finch	x	x	x	x		x	x
Northern flicker	x	x	x	x		x	x
Empidonax flycatcher		x					
Blue-gray gnatcatcher	x	x					x
American goldfinch	x	x	x	x		x	x
Canada goose		x	x				x
Common grackle	x	x	x				x
Cooper's hawk			x	x			x
Red-tailed hawk		x		x			x
Rough-legged hawk			x				
Sharp-shinned hawk			x	x			
Great blue heron	x		x	x			
Green-backed heron	x	x					x
Ruby-throated hummingbird		x					x
Blue jay	x	x	x	x		x	x
Dark-eyed junco			x	x			
American kestrel	x	x				x	x
Killdeer	x	x			x		x
Eastern kingbird	x						x
Belted kingfisher	x	x	x	x			x
Golden-crowned kinglet			x	x			
Ruby-crowned kinglet		x	x	x			
Mallard	x	x	x	x	x		x
Purple martin		x					x
Eastern meadowlark	x	x	x		x		x

Table III.26. (page 2 of 3)

Species	Season				Nesting Status		
	Sp[a]	Su[b]	Fa[c]	Wi[d]	KN[e]	SN[f]	AN[g]
Northern mockingbird	x	x	x	x	x		x
Common nighthawk		x					x
Northern oriole	x	x			x		x
Eastern phoebe	x						x
American redstart	x						x
American robin	x	x	x	x	x		x
Barred owl				x			x
Great horned owl				x			x
Eastern screech owl	x					x	x
Spotted sandpiper	x	x					x
Chipping sparrow	x	x					x
Field sparrow	x	x	x				x
House sparrow	x	x	x			x	x
Song sparrow	x	x	x	x	x		x
Swamp sparrow			x				
White-throated sparrow			x	x			
European starling	x	x	x	x	x		x
Barn swallow	x	x				x	x
Northern rough-winged swallow	x						x
Tree swallow		x					x
Chimney swift	x	x				x	x
Brown thrasher	x	x			x		x
Tufted titmouse	x	x				x	x
Rufous-sided towhee	x	x	x			x	x
Red-eyed vireo	x	x					x
Warbling vireo	x						x
Turkey vulture		x					x
Bay-breasted warbler			x				
Black-throated green warbler		x					
Chestnut-sided warbler		x					
Tennessee warbler	x						
Yellow warbler	x						x
Yellow-rumped warbler			x				
Cedar waxwing			x				x
American woodcock		x	x				x
Downy woodpecker	x	x	x	x		x	x
Hairy woodpecker	x			x		x	x
Red-bellied woodpecker	x	x				x	x
Eastern wood-pewee	x						x
Carolina wren	x	x	x	x		x	x

Table III.26. (page 3 of 3)

Species	Season				Nesting Status		
	Sp[a]	Su[b]	Fa[c]	Wi[d]	KN[e]	SN[f]	AN[g]
House wren	x	x				x	x
Common yellowthroat	x	x				x	x
TOTALS	53	50	38	28	11	21	61

[a]Spring
[b]Summer
[c]Fall
[d]Winter
[e]Known to nest on Mound site
[f]Suspected to nest on Mound site
[g]Known to nest in the Miamisburg vicinity

As a whole, the greatest number of birds was observed during the fall surveys. A total of 2,138 birds was counted at all transects combined. In large measure, this high seasonal count was because of the large congregations of robins in the vicinity of the SM/PP Hill and on the South Property, especially at KX 1B, 2A, and 3B.

As expected, the number of species peaked at most of the transects during the spring surveys (based on the total and average number of species at each transect for a given season) (Table E-1). This peak coincided with the spring migration of neotropical species. In general, the summer transect surveys produced the second highest species totals. The summer species totals were higher than the fall totals because of the actual survey dates. The summer surveys were conducted rather late in the summer season, when many of the neotropical migrants are passing back through southern Ohio. A few of the fall transects were surveyed in December. Usually, by December, most of the fall migrants and spring and summer residents are gone and the winter residents have arrived.

No single transect stood alone in producing the highest abundance and species counts, although as a group the South Property (1A, 1B, 2A, 2B, 3X) produced higher species counts than the Miami-Erie Canal and North Property. This is probably attributable to the greater distance and wider array of habitats covered by the South Property (Tables III.26 and E-1).

Typically, birds are more active during the morning hours. The Mound Plant bird data support this (Tables E-2 and E-3). Based on the abundance and species totals for all seasons combined, more than twice as many individuals and nearly twice as many species were observed during the morning. For all transects and seasons combined, an average of 13 species and 33 individuals were counted per transect during the morning surveys, compared to seven species and 19 individuals per transect during the evening surveys.

3.2.1.3. Species Accounts

Based on the results of the transect data, the ten most common birds at the Mound Plant, in decreasing order of abundance, were: American robin, European starling, northern cardinal, American goldfinch, Carolina chickadee, house finch, mourning dove, red-winged blackbird, song sparrow, and common grackle (Tables E-4 and E-5). The American robin and European starling were common throughout all four seasons and were especially common in the fall. Except for the large congregations observed along the crest of the SM/PP Hill, robins were fairly evenly distributed throughout the Mound Plant. Starlings were observed at all transects in almost every season. Starlings were especially common around the buildings on the Main Hill and lower SM/PP slope (transects 5A and 5B), as well as on the South Property in the subxeric and mesic grasslands (transects 1A and 2B).

Northern cardinals were also fairly evenly distributed across the Mound Plant, but were especially common along the ecotones between the scrub/shrub and wooded areas on the SM/PP slope (transect 6X). American goldfinches were found at all transects but, as expected, were more common during the summer in the subxeric and mesic grasslands on the South Property (transects 1A, 1B, 2A, and 2B). Carolina chickadees were found during all four seasons in the transects that had at least some wooded or scrub/shrub habitat. Carolina chickadees were most common in the slope forest along the crest of the SM/PP Hill (transect 7X). House finches were more common in the spring and summer than in the fall or winter. House finches were fairly uniformly distributed across the Mound Plant, but were absent from the area around the Overflow Pond and Plant Drainage Ditch (transect 5A).

Mourning doves were more common in the summer than in the other seasons, and were most often observed in the vicinity of the buildings on the lower slope of the Main Hill and in the maintained grassland corridors at the top of the SM/PP Hill. Red-winged blackbird distribution was seasonal. They were equally common in the spring and fall, but completely absent during the summer and winter. Although no nests were ever found, male red-winged blackbirds frequently exhibited obvious territoriality toward the bird surveyors as they conducted the spring surveys of the mesic grassland on the South Property (transects 1A and 1B). Song sparrows were found along all transects and were present at the Mound Plant during all four seasons. The greatest number of individuals was counted during the spring surveys, and the greatest number of individuals was found in the vicinity of the Overflow Pond and Plant Drainage Ditch (transect 5B). Common grackle abundance was highest in the spring and fall, although a few scattered individuals were found in the riparian forest along the Miami-Erie Canal and elsewhere on the North Property and South Property during the summer surveys. During the spring, common grackles were most common along the riparian forest near the interior of the South Property (transect 2B) and the Miami-Erie Canal (transect 4B). The greatest concentration of grackles at the Mound Plant was found during the fall surveys in the mesic grassland along transect 1B.

A total of 22 observations of raptors, representing five species, was observed at the Mound Plant during the transect surveys (the unidentified *Accipiter* observed along transect 2A during the fall survey was probably either a sharp-shinned hawk or a Cooper's hawk). The American kestrel was the most commonly observed raptor species (N = 9) and the only species suspected of nesting at the Mound Plant. Various members of the ecological characterization team observed a single individual on numerous occasions as it perched on the water tower at the top of the SM/PP Hill.

An eastern screech owl was identified on the South Property during the nighttime owl survey. On the evening of August 28, 1992, a screech owl approached to within a few feet of a bird survey team member while the individual was broadcasting a taped screech owl call. Faint responses were heard

from a great horned owl and a barred owl during subsequent nighttime owl surveys, but neither species could be confirmed as occurring on the Mound Plant. However, with the relatively large expanses of mesic and subxeric grasslands on the South Property that support high densities of small mammals, and the preference of both of these owl species for such prey, it is likely that both the great horned owl and the barred owl at least occasionally forage on the site.

3.2.1.4. Summary of Avian Investigation

A total of 81 species of birds was observed at the Mound Plant. Of these, 11 species were confirmed as nesting on the site and an additional 22 species were suspected to nest there. All of the species confirmed or suspected to nest on the Mound Plant are common species and all are known to nest in the area around the site. No bird species listed by the U.S. Department of the Interior as threatened or endangered was observed on the site. The dark-eyed junco, listed by the state of Ohio as an endangered species, occurs on the site as a fall and winter visitor. Numerous individuals were observed in the mesic/subxeric grasslands on the South Property, and in the slope forest and scrub/shrub on the SM/PP Hill. Four subspecies of the dark-eyed junco are recognized in North America. Formerly split into several different species, four races are now recognized. In the winter, the slate-colored race of the dark-eyed junco is abundant throughout North America in weedy fields, brush, and wood margins. In Ohio, there is a small area in the northeast part of the state where a breeding population occurs. It is for the protection of this population that the Ohio Department of Natural Resources listed the dark-eyed junco as a state-endangered species.

Several game species were observed on or in proximity to the Mound Plant. The mourning dove was one of the more common species observed on both the North Property and South Property. Pairs of mallards were often seen on the Overflow Pond, and two hens each raised a brood on the Asphalt-lined Pond during the summer of 1992. An American woodcock was found along an intermittent stream on the South Property in the summer and fall of 1992. A female wild turkey with three or four poults was observed crossing Benner Road just east of the South Property during the summer 1992 survey. On numerous occasions during the summer 1992 and winter 1992/1993 surveys, Canada geese were seen flying over the Mound Plant. Numerous shotgun shells were found in a wooded area on the South Property, indicating that hunters may have been pursuing one or more of the species.

3.2.2. Mammal Investigations

Sixteen species of small and large mammals were observed at the Mound Plant (Table III.27). An annotated list of all mammal species confirmed at the Mound Plant is presented in Appendix D.

Table III.27. List of Mammals Observed at Mound Plant, Montgomery County, Ohio

Common Name	Scientific Name
Opossum	*Didelphis virginiana*
Short-tailed shrew	*Blarina brevicauda*
Eastern cottontail	*Sylvilagus floridanus*
Eastern chipmunk	*Tamias striatus*
Groundhog	*Marmota monax*
Gray squirrel	*Sciurus carolinensis*
Fox squirrel	*Sciurus niger*
Deer mouse	*Peromyscus maniculatus*
White-footed mouse	*Peromyscus leucopus*
Meadow vole	*Microtus pennsylvanicus*
House mouse	*Mus musculus*
Meadow jumping mouse	*Zapus hudsonius*
Gray fox	*Urocyon cinereoargenteus*
Raccoon	*Procyon lotor*
Striped skunk	*Mephitis mephitis*
White-tailed deer	*Odocoileus virginianus*
Muskrat	*Ondatra zibethicus*

3.2.2.1. Small Mammal Trapping

Table F-1 (Appendix F) presents the number of trap observations by sampling location, season, and time of day. A total of 4,738 trap observations was made during the spring, summer, and fall (1992) survey seasons. Table F-1 shows that the North Slope grid was not maintained during the fall survey. This was because there was no access agreement with the city of Miamisburg for offsite areas where mammal sampling had been conducted during the previous spring and summer surveys (i.e., the northern slope of the Main Hill and the Miami-Erie Canal). The sampling team was able to move the Miami-Erie transect a few meters to the east so that the line of traps was just inside the Mound Plant boundary on the South Property. No similar arrangement was possible with the northern slope grid; fall sampling in that area had to be abandoned.

The difference in the number of observations between the summer survey sampling and the spring and fall surveys was also due to a severe electrical storm that struck the Mound Plant area on August 27, 1992. The plant sirens indicated severe thunderstorm warnings; guardhouse personnel advised the sampling team that no one should be outside on the Mound Plant. Thus, the small mammal sampling team was unable to tend the small traps for several hours, resulting in fewer observations during the summer survey.

Trap activity is summarized in Tables F-2, F-3, and F-4. Table F-2 reports the number of traps sprung, without an animal being captured, for each sampling location, by season and time of day. Table F-3 reports the number of traps robbed (bait removed), but not sprung, for each sampling location, by season and time of day. Table F-4 presents the number of mammals captured at each sampling location, by season and time of day. By far, the greatest period of activity occurred at night, as indicated by the number of traps checked during the morning that were either sprung, robbed, or had captured an animal. In general, the most common small mammal occurring in open areas around the Mound Plant was the primarily nocturnal *Peromyscus*, whereas the most common small mammal in the wooded areas was *Tamias striatus*, the eastern chipmunk (a diurnal species).

<u>Transects</u>

Each of the three transects was placed along water courses. Two of those transects, Benner Branch and Drainage Ditch, were along windrows; each was near a habitat transition zone, or ecotone. There, direct sunlight struck a large portion of the transect. The ground cover along Benner Branch and the Drainage Ditch was thick compared to the Miami-Erie Canal. As described in Section 3.3, the Miami-Erie Canal transect was originally adjacent to the wetted channel on property owned by the city of Miamisburg, within a broader zone of shaded woodland where the ground cover was more sparse than

along the Benner Branch or Drainage Ditch transects. During the fall survey, the Miami-Erie transect was moved a few meters to the east into the unmowed portion of a fence row. For the Miami-Erie transect, this resulted in a sharp contrast between the habitat sampled in the spring and summer with the habitat sampled in the fall.

Results of the trapping efforts along the three transects are presented in Table III.28. A total of 16 chipmunks (*Tamias striatus*), 47 *Peromyscus*, and one *Blarina brevicauda* (short-tailed shrew) was collected from the combined transects. The success rate (defined as the number of animals captured divided by the number of observations) was comparable between the Benner Branch, Drainage Ditch, and Miami-Erie Canal transects (3.5 percent, 4.8 percent, and 6.9 percent, respectively). Most of the *Peromyscus* collected at the three transects were found in the traps during the morning check, indicating that they had been trapped during the night. The lack of eastern chipmunks in the traps set along the Miami-Erie Canal during the fall survey may have been the result of moving the transect away from the forested canal to the Mound Plant fenceline, a sunlit, grassy habitat.

During the spring sampling effort, 42 of the 50 traps deployed along the Miami-Erie Canal were sprung without an animal being captured (see Tables F-2 and F-4). In the remaining eight observations, the bait had been robbed. In an effort to identify the robber, medium-sized live traps were deployed at two locations on the South Property during the summer sampling effort. A skunk and an opossum were captured in the traps.

Small Grids

Small grids were placed on the northern forested slope of the Main Hill just downstream from Seep 607 (North Slope or NS), on the open southern slope of the Main Hill in the vicinity of Seep 602 (Main Hill or MH), the northern forested slope of the SM/PP Hill (plutonium processing or PP), and the open western slope of the SM/PP Hill (scrub/shrub or SS).

A total of 90 animals representing five species (eastern chipmunk, *Peromyscus*, short-tailed shrew, meadow vole, and house mouse) were trapped at the small grids (Table III.29). Most of the *Peromyscus* were collected in the morning (N = 60). The success rate for the four small grids was comparable to that transect. The success rate for the Main Hill, North Slope, plutonium processing, and scrub/shrub was 7.7 percent, 7.4 percent, 3.4 percent, and 6.3 percent, respectively.

One meadow vole and one house mouse were collected in the spring at the Main Hill grid. A total of 26 mice were trapped at both the Main Hill and the scrub/shrub grids, compared to seven and eight mice collected at the North Slope and plutonium processing grids, respectively. The greater occurrence

Table III.28. Transect Trapping Results, Mound Plant, Montgomery County, Ohio

	Tamias			*Peromyscus*			*Blarina*		
Transect	Mom.	Aft.	Eve.	Mom.	Aft.	Eve.	Mom.	Aft.	Eve.
Benner Branch									
Spring				6	1				
Summer				4					
Fall				4					
Drainage Ditch									
Spring				11					
Summer				5					
Fall				4					
Miami-Erie Canal									
Spring		9	6						
Summer	1			3					
Fall				9			1		
Total	1	9	6	46	1	0	1	0	0

Table III.29. Small Grid Trapping Results, Mound Plant, Montgomery County, Ohio

Grid	*Tamias*			*Peromyscus*			*Blarina*		
	Mom.	Aft.	Eve.	Mom.	Aft.	Eve.	Mom.	Aft.	Eve.
Main Hill[a]									
Spring				1			1		
Summer				6	1				
Fall				16	1	1	1		1
North Slope									
Spring				1					
Summer	3	3	5	4	2				
Fall									
Plutonium Processing									
Spring	1	3	1	7					
Summer				1					
Fall									
Scrub/Shrub									
Spring				8	1				
Summer		1		11	1				
Fall				5			3		
Total	4	7	6	60	6	1	5	0	1

[a]A single house mouse and a single meadow vole were collected in the Main Hill grid.

of *Peromyscus* in the traps set at the Main Hill and scrub/shrub grids is a reflection of habitat. Both of these areas are sunlit and have a vegetative community dominated by grasses with sparse young trees or bushes also present. Conversely, except for a single individual collected from the scrub/shrub grid, all of the eastern chipmunks were collected at the forested North Slope and Plutonium Processing grids (N = 11 and N = 5, respectively).

Large Grids

At the two large grids, a total of 24 animals were trapped, representing the same three principal species collected at the small grids (Table III.30). As expected, nearly all of the *Peromyscus* were collected at night and all of the eastern chipmunks were trapped in the afternoon and evening. The success rate for the traps deployed at the two large grids was substantially lower than at the small grids (0.8 percent for the South Central grid and 1.6 percent for the South West grid).

During the spring sampling effort, a fairly high percentage of the large grid traps was disturbed. At the South Central and South West grids, 89 percent and 90 percent of the traps were sprung, but only three and six mammals were captured, respectively. As discussed above, it is likely that raccoons, skunks, or opossums were responsible. In several instances, traps were moved long distances or were never found at all. One trap was even found 2 meters above the ground in a tree.

3.2.2.2. Large Mammal Surveys

A total of 16.27 hours (976 minutes) was spent at night surveying the North and South Properties for deer and other wildlife. Six species were confirmed during the spotlight surveys: grey fox (*Urocyon cinereoargenteus*), white-tailed deer (*Odocoileus virginianus*), muskrat (*Ondatra zibethicus*), opossum (*Didelphys marsupialis*), and eastern cottontail (*Sylvilagus floridanus*) (Table III.31). As anticipated, the white-tailed deer was the most commonly encountered species. On 17 separate occasions, one or more individuals were observed. No deer were observed within the boundaries of the North Property during spotlight surveys. Interviews with EG&G security personnel revealed that white-tailed deer do not occur within the fenced portions of the North Property, presumably because of the high, heavy-gauge concertina wire barrier. Several of the facility guards told the survey team that, some years earlier, a deer had become entangled and injured in the security fencing after attempting to enter the North Property.

Because the spotlight survey team was able to access and observe all open areas at the Mound Plant site, the presence and abundance of deer were not difficult to determine. The size of the deer herd on the South Property on any given night apparently varies since there are no barriers to movement.

Table III.30. Large Grid Trapping Results, Mound Plant, Montgomery County, Ohio

Grid	*Tamias*			*Peromyscus*			*Blarina*		
	Mom.	Aft.	Eve.	Mom.	Aft.	Eve.	Mom.	Aft.	Eve.
South Central									
Spring				3					
Summer		1		3	1				
Fall									
South West									
Spring		3	2						
Summer		2	1	2					
Fall				5			1		
Total	0	6	3	13	1	0	1	0	0

Table III.31. Summary of Spotlight Observations

Date	Area	Time	Species	No. of Individuals	Sex	Comments
6-11-93	14	2256	Gray fox	1	U	
6-11-93	8	2254	White-tailed deer	1	U	
6-11-93	2	2320	Unidentified mustelid	1	U	Red eyeshine
6-11-93	10	2358	White-tailed deer	1	U	
6-13-93	16	2220	Muskrat	1	U	Swimming in retention basin
6-13-93	8	2229	White-tailed deer	1	U	
6-13-93	1	2300	White-tailed deer	1	U	
6-13-93	5	2320	White-tailed deer	1	U	
6-14-93	20	2259	White-tailed deer	1	U	
6-14-93	2	2314	White-tailed deer	2	U	
6-15-93	3	2337	White-tailed deer	1	U	
6-15-93	9	2350	Opossum	1	U	Climbing in trees
8-29-93	8	2218	White-tailed deer	3	U	
8-29-93	11	2228	Gray fox	1	U	
8-30-93	9	2130	White-tailed deer	3	M	One individual had antlers with 10 to 12 points; the other two had six points each.
8-30-93	4	2145	White-tailed deer	1	F	
12-12-93	18	2208	Opossum	1	U	
12-12-93	12	2220	Eastern cottontail	3	U	
12-12-93	7	2330	Opossum	1	U	
12-10-93	3	2130	White-tailed deer	1	U	
12-10-93	19	2140	Unidentified fox	1	U	

Table III.31. (page 2 of 2)

Date	Area	Time	Species	No. of Individuals	Sex	Comments
12-10-93	*	2130-2145	Eastern cottontail	5	U	Total of five rabbits seen in all areas combined.
1-26-93	17	2208	Opossum	1	U	
1-26-93	3	2302	White-tailed deer	7	F	Five adults, two yearlings.
1-26-93	3	2322	White-tailed deer	1	M	Three antler points on left side; single spike on right. Feeding with seven deer listed above.
1-27-93	1	2305	White-tailed deer	3	F	
1-27-93	6	2329	White-tailed deer	3	F	One adult with two yearlings.
1-27-93	4	2340	White-tailed deer	4	F	Two adults and two yearlings.
1-28-93	12	2300	Eastern cottontail	1	U	
1-28-93	6	2330	Gray fox	1	U	
4-6-93	13	2224	Eastern cottontail	2	U	
4-6-93	20	2226	Eastern cottontail	1	U	
4-6-93	7	2300	Eastern cottontail	1	U	
4-6-93	21	2310	Opossum	1	U	
4-6-93	22	2312	Eastern cottontail	1	U	
4-6-93	1	2323	White-tailed deer	3	U	

On several occasions, both during the daytime and nighttime, one or more deer was observed entering the South Property from adjacent scrub/shrub and farmland areas to the west and south.

White-tailed deer were seen in ten areas on the South Property (see Table III.31 and Plate 3). Area 3 supported the greatest number of deer (an average of 2.5 deer were seen on four separate occasions). The deer's affinity for this area may be related to size, location, and vegetational makeup. Area 3 is one of the larger fields on the South Property; it is bordered on three sides by woodlands. Routine mowing by Mound maintenance personnel has prevented woody vegetation from becoming established and has fostered the growth of highly palatable grasses and forage plants.

The largest herd of deer seen during spotlighting activities was in Area 3 on January 26, 1993. This group consisted of seven antlerless deer (five adults and two juveniles) and one buck. The largest single herd of deer observed during daylight hours was a group of seven antlerless deer (seen by the bird survey team in Area 7 on October 13, 1992). It is likely that these two herds were comprised of the same individuals.

Several of the EG&G guards reported to the spotlight survey team that, in past years, they had, on numerous occasions, observed deer on the South Property in groups numbering 12 or more. Normal fluctuations in population level and local hunting pressure probably combine to affect the size of the deer herd on the South Property in any given year.

Based on observations by the small mammal and bird survey teams, there are several additional species of terrestrial wildlife present at the Mound Plant that were not observed during the spotlight surveys. These include:

- eastern gray squirrel (*Sciurus carolinensis*),
- eastern fox squirrel (*Sciurus niger*),
- woodchuck (*Marmota monax*),
- raccoon (*Procyon lotor*), and
- striped skunk (*Mephitis mephitis*).

Leaf and cavity nests of the eastern gray squirrel were evident in most woodland areas at the Mound Plant. Furthermore, individuals were observed during all seasons. A black phase of this species was sighted by the bird survey team along the crest of the SM/PP Hill on January 26, 1993. On October 14, 1992, the bird survey team observed an eastern fox squirrel in the trees along the western side

of Area 7; during the period from December 10 to 13, 1992, an eastern fox squirrel was observed in Area 3 by the small mammal survey team. These sightings may have been of the same individual.

Judging from the presence of den openings, woodchucks are prevalent on both the North and South Properties. Moreover, the presence of dens in all available habitat types suggests that the species is highly adaptable to a wide range of site conditions (variable food sources, dispersal mechanisms, etc.). Given the popularity of this species with hunters, exclusion of the general public from all areas at the Mound Plant has contributed to its abundance at the site.

On December 10, 1992, a dead juvenile raccoon was found on Benner Road at the gate to the South Property. Raccoon tracks and scats along the intermittent stream channel confirmed that this species occurs within the boundaries of the site. On the evening of December 11, 1992, the small mammal sampling team set a medium-sized live trap in the vicinity of the southwest trap grid in an effort to catch the animal that had been robbing bait from the live traps. On the following morning, a striped skunk was found in the trap and released unharmed. Raccoon and skunk were never observed on the North Property.

3.2.2.3. Summary of Mammal Investigation

A summary of the small mammal trapping efforts at the Mound Plant is presented in Table F-5. A total of five small mammal species was captured in the live traps. Two small mammal species dominated the catch, eastern chipmunk and *Peromyscus*. A third species, the short-tailed shrew, was also collected during the spring and summer surveys, but numerically was of minor importance. Two species, the house mouse and meadow vole, were represented by single individuals. Both were collected from the Main Hill grid during the summer survey. One meadow jumping mouse, *Abundance hudsonius*, was collected in a drift fence bucket. This species was never captured in a small mammal trap. The number of traps sprung without capture was dramatically higher during the spring than the subsequent summer and fall surveys. On the other hand, the number of traps robbed was highest during the summer survey. The number of animals captured was fairly consistent across the three surveys, but was slightly higher in the spring.

Table III.32 presents the body weights, by sex, of the captured eastern chipmunks, *Peromyscus*, and short-tailed shrews. The minimum and maximum weight for each is within the range described by Burt and Grossenheider (1976) for that species. For the eastern chipmunk, the average weight of the females in the spring and summer was larger than for the males (105 and 92.3 g versus 87.6 and 82.0 g). For both sexes, the average weight in the spring was larger than during the summer (99 g versus 91 g).

Table III.32. Body Weights of Eastern Chipmunks, Deer/White-Footed Mice, and Short-Tailed Shrews Collected in Live Traps at the Mound Plant, Montgomery County, Ohio[a]

		Spring				Summer				Fall			
		♀	♂	?[b]	Total	♀	♂	?[b]	Total	♀	♂	?[b]	Total
Eastern chipmunk	No. of Individuals	2	17	4	23	9	2	0	11	0	0	0	0
	Min. Weight (gr)	100	75	85	75	73	65	–	65	–	–	–	–
	Max. Weight (gr)	110	125	185	185	120	99	–	120	–	–	–	–
	$\bar{x}$ (gr)	105	87.6	143.8	99.4	92.3	82.0	–	90.5	–	–	–	–
	S.D.	7.1	14.6	49.7	29.8	15.7	24.0	–	16.5	–	–	–	–
Deer/white-footed mouse	No. of Individuals	6	28	5	39	17	16	1	34	10	32	–	42
	Min. Weight (gr)	17.5	9.0	15.5	9.0	14.0	17.5	24.5	14.0	17.0	9.5	–	9.5
	Max. Weight (gr)	27.0	26.0	27.0	27.0	26.0	28.5	24.5	28.5	25.0	31.5	–	31.5
	$\bar{x}$ (gr)	23.7	17.6	22.4	19.1	20.3	20.6	24.5	20.4	21.6	19.8	–	20.2
	S.D.	3.5	4.5	4.4	5.0	3.5	2.9	0	3.2	2.4	4.7	–	4.4
Short-tailed shrew	No. of Individuals	0	1	0	1	0	0	0	0	0	5	2	7
	Min. Weight (gr)	–	26.0	–	26.0	–	–	–	–	–	16.0	13.0	13.0
	Max. Weight (gr)	–	26.0	–	26.0	–	–	–	–	–	24.0	17.5	24.0
	$\bar{x}$ (gr)	–	26.0	–	26.0	–	–	–	–	–	20.4	15.3	18.9
	S.D.	–	0	–	0	–	–	–	–	–	2.9	3.2	3.7

[a] Calculations do not include recaptures.
[b] Gender not recognizable.
– No calculation performed.

For the *Peromyscus*, the average weight of females captured during the spring and fall surveys was larger than for males (23.7 and 21.6 g versus 17.6 and 19.8 g). In the summer, the sexes were similar (20.3 g for the females and 20.6 g for the males).

Several species of large mammals that are managed as game species occur on the South Property of the Mound Plant, including white-tailed deer, eastern gray and eastern fox squirrel, woodchuck, and gray fox. Of these, the white-tailed deer is sought after most often by hunters. Evidence of previous hunting activities, in the form of shotgun shells and a tree stand, was found on the site. A tree stand, typically used by gun and bow hunters during the deer season, was found in the slope forest near the northern border of the South Property. Numerous empty shotgun shells were found in this area and on the wooded northern slope of the Main Hill, indicating that hunting may have occurred.

No threatened or endangered species of mammals were observed during the mammal investigations at the Mound Plant. All species confirmed as occurring on the site also commonly occur throughout Ohio and most of eastern North America.

3.2.3. Herptile Investigations

Ten species of reptiles and amphibians were identified at the Mound Plant by roving searches, drift fence sampling, and quadrat searches (Table III.33). Each species is described in detail in an annotated list (Appendix D).

Use of diversity indices to facilitate characterization of the Mound Plant herpetological fauna was impractical because of the low numbers of species and individuals encountered. For the same reason, quadrat observation to effort ratios was not done because the low numbers would result in ambiguous index and ratio values.

3.2.3.1. Roving Searches

Roving searches were conducted on 6 days during the spring and summer for a total of 20.3 hours (1220 minutes). Information on the herptiles encountered during the roving searches is presented in Table III.34. The most abundant amphibian encountered was *Rana catesbeiana* (bullfrog), while the most common reptile encountered was *Elaphe obsoleta* (rat snake). In all, 28 animals were encountered.

Table III.33. List of Reptiles and Amphibians Observed at the Mound Plant, Montgomery County, Ohio

Common Name	Scientific Name
Red-backed salamander	*Plethodon cinereus*
American toad	*Bufo americanus*
Bullfrog	*Rana catesbeiana*
Snapping turtle	*Chelydra serpentina*
Eastern box turtle	*Terrapene carolina*
Blue racer	*Coluber constrictor*
Rat snake	*Elaphe obsoleta*
Northern water snake	*Nerodia sipedon*
Queen snake	*Regina septemvittata*
Brown snake	*Stoeria dekayi*

Table III.34. Abundance Data on the Amphibians and Reptiles Encountered During Roving Searches During the Mound Ecological Assessment

Species	Season	
	Spring (March 21-June 21)	Summer (June 21-September)
Red-backed salamander	1	1
American toad	0	1
Bullfrog	3	14[a]
Snapping turtle	0	1
Blue racer	1	0
Rat snake	3[b]	0
Northern watersnake	1	0
Queen snake	1	0
Brown snake	1	0

[a]Including approximately ten larvae.
[b]One specimen counted from a shed skin only.

3.2.3.2. Drift Fence Sampling

During the herpetological survey, no amphibians or reptiles were trapped in the drift fences. However, the only specimen of *Zapus hudsonius*, the meadow jumping mouse, was collected from the drift fence deployed along the Miami-Erie Canal. The failure of the drift fences to capture a single herptile was unexpected. The drift fence is one of the most valuable and frequently used collecting tools for the field herpetologist. Many herptile species use ecotonal tracks or breaks in the habitat and will move through these corridors over short periods of time, often overnight. Fences often catch secretive species that are almost never collected during roving collections. Fences also provide shade for many herptiles that avoid sunlight.

3.2.4. Quadrats Searches

Four herptile species were collected from the three quadrats examined during the spring and summer sampling efforts (Table III.35). The only species found on the North Slope was *Plethodon cinereus*, the red-backed salamander. The greatest number of individuals of this species was collected during the early spring effort.

On the South Property quadrat, only two animals were captured. A single specimen of *Bufo americanus*, the bullfrog, and a single specimen of *Elaphe obsoleta*, the rat snake, were found during the summer 1992 sampling effort. At the North Property quadrat, three herptile species were found, all during the late-summer sampling effort. One individual of *P. cinereus*, one of *B. americanus*, and one of *Terrapene obsoleta* (the eastern box turtle) were collected.

Summary of Herptile Sampling

A summary of all herptiles collected or observed at the Mound Plant during the ecological characterization is presented in Table III.36. No threatened or endangered species were encountered. In general, the herpetological fauna was depauperate in the number of species and the number of individuals encountered. The most commonly encountered amphibian, the red-backed salamander, is a common northern species that survives in a wide range of soil and habitat types. The most commonly encountered reptile, the rat snake, is also found in a wide range of habitat types and can adapt well to areas disturbed by humans. All amphibians and reptiles encountered during the survey, except for *Regina septemvittata* (the queen snake), tend to be habitat and feeding generalists. The queen snake is found in a wide variety of lotic habitats but requires crayfish for food.

Table III.35. Quadrat Abundance Data of Amphibians and Reptiles for the Mound Ecological Assessment

Species	Quadrat								
	North Slope			South Property			North Property		
	ES[a]	LS[b]	S[c]	ES	LS	S	ES	LS	S
Red-backed salamander	30	11	5	0	0	0	0	1	0
American toad	0	0	0	0	0	1	0	1	0
Eastern box turtle	0	0	0	0	0	0	0	1	0
Rat snake	0	0	0	0	0	1	0	0	0

[a]Early spring (March 7-8, 1993)
[b]Late spring (May 19-20, 1993)
[c]Summer (August 26-27, 1992)

Table III.36. Summary of Amphibians and Reptiles Encountered at the Mound Plant, Montgomery County, Ohio

Species	Length	Weight	Location/Habitat	Date	Time	Encounter	Condition
Red-backed salamander	7.0	--	North Slope of Main Hill/Wooded Slope	8-26-92	1230	NS[a] Quadrat	Good
Red-backed salamander	6.5	--	North Slope of Main Hill/Wooded Slope	8-26-92	1230	NS Quadrat	Good
Red-backed salamander	6.0	--	North Slope of Main Hill/Wooded Slope	8-26-92	1230	NS Quadrat	Good
Red-backed salamander	5.5	--	North Slope of Main Hill/Wooded Slope	8-26-92	1230	NS Quadrat	Good
Red-backed salamander	6.0	--	North Slope of Main Hill/Wooded Slope	8-26-92	1230	NS Quadrat	Good
Red-backed salamander	--	--	North Property/Dry Wooded Slope	8-27-92	1000	NP[b] Quadrat	Good
Red-backed salamander	--	--	Train Trestle at Hwy 25/Flat	8-29-72	1540	Roving	Good
Red-backed salamander	9.0	2.5	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	7.6	1.0	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	10.1	3.5	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	6.5	1.0	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	10.1	3.5	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	8.6	1.5	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	9.6	2.0	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	8.5	1.0	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	8.8	1.0	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	10.0	1.5	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	6.0	1.5	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Tail Missing
Red-backed salamander	10.3	1.5	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	7.5	1.0	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	8.3	1.0	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	7.7	1.0	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Tail Missing
Red-backed salamander	10.4	1.0	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	10.0	1.0	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	7.7	1.0	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	10.5	2.0	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	9.2	1.5	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	12.6	3.0	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good

Table III.36. (page 2 of 3)

Species	Length	Weight	Location/Habitat	Date	Time	Encounter	Condition
Red-backed salamander	9.6	2.0	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	12.2	3.0	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	2.5	--	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	9.5	2.0	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	8.6	1.5	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	10.5	2.0	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	10.0	2.0	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	10.5	1.5	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	8.0	1.5	North Slope of Main Hill/Wooded Slope	4-7-93	0830	NS Quadrat	Good
Red-backed salamander	8.5	1.5	Miami-Erie Canal/Wooded Slope	4-8-93	1615	Roving	Good
Red-backed salamander	6.9	1.0	North Slope of Main Hill/Wooded Slope	5-20-93	1100	NS Quadrat	Good
Red-backed salamander	7.3	1.0	North Slope of Main Hill/Wooded Slope	5-20-93	1100	NS Quadrat	Good
Red-backed salamander	9.3	1.5	North Slope of Main Hill/Wooded Slope	5-20-93	1100	NS Quadrat	Good
Red-backed salamander	3.8	0.5	North Slope of Main Hill/Wooded Slope	5-20-93	1100	NS Quadrat	Good
Red-backed salamander	3.0	0.5	North Slope of Main Hill/Wooded Slope	5-20-93	1100	NS Quadrat	Good
Red-backed salamander	8.4	1.3	North Slope of Main Hill/Wooded Slope	5-20-93	1100	NS Quadrat	Good
Red-backed salamander	7.9	1.0	North Slope of Main Hill/Wooded Slope	5-20-93	1100	NS Quadrat	Good
Red-backed salamander	7.2	1.5	North Slope of Main Hill/Wooded Slope	5-20-93	1100	NS Quadrat	Good
Red-backed salamander	7.4	1.5	North Slope of Main Hill/Wooded Slope	5-20-93	1100	NS Quadrat	Good
Red-backed salamander	8.8	1.8	North Slope of Main Hill/Wooded Slope	5-20-93	1100	NS Quadrat	Good
Red-backed salamander	8.2	1.0	North Slope of Main Hill/Wooded Slope	5-20-93	1100	NS Quadrat	Good
American toad	--	10.0	South Property/Wooded Slope	8-26-92	1615	SP[a] Quadrat	Good
American toad	6.0	--	North Property/Wooded Slope	8-27-92	1000	Quadrat	Good
American toad	--	--	North Property/Plant Drainage Ditch	8-29-92	0815	Roving	Good
Bullfrog	--	--	North Property/Plant Drainage Ditch	6-11-92	--	Roving	Good
Bullfrog	--	--	North Property/Plant Drainage Ditch	6-13-92	1200	Roving	Good
Bullfrog	--	--	North Property/Overfow Pond	8-28-92	2030	Roving	Good
Bullfrog	--	--	Miami-Erie Canal	8-28-92	2230	Roving	Good

Table III.36. (page 3 of 3)

Species	Length	Weight	Location/Habitat	Date	Time	Encounter	Condition
Bullfrog	--	--	Miami-Erie Canal	8-28-92	2230	Roving	Good
Bullfrog	--	--	Miami-Erie Canal	8-28-92	2230	Roving	Good
Bullfrog	--	--	Miami-Erie Canal	5-18-93	1900	Roving	Good
Bullfrog	--	--	North Property/Overflow Pond	5-18-93	2245	Roving	Good
Snapping turtle	--	--	North Property/Overflow Pond	7-28-92	--	Roving	Good
Eastern terrapin	14.0	60.0	North Property/Wooded Slope	8-27-92	1000	Quadrat	Good
Blue racer	--	--	South Property/Wooded Slope	5-19-93	1615	Roving	Good
Rat snake	--	--	North Slope of Main Hill/Wooded Slope	6-14-92	--	Roving	Good
Rat snake	28.0	22.5	Miami-Erie Canal/Wooded Slope	6-14-92	--	Roving	Good
Rat snake (female)	119.0	60.0	South Property/Wooded Slope	8-26-92	1615	SP Quadrat	Good
Rat snake (skin)	--	--	Miami-Erie Canal	5-18-93	1930	Roving	--
Northern watersnake (male)	90.1	--	Miami-Erie Canal	5-19-93	1830	Roving	Good
Queen snake	67.9	--	Miami-Erie Canal	5-19-93	1700	Roving	Good
Brown snake	--	--	On Hwy 25 at RR Trestle	4-8-93	--	Roving	Flat

[a]NS - North Slope
[b]NP - North Property
[c]SP - South Property

Given the habitats surveyed and geographic locality, the species encountered do account for most of the herpetological fauna that would be expected in the survey area. Most markedly missing were any species of lizards (*Eumeces*) that are commonly found in these habitats. More noticeable was the low numbers of *Bufo americanus* and *Storeria dekayi*, the brown snake. During the extensive roving searches, these species would be expected to be have been more commonly encountered. The failure of the drift fences to trap any amphibians and reptiles may be attributable to the lack of species in the area most susceptible to this type of trapping. Frogs, lizards, and small snakes are the most commonly captured animals in drift fences. Despite the low abundances, the area does not exhibit an alarming lack of diversity. Geographic locality accounts for much of the depauperate fauna. The survey area is just north of the northern-most range of many of the common southern species. These northern transitional zones tend to be poor in species richness and abundance.

3.3. AQUATIC INVESTIGATION

Aquatic sampling for fish and macroinvertebrates was conducted in streams and ponds at the Mound Plant. *In situ* parameters and substrate characteristics of the streams examined as part of the aquatic investigations are presented in Tables III.37 and III.38.

3.3.1. Fish

Fish sampling for the spring was conducted from June 9 to 13, 1992; for the fall, it was conducted from September 20 to 22, 1993. A total of 19 species of fish representing six families was collected during the stream and pond surveys (Table III.39). All of the species collected during the 1992 and 1993 sampling efforts are common in the Ohio River/Great Miami River drainages. None of these species are considered to be of special concern by the U.S. Department of the Interior or the state of Ohio. An annotated list and description of fish species observed for the Mound Plant and offsite areas are presented in Appendix J. The results of the 1992 and 1993 fish surveys are listed by station in Tables III.40 and III.41, respectively. Average weight and capture efficiency (catch per unit effort) for fish species collected at each station are presented in Appendix K. Different fishing methods were used in the spring (electroshocking) as compared to the fall seining. Comparisons of capture rates between the first and second passes indicated that the methods were equally efficient.

Fifteen species were collected during each season; however, some variation in species composition was observed. Eleven species were collected during both seasons, including:

- gizzard shad (*Dorosoma cepedianum*),
- spotfin shiner (*Cyprinella spiloptera*),
- bluntnose minnow (*Pimephales notatus*),

Table III.37. Summary of Field Parameters in Streams, Mound Plant, Montgomery County, Ohio, June 1992 and November 1993

Aquatic Station	Temperature (°C)		pH		Dissolved Oxygen (mg/l) Measured		Dissolved Oxygen (mg/l) Calculated Saturation[1]		Specific Conductance (µmho)		Channel Width (feet)		Average Channel Depth (inches)		Stream Velocity (ft/sec)		Estimated Flow (GPM)	
	Spring[2]	Fall	Spring	Fall	Summer[2]	Fall	Summer[2]	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
EF	17.2	7.0	7.0	7.4	—	8.0	—	11.8	970	1120	1.7	3.0	1.5	4.0	0.0	0.0	0.0	0.0
BB	14.5	8.5	7.5	7.0	—	8.2	—	11.3	900	900	1.3	1.3	1.0	2.0	0.4	0.0	0.3	0.0
DD1	22.0 (20.0)	13.0	8.0	7.0	7.4	9.2	8.8	10.2	1250	800	5.0	5.0	3.0	2.5	0.7	1.1	6.5	8.6
DD2	21.0 (20.0)	10.5	7.2	8.0	9.2	10.3	8.8	10.8	1130	870	4.5	6.0	5.5	5.0	0.2	0.3	3.1	5.6
ME1	20.5 (20.0)	10.0	7.5	7.3	10.2	10.2	8.8	10.7	1040	850	10	6.0	3.5	5.0	0.1	0.4	2.2	8.7
ME2	21.0 (19.0)	8.0	7.5	8.3	6.5	10.5	9.0	11.5	1180	800	6.5	8.0	2.3	3.0	0.6	0.7	3.9	10.5
OC1	19.5 (20.0)	5.0	7.5	8.0	6.4	10.5	8.8	12.4	1190	780	9.0	20.0	1.0	50.0	1.3	0.0	3.2	0.0
OC2	23.0 (20.0)	6.5	7.0	7.4	9.2	11.2	8.8	11.9	880	510	15.0	15.0	36.0	24.0	0.0	0.0	0.0	0.0

[1]Solubility in pure water in relation to temperature from saturated air at 760 mm mercury pressure.
[2]Dissolved oxygen (DO) equipment failed during spring 1992 survey; DO reanalyzed on 9/20/93; oxygen saturation calculated from summer temperatures (in parentheses).

Table III.38. Summary of Substrate Characteristics in Streams, Mound Plant, Montgomery County, Ohio, June 1992 and November 1993

Aquatic Station	Substrate							Aquatic Vegetation Coverage		Embeddedness
	Clay Hardpan or % Bedrock	% Large Cobble	% Small Cobble	% Pebble	% Gravel and Sand	% Silt	% Detritus	% Algae	% Rooted	Distance From Top of Rocks to Matrix (in.)
EF	40	50	0	0	10	0	0	0	0	1.0
BB	0	0	5	5	75	15	0	75	0	1.5
DD1	0	10	40	40	10	0	0	25	0	2.0
DD2	0 (5)	0 (10)	0 (10)	0 (5)	0 (25)	100 (45)	0	0	0	0.0 (1.0)
ME1	0	10	5	5	0	80	0	0	30	0.0
ME2	0	5	5	5	40	40	5	0	5	0.0
OC1	0	5	0	5	75	10	5	0	0	0.0
OC2	0	5	5	0	0	85	5	5	0	0.0

[1]Fall sampling was upstream from spring sampling and had a different substrate; fall substrate in parentheses.

Table III.39. List of Fish Species Collected at Mound Plant, Montgomery County, Ohio

Scientific Name	Common Name
Dorosoma cepedianum	Gizzard shad
Campostoma anomalum	Central stoneroller
Cyprinella spiloptera	Spotfin shiner
Cyprinus carpio	Common carp
Luxilus chrysocephalus	Striped shiner
Notemigonus chrysoleucas	Golden shiner
Pimephales notatus	Bluntnose minnow
Rhinichthys atratulus	Blacknose dace
Semotilus atromaculatus	Creek chub
Catostomus commersoni	White sucker
Ameirus melas	Black bullhead
Gambusia affinis	Mosquitofish
Lepomis cyanellus	Green sunfish
Lepomis humilis	Orangespotted sunfish
Lepomis macrochirus	Bluegill
Lepomis megalotis	Longear sunfish
Lepomis cyanellus x L. macrochirus	Hybrid sunfish (green sunfish x bluegill)
Micropterus salmoides	Largemouth bass
Pomoxis nigromaculatus	Black crappie
Perca flavescens	Yellow perch

Table III.40. Spring 1992 Fish Sampling Results[a]

Species		Station								
		ME1	ME2	OC1	DD2	DD1	SP	OP	RB	OC2
Dorosoma cepedianum	Pass 1 Pass 2			1 (125) 23.6 1 (150) 21.6						
Campostoma anomalum	Pass 1 Pass 2			2 (74-75) 8.2						
Cyprinella spiloptera	Pass 1 Pass 2			1 (62) 1.4						1 (75) 4.6 1 (75) 3.4
Notemigonus chrysoleucas	Pass 1 Pass 2			13 (88-112) 129.8						
Pimephales notatus	Pass 1 Pass 2			1 (91) 6.8 1 (90) 6.9						
Rhinichthys atratulus	Pass 1 Pass 2			3 (62-65) 9.9						
Semotilus atromaculatus	Pass 1 Pass 2			29 (68-121) 363.3 6 (60-125) 60.7						
Gambusia affinis	Pass 1 Pass 2	12 (30-50) 9.5 1 (45) 1.0	2 (40) 1.6							3 (25-40) 1.4 3 (30-40) 1.7
Catostomus commersoni	Pass 1 Pass 2									1 (30) 0.3 5 (NM)[b] 1.3
Lepomis cyanellus	Pass 1 Pass 2	243(40-150)4501.7 87(40-140)942.0	2(80-110)28.5 1(50)2.6	78(40-130)695.2 18(45-90)111.2	334(35-140)2870.5 203(45-135)1436.8	44(45-130)383.7 27(50-125)159.2		218(45-155)2859.7	101(35-135)1073.1	66(30-80)171.6 52(30-75)123.6
L. humilis	Pass 1 Pass 2									
L. macrochirus	Pass 1 Pass 2			26(45-208)217.7 6(40-130)130.1			1(110)24.6			
L. megalotis	Pass 1 Pass 2			2(73-75)15.4						
L. cyanellus x macrochirus	Pass 1 Pass 2			7(70-90)62.3						
Micropterus salmoides	Pass 1 Pass 2						2(250-270)433.0			
Ameirus melas	Pass 1 Pass 2			1(140)39.5 1(145)34.3						

[a] Number of individuals is followed by the range in total lengths in millimeters, followed by the weight in grams.
[b] NM = Not measured.

Table III.41. Fall 1993 Fish Sampling Results[a]

Species		Station								
		ME1	ME2	OC1	DD2	DD1	SP	OP	RB	OC2
Dorosoma cepedianum	Pass 1			4 (65-81) 14.4						
	Pass 2			1 (69) 3.4						
Cyprinella spiloptera	Pass 1			1 (83) 5.3						
	Pass 2			1 (64) 2.3						
Cyprinus carpio	Pass 1			1 (74) 6.5						
	Pass 2									
Luxilus chrysocephalus	Pass 1			2 (51-54) 2.9						
	Pass 2			5 (44-60) 7.7						
Pimephales notatus	Pass 1			1 (80) 4.7						
	Pass 2			2 (50-83) 6.2						
Rhinichthys atratulus	Pass 1	1 (56) 2.3								
	Pass 2									
Semotilus atromaculatus	Pass 1		1 (65) 3.3	5 (67-75) 21.7	1 (72) 4.6					
	Pass 2	1 (76) 6.2	1 (60) 4.7	2 (70-76) 9.2	1 (68) 4.0					
Gambusia affinis	Pass 1	1 (37) 0.9	1 (37) 0.9							
	Pass 2	4 (36-44) 2.6	1 (43) 1.0							
Catostomus commersoni	Pass 1			2 (68-72) 7.4						2 (215-345)480.4
	Pass 2			2 (75-80) 9.5						
Lepomis cyanellus	Pass 1	19 (58-89) 130.2	15(27-96)111.1	22 (58-100) 137.9	1 (NC)[b]		87(34-52)590.2	87 (34-152) 590.2	18(41-105)151.4	1 (95) 16.9
	Pass 2	11 (57-100) 89.8	2 (32-81) 12.1	14 (56-81) 74.8						
L. macrochirus	Pass 1			2 (57-95) 18.1			1 (107) 17.5			1 (49) 2.0
	Pass 2			4 (54-169) 184.3						
L. megalotis	Pass 1									6 (69-120) 85.1
	Pass 2									
Micropterus salmoides	Pass 1			6 (50-64) 13.3			1 (64) 2.6			
	Pass 2			3 (55-93) 14.7						
Perca flavescens	Pass 1			1 (60) 2.9						
	Pass 2									
Pomoxis nigromaculatus	Pass 1						1 (162) 48.8			
	Pass 2									

[a] Number of individuals is followed by the range in total lengths in millimeters, followed by the weight in grams.
[b] Not captured. A single sunfish, presumably *Lepomis cyanellus*, was observed but escaped capture.

- blacknose dace (*Rhynichthys atratulus*),
- creek chub (*Semotilus atromaculatus*),
- mosquitofish (*Gambusia affinis*),
- white sucker (*Catostomas commersoni*),
- green sunfish (*Lepomis cyanellus*),
- bluegill (*L. macrochirus*),
- longear sunfish (*L. megalotis*), and
- largemouth bass (*Micropterus salmoides*).

Fish species that were only collected during the spring 1992 included:

- stoneroller (*Campostoma anomalum*),
- golden shiner (*Notemigonus chrysoleucas*),
- orange-spotted sunfish (*Lepomis humilis*), and
- black bullhead (*Ameirus melas*).

Fish species that were only collected during the fall 1993 included:

- common carp (*Cyprinus carpio*),
- striped shiner (*Luxilus chrysocephalus*),
- yellow perch (*Perca flavescens*), and
- black crappie (*Pomoxis nigromaculatus*).

Seasonal variations in species composition were observed only offsite at the upstream Overflow Creek location (OC1) and in the South Pond (SP).

A total of 1927 individuals were collected, 1607 during the spring and 320 during the fall survey. Green sunfish were the most common species collected during both the spring 1992 and fall 1993 surveys, both in the number of individuals and the number of locations where they were collected. A total of 1474 green sunfish were collected in the spring survey and 250 in the fall. Green sunfish was also the only species observed on the Mound Plant property (Stations DD1, SB, and OP), while 18 species were collected offsite (Stations DD2, ME1, ME2, OC1, OC2, and SP). The creek chub was the second most abundant species collected during each seasonal survey, with 35 individuals collected in the spring and 12 in the fall.

More fish species were collected from the upstream OC1 than from any other location in the Mound drainage. This location was close to the Great Miami River; there was no permanent barrier to fish migration between the river with its diverse fish fauna and OC1. A weir upstream from OC1 prevents fish movement into the Miami-Erie Canal and the Mound Plant site. Eleven fish species were observed

at OC1 during each of the two seasonal surveys, while only two species were observed upstream from the weir (Stations ME2, ME1, DD2, and DD1) during the spring 1992 survey and four species during the fall survey. Blacknose dace and creek chub, common headwater or pioneering species (OEPA 1988), were collected upstream from the weir during the fall 1993 survey, but not in the spring of 1992.

3.3.1.1. Stream Fish

Index of Biotic Integrity (IBI) values were computed for the fish communities at each stream sample location surveyed during the spring 1992 and fall 1993. The IBI was developed by the OEPA (1987) to provide a method for the evaluation of the overall fish community condition. It is based on 12 structural attributes and functional characteristics.

All permanent streams in the Mound drainage were channelized. OEPA evaluates channelized streams separately under the MWH category. The MWH IBI criterion for the ECBP region is 24 (OEPA 1989). QHEI values indicate that IBI values from the Mound drainage should meet or exceed that criterion (see Appendix G). IBI values were at or above the MWH criterion at four of six stream locations in the spring of 1992 and three of six locations in the fall of 1993 (Table III.42).

The lowest IBI values were upstream from the Overflow Creek weir. Access by fish from the Great Miami River and the Overflow Creek to the Miami-Erie Canal is blocked. Access further upstream into the Drainage Ditch is blocked again by another weir. Fish populations in the Miami-Erie Canal and the Drainage Ditch must, therefore, be reproductively self-supporting. With very little total area underwater year-round in the Miami-Erie Canal and the Drainage Ditch, few populations could be expected to persist. Those that could would likely be habitat generalists and, as such, not add much to the IBI value.

Furthermore, many of the IBI metrics do not have values predicted for watersheds at less than 1 sq mi. This is the situation throughout the Miami-Erie Canal, particularly upstream from the confluence with Benner Branch (MEI) and in the Drainage Ditch where flow is artificially maintained. While it may not be appropriate to apply the MWH IBI criterion to these locations, three of four spring IBI values in the canal and the ditch were very near or met the criterion. Only the downstream end of the Miami-Erie Canal (ME2), where very few fish were caught, was the IBI value at a minimum (IBI = 12) and well below the criterion.

At three locations, fall IBI values met or exceeded spring values. At these locations, fall IBI values would have been lower than spring values except for a higher incidence of DELT anomalies in the

Table III.42. Index of Biotic Integrity, Mound Plant, Montgomery County, Ohio

	Metric	Stations																							
		DD1				DD2				ME1				ME2				OC1				OC2			
		Spring[b]		Fall		Spring		Fall		Spring		Fall		Spring		Fall		Spring		Fall		Spring		Fall	
		V[a]	R[a]	V	R	V	R	V	R	V	R	V	R	V	R	V	R	V	R	V	R	V	R	V	R
1.	Total Number of Species	1	1	1	1	1	1	2	1	2	1	4	3	2	1	3	1	12	5	11	5	4	3	4	3
2.	Number of Darter and Sculpin Species	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
3.	Number of Headwaters Species	0	1	0	1	0	1	0	1	0	1	1	1	0	1	0	1	1	1	0	1	0	1	0	1
4.	Number of Minnow Species	0	1	0	1	0	1	0	1	0	1	2	1	0	1	1	1	4	3	2	1	0	1	0	1
5.	Number of Sensitive Species	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	1	1	0	1	0	1	1	1
6.	Percent Tolerant Species	100	1	100	1	100	1	100	1	96	1	86	1	80	1	90	1	69	1	63	1	94	1	30	5
7.	Percent Omnivores	0	5	0	1[e]	0	5	0	5	0	5	0	5	0	1[e]	0	1[e]	2	5	16	3	89	1	10	1[e]
8.	Percent Insectivorous Species	100	5	100	1[e]	100	5	97	5	100	5	95	5	100	1[e]	90	1[e]	74	5	63	5	5	5	20	1[e]
9.	Percent Pioneering Species	100	1	100	1	100	1	100	1	98	1	84	1	60	1	90	1	68	1	57	1	95	5	80	1[e]
10.	Number of Individuals[c]	71	3	1	1	537	5	62	3	343	5	37	3	5	1	21	1	190	5	80	3	132	5	10	1
11.	Number of Simple Lithophilic Species	0	1	0	1	0	1	0	1	0	1	1	1	0	1	0	1	3	3	4	5	1	1	1	1
12.	Percent DELT Anomalies[d]	7	1	0	1[e]	3	1	0	5	6	1	0	5	0	1[e]	0	1[e]	2	1	0	5	5	1	0	1[e]
	Final Index Score (sum of ratings)	22		12		24		25		24		28		12		12		32		32		26		18	

[a]V = Value; R = Rating
[b]Excludes exotic species.
[c]Excludes species designated as tolerant, hybrids, and exotics.
[d]Includes deformities, eroded fins, lesions, and external tumors (DELT).
[e]Rating of 1 substituted because the total number of individuals collected was less than 25.

spring (deformities, eroded fins, lesions, and tumors; Table III.42). None of these anomalies, or any other signs of poor health, was observed with fish collected during the fall.

DELT anomalies can be caused by pollution, but they may also be an indication of stress and improper diet caused by overcrowding. More fish, over six times as many individuals, were collected in the spring of 1992 than in the fall of 1993 at the five stream locations showing DELT anomalies. Four of these five locations also had badly emaciated fish in the spring, but not in the fall. It is possible that the DELT anomalies were caused by overcrowding.

3.3.1.2. Pond Fish

Fish were collected from three of the four ponds (Tables III.40 and III.41). No fish were found in the Asphalt Pond. Few fish were collected from the South Pond, representing three species: largemouth bass, bluegill, and black crappie. None of these species was found in the Mound Plant ponds. Many individuals of only a single species (green sunfish) were collected from the Settling Basins and the Overflow Pond. Recolonization of these ponds by fish from downstream areas is not possible because of physical barriers.

Fish size ranges indicated that reproduction was occurring in the Overflow Pond and Settling Basins to the point where overpopulation may have been a problem in the spring of 1992. In the spring survey, many fish in the Overflow Pond were found to have parasites. The transmission of parasites is promoted by overpopulation. Fish emaciation and DELT anomalies were seen in the Settling Basins.

The numbers and sizes of fish decreased dramatically between the spring of 1992 and the fall of 1993 in both the Overflow Pond and Settling Basins. There was a 60 percent reduction in the number of fish collected from the Overflow Pond and an 80 percent reduction in the Settling Basins. In the spring survey, the average weight of fish in the Overflow Pond and Settling Basins was 13 g and 11 g, respectively. In the fall survey, the average weight of fish in these two waterbodies was 6 g and 8 g, respectively.

During the spring survey, fish were seen gulping air in the Overflow Pond. A fish kill was reported several days later, apparently from low dissolved-oxygen concentrations. This kill may have extended to the Settling Basins. Reduction in size and numbers of fish during the fall survey may have been the result of the fish kill. No parasites, emaciation, or DELT anomalies were seen in the reduced populations in the fall survey.

3.3.2. Aquatic Macroinvertebrates

3.3.2.1. Stream Benthic Macroinvertebrates

A combined total of 19,189 macroinvertebrates representing 135 taxa was collected from eight stream locations in the Mound area (Appendix L) and were present at every sampled location. The risk presented by contaminants to benthic fauna has not been developed for specific taxa, but applies to the community in general. Nevertheless, specific receptor taxa can be identified for each location from lists provided in Appendix L. Six of these locations were sampled with a combination of Hester-Dendy artificial substrates and qualitative methods: two locations in the Drainage Ditch (DD1 and DD2); two locations in the Miami-Erie Canal (ME1 and ME2); and two locations in the Overflow Creek (OC1 and OC2). Two additional locations were in intermittent streams: East Fork (EF) and Benner Branch (BB). In the spring survey, these locations were sampled with Surber samplers and qualitative methods. In the fall survey, the intermittent streams were sampled with Surber samplers only. All eight locations were sampled in both the spring of 1992 and the fall of 1993.

There were seasonal differences at the intermittent stream locations. Based on normal habitat preferences (Merritt and Cummins 1984), the insects of the benthic communities at both EF and BB were dominated by organisms adapted to living in erosional situations in the spring. Conversely, in the fall, the insect dominants were species generally associated with depositional situations. In the fall, greater proportions of the insects at both EF and BB were species generally found in shallow, standing water.

The observed differences in the ecology of the benthic insects at EF and BB were consistent with typical spring to fall habitat changes for such an environment. In intermittent streams, flow and therefore erosion occur primarily in the spring. Pockets of standing water are few. In the fall, however, isolated pools are frequently the only surface water remaining.

At DD1, insect dominance was shared among organisms adapted to erosional and depositional situations. Insects were a large proportion of the community at DD1 in both the spring and the fall. These results probably reflect a constant flow condition throughout the year. A large number of the insects collected in the fall at DD1 are species typically associated with vegetation.

Species adapted to living in shallow, standing water comprised a large proportion of the insects collected from DD2 in the spring. These organisms were not prevalent in the fall at DD2. This difference probably reflects the fact that Hester-Dendy artificial substrates were deployed in a pool in the spring of 1992 and in a more run-like situation upstream from the pool in the fall of 1993.

At ME1, insects comprised a large proportion of the benthic organisms collected from the artificial substrates in both the spring and fall surveys. This is consistent with constant flow throughout the year. During both seasons, most of the insects collected were species associated with erosional habitats. A greater proportion of insects collected in the spring than in the fall were adapted to living in standing water, but this and the greater total number of organisms collected in the fall were apparently due to more successful qualitative sampling.

Downstream in the canal at ME2, most of the insects in the fall collection were species associated with erosional habitats and flowing water. In the spring survey, the community was dominated by species typically found in depositional situations, standing water, and vegetation. While these differences may reflect actual seasonal changes, they may also reflect habitat differences in the placement of the artificial substrates and where qualitative samples were collected.

At OC1, seasonal differences were small. In the fall, there was a smaller proportion of insects adapted to erosional situations and a larger proportion adapted to deep standing water. The differences may have been caused by inundation from the debris dam at the concrete culvert upstream of the sewage treatment plant or simply by natural variation.

At the mouth of the Overflow Creek (OC2), the adaptations of the insect community were decidedly different from any other community upstream. There, the insect community was overwhelmingly dominated by organisms adapted to living in deep water and depositional situations, a reflection of the conditions encountered at OC2.

Benthic community collections among locations and between seasons were compared with the Invertebrate Community Index (ICI) (OEPA 1988; Addendum 1989). ICI values were also compared to the ICI MWH criterion for the ECBP region (Table III.43).

ICI values were designed to be calculated from Hester-Dendy artificial substrate results. However, those devices are not designed for use in intermittent streams. In intermittent streams, there are no runs (the prescribed habitat for deployment), potholes are frequently unconnected, and downstream drift, therefore, does not occur. Further, the devices are likely to become exposed between deployment and retrieval. WESTON has developed comparisons between the Hester-Dendy and Surber data collected at the same time for seven locations in a second order (two sources) permanent stream. In that comparison, ICI values developed from Surber data (five replicates) averaged 8 points higher than values from Hester-Dendy data (five replicates). ICI values are presented for both Surber data from intermittent streams (EF and BB) and Hester-Dendy data from permanent streams (Table III.44).

Table III.43. Invertebrate Community Index, Mound Plant, Montgomery County, Ohio

	Metric	Stations															
		EF				BB				DD1				DD2			
		Spring[b]		Fall		Spring		Fall		Spring		Fall		Spring		Fall	
		V[a]	R[a]	V	R	V	R	V	R	V	R	V	R	V	R	V	R
1.	Total Number of Taxa	15	2	13	2	27	4	11	0	6	0	9	0	24	2	13	1
2.	Total Number of Mayfly Taxa	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
3.	Total Number of Caddisfly Taxa	0	0	0	0	2	6	0	0	0	0	1	4	0	0	1	4
4.	Total Number of Dipteran Taxa	11	2	5	0	17	4	2	0	4	0	7	2	14	4	9	2
5.	Percent Mayfly Composition	0	0	0	0	0	0	0	0	0	0	0	0	0.1	2	0	0
6.	Percent Caddisfly Composition	0	0	0	0	0.2	2	0	0	0	0	2.1	4	0	0	0.3	2
7.	Percent Tribe Tanytarsini Midge Composition	1	2	0	0	0	0	0	0	0	0	0	0	1.1	2	0.7	2
8.	Percent Other Dipteran and Non-Insect Composition	89	0	99.4	0	98	0	98	0	100	0	87.9	0	98.5	0	99.3	0
9.	Percent Tolerant Organisms	6.2	6	33.5	0	0.7	6	2.4	6	25	2	30.9	0	58.9	0	4.7	6
10.	Number of Qualitative EPT Taxa	0	0	0	0	4	2	2	0	1	0	1	0	2	0	3	0
Final Index Score (sum of ratings)		12		2		24		6		2		10		10		17	

	Metric	Stations															
		ME1				ME2				OC1				OC2			
		Spring[b]		Fall		Spring		Fall		Spring		Fall		Spring		Fall	
		V[a]	R[a]	V	R	V	R	V	R	V	R	V	R	V	R	V	R
1.	Total Number of Taxa	24	2	15	1	18	2	9	0	21	2	18	1	25	4	13	1
2.	Total Number of Mayfly Taxa	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0
3.	Total Number of Caddisfly Taxa	1	4	1	4	1	4	2	6	1	4	1	4	1	4	0	0
4.	Total Number of Dipteran Taxa	18	4	9	2	10	2	1	0	14	4	11	2	15	4	7	2
5.	Percent Mayfly Composition	0	0	0	0	0	0	0	0	0	0	0	0	0.3	2	0	0
6.	Percent Caddisfly Composition	2	2	1.2	2	15	6	11	6	1.1	2	1	2	0.1	2	0	0
7.	Percent Tribe Tanytarsini Midge Composition	6.3	2	1	2	0.4	2	0	0	3.4	2	12.2	4	1.4	2	6.5	2
8.	Percent Other Dipteran and Non-Insect Composition	91.7	0	95.6	0	83.9	0	89	0	94.3	0	98.3	0	98	0	99.9	0
9.	Percent Tolerant Organisms	32.9	0	45.1	0	36.3	0	78	0	23.9	2	33.9	0	5.5	6	92	0
10.	Number of Qualitative EPT Taxa	2	0	2	0	2	0	2	0	1	0	1	0	0	0	1	0
Final Index Score (sum of ratings)		14		11		16		12		16		13		26		5	

[a]V = Value; R = Rating

Table III.44. Summary of Pond Macroinvertebrate Community Analysis, Mound Plant, Montgomery County, Ohio, June 1992 and November 1993

Station No.*	Number of Organisms		Number of Taxa		Shannon Diversity		Biotic Index	
	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
SP	98	1,058	16	15	1.72	0.78	3.19	3.08
OP	854	670	9	11	0.86	1.13	3.48	4.53
SB	1,082	2,201	21	17	1.73	1.89	3.78	3.83
AP	392	14,490	16	18	0.78	1.43	4.70	4.69

*SP = South Pond; OP = Overflow Pond; SB = Settling Basins; AP = Asphalt Pond.

ICI values from Mound data were consistently below the ECBP MWH criterion of 22 (Table III.44). Like the IBI, the ICI criterion was not developed from and may not apply to drainages of less than 1 sq mi, such as the Mound drainage. The QHEI was not specifically developed for comparison to ICI values. However, QHEI values indicate that the general habitat in permanent streams was not responsible for low ICI values at the Mound Plant.

EPA's ICI criterion was developed from samples consisting of data from five Hester-Dendy artificial substrate devices collected between June 15 and September 30. As such, the criterion may not apply to Mound fall data collected with devices deployed between September 22 and November 3. It may also not apply to the Mound data, because only three devices were deployed (as stipulated in the work plan and approved by the OEPA).

Seasonal comparisons of Surber data (EF and BB) show that fall ICI values are substantially lower than spring values. This can be attributed to the presence of far fewer insects in the fall. Values developed by Hester-Dendy sampling in the Miami-Erie Canal and the Overflow Creek (ME1,ME2, OC1, and OC2) were also lower in the fall, indicating that lower fall values are perhaps a general phenomenon. However, ICI values developed from the Drainage Ditch data do not follow this trend.

The higher ICI value in the fall at DD2 was probably due, at least in part, to the placement of the Hester-Dendy devices in the spring. In the spring, the devices were deployed in a pool. In the fall, the devices were deployed in a more run-like habitat. Runs are the recommended habitat for Hester-Dendy device deployment. In the spring, if the devices had been deployed in a run, the resulting ICI value might have been higher.

The extremely low ICI value at DD1 in the spring was probably due at least in part to the burial of two of three Hester-Dendy devices. Neither of these devices collected organisms. In the fall, one device was partially buried, but still collected organisms. At DDI, the ICI value was higher in the fall; where at other locations, ICI values were higher in the spring.

If spring ICI values are representative of the actual conditions in permanent streams draining the Mound Plant (and are not experimental artifacts as discussed above), then there is a trend of increasing ICI values downstream. This trend culminates with an ICI value exceeding the criterion at OC2. The total drainage area at OC2, less than 1 sq mi, is well below the minimum drainage area from which the criterion was developed, 10 sq mi.

In drainages between 10 and 100 sq mi, the development of ICI values is dependent on drainage area. In seven of ten categories used to develop ICI values, smaller drainages require a lower data value to

be scored the same as larger drainages. If scores were not dependent on drainage size, ICI values would increase with drainage size.

ICI values are not given in nine of the ten categories for drainages less than 10 sq mi. To develop ICI values for the Mound data, scoring for a 10 sq-mi drainage was used regardless of the actual Mound drainage size (i.e., scoring was not dependent on drainage size).

If ICI values must be adjusted for increasing drainage size with drainages between 10 and 100 sq mi, the same phenomenon might operate with smaller drainages and might produce a trend similar to that observed with the Mound data. In that situation, the value developed at the most downstream location would be the value most comparable to the criterion. At Mound, the most downstream value (26) exceeds the criterion (22).

3.3.2.2. Pond Benthic Macroinvertebrates

A combined total of 20,846 benthic macroinvertebrates, representing 45 taxa, was collected from four ponds in the Mound area (Appendix L). These ponds were:

- The South Pond,
- The Overflow Pond,
- The Settling Basins, and
- The Asphalt Pond.

Summaries of the field parameters and substrate characteristics are presented in Tables III.45 and III.46, respectively. Statistical analysis of the pond macroinvertebrate communities is summarized in Tables III.47, III.48, and III.49.

Each of these ponds was sampled in both the spring and fall. As expected, macroinvertebrate communities consisted of organisms adapted to habitats with little or no flow (Merritt and Cummins 1984). Only in the Settling Basins, where there was some consistent water flow, were organisms adapted primarily to flowing water present in appreciable numbers. These were the mayfly *Centroptilum* sp. (spring survey) and the midge *Rheotanytarsus* sp. (fall survey).

The macroinvertebrate community in the four ponds was evaluated and compared, using the following community parameters:

- Similarity with the Percent Similarity Index,
- Number of individuals,

Table III.45. Summary of Field Parameters in Ponds, Mound Plant, Montgomery County, Ohio, June 1992 and November 1993

Station No.[1]	Temperature (°C)		pH		Dissolved Oxygen (mg/l) Measured		Dissolved Oxygen (mg/l) Calculated Saturation[2]		Specific Conductance (µmho)		Surface Area (acres)	Maximum Depth (feet)
	Spring[3]	Fall	Spring	Fall	Summer[3]	Fall	Summer	Fall	Spring	Fall		
SP	22.0 (19.5)	5.5	7.5	7.4	1.8	8.2	8.9	12.2	740	220	0.5	3.0
OP	28.0 (20.0)	6.0	9.5	8.5	9.2	12.2	8.8	12.1	1100	720	1.5	3.5
SB	17.4 (18.5)	10.5	9.5	7.5	11.0	8.5	9.1	10.8	1290	720	0.2	5.0
AP	23.0	6.0	9.0	8.0	—	10.3	—	12.1	1320	600	0.4	1.5

[1]SP = South Pond; OP = Overflow Pond; SB = Settling Basins; AP = Asphalt Pond.
[2]Solubility in pure water in relation to temperature from saturated air at 760 mm Hg pressure.
[3]Equipment failure, reanalyzed 9/20/93; oxygen saturation calculated from summer temperature (in parentheses).

Table III.46. Summary of Substrate Characteristics in Ponds, Mound Plant, Montgomery County, Ohio, June 1992 and November 1993

Station No.*	Substrate							Aquatic Vetetation Coverage		Embeddedness
	% Bedrock	% Large Cobble	% Small Cobble	% Pebble	% Gravel and Sand	% Silt	% Detritus	% Attached Algae	% Rooted	Distance From Top of Rocks to Matrix (in.)
SP	0	0	0	0	0	80	20	40	40	0.0
OP	0	0	0	0	0	100	0	1	0	0.0
SB	0	0	0	0	0	90	10	50	50	0.0
AP	0	0	0	0	0	100	0	0	5	0.0

*SP = South Pond; OP = Overflow Pond; SB = Settling Basins; AP = Asphalt Pond.

Table III.47. Benthic Macroinvertebrate Pond Community Analysis Values Used in Statistical Comparisons, Mound Plant, Montgomery County, Ohio, June 1992 and November 1993

		Location Identifier*							
		SP		OP		SB		AP	
		Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Number of Organisms									
Sample Number	1	24	176	266	75	497	841	48	949
	2	15	149	351	374	321	161	75	805
	3	37	363	224	39	112	696	224	434
	Average	25.3	229.3	280.3	162.7	310.0	566.0	115.7	729.3
Number of Taxa									
Sample Number	1	7	6	3	4	10	10	3	11
	2	1	5	5	6	4	9	5	6
	3	4	4	4	4	4	8	5	11
	Average	4.0	5.0	4.0	4.7	6.0	9.0	4.3	9.3

*SP = South Pond, OP = Overflow Pond, SB = Settling Basins, AP = Asphalt Pond.

Table III.48. Benthic Macroinvertebrate Pond Community Analysis Statistical Results—Number of Organisms, Mound Plant, Montgomery County, Ohio, June 1992 and November 1993

Stations[1]	F-Test p-Values						
	SP	OP		SB		AP	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall
SP Spring	0.006*	0.003*	0.015*	0.146	0.062	0.079	0.001*
Fall		0.544	0.569	0.624	0.610	0.260	0.041*
OP Spring			0.813	0.355	0.740	0.068	0.047*
Fall				0.392	0.842	0.192	0.091
SB Spring					0.479	0.714	0.039*
Fall						0.364	0.269
AP Spring							0.020*

[1]SP = South Pond; OP = Overflow Pond; SB = Settling Basins; AP = Asphalt Pond.
*Statistically significant at $\alpha = 0.05$.

Table III.49. Benthic Macroinvertebrate Pond Community Analysis Statistical Results—Number of Taxa, Mound Plant, Montgomery County, Ohio June 1992 and November 1993

Stations[1]	F-Test	F-Test p-Values					
	SP	OP		SB		AP	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall
SP Spring	0.335	1.000	0.492	0.738	0.052	0.866	0.091
Fall		0.071	1.000	0.205	0.021*	0.132	0.132
OP Spring			0.391	0.492	0.004*	0.725	0.039*
Fall				0.561	0.223	0.473	0.270
SB Spring					0.008*	0.742	0.060
Fall						0.006*	0.859
AP Spring							0.050*

[1]SP = South Pond; OP = Overflow Pond; SB = Settling Basins; AP = Asphalt Pond.
*Statistically significant at α = 0.05.

- Number of taxa,
- Shannon diversity, and
- Hilsenhoff Biotic Index.

Benthic macroinvertebrate collections can be compared with the Percent Similarity (PS) index to determine if they come from similar habitats. Generally, different locations with similar habitats share taxa, particularly numerically dominant taxa, whereas different habitats will be dominated numerically by different taxa. Generally, numerically dominant taxa are best adapted to survive in a particular habitat. Through sheer numbers, numerically dominant taxa are more likely to spread over a wide area, find and populate all suitable habitat. Similarity in numerically dominant taxa between locations indicates similar habitat.

The PS index is based on numerical dominance. This index considers the number of taxa represented at each of two compared locations, the number of those taxa shared by both locations, and the proportion of the total number of individuals represented by each taxa at each location. This index is high when taxa shared between locations are numerically dominant. This generally occurs when habitats are similar.

The South Pond community changed little between spring and fall (PS = 61%). Conversely, communities in the Overflow Pond, Settling Basins, and the Asphalt Pond changed considerably between spring and fall (Average PS = 24%).

The spring communities in the South Pond, Overflow Pond, and Settling Basins were similar to each other (Average PS = 61%). The fall communities in the Overflow Pond and Settling Basins were also fairly similar to each other (PS = 50%), but were no longer similar to the fall South Pond community, where there was little seasonal change (Average PS = 11%).

The spring community in the Asphalt Pond was considerably different from any other spring pond community (Average PS = 16%). Likewise, the fall Asphalt Pond community was different from any other pond community (Average PS = 13%). However, the spring Asphalt Pond community was fairly similar to the distinguishable fall communities in the Overflow Pond and the Settling Basins (59%).

This similarity analysis indicates that there were three basic benthic community types in Mound ponds:

- Type I - found in the South Pond in both spring and fall and in the Overflow Pond and Settling Basins in the spring.

- Type II - found in the Overflow Pond and Settling Basins in the fall and in the Asphalt Pond in the spring.

- Type III - found in the Asphalt Pond in the fall.

In each of these communities, the majority of organisms was comprised of a few taxa. *Limnodrilus* sp. and other tubificid worms without hair chaetae comprised 75 percent of the Type I community. Generally, *Limnodrilu* sp. is slightly more sensitive to the effects of oxygen depletion than the midge *Chironomus* sp. and tubificid worms with hair chaetae, which together comprised 77 percent of the Type II community. The midge *Glyptotendipes* sp. and the crustacean *Ceriodaphnia* sp. comprised 71 percent of the Type III community.

The seasonal change in the Overflow Pond and the Settling Basins could have been caused by low dissolved oxygen concentrations during the summer. The Type II community had a higher average biotic index than the Type I community (4.35: 3.38), indicating that overall, the Type II community was comprised of organisms more tolerant to low dissolved-oxygen concentrations (Table III.44). *Chironomus* sp. and tubificid worms with hair chaetae frequently dominate communities during summer stagnation (Pennak 1978). Although oxygen concentrations were not low during the fall benthic collection (Table III.45), community recovery from summer stagnation will not occur immediately after a fall rise in dissolved-oxygen concentrations (Tarzwell and Gaufin 1953), and may not occur until the following spring.

During other aspects of the ecological characterization, heavy algal blooms were observed in the Overflow Pond. Algae, through the process of photosynthesis, contributes dissolved oxygen to the water during the day, but at night, algal respiration can entirely deplete dissolved oxygen. This process, by itself, can cause fish kills (Tarzwell and Gaufin 1953), and no doubt affects the benthic community as well.

Apparently, low dissolved-oxygen concentrations occurred in Overflow Pond. During fish sampling in June, hundreds of green sunfish were seen gulping air. This behavior is associated with low dissolved oxygen. A fish kill was reported a few days later in Overflow Pond. Fish populations apparently did not recover even a year later (Section 3.3.1.2).

The South Pond had thin, gray sediments with a brown surface, indicating that they never become entirely anoxic. Dissolved oxygen in the sediments throughout the year probably allows the benthic community in the South Pond to persist across seasons without major changes.

The sediments in the Asphalt Pond were black, and had a sheen and odor typical of anoxic conditions. The sediments also contained a tar-like substance. The basin of the pond protects it from wind. Unlike the Overflow Pond and Settling Basins, flow through the Asphalt Pond is minimal and generally is significant only during prolonged rainfall. For these reasons, the sediments in the Asphalt Pond probably remain anoxic throughout the year. This may explain why the Asphalt Pond community in the spring resembled fall communities in the Overflow Pond and Settling Basins.

It does not seem reasonable that further oxygen depletion produced the community change in the Asphalt Pond from spring to fall. Apparently, oxygen depletion was already present in the spring; the biotic index value did not change from spring to fall. The Type III community in the Asphalt Pond was dominated by two taxa (*Glyptotendipes* sp. and *Ceriodaphnia* sp.). These taxa were seldom, if at all, found elsewhere in the Mound ponds (Appendix L). The Type III community also had a substantially greater density of organisms than Type II communities at other locations, although neither the number of organisms nor the number of taxa were statistically greater (Tables III.47 to III.49). When the two dominant taxa in the Asphalt Pond were removed from similarity calculations, the Type III community still had more organisms than elsewhere and was fairly similar to the Type II community (Average PS = 53%).

A major environmental distinction between the Asphalt Pond and elsewhere was the absence of fish in that pond (Section 3.3.1.2). Fish predation, particularly from larval fish, has been shown to greatly affect invertebrate communities in general, and *Ceriodaphnia* in particular, to the point of population extirpation (Wetzel 1975).

3.3.3. Summary of Aquatic Sampling

Aquatic sampling for fish and macroinvertebrates was conducted at the Mound Plant in the spring of 1992 and the fall of 1993. No species listed by the U.S. Department of Interior or state of Ohio as threatened or endangered were found. OEPA's method for evaluating aquatic habitats (QHEI) was applied to the aquatic sampling locations. The conclusions regarding the stream habitats examined as part of this study are as follows:

- The only continuous surface water discharge from the Mound Plant is from the Plant Drainage Ditch.
- All of the stream flow emanating from the Mound Plant flows into the Great Miami River via the Miami-Erie Canal and the Overflow Creek. Two weirs are located in this stream system. The lower weir separates the Overflow Creek from the Miami-Erie Canal. The upper weir separates the Miami-Erie Canal from the Plant Drainage Ditch.
- The drainage area of the Mound Plant stream system is less than 1 sq mi.
- All sampling locations within the Mound Plant stream system produced QHEI values within the upper 25 percent of QHEI values developed by the OEPA for channelized headwaters.

A total of 1927 individuals, representing 19 species of fish, was collected in streams and ponds at the Mound Plant during the aquatic surveys. In the streams, a combined total of 1497 fish, representing 17 species and one hybrid, was collected. Fish were found to inhabit three connected stream reaches

(Plant Drainage Ditch, Miami-Erie Canal, and the Overflow Creek). The IBI was used to evaluate the fish data from the aquatic surveys. Sampling for fish in the streams at the Mound Plant led to the following conclusions:

- The fish community in areas with unobstructed communication to the Great Miami River was more diverse than in upstream areas isolated from the river by weirs.
- Downstream of the lower weir (i.e., in the Overflow Creek), IBI values exceeded the OEPA criterion for headwaters three of the four times this area was sampled (two locations in each of two seasons).
- Upstream of the weirs (i.e., in the Miami-Erie Canal and the Plant Drainage Ditch), IBI values met the criterion for headwaters four of the eight times this area was sampled (four locations in each of two seasons).
- The IBI criterion for headwaters may not be applicable to the Mound drainage since the criterion may only apply to drainages larger than 1 sq mi. The Mound drainage is less than 1 sq mi.
- Six times more fish were collected during the spring effort from the streams. Many of these fish were badly emaciated. DELT anomalies are often associated with overcrowding and improper diet

Three ponds and one settling basin were sampled during the aquatic surveys. A combined total of 43 individuals, representing four species of fish, was collected from the ponds. The only fish species in the Overflow Pond and the Settling Basins was green sunfish. In the South Pond in the Miamisburg Municipal Park, largemouth bass, bluegill, and black crappie were found. Fish were absent from the Asphalt Pond. The following conclusions were drawn from the survey for fish in the ponds at the Mound Plant:

- All ponds are isolated from colonization by fish inhabiting downgradient surface waters.
- There are no fish in the Asphalt Pond.
- The South Pond has fewer fish, but more species, than the Overflow Pond and Settling Basins.
- There were fewer and smaller fish in the Overflow Pond and Settling Basins during the fall survey, apparently because of a fish kill associated with oxygen depletion that occurred subsequent to the spring sampling effort.
- DELT anomalies, emaciation, and parasites were common in fish from the Overflow Pond and Settling Basins during the spring survey, but not during the fall survey.

A total of 19,189 individual macroinvertebrates, representing 135 taxa, was collected from streams at the Mound Plant. The ICI was used to evaluate the macroinvertebrates in both the intermittent and

permanent streams at the Mound Plant. The following conclusions were drawn from the macroinvertebrate data:

- Seasonal differences in the macroinvertebrate communities of the intermittent streams on the South Property were typical for such habitats.
- ICI values were generally lower in the fall, especially in the intermittent streams.
- Macroinvertebrate community data from the nearly all of the permanent stream locations in both surveys produced ICI values that failed to meet the OEPA criterion for channelized headwater streams in the region that includes the Mound Plant (Eastern Corn Belt).
- ICI values from the lower reach of the Overflow Creek (i.e., the stream reach having the largest drainage area) exceeded the criterion.
- OEPA's criterion was developed from ICIs calculated, using five artificial substrates. As such, OEPA's criterion may not be applicable to the Mound data since only three artificial substrates were used.
- OEPA's criterion was developed for drainages greater than 10 sq mi and, as such, may not be applicable to the Mound data because of the small drainage size of the study area (less than 1 sq mi).

A total of 32,004 individual macroinvertebrates, representing 123 taxa, was collected from the ponds at the Mound Plant. There is no accepted approach for assessing macroinvertebrate communities in ponds. For this reason, standard statistical treatments were applied to the pond data. The following conclusions were drawn from the pond data:

- The macroinvertebrate communities in the ponds were comprised of taxa typical of pond habitats.
- Three basic types of communities were found to inhabit the Mound ponds.
- In the spring, the South Pond, Overflow Pond, and Settling Basins had similar macroinvertebrate communities.
- Macroinvertebrate communities in the Overflow Pond and Settling Basins changed in the fall to resemble the macroinvertebrate community found in the Asphalt Pond in the spring.
- Seasonal changes in the macroinvertebrate communities in the Overflow Pond and Settling Basins appeared to be related to naturally occurring changes in the dissolved-oxygen content of the sediment.
- Seasonal changes in the Asphalt Pond community appeared to be the result of a natural proliferation of certain taxa.

4. IMPORTANT AND SENSITIVE ENVIRONMENTS AND RARE, THREATENED, AND ENDANGERED SPECIES

To satisfy sampling objective 1 of the OU 9 Field Sampling Plan (DOE 1992), Section 3 of this report provides both qualitative and quantitative information necessary for a general characterization of the flora and fauna present at the Mound facility. The intent of the current section is to make use of the biological characterization data to identify sensitive environments in and around the site, and also to report on the presence of state and federally listed rare, threatened, and endangered (RTE) species (sampling objectives 2 and 3). Disclosure of the occurrence of these site attributes is required by Section 120 of the FFA and will be of importance to any future site remediation activities. Information of this kind will also be critical for the selection of potential receptor organisms as part of the ecological risk assessment.

Investigating RTE species is a rather straightforward endeavor that first requires the identification of protected organisms potentially present within the survey area. This is followed by intensive searches within all appropriate support habitats. Information regarding potential RTE occurrences and habitat preference is generally available through local, state, and federal resource trustees. Identification of sensitive environments, however, is significantly more difficult to assess. Although state and federal laws have been promulgated to protect clearly defined taxonomic entities, no such regulatory statutes or definitions are available for sensitive environments. The FFA suggests that sensitive areas include sites such as wetlands, floodplains, and wildlife breeding areas. However, depending on the type of approach used, nearly the entire Mound facility could be considered a wildlife breeding area.

Although the Final Environmental Impact Statement (FEIS) for the Mound Plant (DOE 1979) concluded that there are no sensitive environments, no site-specific ecological information was provided to substantiate this assertion. Furthermore, there is even the question as to what type of habitats were considered potentially sensitive. Perhaps as a result of these data gaps, the FFA directed the remedial investigation to formally address these issues.

4.1. IMPORTANT AND SENSITIVE ENVIRONMENTS

For the purposes of the current investigation, sensitive environments are considered to be those areas that are sensitive because of their regulatory status (e.g., wetlands and waterways) or those areas which may be sensitive or important from a biological standpoint. While the phrase "biologically important" can connote a variety of meanings, the significance here is related to the relative ability of a particular habitat to support rare and unique entities or a highly diverse assemblage of species.

Diversity within a given environment is ascertained by using a simple species index (SI) whereby the known number of taxa within a community are divided by the areal coverage of that community. The larger the species index value, the greater the community diversity.

The following discussion addresses important and sensitive environments by examining the linkages that exist between the various biotic groups and the habitats which they occupy. Table 4.1 summarizes species occurrences within the various community types and shows the derivation of SI values. The SI was developed specifically for the Mound Plant ecological data as a tool for ranking each habitat according to its ability to provide for species of terrestrial flora and fauna. The SI is defined as the total number of species within a habitat type, divided by the surface area of the habitat type. Major vegetated habitat types have been defined in Sections 2 and 3 of this document. Type definitions and site locations for wetlands and waterways have been presented in the OU 9 Wetlands Determination Report (DOE 1994).

4.1.1. North-Facing Slope Forests

With 102 species occurring on 21.6 ha, north-facing slope forests had a SI of 4.7, the lowest of any of the major terrestrial habitats investigated. The primary factor responsible for this low diversity index was the inhibitory influence of Amur honeysuckle on plant species occurrence. Only 51 species of vascular plants were tallied during the course of the investigation. Twenty-five percent of these, however, were unique to the type and consisted primarily of shade-tolerant herbaceous mesophytes, such as Dutchman's breeches, sessile trillium, and harbinger-of-spring.

Although the dense cover afforded by Amur honeysuckle was responsible for limiting the number and diversity of plant species, the thick undergrowth and palatable honeysuckle berries may have been the principal factors responsible for the relatively large number of bird species (41) found in this habitat. This was the third highest among all habitats. During the fall 1992 bird survey, several hundred robins were observed making use of this habitat. It is also likely that robins and other locally breeding species (such as cardinals, northern orioles, and song sparrows) would use sites such as these for nesting purposes.

Moist, shaded understory conditions and an abundance of surficial slab-rock made the north-facing slope forests of the Main Hill ideal habitat for Mound Plant's most conspicuous amphibian, the red-backed salamander. Of the 49 individuals observed during the course of the ecological investigations, all but two were located within this area.

Table IV.1. Species Occurrence Within Major Habitats and Derivation of Species Index Values

Biotic Group	Community Type							
	North-Facing Slope Forest	South-Facing Slope Forest	Riparian Forest	Scrub/ Shrub Community	Suboxeric Grassland	Mesic Grassland	Industrial & Maintained Areas	Wetlands & Waterways
Vascular Plants								
• Total Species Unique to Community Type	51	43	105	114	111	136	156	57
• Total Species within Community Type	13	2	32	22	13	16	42	24
• Unique Species as Percent of Community Total	25.5	4.7	30.5	19.3	11.7	11.8	26.7	42.1
Birds								
• Total Species within Community Type	41	51	35	45	36	39	28	19
• Total Species Unique to Community Type	0	6	2	5	36	1	0	4
• Unique Species as Percent of Community Total	0.0	11.8	5.7	11.1	0.0	2.6	0.0	21.1
Mammals								
• Total Species within Community Type	6	9	12	6	7	6	5	8
• Total Species Unique to Community Type	0	0	2	0	0	0	0	1
• Unique Species as Percent of Community Total	0.0	0.0	16.7	0.0	0.0	0.0	0.0	12.5
Herptiles								
• Total Species within Community Type	4	5	4	1	0	0	0	5
• Total Species Unique to Community Type	0	1	1	0				3
• Unique Species as Percent of Community Total	0.0	20.0	25.0	0.0				60.0
Total Species for all Biotic Groups	102	108	156	166	154	181	189	89
Community Area (ha)	21.6	17.2	11.1	8.6	20.7	2.7	34.9	1.5
Species Index	**4.7**	**6.3**	**14.1**	**19.3**	**7.4**	**67.0**	**5.4**	**59.3**

4.1.2. South-Facing Slope Forests

Because of structural similarities, such as overstory composition and Amur honeysuckle-dominated shrub layers, both north- and south-facing slope forests possessed comparable habitat attributes. It was not unexpected, therefore, that both areas yielded similarly low SI results. South-facing forests contained a total of 108 plant and animal species distributed on 17.2 ha (SI = 6.3). One notable difference between north and south slopes, however, was that south slopes supported ten additional bird species. Furthermore, six of those species were exclusive to the type (i.e., they were found nowhere else on site). While species such as the yellow-billed cuckoo, brown creeper, and black-throated green warbler could be casually linked with any woodland habitat, American woodcock and Cooper's hawk require certain habitat features that were best provided within south-slope forests. The availability of moist, pliable soils within isolated woodland thickets proved ideal for woodcock. Such sites were limited to lower back slopes and toe slopes on the South Property. Ecotonal transition zones between forested sites and the numerous grassland and scrub/shrub areas scattered through the South Property afforded excellent hunting venues for raptors. Such sites were especially desirable because they tended to be far removed from most human activity.

4.1.3. Riparian Forests

Riparian forests were restricted to the extreme western portion of the site adjacent to the Miami-Erie Canal and along the Overflow Creek. Together they occupied only 11.1 ha. Despite the limited areal coverage, 156 species were documented as occurring within this type of habitat (SI = 14.1). Most of the biodiversity can be attributed to a rather robust assemblage of plant species specifically adapted to moist, fertile conditions such as those present along riverine terraces. While greater than 75 percent of the 105 total plant species were documented as being native, many of the most conspicuous entities were woody Asiatic ornamentals, which presumably escaped from nearby residential plantings. Plants of this type, unique to the riparian zones, were fragrant honeysuckle, Tartarian honeysuckle, and wintercreeper euonymus.

A dozen species of mammals were found in the riparian habitats. This was by far the greatest representation of mammals within any one habitat type. Because the requirements of the various animals are so diverse, it is difficult to speculate why riparian forests seemed to be favored. Plausible explanations for the diversity of mammals in the riparian forests include a readily available supply of water, presence of a dense protective herbaceous layer, and close proximity to the mesic grasslands that provide an abundant food supply.

4.1.4. Scrub/Shrub Communities

Scrub/shrub communities represent a transitional stage between herb-dominated pioneer communities and later successional types dominated, to a great extent, by woody species. This melding of forbs, grasses, and woody entities was responsible for a large and varied floristic contingent and, therefore, a high species diversity index (SI = 19.3). A total of 114 plant taxa, or nearly one-third of all plant species discovered at Mound, was present within the scrub/shrub type.

Notable too within the type was the large number of bird species present. The 45 species observed were second only to the south-facing forests in terms of avian diversity. The structural and compositional heterogeneity of the type, particularly at the microsite level, provided a wide array of cover and feeding opportunities. Several species were exclusive to type. By far the most conspicuous were American redstart, ruby-throated hummingbird, and swamp sparrow.

4.1.5. Subxeric Grasslands

As with nearly all early successional pioneer types in the humid east, plant diversity within the subxeric grassland type was rather high. Despite the seasonally droughty growing conditions, 111 different species of plants were inventoried. Given the past land use history of the South Property, which primarily included livestock grazing on the uplands, it was not unexpected that much of the plant diversity took the form of residual forage grass species that were introduced from Europe and Asia. The attending European and Asiatic weed species that so often adulterate grass seed mixtures were also present in large numbers. When considered together, these exotic entities comprised in excess of 50 percent of the cumulative plant species total for the type.

The complete lack of herptiles and the moderate contribution by mammals and birds offset the high plant diversity. Consequently, the SI within the subxeric grasslands was quite low at 7.4, the third lowest observed. Underuse of the type, particularly by birds, was probably tied to the lack of adequate protective cover and food shortfalls during certain parts of the growing season.

Although the subxeric grassland cannot be considered biologically significant in terms of overall species richness, it was the type locale for the Mound facility's only state-listed endangered species, the inland rush. Despite suitable growing conditions, however, only one individual was identified. Until additional plants are discovered and it is established that viable breeding populations do occur, the inland rush should be considered only a casual waif.

4.1.6. Mesic Grasslands

In many ways, the representation of the various biotic groups within the mesic grasslands paralleled those of the subxeric grasslands (i.e., high plant species diversity, large contingency of exotic plant species, and moderate diversity among most vertebrate groups). Such parallels were anticipated because of the structural similarities of the two types and a shared land-use history. Mesic grasslands, however, because of a better soil moisture regime, were found capable of supporting an even greater array of plant species. The type's close proximity to the Miami-Erie Canal, the Dayton-Cincinnati Pike, and numerous residential properties may have also contributed to this higher level of diversity. In all, 136 plant taxa were observed. The fact that all of these elements were found to occur on an area only one-tenth the size of the subxeric grasslands, however, was considered important. Consequently, the SI of the mesic grassland type was the greatest of any of the terrestrial communities evaluated (SI = 67.0).

4.1.7. Industrial and Maintained Areas

Industrial and maintained areas included all vegetated or partially vegetated areas not falling within a well-defined community type. The major constituents of such areas were frequently mowed lawns. However, dirt and gravel roadsides, pull-offs, parking lots, and material staging areas were also examined.

Just as in other well-travelled industrial zones, the occurrence of imported exotic plant species was found to be exceptionally high. Of the 156 plant taxa discovered, 62.2 percent were non-native. This was approximately three times the rate of exotic species occurrence within relatively non-disturbed areas, such as slope and riparian forests. Forty-two species of plants were found to occur exclusively within disturbed industrial areas. Although most were exotic weeds, such as sow thistles, cresses, clovers, and the like, some turned out to be somewhat unusual native entities. Windmill grass and inland blue grass, for example, are well-known prairie plants that are only weakly adventive in the eastern U.S. Despite being native, these grasses, like the exotics, were probably unknowingly transported to the Mound Plant on vehicles and railroad cars during the course of normal business activities.

Even though plant species diversity was greater in disturbed industrial areas than anywhere else on site, the SI for such sites was among the lowest at 5.4. Much of this was due to the fact that the species were dispersed over a large area (34.9 ha). Just as important, though, was the poor representation by the other biotic groups within this habitat type. Industrial zones did not support any

herptiles, they had the lowest occurrence of mammalian species, and had the second lowest occurrence of birds. Additionally, no species unique to this habitat type were found.

4.1.8. Wetlands and Waterways

Onsite and associated offsite wetlands and waterways occupied only 1.5 ha. This was the smallest area of any of the habitats considered. It included those areas delineated as jurisdictional wetlands (DOE 1994), as well as those lands immediately adjacent to perennial waterbodies such as the Overflow Pond, Retention Basins, South Pond, and north section of the Miami-Erie Canal and Overflow Creek.

Despite a small areal extent, wetlands and waterways were found to support as many as 89 total species. This resulted in an SI of 59.3, the second highest observed. The type consistently possessed the highest percentage of unique species, regardless of the biotic group. Moreover, this does not include the various fish and macroinvertebrate taxa examined during the aquatics investigation (Section 3.3). More than 42 percent of all the vascular plant species found in wetlands and waterways were exclusive to that type of habitat. Many of those species exhibited morphological features that allowed them to be specially adapted to hydric environments. Sixty percent of the herptiles and nearly one in four of the birds found using wetlands and waterways can also be considered to be specifically suited to such habitats. These include such species as the northern water snake, queen snake, snapping turtle, mallard duck, spotted sandpiper, and green and great blue herons.

4.2. RARE, THREATENED, AND ENDANGERED SPECIES

During the development of the FEIS for the Mound facility, federal and state of Ohio resource trustees were contacted to assess onsite occurrences of RTE species. Based on these consultations, it was discovered that there were no known records of such species on the Mound property. Furthermore, because of the lack of habitat availability and because of widespread construction impacts, the FEIS concluded "that the probability of endangered or threatened species occurring onsite is extremely remote" (DOE 1979).

Prior to the initiation of its own field survey activities in 1992, WESTON contacted the Ohio Department of Natural Resources-Division of Natural Areas and Preserves (ODNAP) and the U.S. Fish and Wildlife Service (USFWS) regarding RTE occurrences. Besides providing updated information, WESTON's inquiry also included the area that is now contained within the South Property. (This parcel was not considered in the 1979 FEIS since it was not acquired by DOE until 1981.) Although information from these sources once again suggested a very low probability of RTE occurrence, onsite

reconnaissance revealed the presence of limited areas of specialized habitat that were believed capable of harboring protected species. Whenever encountered during formal field evaluations, areas such as wetlands, pond margins, seeps and springs, and riparian zones received a high degree of scrutiny.

While specialized habitat surveys failed to disclose the presence of any RTE species, general systematic surveys did. During the early summer 1992, inland rush (*Juncus interior*) was discovered at the Mound facility. Inland rush has been designated a state "endangered species" by ODNAP (ODNAP 1992). A single individual of this grass species was found growing adjacent to a limestone seepage area in an open grassland on the South Property.

The criteria used to declare a species "endangered" within a given state are varied. They most often relate to a species' restricted geographic distribution and/or limited numerical occurrence. Inland rush is a prairie plant living at the extreme eastern edge of its natural range in Ohio. While abundant elsewhere, only five populations scattered over four counties have been conclusively documented within the state. Together, these populations consist of less than 100 individuals (Woischke 1993).

Because only a single individual was located (despite intensive efforts to discover others), inland rush at the Mound facility cannot be considered a viable breeding population. Furthermore, the solitary occurrence should in no way interfere with ongoing or future activities at the site. Though perhaps not biologically significant, WESTON has recommended that the DOE Dayton Area Office officially notify the CERCLA Natural Resource Trustee and ODNAP of the occurrence.

A second state endangered species, a bird, discovered at Mound is the dark-eyed junco (*Junco hyemalis*). Several individuals were observed foraging in grassland, scrub/shrub and forested habitats during both the fall 1992 and winter 1993 bird surveys. Despite being a common winter visitor to Ohio and to much of the eastern U.S., only a small contingent of the population is known to actually breed within the state. It is this small group of breeding birds that is responsible for state listing and that is the target of special protection. It should be stressed that there are currently no known breeding populations of dark-eyed junco in southern Ohio. The only known breeding populations in Ohio occur in the extreme northeastern portion of the state, where they inhabit isolated bogs or hemlock ravines (Hillmer 1994).

4.3. SUMMARY

In all, 376 species of plants, 17 species of mammals, ten species of herptiles, and 81 species of birds were documented as occurring in a variety of upland and wetland habitats during this initial phase of ecological studies at the Mound Plant. In the permanent and intermittent streams, 17 species of fish

and 135 species of aquatic macroinvertebrates were identified. Within ponds, three species of fish and 45 species of macroinvertebrates were found. From these data, it can be concluded that a wide diversity of flora and fauna occurs at the Mound Plant. Based on a strict interpretation of the language presented in Attachment 1 of the CERCLA 120 FFA, significant acreages within the Mound Plant and adjacent properties could be considered to contain sensitive environments. Wetlands were delineated on the North Property and along the Miami-Erie Canal and Overflow Creek. Nests and/or juveniles of various species of wildlife were observed during the surveys of terrestrial fauna, indicating that wildlife breeding is occurring throughout the site.

The sensitivity and importance of the environments on the Mound Plant should be viewed in relation to the general area around the site. As mentioned in Section 1, offsite control sampling was not conducted as part of Phase I. Nonetheless, based on casual observations of offsite areas by the ecological characterization team, the habitats and species composition of the Mound Plant is neither unique nor even of local importance. Numerous state and local conservancy land holdings occur within a few miles of the Mound Plant (e.g., Spring Valley Wildlife Area, Germantown Reserve, Possum Creek Reserve, and Sugarcreek Reserve, among others). Although these land holdings consist of several hundred acres, perhaps given time and protection, the significance of Mound Plant could be increasingly important as a refugium in an area that is already under pressure from industrial and residential development.

Finally, in spite of an intensive effort, no federal threatened or endangered species were documented and none are expected to occur. Two state protected species were found, the dark-eyed junco (bird) and the inland rush (grass). The dark-eyed junco is a common winter visitor throughout most of the eastern U.S. At the Mound Plant, numerous individuals were found in the fall and the winter in several areas on the North and South Properties. The inland rush was found in a seasonal grassland seepage area on the South Property and is apparently a casual waif. As such, it is not expected to be a permanent part of the Mound Plant flora.

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APPENDIX A

FLORISTIC INVESTIGATIONS
FIXED-AREA SAMPLING SUPPORT DATA

Table A.1. North-Facing Slope Forest: Average Substrate/Species Cover Percentage

Substrate/Species	Average Percent Cover on 10 1x1-m Plots*						
	June	July		August		October	
Bare rock	5.4	5.4	--	5.4	--	5.4	--
Bare soil	16.9	27.8	(+10.9)	32.5	(+4.7)	11.2	(-21.3)
Standing bole	1.2	1.2	--	1.2	--	1.2	--
Twig/leaf litter	64.3	49.9	(-14.4)	45.1	(-4.8)	67.1	(+22.0)
Woody debris	1.3	1.3	--	1.3	--	1.3	--
American elm	0.1	0.1	--	0.1	--	0.1	--
Amur honeysuckle	4.9	7.2	(+2.3)	7.7	(+0.5)	7.7	--
Black walnut	0.0	0.2	(+0.2)	0.2	--	0.1	(-0.1)
Bloodroot	0.1	0.1	--	0.1	--	0.0	(-0.1)
Blue ash	0.3	0.6	(+0.3)	0.6	--	0.6	--
Boxelder	0.0	0.1	(+0.1)	0.1	--	0.1	--
Clearweed	0.0	0.4	(+0.4)	0.8	(+0.4)	0.8	--
Fissidens moss	0.3	0.3	--	0.4	(+0.1)	0.5	(+0.1)
Frost grape	0.7	0.8	(+0.1)	1.0	(+0.2)	1.0	--
Garlic mustard	3.1	3.3	(+0.2)	2.2	(-1.1)	1.6	(-0.6)
Hackberry	0.9	0.7	(-0.2)	0.7	--	0.7	--
Multiflora rose	0.1	0.1	--	0.1	--	0.1	--
Redbud	0.4	0.2	(-0.2)	0.2	--	0.2	--
Soft hawthorne	0.0	0.1	(+0.1)	0.1	--	0.1	--
White snakeroot	0.0	0.2	(+0.2)	0.2	--	0.2	--
TOTALS	100.0	100.0		100.0		100.0	

*Figures within parentheses represent change in average cover percent from previous sampling effort. Dashes indicate no change.

Table A.2. North-Facing Slope Forest: Average Substrate/Species Frequency Percentage

Substrate/Species	Average Percent Frequency on 10 1x1-m Plots*						
	June	July		August		October	
Bare rock	80	80	--	80	--	80	--
Bare soil	100	100	--	100	--	100	--
Standing bole	20	20	--	20	--	20	--
Twig/leaf litter	100	100	--	100	--	100	--
Woody debris	40	40	--	40	--	40	--
American elm	100	100	--	100	--		
Amur honeysuckle	20	20	--	20	--	20	--
Black walnut	0	10	(+10)	10	--	10	--
Bloodroot	10	10	--	10	--	0	(-10)
Blue ash	20	20	--	20	--	20	--
Boxelder	0	10	(+10)	10	--	10	--
Clearweed	0	30	(+30)	40	(+10)	40	--
Fissidens moss	30	30	--	40	(+10)	40	--
Frost grape	70	80	(+10)	80	--	80	--
Garlic mustard	80	100	(+20)	100	--	100	--
Hackberry	80	60	(-20)	60	--	60	--
Multiflora rose	10	10	--	10	--	10	--
Redbud	40	20	(-20)	10	(-10)	10	--
Soft hawthorne	0	10	(+10)	10	--	10	--
White snakeroot	0	20	(+20)	20	--	20	--

*Figures within parentheses represent change in average frequency percent from previous sampling effort. Dashes indicate no change.

Table A.3. South-Facing Slope Forest: Average Substrate/Species Cover Percentage

Substrate/Species	Average Percent Cover on 10 1x1-m Plots*						
	June	July		August		October	
Bare rock	1.2	1.2	--	1.2	--	1.2	--
Bare soil	29.1	35.7	(+6.6)	38.7	(+3.0)	16.5	(-22.2)
Standing bole	1.5	1.5	--	1.5	--	1.5	--
Twig/leaf litter	44.6	33.5	(-11.1)	30.7	(-2.8)	53.0	(+22.3)
Woody debris	1.5	1.5	--	1.5	--	1.5	--
Amur honeysuckle	19.0	23.0	(+4.0)	22.7	(-0.3)	22.7	--
Blue ash	1.2	1.2	--	1.2	--	1.2	--
Field garlic	0.0	0.0	--	0.0	--	0.2	(+0.2)
Frost grape	0.3	0.5	(+0.2)	0.6	(+0.1)	0.5	(-0.1)
Garlic mustard	0.9	1.2	(+0.3)	1.1	(-0.1)	0.9	(-0.2)
Hackberry	0.1	0.1	--	0.1	--	0.1	--
Poison ivy	0.1	0.1	--	0.1	--	0.1	--
White ash	0.5	0.5	--	0.6	(+0.1)	0.6	--
TOTALS	100.0	100.0		100.0		100.0	

*Figures within parentheses represent change in average cover percent from previous sampling effort. Dashes indicate no change.

Table A.4. South-Facing Slope Forest: Average Substrate/Species Frequency Percentage

Substrate/Species	Average Percent Frequency on 10 1x1-m Plots*						
	June	July		August		October	
Bare rock	30	30	--	30	--	30	--
Bare soil	100	100	--	100	--	100	--
Standing bole	10	10	--	10	--	10	--
Twig/leaf litter	100	100	--	100	--	100	--
Woody debris	10	10	--	10	--	10	--
Amur honeysuckle	100	100	--	100	--	100	--
Blue ash	20	20	--	20	--	20	--
Field garlic	0	0	--	0	--	20	(+20)
Frost grape	20	50	(+30)	50	--	50	--
Garlic mustard	50	80	(+30)	80	--	80	--
Hackberry	10	10	--	10	--	10	--
Poison ivy	10	10	--	10	--	10	--
White ash	10	10	--	20	(+20)	20	--

*Figures within parentheses represent change in average frequency percent from previous sampling effort. Dashes indicate no change.

Table A.5. Riparian Forest: Average Substrate/Species Cover Percentage

Substrate/Species	Average Percent Cover on 10 1x1-m Plots[a,b]						
	June	July		August		October	
Bare rock	0.2	0.4	(+0.2)	0.3	(-0.1)	0.3	--
Bare soil	3.8	13.1	(+9.3)	8.2	(-4.9)	4.6	(-3.3)
Standing bole	1.1	1.1	--	1.1	--	1.1	--
Twig/leaf litter	46.5	39.5	(-7.0)	51.0	(+11.5)	49.5	(-1.5)
Woody debris	0.8	0.8	--	0.8	--	0.8	--
American elm	0.3	0.9	(+0.6)	0.9	--	0.9	--
Amur honeysuckle	4.0	5.4	(+1.4)	5.4	--	5.4	--
Bedstraw	4.0	0.0	(-4.0)	0.0	--	0.0	--
Black cherry	0.4	0.3	(-0.1)	0.3	--	0.3	--
Blue violet	0.1	0.3	(+0.2)	0.3	--	0.4	(+0.1)
Boxelder	1.7	2.4	(+0.7)	1.6	(-0.8)	1.6	--
Canada black snakeroot	0.1	0.1	--	0.2	(+0.1)	0.2	--
Clearweed	0.0	0.2	(+0.2)	0.3	(+0.1)	0.3	--
Common chickweed	1.5	0.1	(-1.4)	1.6	(+1.5)	5.6	(+4.0)
Field garlic	0.0	0.0	--	0.0	--	0.5	(+0.5)
Fissidens moss	0.8	0.8	--	0.9	(+0.1)	0.9	--
Frost grape	0.0	0.3	(+0.3)	0.3	--	0.3	--
Garlic mustard	28.8	29.9	(+0.9)	20.7	(-9.2)	21.1	(+0.4)
Hackberry	0.5	0.9	(+0.4)	0.7	(-0.2)	0.7	--
Leskea moss	0.2	0.1	(-0.2)	0.3	(+0.2)	0.3	--
Miami mist	0.3	0.0	(-0.3)	0.0	--	0.0	--
Mnium moss	0.4	0.4	--	0.5	(+0.1)	0.5	--
Poison ivy	0.1	0.3	(+0.2)	0.3	--	0.3	--
Silver maple	0.1	0.0	(-0.1)	0.0	--	0.0	--
Sterecleus moss	0.3	0.2	(-0.1)	0.2	--	0.2	--
Stinging nettle	0.0	0.1	(+0.1)	0.1	--	0.0	(-0.1)
Virginia creeper	0.1	0.0	(-0.1)	0.0	--	0.0	--
White avens	0.0	0.0	--	0.0	--	0.3	(+0.3)
White snakeroot	3.0	1.7	(-1.3)	3.2	(+1.5)	3.2	--

Table A.5. (page 2 of 2)

Substrate/Species	Average Percent Cover on 10 1x1-m Plots[a,b]						
	June	July		August		October	
Unknown *Asteraceae*	0.0	0.1	(+0.1)	0.1	--	0.0	--
Unknown *Carex*	0.7	0.3	(-0.4)	0.4	(+0.1)	0.3	(-0.1)
Unknown	0.2	0.2	--	0.3	(+0.2)	0.4	(+0.1)
TOTALS	100.0	100.0		100.0		100.0	

[a]Figures within parentheses represent change in average cover percent from previous sampling effort. Dashes indicate no change.
[b]July, August, and October data collected in 1992; June data obtained in 1993.

Table A.6. Riparian Forest: Average Substrate/Species Frequency Percentage

Substrate/Species	Average Percent Frequency on 10 1x1-m Plots[a,b]						
	June	July		August		October	
Bare rock	20	20	--	20	--	20	--
Bare soil	80	90	(+10)	90	--	100	(+10)
Standing bole	40	40	--	40	--	40	--
Twig/leaf litter	100	100	--	100	--	100	--
Woody debris	20	20	--	20	--	20	--
American elm	30	90	(+60)	90	--	90	--
Amur honeysuckle	80	100	(+20)	100	--	100	--
Bedstraw	90	0	(-90)	0	--	0	--
Black cherry	40	30	(-10)	30	--	30	--
Blue violet	10	20	(+10)	20	--	30	(+10)
Boxelder	80	100	(+20)	100	--	100	--
Canada black snakeroot	10	10	--	20	(+10)	20	--
Clearweed	0	20	(+20)	30	(+10)	30	--
Common chickweed	70	10	(-60)	60	(+50)	100	(+40)
Field garlic	0	0	--	0	--	50	(+50)
Fissidens moss	50	50	--	50	--	50	--
Frost grape	0	30	(+30)	30	--	30	--
Garlic mustard	100	100	--	100	--	100	--
Hackberry	40	50	(+10)	50	--	50	--
Leskea moss	20	10	(-10)	20	(+10)	20	--
Miami mist	20	0	(-20)	0	--	0	--
Mnium moss	30	30	--	30	--	30	--
Poison ivy	10	20	(+20)	30	(+10)	30	--
Silver maple	10	0	(-10)	0	--	0	--
Sterecleus moss	20	20	--	20	--	20	--
Stinging nettle	0	10	(+10)	10	--	0	(-10)
Virginia creeper	10	0	(-10)	0	--	0	--
White avens	0	0	--	0	--	20	(+20)
White snakeroot	40	30	(-10)	60	(+30)	60	--
Unknown *Asteraceae*	0	10	(+10)	10	--	0	(-10)

Table A.6. (page 2 of 2)

Substrate/Species	Average Percent Frequency on 10 1x1-m Plots[a,b]						
	June	July		August		October	
Unknown *Carex*	30	20	(-10)	20	--	20	--
Unknown	20	20	--	20	--	40	(+20)

[a]Figures within parentheses represent change in average frequency percent from previous sampling effort. Dashes indicate no change.
[b]July, August, and October data collected in 1992; June data obtained in 1993.

Table A.7. Early Successional Scrub-Shrub: Average Substrate/Species Cover Percentage

Substrate/Species	Average Percent Cover on 10 1x1-m Plots[a,b]						
	June	July		August		October	
Bare rock	1.5	3.7	(+2.2)	2.1	(-1.6)	2.4	(+0.3)
Bare soil	0.2	0.2	--	0.8	(+0.6)	1.0	(+0.2)
Twig/leaf litter	16.7	9.7	(-7.0)	5.7	(-4.0)	10.4	(+4.7)
Amblystegium moss	0.5	0.3	(-0.2)	0.4	(+0.1)	0.4	--
American elm	0.0	0.0	--	0.0	--	0.1	(+0.1)
Amur honeysuckle	18.6	13.4	(-5.2)	13.4	--	14.2	(+0.8)
Bedstraw	0.2	0.0	(-0.2)	0.0	--	0.0	--
Bitterweed	0.0	0.7	(+0.7)	1.0	(+0.3)	1.0	--
Black medic	5.6	3.6	(-2.0)	2.2	(-1.4)	2.7	(+0.5)
Boxelder	0.0	0.1	(+0.1)	0.1	--	0.1	--
Canada goldenrod	6.5	8.5	(+2.0)	9.5	(+1.0)	10.2	(+0.7)
Canada thistle	0.5	1.0	(+0.5)	0.2	(-0.8)	0.0	(-0.2)
Common brome grass	1.5	0.0	(-1.5)	0.0	--	0.0	--
Common dandelion	0.3	0.1	(-0.2)	0.6	(+0.5)	0.6	--
Common ragweed	0.0	0.1	(+0.1)	0.5	(+0.4)	0.1	(-0.4)
Corn speedwell	0.3	0.0	(-0.3)	0.0	--	0.0	--
Curly dock	0.0	0.3	(+0.3)	0.2	(-0.1)	0.2	--
Daisy fleabane	0.3	0.2	(-0.1)	0.0	(-0.2)	0.0	--
Downy aster	0.5	1.0	(+0.5)	8.2	(+7.2)	12.7	(+4.5)
Field bindweed	3.7	5.9	(+2.2)	2.9	(-3.0)	1.5	(-1.4)
Frost grape	0.0	0.2	(+0.2)	0.3	(+0.1)	0.3	--
Hackberry	0.0	0.0	--	0.1	(+0.1)	0.1	--
Honeyvine	0.0	0.5	(+0.5)	0.0	(-0.5)	0.0	--
Horseweed	0.0	0.0	--	0.1	(+0.1)	0.3	(+0.2)
Japanese hedge parsley	0.0	0.1	(+0.1)	0.0	(-0.1)	0.0	--
Kentucky blue grass	6.7	8.1	(+1.4)	9.6	(+1.5)	7.5	(-2.1)
Meadow fescue	16.2	11.9	(-4.3)	16.6	(+5.1)	18.2	(+1.6)
Mouse-ear chickweed	0.2	0.0	(-0.2)	0.0	--	0.0	--
Orchard grass	0.4	0.0	(-0.4)	0.0	--	0.0	--
Queen Anne's lace	13.0	8.2	(-4.8)	11.0	(+2.8)	9.8	(-1.2)
Red clover	0.0	0.0	--	0.0	--	0.5	(+0.5)

Table A.7. (page 2 of 2)

Substrate/Species	Average Percent Cover on 10 1x1-m Plots[a,b]						
	June	July		August		October	
Soft hawthorne	0.1	0.1	--	0.1	--	0.1	--
Spring avens	0.2	0.1	(-0.1)	0.1	--	0.1	--
Teasel	3.2	9.1	(+5.9)	6.8	(-2.3)	2.1	(-4.7)
Timothy grass	0.0	0.1	(+0.1)	0.5	(+0.4)	0.2	(-0.3)
Willow-leaved lettuce	0.4	0.6	(+0.2)	0.6	--	0.6	--
Yellow sorrell	0.2	0.0	(-0.2)	0.0	--	0.0	--
Yellow sweet clover	1.7	11.5	(+9.8)	5.5	(-6.0)	1.9	(-3.6)
Unknown *Asteraceae*	0.9	0.7	(-0.2)	0.8	(+0.1)	0.6	(-0.2)
Unknown	0.0	0.0	--	0.1	(+0.1)	0.1	--
TOTALS	100.0	100.0		100.0		100.0	

[a]Figures within parentheses represent change in average cover percent from previous sampling effort. Dashes indicate no change.

[b]Original vegetation plots were accidentally destroyed by geology assessment crews after the June 1992 sampling effort. Replacement plots were established in a different location in July 1992 of that year. July-October data, therefore, were acquired in 1992, while June data were obtained in 1993.

Table A.8. Early Successional Scrub-Shrub: Average Substrate/Species Frequency Percentage

Substrate/Species	Average Percent Frequency on 10 1x1-m Plots[a,b]						
	June	July		August		October	
Bare rock	50	60	(+10)	50	(-10)	50	--
Bare soil	10	10	--	40	(+30)	40	--
Twig/leaf litter	100	90	(-10)	100	(+10)	100	--
Amblystegium moss	30	20	(-10)	20	--	20	--
American elm	0	0	--	0	--	10	(+10)
Amur honeysuckle	100	90	(-10)	90	--	90	--
Bedstraw	10	0	(-10)	0	--	0	--
Bitterweed	0	10	(+10)	10	--	10	--
Black medic	80	70	(-10)	80	(+10)	80	--
Boxelder	0	10	(+10)	10	--	10	--
Canada goldenrod	60	50	(-10)	60	(+10)	60	--
Canada thistle	10	10	--	10	--	0	(-10)
Common brome grass	50	0	(-50)	0	--	0	--
Common dandelion	20	10	(-10)	40	(+30)	40	--
Common ragweed	0	10	(+10)	30	(+20)	10	(-20)
Corn speedwell	30	0	(-30)	0	--	0	--
Curly dock	0	10	(+10)	10	--	10	--
Daisy fleabane	20	10	(-10)	0	(-10)	0	--
Downy aster	20	20	--	60	(+40)	90	(+30)
Field birdweed	90	90	--	100	(+10)	100	--
Frost grape	0	20	(+20)	30	(+10)	30	--
Hackberry	0	0	--	10	(+10)	10	--
Honeyvine	0	10	(+10)	0	(-10)	0	--
Horseweed	0	0	--	10	(+10)	10	--
Japanese hedge parsley	0	10	(+10)	0	(-10)	0	--
Kentucky blue grass	50	40	(-10)	40	--	40	--
Meadow fescue	90	70	(-20)	90	(+20)	90	--
Mouse-ear chickweed	20	0	(-20)	0	--	0	--
Orchard grass	20	0	(-20)	0	--	0	--
Queen Anne's lace	100	100	--	100	--	100	--

Table A.8. (page 2 of 2)

Substrate/Species	Average Percent Frequency on 10 1x1-m Plots[a,b]						
	June	July		August		October	
Red clover	-	0	--	0	--	10	(+10)
Soft hawthorne	10	10	--	10	--	10	--
Spring avens	10	10	--	10	--	10	--
Teasel	60	50	(-10)	50	--	40	(-10)
Timothy grass	0	10	(+10)	10	--	10	--
Willow-leaved lettuce	20	40	(+20)	50	(+10)	60	(+10)
Yellow sorrell	10	0	(-10)	0	--	0	--
Yellow sweet clover	30	80	(+50)	70	(-10)	30	(-40)
Unknown *Asteraceae*	50	30	(-20)	70	(+40)	50	(-20)
Unknown	0	0	--	10	(+10)	10	--

[a]Figures within parentheses represent change in average frequency percent from previous sampling effort. Dashes indicate no change.

[b]Original vegetation plots were accidentally destroyed by geology assessment crews after the June 1992 sampling effort. Replacement plots were established in a different location in July 1992 of that year. July-October data, therefore, were acquired in 1992, while June data were obtained in 1993.

Table A.9. Subxeric Grassland: Average Substrate/Species Cover Percentage

Substrate/Species	Average Percent Cover on 10 1x1-m Plots[a,b,c]						
	June	July		August		October	
Bare rock	1.3	0.6	(-0.7)	0.7	(+0.1)	0.7	--
Bare soil	0.5	0.0	(-0.5)	0.1	(+0.1)	0.1	--
Stream/Seep	5.5	6.3	(+0.8)	6.2	(-0.1)	5.6	(-0.6)
Twig/leaf litter	27.7	23.2	(-4.5)	23.1	(-0.1)	27.2	(+4.1)
Amblystegium moss	1.2	1.0	(-0.2)	0.8	(-0.2)	0.6	(-0.2)
American elm	0.1	*	--	*	--	*	--
Amur honeysuckle	0.6	0.6	--	0.7	(+0.1)	0.7	--
Bitterweed	*	0.1	--	0.2	(+0.1)	0.5	(+0.3)
Black cherry	*	0.1	--	0.1	--	0.1	--
Black medic	1.2	0.9	(-0.3)	0.7	(-0.2)	0.5	(-0.2)
Boxelder	0.1	0.1	--	0.2	(+0.1)	0.2	--
Broad-leaved plantain	0.2	0.4	(+0.2)	0.4	--	0.7	(+0.3)
Broomsedge	0.0	0.3	(+0.3)	0.2	(-0.1)	0.4	(+0.2)
Canada blue grass	4.1	2.4	(-1.7)	2.0	(-0.4)	1.8	(-0.2)
Canada goldenrod	1.1	1.7	(+0.6)	1.8	(+0.1)	1.7	(-0.1)
Canada thistle	0.4	0.1	(-0.3)	0.4	(+0.3)	0.5	(+0.1)
Charming sedge	0.1	0.0	(-0.1)	0.0	--	0.0	--
Chickory	0.7	1.1	(+0.4)	0.2	(-0.9)	0.1	(-0.1)
Clammy ground cherry	0.2	0.2	--	0.3	(+0.1)	0.2	(-0.1)
Climbing buckwheat	*	0.1	--	0.1	--	0.1	--
Common brome grass	0.9	0.2	(-0.7)	0.0	(-0.2)	0.0	--
Common dandelion	0.6	0.2	(-0.4)	0.2	--	0.3	(+0.1)
Common mouse-ear chickweed	0.1	0.0	(-0.1)	0.0	--	0.0	--
Common ragweed	0.2	0.2	--	0.3	(+0.1)	0.1	(-0.2)
Corn speedwell	0.1	0.0	(-0.1)	0.0	--	0.0	--
Crab grass	0.0	0.0	--	0.0	--	0.2	(+0.2)
Daisy fleabane	0.3	0.3	--	*		0.0	--
Deptford pink	*	*		0.0	--	0.0	--
Downy aster	0.1	0.4	(+0.3)	0.4	--	0.6	(+0.2)
English plantain	0.4	0.6	(+0.2)	1.1	(+0.5)	1.5	(+0.4)
Field garlic	0.2	0.4	(+0.2)	0.0	(-0.4)	0.0	--
Field penny cress	*	*		0.0		0.0	--

Table A.9. (page 2 of 3)

Substrate/Species	Average Percent Cover on 10 1x1-m Plots[a,b,c]						
	June	July		August		October	
Flat-topped goldenrod	0.0	0.0	--	0.0	--	0.1	(+0.1)
Fox sedge	0.0	0.3	(+0.3)	0.3	--	0.0	(-0.3)
Frank's sedge	0.7	0.3	(-0.4)	0.3	--	0.7	(+0.4)
Frost grape	0.1	0.1	--	0.2	(+0.1)	0.2	--
Goat's beard	*	0.1		0.0	(-0.1)	0.0	--
Green bulrush	*	0.4		0.3	(-0.1)	0.3	--
Head-bearing sedge	1.0	0.5	(-0.5)	0.0	(-0.5)	0.0	--
Heal all	0.0	*		0.0		0.0	--
Horse nettle	0.1	0.2	(+0.1)	0.2	--	0.2	--
Indian hemp	0.2	0.3	(+0.1)	0.2	(-0.1)	0.1	(-0.1)
Kentucky blue grass	12.2	17.0	(+4.8)	16.2	(-0.8)	16.2	--
Lined bulrush	0.7	0.6	(-0.1)	0.8	(+0.2)	0.1	(-0.7)
Low hop clover	0.1	0.1	--	0.0	(-0.1)	0.0	--
Lyre-leaved sage	*	*		*		0.1	
Meadow fescue	7.7	6.1	(-1.6)	5.7	(-0.4)	6.4	(+0.7)
Moth mullein	0.0	0.0	--	*		0.0	
Mouse-ear chickweed	0.1	0.1	--	0.1	--	0.1	--
New England aster	0.1	*		0.1		0.2	(+0.1)
Nodding spurge	0.0	0.1	(+0.1)	0.2	(+0.1)	0.2	--
Path rush	0.5	0.5	--	0.3	(-0.2)	0.1	(-0.2)
Poison ivy	0.5	0.6	(+0.1)	0.7	(+0.1)	0.5	(-0.2)
Prickly lettuce	0.1	0.0	(-0.1)	*		0.0	
Purple top	0.0	0.0	--	0.1	(+0.1)	0.1	--
Queen Anne's lace	1.2	1.4	(+0.2)	1.9	(+0.5)	2.0	(+0.1)
Rough dropseed	20.4	21.3	(+0.9)	23.3	(+2.0)	20.5	(-2.8)
Rough-fruited cinquefoil	0.3	0.5	(+0.2)	0.3	(-0.2)	0.4	(+0.1)
Scratch grass	0.0	0.0	--	*		*	
Smooth ground cherry	0.1	0.1	--	0.1	--	0.2	(+0.1)
Soft hawthorne	0.7	0.7	--	0.7	--	0.5	(-0.2)
Spotted knapweed	0.3	0.3	--	1.1	(+0.8)	0.9	(-0.2)
Spurge	0.0	*		*		*	
Tall ironweed	0.6	0.8	(+0.2)	1.1	(+0.3)	0.4	(-0.7)
Teasel	0.7	0.1	(-0.6)	0.2	(+0.1)	0.2	--

Table A.9. (page 3 of 3)

Substrate/Species	Average Percent Cover on 10 1x1-m Plots[a,b,c]						
	June	July		August		October	
Three-seeded mercury	0.0	0.1	(+0.1)	0.3	(+0.2)	0.4	(+0.1)
Timothy grass	0.1	0.1	--	0.1	--	0.1	--
Torrey's rush	1.6	2.0	(+0.4)	2.1	(+0.1)	0.7	(-1.4)
Umbrella sedge	*	*		*		0.1	
White ash	0.4	0.4	--	0.5	(+0.1)	0.4	(-0.1)
White sweet clover	0.3	1.4	(+1.1)	0.1	(-1.3)	0.0	(-0.1)
White-top fleabane	0.4	0.4	--	*		0.0	
Witch grass	0.0	0.0	--	*		0.1	
Woolly panic grass	0.1	0.2	(+0.1)	0.1	(-0.1)	0.7	(+0.6)
Yellow foxtail grass	0.0	*		0.7		1.7	(+1.0)
Yellow sorrell	0.1	0.2	(+0.1)	0.2	--	0.2	--
Yellow sweet clover	0.1	0.2	(+0.1)	0.0	(-0.2)	0.0	--
Unknown *Asteraceae*	0.1	0.2	(+0.1)	0.3	(+0.1)	*	
Unknown grass	0.1	0.1	--	0.1	--	0.0	(-0.1)
Unknown moss	0.4	0.6	(+0.2)	0.6	--	0.6	--
Unknown sedge	0.1	*		0.0	--	0.0	--
Unknown	0.0	*		0.0		0.2	(+0.2)
TOTALS	100.0	100.0		100.0		100.0	

[a]Figures within parentheses represent change in average cover percent from previous sampling effort. Dashes indicate no change.
[b]Asterisks indicate a cover contribution of less than 0.1 percent.
[c]A portion of the sample area was impacted by mowing after the June 1992 sampling effort and had to be abandoned. June data, therefore, contain information obtained in June 1993 from 16 replacement plots plus 22 plots remaining intact from 1992.

Table A.10. Subxeric Grassland: Average Substrate/Species Frequency Percentage

Substrate/Species	Average Percent Frequency on 38 1x1-m Plots[a,b]						
	June	July		August		October	
Bare rock	15.8	21.1	(+5.3)	21.1	--	18.4	(-2.7)
Bare soil	2.6	0.0	(-2.6)	2.6	(+2.6)	2.6	--
Stream/Seep	28.9	23.7	(-5.2)	21.1	(-2.6)	21.1	--
Twig/leaf litter	97.4	100.0	(+2.6)	97.4	(-2.6)	94.7	(-2.7)
Amblystegium moss	7.9	7.9	--	7.9	--	7.9	--
American elm	5.3	2.6	(-2.7)	2.6	--	2.6	--
Amur honeysuckle	5.3	7.9	(+2.6)	7.9	--	7.9	--
Bitterweed	2.6	5.3	(+2.7)	7.9	(+2.6)	5.3	(-2.6)
Black cherry	2.6	5.3	(+2.7)	5.3	--	5.3	--
Black medic	26.3	44.7	(+18.4)	50.0	(+5.3)	39.5	(-10.5)
Boxelder	7.9	13.2	(+5.3)	13.2	--	13.2	--
Broad-leaved plantain	5.3	15.8	(+10.5)	15.8	--	15.8	--
Broomsedge	0.0	10.5	(+10.5)	7.9	(-2.6)	10.5	(+2.6)
Canada blue grass	44.7	42.1	(-2.6)	44.7	(+2.6)	36.8	(-7.9)
Canada goldenrod	28.9	36.8	(+7.9)	34.2	(-2.6)	26.3	(-7.9)
Canada thistle	5.3	2.6	(-2.7)	5.3	(+2.7)	5.3	--
Charming sedge	7.9	0.0	(-7.9)	0.0	--	0.0	--
Chickory	5.3	15.8	(+10.5)	13.2	(-2.6)	5.3	(-7.9)
Clammy ground cherry	18.4	18.4	--	18.4	--	15.8	(-2.6)
Climbing buckwheat	2.6	13.2	(+10.6)	5.3	(-7.9)	5.3	--
Common brome grass	23.7	18.4	(-5.3)	0.0	(-18.4)	0.0	--
Common dandelion	21.1	15.8	(-5.3)	21.1	(+5.3)	26.3	(+5.2)
Common mouse-ear chickweed	7.9	0.0	(-7.9)	0.0	--	0.0	--
Common ragweed	15.8	18.4	(+2.6)	21.1	(+2.7)	10.5	(-10.6)
Corn speedwell	5.3	0.0	(-5.3)	0.0	--	0.0	--
Crab grass	0.0	0.0	--	0.0	--	5.3	(+5.3)
Daisy fleabane	10.5	10.5	--	2.6	(-7.9)	0.0	(-2.6)
Deptford pink	2.6	2.6	--	0.0	(-2.6)	0.0	--
Downy aster	7.9	15.8	(+7.9)	21.1	(+5.3)	34.2	(+13.1)
English plantain	18.4	26.3	(+7.9)	26.3	--	26.3	--
Field garlic	21.1	34.2	(+13.1)	0.0	(-34.2)	0.0	--
Field penny cress	2.6	2.6	--	0.0	(-2.6)	0.0	--

Table A.10. (page 2 of 3)

Substrate/Species	Average Percent Frequency on 38 1x1-m Plots[a,b]						
	June	July		August		October	
Flat-topped goldenrod	0.0	0.0	--	0.0	--	7.9	(+7.9)
Fox sedge	0.0	5.3	(+5.3)	5.3	--	0.0	(-5.3)
Frank's sedge	7.9	7.9	--	7.9	--	10.5	(+2.6)
Frost grape	5.3	5.3	--	15.8	(+10.5)	18.4	(+2.6)
Goat's beard	2.6	5.3	(+2.7)	0.0	(-5.3)	0.0	--
Green bulrush	2.6	2.6	--	2.6	--	2.6	--
Head-bearing sedge	28.9	23.7	(-5.2)	0.0	(-23.7)	0.0	--
Heal all	0.0	2.6	(+2.6)	0.0	(-2.6)	0.0	--
Horse nettle	2.6	5.3	(+2.7)	5.3	--	5.3	--
Indian hemp	10.5	7.9	(-2.6)	10.5	(+2.6)	7.9	(-2.6)
Kentucky blue grass	63.2	55.3	(-7.9)	55.3	--	65.8	(+10.5)
Lined bulrush	7.9	7.9	--	7.9	--	2.6	(-5.3)
Low hop clover	7.9	7.9	--	0.0	(-7.9)	0.0	--
Lyre-leaved sage	2.6	2.6	--	2.6	--	5.3	(+2.7)
Meadow fescue	28.9	28.9	--	34.2	(+5.3)	44.7	(+10.5)
Moth mullein	0.0	0.0	--	2.6	(+2.6)	0.0	(-2.6)
Mouse-ear chickweed	7.9	13.2	(+5.3)	5.3	(-7.9)	5.3	--
New England aster	2.6	2.6	--	5.3	(+2.7)	5.3	--
Nodding spurge	0.0	5.3	(+5.3)	15.8	(+10.5)	18.4	(+2.6)
Path rush	10.5	28.9	(+18.4)	21.1	(-7.8)	2.6	(-18.5)
Poison ivy	13.2	15.8	(+2.6)	18.4	(+2.6)	18.4	--
Prickly lettuce	2.6	0.0	(-2.6)	2.6	(+2.6)	0.0	--
Purple top	0.0	0.0	--	2.6	(+2.6)	5.3	(+2.7)
Queen Anne's lace	78.9	89.5	(+10.6)	89.5	--	89.5	--
Rough dropseed	60.5	65.8	(+5.3)	73.7	(+7.9)	73.7	--
Rough-fruited cinquefoil	21.1	26.3	(+5.2)	26.3	--	28.9	(+2.6)
Scratch grass	0.0	0.0	--	2.6	(+2.6)	2.6	--
Smooth ground cherry	5.3	7.9	(+2.6)	7.9	--	7.9	--
Soft hawthorne	39.5	39.5	--	44.7	(+5.2)	44.7	--
Spotted knapweed	10.5	10.5	--	21.1	(+10.6)	21.1	--
Spurge	0.0	2.6	(+2.6)	2.6	--	2.6	--
Tall ironweed	21.1	21.1	--	26.3	(+5.2)	18.4	(-7.9)

Table A.10. (page 3 of 3)

Substrate/Species	Average Percent Frequency on 38 1x1-m Plots[a,b]						
	June	July		August		October	
Teasel	10.5	2.6	(-7.9)	7.9	(+5.3)	10.5	(+2.6)
Three-seeded mercury	0.0	10.5	(+10.5)	34.2	(+23.7)	39.5	(+5.3)
Timothy grass	2.6	2.6	--	2.6	--	2.6	--
Torrey's rush	2.6	2.6	--	5.3	(+2.7)	5.3	--
Umbrella sedge	2.6	2.6	--	2.6	--	5.3	(+2.7)
White ash	26.3	31.6	(+5.3)	34.2	(+2.6)	34.2	--
White sweet clover	2.6	13.2	(+10.6)	5.3	(-7.9)	0.0	(-5.3)
White-top fleabane	2.6	5.3	(+2.7)	2.6	(-2.7)	0.0	(-2.6)
Witch grass	0.0	0.0	--	2.6	(+2.6)	7.9	(+5.3)
Woolly panic grass	5.3	10.5	(+5.2)	10.5	--	23.7	(+13.2)
Yellow foxtail grass	0.0	2.6	(+2.6)	31.6	(+29.0)	39.5	(+7.9)
Yellow sorrell	7.9	21.1	(+13.2)	18.4	(-2.7)	18.4	--
Yellow sweet clover	2.6	5.3	(+2.7)	0.0	(-5.3)	0.0	--
Unknown *Asteraceae*	7.9	21.1	(+13.2)	26.3	(+5.2)	5.3	(-21.0)
Unknown grass	2.6	5.3	(+2.7)	7.9	(+2.6)	0.0	(-7.9)
Unknown moss	7.9	18.4	(+10.5)	23.7	(+5.3)	23.7	--
Unknown sedge	5.3	2.6	(-2.7)	0.0	(-2.6)	0.0	--
Unknown	0.0	2.6	(+2.6)	0.0	--	0.0	--

[a]Figures within parentheses represent change in average frequency percent from previous sampling effort. Dashes indicate no change.

[b]A portion of the sample area was impacted by mowing after the June 1992 sampling effort and had to be abandoned. June data, therefore, contain information obtained in June 1993 from 16 replacement plots plus 22 plots remaining intact from 1992.

Table A.11. Mesic Grassland: Average Substrate/Species Cover Percentage

Substrate/Species	Average Percent Cover on 10 1x1-m Plots[a,b]		
	June	July	
Leaf/twig Litter	13.0	3.8	(-9.2)
Bedstraw	1.0	0.0	(-1.0)
Black medic	0.0	0.4	(+0.4)
Blue violet	0.2	0.3	(+0.1)
Boxelder	0.5	0.7	(+0.2)
Burdock	0.1	0.0	(-0.1)
Canada goldenrod	0.2	1.5	(+1.3)
Canada thistle	19.4	15.8	(-3.6)
Chickweed	0.2	0.3	(+0.1)
Clearweed	0.0	0.1	(+0.1)
Common brome grass	12.0	1.6	(-10.4)
Common dandelion	0.5	0.5	--
Common mouse-ear chickweed	0.1	0.0	(-0.1)
Corn salad	0.3	0.0	(-0.3)
Corn speedwell	0.9	0.2	(-0.7)
Dead nettle	0.1	0.0	(-0.1)
Downy aster	0.1	0.0	(-0.1)
Field bindweed	0.5	1.0	(+0.5)
Frost grape	0.1	0.2	(+0.1)
Garlic mustard	0.0	1.5	(+1.5)
Granular sedge	0.1	0.1	--
Head-bearing sedge	1.7	0.2	(-1.5)
Hedge nettle	0.1	0.5	(+0.4)
Henbit	0.1	0.0	(-0.1)
Honeyvine	0.0	0.1	(+0.1)
Hungarian brome grass	0.0	0.2	(+0.2)
Indian hemp	3.5	2.8	(-0.7)
Ivy-leaved morning glory	0.1	0.1	--
Japanese brome grass	5.4	0.1	(-5.3)
Johnson grass	5.5	22.5	(+17.0)
Kentucky blue grass	11.7	16.3	(+4.6)
Lamb's lettuce	0.1	0.1	--

Table A.11. (page 2 of 2)

Substrate/Species	Average Percent Cover on 10 1x1-m Plots[a,b]		
	June	July	
Meadow fescue	6.5	4.0	(-2.5)
Miami mist	0.2	0.0	(-0.2)
Mouse-ear chickweed	0.1	0.1	--
Poison hemlock	5.3	2.0	(-3.3)
Poison ivy	0.2	0.6	(+0.4)
Prickly lettuce	0.2	0.0	(-0.2)
Queen Anne's lace	0.2	0.3	(+0.1)
Rough avens	0.0	0.2	(+0.2)
Rough-fruited cinquefoil	0.1	0.1	--
Spring avens	0.2	0.1	(-0.1)
Sterile brome grass	1.5	2.7	(+1.2)
Stinging nettle	0.0	0.5	(+0.5)
Tall ironweed	1.5	6.5	(+5.0)
Tall thoroughwort	4.8	4.5	(-0.3)
Three-seeded mercury	0.1	0.4	(+0.3)
White avens	0.1	0.2	(+0.1)
Wild potato vine	0.1	3.1	(+3.0)
Yellow sorrell	0.8	3.6	(+2.8)
Unknown *Cyperaceae*	0.5	0.1	(-0.4)
Unknown *Fabaceae*	0.1	0.0	(-0.1)
Unknown	0.0	0.1	(+0.1)
TOTALS	100.0	100.0	

[a]Figures within parentheses represent change in average cover percent from previous sampling effort. Dashes indicate no change.
[b]Vegetation plots were inadvertently destroyed by mowing activities after the July 1992 sampling effort. Because this occurred so late in the growing season, continued vegetation surveys were abandoned.

Table A.12. Mesic Grassland: Average Substrate/Species Frequency Percentage

Substrate/Species	Average Frequency Percentage on 10 1x1-m Plots[a,b]		
	June	July	
Leaf/twig Litter	100	3.8	
Bedstraw	40	0	(-40)
Black medic	0	40	(+40)
Blue violet	20	20	--
Boxelder	40	70	(+30)
Burdock	10	0	(-10)
Canada goldenrod	10	10	--
Canada thistle	50	60	(+10)
Chickweed	20	30	(+10)
Clearweed	0	10	(+10)
Common brome grass	30	40	(+10)
Common dandelion	50	40	(-10)
Common mouse-ear chickweed	10	0	(-10)
Corn salad	30	0	(-30)
Corn speedwell	50	20	(-30)
Dead nettle	10	0	(-10)
Downy aster	10	0	(-10)
Field bindweed	50	50	--
Frost grape	10	10	--
Garlic mustard	0	10	(+10)
Granular sedge	10	10	--
Head-bearing sedge	20	10	(-10)
Hedge nettle	10	10	--
Henbit	10	0	(-10)
Honeyvine	0	10	(+10)
Hungarian brome grass	0	10	(+10)
Indian hemp	30	40	(+10)
Ivy-leaved morning glory	10	10	--
Japanese brome grass	10	10	--
Johnson grass	40	60	(+20)
Kentucky blue grass	40	60	(+20)
Lamb's lettuce	10	10	--

Table A.12. (page 2 of 2)

Substrate/Species	Average Frequency Percentage on 10 1x1-m Plots[a,b]		
	June	July	
Meadow fescue	20	20	--
Miami mist	20	0	(-20)
Mouse-ear chickweed	10	10	--
Poison hemlock	10	10	--
Poison ivy	20	30	(+10)
Prickly lettuce	10	0	(-10)
Queen Anne's lace	10	30	(+20)
Rough avens	0	10	(+10)
Rough-fruited cinquefoil	10	10	--
Spring avens	20	10	(-10)
Sterile brome grass	10	30	(+20)
Stinging nettle	0	10	(+10)
Tall ironweed	20	40	(+20)
Tall thoroughwort	40	20	(-20)
Three-seeded mercury	10	20	(+10)
White avens	10	20	(+10)
Wild potato vine	10	60	(+50)
Yellow sorrell	70	90	(+20)
Unknown *Cyperaceae*	10	10	--
Unknown *Fabaceae*	10	0	(-10)
Unknown	0	10	(+10)

[a]Figures within parentheses represent change in average frequency percent from previous sampling effort. Dashes indicate no change.

[b]Vegetation plots were inadvertently destroyed by mowing activities after the July 1992 sampling effort. Because this occurred so late in the growing season, continued vegetation surveys were abandoned.

APPENDIX B

ANNOTATED CHECKLIST OF THE NATIVE AND NATURALIZED VASCULAR FLORA OF THE MOUND PLANT MONTGOMERY COUNTY, OHIO

CHECKLIST FORMAT:

Families are arranged alphabetically within four major groups: 1) Pteridophyta, 2) Gymnos-permae, 3) Angiospermae-Monocotyledoneae, and 4) Angiospermae-Dicotyledoneae. Under each family, the associated genera and species within genera are also listed alphabetically. Taxonomic nomenclature, including author citations, follow those of Kartesz and Kartesz 1980. Binomials preceded by an asterisk indicate that the species is not native to southwestern Ohio, but has become a naturalized element in the flora.

Each species is assigned a common name. While most species typically have more than one common name, the name selected for the checklist is that which most often appears in traditional floristic manuals. In cases where no common name could be found, a translation of the binomial is used (e.g., "Frank's sedge" for *Carex frankii*).

Following the common name, a subjective assessment of the overall abundance of the species at the Mound Site is indicated. The various categories take into account both frequency and coverage. The scheme used is generally that of White 1982.

VERY RARE	- a single locale, few individuals
RARE	- 1 or 2 locales, small populations
SCARCE	- several locales, or scattered small populations
INFREQUENT	- scattered locales throughout
OCCASIONAL	- well-distributed but not anywhere abundant
FREQUENT	- generally encountered
COMMON	- characteristic and dominant

It should be stressed that these assessments are specific to the Mound property and should not be construed to reflect the abundance of a given species at the state, or even local, level.

After abundance, a short description of distribution and habitat preference is provided. The rare occasions when a species identification is tentative due to the absence of diagnostic characters, such as flowers or fruit, are also indicated here. Finally, in the case of exotics, a statement regarding the plant's place of origin is included.

ANNOTATED CHECKLIST OF THE NATIVE AND NATURALIZED FLORA OF THE MOUND PLANT, MONTGOMERY COUNTY OHIO

-PTERIDOPHYTA-

ASPLENIACEAE (Spleenwort Family)

Asplenium platyneuron (L.) Oakes. "Ebony spleenwort." Scarce. Early successional upland forests on south property only.

EQUISETACEAE (Horsetail Family)

Equisetum arvense L. "Field horsetail." Very rare. Seepage area on north property only.

OPHIOGLOSSACEAE (Adder's-Tongue Family)

Botrychium virginianum (L.) Sw. "Rattlesnake fern." Rare. Moist riverine terraces in vicinity of Miami-Erie Canal.

-SPERMATOPHYTA-

GYMNOSPERMAE

CUPRESSACEAE (Cypress Family)

Juniperus virginiana L. "Eastern redcedar." Scarce. Calciphytic species occurring in well-drained fields and disturbed areas.

PINACEAE (Pine Family)

****Pinus strobus*** L. "Eastern white pine." Very rare. Scarcely established in disturbed area on north property adjacent to ornamental plantings. Native to eastern Ohio.

****Pinus sylvestris*** L. "Scotch pine." Very rare. Originating from onsite ornamental plantings. Weakly adventive in disturbed area on north property. Native to Eurasia.

ANGIOSPERMAE - MONOCOTYLEDONEAE

AGAVACEAE (Century Plant Family)

* *Yucca filamentosa* L. "Spanish bayonet." Very rare. Introduced ornamental, spreading vegetatively at old home site on south property. Native to southeastern coastal plain of U.S.

ALISMACEAE (Water-Plantain Family)

Alisma plantago-aquatica L. "Water-plantain." Rare. Borders of retention basins and sediment ponds on north property. (Includes *Alisma subcordatum* Raf.)

COMMELINACEAE (Spiderwort Family)

* *Commelina communis* L. "Common dayflower." Rare. Moist depressions, streambanks, and gravel bars. Native to Asia.

CYPERACEAE (Sedge Family)

Carex amphibola Steud. "Ambiguous sedge." Rare. Moist fields and riparian woodlands on south property only.

Carex blanda Dewey. "Charming sedge." Scarce. Moist fields, seepage areas, and shaded woodlands.

Carex cephalophora Willd. "Head-bearing sedge." Occasional. Moist or dry fields and pastures.

Carex festucacea Willd. "Fescue sedge." Infrequent. Scattered in moist or dry fields and pastures.

Carex frankii Kunth. "Frank's sedge." Scarce. Moist seepage areas and depressions.

Carex granularis Muhl. ex Willd. "Granular sedge." Rare. Facultative calciphyte found in moist fields on south property.

Carex jamesii Schwein. "Jame's Sedge." Rare. Mesic calcareous woodlands on south property only.

Carex vulpinoidea Michx. "Fox sedge." Occasional. Seepage areas and depressions.

Cyperus esculentus L. "Yellow nut-grass." Scarce. Moist fields, pastures, and lawns.

Cyperus flavescens L. "Yellow umbrella-sedge." Rare. Moist depressions, vicinity overflow pond, and retention basins on north property.

Cyperus odoratus L. "Fragrant umbrella-sedge." Scarce. Wet ditches and depressions scattered throughout.

Cyperus strigosus L. "Umbrella-sedge." Infrequent. Moist or well-drained fields, pastures, and lawns.

Eleocharis erythropoda Steud. "Creeping spike-rush." Very rare. Moist embankments and shallow flats of sediment pond on north property.

Eleocharis obtusa (Willd.) Schultes. "Blunt spike-rush." Very rare. Growing in association with previous species.

Scirpus atrovirens Willd. "Green bulrush." Occasional. Seepage areas and moist depressions throughout.

Scirpus pendulus Muhl. "Lined bulrush." Scarce. Seepage areas primarily on south property.

Scirpus tabernaemontanii K.C. Gmel. "Great bulrush." Scarce. Seepage areas, open creek embankments, drainage ditches, and pond margins.

IRIDACEAE (Iris Family)

* *Crocus vernus* L. "Spring crocus." Very rare. Ornamental species, expanding vegetatively near old homesite on south property. Native to south and central Europe.

Sisyrinchium angustifolium P. Mill. "Blue-eyed grass." Scarce. Open fields, disturbed areas and woodland borders scattered throughout.

JUNCACEAE (Rush Family)

Juncus articulatus L. "Jointed rush." Very rare. Sediment pond on north property only. Associated with *Eleocharis spp.*

Juncus interior Wieg. "Inland rush." Very rare. Well-drained upland pasture on south property only. This prairie species is listed by the Ohio Division of Natural Areas and Preserves as "endangered" in the state.

Juncus nodosus L. "Noded rush." Rare. Seepage areas and moist depressions.

Juncus tenuis Willd. "Path rush." Infrequent. Moist to subxeric fields, pastures, and open woodlands. (Includes *J. dudleyi.*)

Juncus torreyi Coville. "Torrey's rush." Infrequent. Seepage areas scattered throughout.

LEMNACEAE (Duckweed Family)

Lemna minor L. "Lesser duckweed." Rare. Sediment ponds and retention basins on north property only. Tentative identification based on sterile material.

LILIACEAE (Lily Family)

Allium canadense L. "Wild garlic." Very rare. Moist woodland on south property in vicinity of Miami-Erie Canal.

* *Allium vineale* L. "Field garlic." Common. Open fields, lawns, and pastures throughout. Native to Europe.

* *Asparagus officinalis* L. "Wild asparagus." Scarce. Open fields, pastures, and woodland thickets. Native to Eurasia.

Erythronium americanum Ker-Gawl. "Trout-lily." Infrequent. Rich, shaded slopes and riparian terraces throughout.

* *Hemerocallis fulva* (L.) L. "Day-lily." Rare. Ornamental persisting near old home sites on south property and north slope of main hill. Highly colonial and apparently spreading vegetatively by branching rhizomes and tuberous roots. Native to Eurasia.

* *Narcissus pseudonarcissus* L. "Daffodil." Very rare. Persistent near old home site on south property and likely spreading by division of subterranean bulbs. Ornamental species native to Europe.

Polygonatum biflorum (Walt.) Ell. "Smooth solomon's seal." Very rare. Moist riparian forest in the vicinity of the Miami-Erie Canal.

Trillium sessile L. "Sessile trillium." Rare. Rich woods on north and northwest-facing slopes.

ORCHIDACEAE (Orchid Family)

Spiranthes cernua (L.) L.C. Rich. "Nodding lady's tresses." Very rare. Subxeric thicket on north property.

POACEAE (Grass Family)

* *Agrostis stolonifera* L. "Redtop." Scarce. Moist soil primarily on north property. Native to Eurasia.

* *Alopecurus geniculatus* L. "Marsh foxtail." Very rare. Moist roadside depression near Overflow Pond on north property. Native to Europe.

Andropogon virginicus L. "Broomsedge." Occasional. Well-drained fields and pastures throughout.

* *Bromus commutatus* Schrad. "Common brome grass." Frequent. Fields, pastures, and moist disturbed sites throughout. Native to Europe.

* *Bromus inermis* Leyss. "Hungarian brome grass." Infrequent. Remnant of cultivation established in fields, pastures, and along roadsides. Native to Europe.

* *Bromus japonicus* Thunb. "Japanese brome grass." Infrequent. Fields, pastures, and woodland borders of south property only. Native to Eurasia.

* *Bromus racemosus* L. "Racemed brome grass." Scarce. Fields and pastures primarily on the south property. Native to Europe.

* *Bromus sterilis* L. "Sterile brome grass." Scarce. Open fields of south property only. Native to Europe.

* *Bromus tectorum* L. "Downy brome grass." Infrequent. Roadsides and waste places. Native to Europe.

Chloris verticillata Nutt. "Windmill grass." Rare. Disturbed area on north property and in vicinity of asphalt-lined pond. Prairie species occasionally adventive in eastern U.S.

* *Dactylis glomerata* L. "Orchard grass." Occasional. Remnant of cultivation persisting in fields, pastures, and woodland borders. Native to Europe.

Dichanthelium acuminatum (Sw.) Gould and Clark. "Woolly panic grass." Infrequent. Moist or subxeric fields, thickets, and woodland borders. (Includes *Panicum lanuginosum* Ell. and *P. meridionale* (Ashe) Freckmann.)

Dichanthelium clandestinum (L.) Gould. "Hidden panic grass." Rare. Upland thickets and woodland borders.

* *Digitaria ischaemum* (Schreb. ex Schweig.) Schreb. ex Muhl. "Smooth crab grass." Infrequent. Freely spreading in upland pastures and lawns. Native to Eurasia.

* *Digitaria sanguinalis* (L.) Scop. "Crab grass." Occasional. Invading lawns, pastures, and open roadsides throughout. Native to Europe.

Diplachne fascicularis (Lam.) Beauv. "Sprangletop." Very rare. Disturbed area on north property only.

* *Echinochloa crusgalli* (L.) Beauv. "Barnyard grass." Infrequent. Moist seeps, ditches, and depressions throughout. Native to Europe.

* *Eleusine indica* (L.) Gaertn. "Goose grass." Infrequent. Lawns, roadsides, and open disturbed areas throughout. Native to Eurasia.

Elymus canadensis L. "Canada wild rye." Very rare. Adjacent to drainage creek on north property.

Elymus villosus Muhl. "Hairy wild rye." Rare. Moist woodland borders on south property only.

Elymus virginicus L. "Virginia wild rye." Occasional. Moist fields, thickets, shaded streamsides, and woodland borders throughout.

Eragrostis pectinacea (Michx.) Nees. "Fringed love grass." Scarce. Disturbed areas and roadsides.

* *Festuca arundinacea* Schreb. "Meadow fescue." Common. Open fields, lawns, and pastures throughout. The commonly planted and freely escaping variant is Kentucky 31 fescue. Originally native to Eurasia.

* *Festuca rubra* L. "Red fescue." Infrequent. Possible remnant of cultivation persisting in open fields and moist depressions. Indigenous to eastern U.S. but doubtfully native in Ohio.

Glyceria striata (Lam.) A.S. Hitchc. "Fowl Mannagrass." Infrequent. Moist shaded depressions, seeps, and streamsides.

* *Hordeum jubatum* L. "Squirrel-tail barley." Scarce. Disturbed areas and roadsides scattered throughout. Native to North America but likely introduced in Ohio.

Hystrix patula Moench. "Bottlebrush grass." Rare. Moist woods and shaded riparian terraces on south property.

Leersia oryzoides (L.) Sw. "Rice cut grass." Infrequent. Moist ditches, seeps, and open streambanks.

Leersia virginica Willd. "White grass." Scarce. Moist shaded woodlands scattered throughout.

* *Lolium perenne* L. "Perennial rye grass." Scarce. Escaped turf and forage grass persisting in lawns on north property. Native to Europe.

Muhlenbergia asperifolia (Nees and Meyen). Parodi. "Scratch grass." Scarce. Open seepage areas primarily on north property.

Muhlenbergia frondosa (Poir.) Fern. "Wirestem muhly." Infrequent. Moist pastures and shaded woodland borders throughout.

Muhlenbergia schreberi J.F. Gmel. "Nimblewill." Infrequent. Fields, thickets, and moist woodlands throughout.

Panicum capillare L. "Witch grass." Scarce. Mesic or subxeric fields and pastures throughout.

Panicum dichotomiflorum Michx. "Fall panic grass." Occasional. Fields, roadsides, and disturbed areas throughout.

Panicum flexile (Gattinger) Scrib. "Narrow panic grass." Scarce. Upland fields, pastures, and open roadsides.

Paspalum pubiflorum Rupr. ex Fourn. "Paspalum." Scarce. Moist woodland borders and open depressions.

o *Phleum pratense* L. "Timothy grass." Occasional. Remnant forage grass persisting in open fields, lawns, and pastures. Native to Europe.

* *Poa annua* L. "Annual bluegrass." Infrequent. Lawns, roadsides, and disturbed areas throughout. Native to Eurasia.

* *Poa compressa* L. "Canada blue grass." Frequent. Drought-resistant cultivated forage species escaping into well-drained fields and pastures throughout. Native to Europe.

Poa interior Rydb. "Inland blue grass." Very rare. Open, disturbed habitat on north property only.

* *Poa pratensis* L. "Kentucky blue grass." Common. Rapidly spreading turf and forage species fields, lawns, and pastures throughout. Native to Europe and possibly eastern Canada.

Poa sylvestris Gray. "Woodland bluegrass." Scarce. Moist, shaded woodlands scattered throughout.

* *Puccinellia distans* (Jacq.) Parl. "Alkali-grass." Very rare. Disturbed area near water tower on SM/PP Hill. The species is restricted to strongly saline or calcareous habitats. Its increased presence, particularly in the north central states, is thought to be related to road salting operations. Native to Europe.

* *Setaria faberi* Herrm. "Chinese foxtail grass." Occasional. Recently introduced to the U.S. and aggressively spreading into moist fields, depressions, and woodland borders. Native to Asia.

* *Setaria glauca* (L.) Beauv. "Yellow foxtail grass." Frequent. Freely escaping into fields, pastures, and along roadsides. Native to Eurasia.

* *Setaria italica* (L.) Beauv. "Foxtail millet." Scarce. Possible remnant of cultivation weakly persisting in fields, pastures, and waste places. Native to Eurasia.

* *Sorghum halepense* (L.) Pers. "Johnson grass." Occasional. Possible remnant of cultivation escaping into fields, pastures, and disturbed areas throughout but most abundant in open moist areas on south property. Native to Mediterranean region.

Sporobolus asper (Michx.) Kunth. "Rough dropseed." Frequent. Well-drained upland fields and pastures. Most dominant on south property, where it sometimes forms nearly pure stands up to a hectare in size.

Sporobolus vaginiflorus (Torr. ex Gray) Wood. "Poverty grass." Infrequent. Dry fields and roadsides.

Tridens flavus (L.) A.S. Hitchc. "Purpletop." Occasional. Fields, pastures, and disturbed areas throughout.

* *Triticum aestivum* L. "Wheat." Rare. Remnant of cultivation very weakly persisting along woodland borders on south property only. Origin unknown.

SMILACACEAE (Greenbrier Family)

Smilax hispida Muhl. "Bristly greenbrier." Rare. Moist riparian forests in vicinity of Miami-Erie Canal.

TYPHACEAE (Cattail Family)

Typha angustifolia L. "Narrow-leaved cattail." Scarce. Seepage areas and moist depressions on north property only.

Typha latifolia L. "Cattail." Scarce. Seepage areas, moist ditches, pond margins, and open streambanks primarily on north property. Typically growing in association with preceding species.

ANGIOSPERMAE-DICOTYLEDONEAE

ACANTHACEAE (Acanthus Family)

Ruellia strepens L. "Smooth ruellia." Very rare. Moist forest opening on south property in vicinity of Miami-Erie Canal.

ACERACEAE (Maple Family)

Acer negundo L. "Boxelder." Common. Riparian woodlands, moist upland forests, fencerows, and thickets throughout.

* ***Acer platanoides*** L. "Norway Maple." Very rare. Ornamental species escaped to woodland border on north property. This is one of the most commonly planted shade trees in yards and along residential streets in the City of Miamisburg. Native to Europe.

Acer rubrum L. "Red maple." Rare. Widely scattered in moist woodlands.

Acer saccharinum L. "Silver maple." Occasional. Riparian forests, especially in vicinity of Miami-Erie Canal.

Acer saccharum Marsh. "Sugar maple." Scarce. Upland and moist lowland forests. (Includes the variety *"schneckii"* Rehd., possibly indicating hybridization with *A. nigrum*.)

AMARANTHACEAE (Amaranth Family)

* ***Amaranthus albus*** L. "White tumbleweed." Scarce. Disturbed areas primarily on north property. Semicosmopolitan weed likely introduced from the American tropics.

* ***Amaranthus hybridus*** L. "Prince's feather." Rare. Open disturbed areas on north property only. Like the preceding, a semicosmopolitan weed.

ANACARDIACEAE (Cashew Family)

Rhus aromatica Ait. "Fragrant sumac." Very rare. Obligate calciphyte restricted to upland woods on south property.

Rhus glabra L. "Smooth sumac." Infrequent. Thickets, early successional forests, and woodland borders scattered throughout.

Toxicodendron radicans (L.) Kuntze. "Poison ivy." Frequent. Widely distributed in subxeric to mesic woodlands, thickets, and fencerows.

ANNONACEAE (Custard-Apple Family)

Asimina triloba (L.) Dunal. "Pawpaw." Very rare. Moist shaded woodland on north property only.

APIACEAE (Parsley Family)

° *Conium maculatum* L. "Poison hemlock." Occasional. Moist forest openings, woodland borders, seeps, and depressions throughout. All parts of this plant are dangerously poisonous to humans and livestock. Native to Europe.

Cryptotaenia canadensis (L.) DC. "Honewort." Rare. Moist shaded woodlands on south property only.

• *Daucus carota* L. "Queen Anne's lace." Common. Fields, lawns, pastures, and thickets throughout. Native to Europe.

Erigenia bulbosa (Michx.) Nutt. "Harbinger-of-spring." Rare. Rich woods on north and northwest-facing slopes.

Osmorhiza longistylis (Torr.) DC. "Anise root." Scarce. Moist woods and shaded riparian terraces.

Pastinaca sativa L. "Wild parsnip." Rare. Open seepage areas on north property only.

Sanicula canadensis L. "Canada black snakeroot." Infrequent. Shaded woodlands and thickets.

• *Torilis japonica* (Houtt.) DC. "Japanese hedge parsley." Scarce. Woodland borders, seeps, and disturbed areas scattered throughout. Native to Asia.

APOCYNACEAE (Dogbane Family)

Apocynum cannibinum L. "Indian hemp." Frequent. Open fields and pastures throughout.

ASCLEPIADACEAE (Milkweed Family)

* *Asclepias syriaca* L. "Common milkweed." Infrequent. Open fields and pastures. Known from midwestern U.S. but doubtfully native in Ohio.

Asclepias tuberosa L. "Butterfly weed." Infrequent. Subxeric fields and pastures, especially on south property.

Cynanchum laeve (Michx.) Pers. "Honeyvine." Infrequent. Seepage areas, thickets, and disturbed sites.

ASTERACEAE (Aster Family)

* *Achillea millefolium* L. "Yarrow." Infrequent. Fields, lawns, pastures, and thickets scattered throughout. Native to Europe.

Ambrosia artemisiifolia L. "Common ragweed." Frequent. Fields, pastures, thickets, and disturbed areas throughout.

Ambrosia trifida L. "Giant ragweed." Infrequent. Moist fields, pastures, and woodland borders, but most conspicuous in vicinity of Miami-Erie Canal.

Antennaria plantaginifolia (L.) Richards. "Plantain-leaved pussytoes." Very rare. Dry open embankment on north property. Tentative identification based on sterile material.

* *Arctium minus* Bernh. "Burdock." Occasional. Woodland borders and disturbed areas. Native to Europe.

Aster cordifolius L. "Heart-leaved aster." Rare. Thickets and forest opening on south property only.

Aster lateriflorus (L.) Britt. "Calico aster." Scarce. Woodland borders and disturbed areas throughout.

Aster novae-angliae L. "New England aster." Occasional. Conspicuous in mesic thickets, meadows, and seepage areas.

Aster pilosus Willd. "Downy aster." Frequent. Fields, pastures, and other open areas throughout.

Aster simplex Willd. "Panicled aster." Scarce. Moist woodland borders, particularly on south property.

Bidens bipinnata L. "Spanish needles." Scarce. Open or partially shaded woods, thickets, and streamsides. Semicosmopolitan weed of American origin.

Bidens frondosa L. "Beggar's-ticks." Scarce. Riparian woodlands, thickets, and disturbed areas.

* *Carduus nutans* L. "Nodding thistle." Infrequent. Fields, pastures, roadsides, and disturbed areas throughout. Native to Europe.

* *Centaurea maculosa* Lam. "Spotted knapweed." Occasional. Fields, pastures, and disturbed areas, but most abundant on south property. Native to Europe.

* *Cichorium intybus* L. "Chickory." Frequent. Fields, pastures, roadsides, and open areas throughout. Cosmopolitan weed native to Eurasia.

* *Cirsium arvense* (L.) Scop. "Canada thistle." Frequent. Open fields, pastures, and seepage areas throughout. Highly colonial and rapidly spreading. Native to Europe.

Cirsium discolor (Muhl. ex Willd.) Spreng. "Field thistle." Occasional. Well-drained fields and pastures. The only native thistle represented at the Mound Site.

* *Cirsium vulgare* (Savi) Tenore. "Bull thistle." Infrequent. Fields and pastures. Native to Europe.

Conyza canadensis (L.) Cronq. "Horseweed." Infrequent. Old fields, pastures, lawns, and disturbed areas throughout.

Coreopsis lanceolata L. "Lance-leaved coreopsis." Very rare. Dry open hillside on north property.

Erechtites hieraciifolia (L.) Raf. ex DC. "Pilewort." Rare. Widely scattered in fields and other disturbed areas.

Erigeron annuus (L.) Pers. "Daisy fleabane." Infrequent. Fields, pastures, and disturbed areas.

Erigeron philadelphicus L. "Philadelphia fleabane." Scarce. Scattered in fields and pastures.

Erigeron strigosus Muhl. ex Willd. "White-top fleabane." Infrequent. Dry fields and pastures. Somewhat more tolerant of dry conditions than preceding species of *Erigeron*.

Eupatorium altissimum L. "Tall thoroughwort." Frequent. Well-drained fields and pastures.

Eupatorium perfoliatum L. "Boneset." Very rare. Moist disturbed area on north property.

Eupatorium rugosum Houtt. "White snakeroot." Frequent. Moist shaded woodlands, especially in the vicinity of the Miami-Erie Canal. Responsible for causing milk sickness in humans.

Euthamia graminifolia (L.) Nutt. ex Cass. "Flat-topped goldenrod." Infrequent. Fields, pastures, and woodland borders throughout.

Helianthus strumosus L. "Pale-leaved sunflower." Scarce. Woodland borders and fencerows, primarily on south property.

Helianthus tuberosus L. "Jerusalem artichoke." Scarce. Woodland borders and open thickets.

Heliopsis helianthoides (L.) Sweet. "Ox-eye." Very rare. Opening in mesic riparian forest on south property only.

Lactuca floridana (L.) Gaertn. "Woodland blue lettuce." Very rare. Forest opening on moist riparian terrace in the vicinity of the Miami-Erie Canal.

* *Lactuca saligna* L. "Willow-leaved lettuce." Occasional. Subxeric fields, pastures, thickets, and disturbed areas. Native to Europe.

* *Lactuca serriola* L. "Prickly lettuce." Infrequent. Fields, pastures, and disturbed areas throughout. Native to Europe.

* *Leucanthemum vulgare* Lam. "Ox-eye daisy." Infrequent. Fields, pastures, lawns, and thickets. Native to Europe.

* *Matricaria matricarioides* (Less.) Porter. "Pineapple-weed." Scarce. Scattered along dry roadsides and open fields throughout. Naturalized from Pacific states.

* *Onopordum acanthium* L. "Scotch-thistle." Scarce. Disturbed areas primarily on north property. Native to Europe.

* *Picris hieracioides* L. "Bitterweed." Infrequent. Scattered throughout in dry fields and open pastures. Native to Europe.

Rudbeckia laciniata L. "Cut-leaved coneflower." Scarce. Moist riverine terraces and open streamside embankments.

Rudbeckia triloba L. "Three-lobed blackeyed susan." Rare. Dry thickets and woodland borders.

Senecio glabellus Poir. "Butterweed." Rare. Moist riparian terraces on south property only.

Senecio obovatus Muhl. ex Willd. "Spatulate-leaved ragwort." Rare. Facultative calciphyte restricted to shaded woods, thickets, and riparian terraces.

Solidago canadensis L. "Canada goldenrod." Common. Conspicuous in subxeric to mesic fields, pastures, and woodland borders throughout.

* *Sonchus asper* (L.) Hill. "Spiny-leaved sow-thistle." Scarce. Fields and other disturbed habitats primarily on north property. Native to Europe.

* *Sonchus oleraceus* L. "Common sow-thistle." Very rare. Moist woodland border in vicinity of Miami-Erie Canal. Native to Europe.

* *Taraxacum officinale* Weber. "Common dandelion." Frequent. Fields, lawns, pastures, and open disturbed areas throughout. Native to Europe.

* *Tragopogon dubius* Scop. "Goat's beard." Occasional. Subxeric fields and pastures throughout. Native to Europe.

* *Tussilago farfara* L. "Coltsfoot." Very rare. Dry, exposed roadside slope on north property only. Native to Europe.

Verbesina alternifolia (L.) Britt. "Yellow wingstem." Occasional. Moist woodland borders and riparian terraces, primarily on south property.

Vernonia gigantea (Walt.) Trel. ex Branner & Coville. "Tall ironweed." Frequent. Mesic to subxeric fields and pastures throughout.

* *Xanthium strumarium* L. "Cocklebur." Scarce. Fields and disturbed open areas throughout. Native to Europe.

BALSAMINACEAE (Touch-Me-Not Family)

Impatiens capensis Meerb. "Touch-me-not." Rare. Riparian woods near Miami-Erie Canal on south property only.

BERBERIDACEAE (Barberry Family)

* *Berberis thunbergii* DC. "Japanese barberry." Very rare. Dry woodland thicket on north property only. This shade-tolerant east Asian ornamental has the potential to become an aggressive forest invader.

Podophyllum peltatum L. "May-apple." Very rare. Moist woods on south property only.

BIGNONIACEAE (Bignonia Family)

Campsis radicans (L.) Seem. ex Bureau. "Trumpet-creeper." Scarce. Thickets, woodland borders, and fencerows.

BORAGINACEAE (Borage Family)

* *Echium vulgare* L. "Viper's bugloss." Rare. Lawns, roadsides, and disturbed areas. Native to Europe.

Hackelia virginiana (L.) I.M. Johnston. "Virginia stickseed." Scarce. Mesic woodlands and thickets primarily on south property.

Myosotis macrosperma Engelm. "Large-seeded forget-me-not." Very rare. Moist shaded woodland on south property.

BRASSICACEAE (Mustard Family)

* ***Alliaria petiolata*** (Bieb.) Cavara & Grande. "Garlic mustard." Common. Very weedy and supplanting native vegetation in moist shaded woodlands. Native to Europe.

* ***Barbarea verna*** (P. Mill.) Aschers. "Spring wintercress." Scarce. Fields, pastures, and shaded riparian terraces. Native to Europe.

* ***Barbarea vulgaris*** R. Br. "Wintercress." Rare. Lawns and disturbed areas. Native to Europe.

* ***Brassica nigra*** (L.) W.D.J. Koch. "Black mustard." Scarce. Fields, pastures, and disturbed habitats. Native to Eurasia.

* ***Capsella bursa-pastoris*** (L.) Medic. "Shepherd's purse." Infrequent. Fields, lawns, pastures, and disturbed areas throughout. Native to Europe.

* ***Cardamine hirsuta*** L. "Hairy bittercress." Infrequent. Fields, lawns, and pastures throughout but most evident on south property. Native to Europe.

Dentaria laciniata Muhl. ex Willd. Infrequent. "Cut-leaved toothwort." Rich woods and forested steam terraces.

* ***Erophila verna*** (L.) Chev. "Whitlow-grass." Scarce. Open fields, lawns, pastures, and roadsides. Native to Europe.

* ***Erysimum repandum*** L. "Worm-seed mustard." Rare. Disturbed sites on north property only. Native to Eurasia.

* ***Lepidium campestre*** (L.) R. Br. "Cow-cress." Rare. Well-drained fields and pastures on south property only. Native to Europe.

Lepidium virginicum L. "Poor man's pepper." Occasional. Fields, lawns, pastures, thickets, and disturbed sites throughout.

* ***Lobularia maritima*** (L.) Desv. "Sweet alyssum." Very rare. Roadside on north property. Native to Europe.

Sibara virginica (L.) Rollins. "Virginia rock-cress." Scarce. Well-drained fields, lawns, and other disturbed areas.

* ***Thlaspi arvense*** L. "Field penny-cress." Occasional. Fields, pastures, open thickets, and woodland borders throughout. Native to Europe.

* ***Thlaspi perfoliatum*** L. "Penny-cress." Rare. Fields on south property only. Native to Europe.

CAMPANULACEAE (Harebell Family)

Lobelia inflata L. "Indian-tobacco." Rare. Old fields, open woods, and thickets scattered throughout.

Triodanis perfoliata (L.) Nieuwl. "Venus' looking-glass." Scarce. Well-drained lawns and other disturbed sites throughout.

CAPRIFOLIACEAE (Honeysuckle Family)

* ***Lonicera fragrantissima*** Lindl. & Paxton. "Fragrant honeysuckle." Very rare. Woodland border of south property near Miami-Erie Canal. Likely originating from planted specimens in the Miamisburg city park. Native to Asia.

* ***Lonicera japonica*** Thunb. "Japanese honeysuckle." Frequent. Woodland borders, thickets, and disturbed areas throughout. This species is an aggressive Asiatic invader.

* ***Lonicera maackii*** (Rupr.) Maxim. "Amur honeysuckle." Common. Aggressive and effectively established in mesic to subxeric calcareous upland forests. Frequently escaping into fields, pastures, and other disturbed areas and undoubtedly supplanting native vegetation. Ornamental landscape species native to Asia.

* ***Lonicera tatarica*** L. "Tartarian honeysuckle." Very rare. Escape from cultivation to woodland border near Miami-Erie Canal. South property only. Native to Eurasia.

Sambucus canadensis L. "American elderberry." Scarce. Moist woodland borders and streambanks.

Viburnum dentatum L. "Arrow-wood." Very rare. Moist lowland forest on north property only. Tentative identification based on sterile material.

CARYOPHYLLACEAE (Pink Family)

* ***Cerastium brachypetalum*** Pers. "Short-petalled chickweed." Scarce. Lawns and dry roadsides on north property only. Native to Europe.

* ***Cerastium fontanum*** Baumg. "Common mouse-ear chickweed." Infrequent. Fields and pastures scattered throughout. Native to Europe.

* ***Cerastium glomeratum*** Thuill. "Mouse-ear chickweed." Occasional. Fields, lawns, pastures, and disturbed areas throughout. Native to Europe.

* ***Dianthus armeria*** L. "Deptford pink." Scarce. Fields, pastures, and open thickets, primarily on south property. Native to Europe.

* ***Saponaria officinalis*** L. "Soapwort." Scarce. Moist woodland borders and open disturbed sites. Most abundant on south property. Native to Europe.

* ***Silene alba*** (P. Mill.) Krause. "White campion." Scarce. Fields, pastures, and woodland orders. Native to Eurasia.

* ***Stellaria media*** (L.) Vill. "Common chickweed." Frequent. Open or shaded habitats throughout. Native to Eurasia. In mid-spring forming dense, carpet-like stands on riparian terraces adjacent to Miami-Erie Canal.

CELASTRACEAE (Stafftree Family)

Celastrus scandens L. "American bittersweet." Scarce. Early successional forests and open thickets.

* ***Euonymus alatus*** (Thunb.) Regel. "Winged euonymus." Rare. Escaped ornamental weakly established along woodland borders and fencerows on north property. Native to Asia.

Euonymus atropurpureus Jacq. "Wahoo." Very rare. Obligate calciphyte restricted to moist riparian terraces in the vicinity of Miami-Erie Canal on south property only.

* *Euonymus fortunei* (Turcz.) Hand.-Maz. "Wintercreeper euonymus." Rare. Vegetatively propagating in moist woodlands and in vicinity of old homesite near Miami-Erie Canal. Native to Asia.

CHENOPODIACEAE (Goosefoot Family)

* *Atriplex patula* L. "Spearscale orache." Rare. Open disturbed areas on north property only. More common in eastern coastal regions. Native to Eurasia.

* *Chenopodium album* L. "Lamb's quarters." Infrequent. Lawns and disturbed sites scattered throughout. Native to Europe.

CLUSIACEAE (St. John's-Wort Family)

* *Hypericum perforatum* L. "Common St. John's-wort." Infrequent. Well-drained fields, pastures, and thickets throughout. Native to Europe.

Hypericum punctatum Lam. "Spotted St. John's-wort." Rare. Open woods and thickets on south property only.

CONVOLVULACEAE (Morning-Glory Family)

* *Convolvulus arvensis* L. "Field bindweed." Frequent. Fields, lawns, thickets, and other disturbed areas throughout. Native to Eurasia.

* *Ipomea nil* (L.) Roth. "Ivy-leaved morning-glory." Infrequent. Fields, pastures, thickets, and disturbed areas. Native to tropical America.

Ipomea pandurata (L.) G. F. W. Mey. "Wild potato vine." Infrequent. Open seeps, stream banks, and disturbed areas.

* *Ipomea purpurea* (L.) Roth. "Purple morning-glory." Scarce. Disturbed areas and woodland borders. Native to tropical America.

CORNACEAE (Dogwood Family)

Cornus drummondii C. A. Mey. "Roughleaf dogwood." Rare. Moist open areas primarily on north property.

CUCURBITACEAE (Gourd Family)

Sicyos angulatus L. "Bur-cucumber." Very rare. Shaded riparian terrace adjacent to Miami-Erie Canal on south property only.

DIPSACACEAE (Teasel Family)

* *Dipsacus fullonum* L. "Teasel." Frequent. Fields, pastures, and disturbed habitats throughout. Native to Europe.

ELAEAGNACEAE (Oleaster Family)

* *Elaeagnus umbellata* Thunb. "Autumn-olive." Rare. Ornamental shrub escaping into moist woodland borders and thickets on south property. Native to Eurasia.

EUPHORBIACEAE (Spurge Family)

Acalypha gracilens Gray. "Narrow-leaved three-seeded mercury." Scarce. Dry calcareous fields and pastures.

Acalypha rhomboidea Raf. "Three-seeded mercury." Occasional. Subxeric to mesic fields, pastures, roadsides, and disturbed areas throughout.

Chamaesyce maculata (L.) Small. "Wartweed." Scarce. Subxeric fields, roadsides, and open disturbed habitats.

Chamaesyce nutans (Lag.) Small. "Nodding spurge." Scarce. Well-drained fields, roadsides, and open disturbed habitats throughout.

Croton monanthogynus Michx. "Prarie-tea." Very rare. Dry calcareous openings on north property only.

Euphorbia corollata L. "Flowering spurge." Infrequent. Dry upland thickets and woodland borders.

* *Euphorbia falcata* L. "Spurge." Rare. Thin subxeric soils in open fields, pastures, and sunny embankments. Recent Ohio introduction native to Mediterranean region.

Poinsettia dentata (Michx.) Klotzsch & Garcke. "Toothed spurge." Infrequent. Dry open habitats scattered throughout.

FABACEAE (Pea Family)

Cassia marilandica L. "Wild senna." Moist forest openings and thickets primarily on south property.

Cercis canadensis L. "Eastern redbud." Occasional. Upland forests, woodland borders, and thickets throughout. *Cercis* is a facultative calciphyte.

* *Coronilla varia* L. "Crown-vetch." Frequent. Likely planted at Mound and now freely established in fields, pastures, lawns, and open disturbed areas. Most abundant on north property. Native to Europe.

Desmodium canescens (L.) DC. "Hoary tick-trefoil." Scarce. Woodland borders primarily on south property.

Gleditsia triacanthos L. "Honeylocust." Occasional. Subxeric to mesic forests throughout, but most abundant in early successional woodlands.

Gymnocladus dioicus (L.) K. Koch. "Kentucky coffeetree." Rare. Calcareous upland forests primarily on south property.

* *Lathyrus latifolius* L. "Everlasting pea." Scarce. Fields, pastures, and disturbed sites primarily on north property. Native to Europe.

* *Medicago lupulina* L. "Black medic." Common. Fields, lawns, pastures, roadsides, and disturbed areas throughout. Native to Europe.

* ***Melilotus alba*** Medic. "White sweet-clover." Frequent. Fields, pastures, and open disturbed areas. Native to Europe.

* ***Melilotus officinalis*** (L.) Pallas. "Yellow sweet-clover." Frequent. Fields, pastures, and open disturbed areas. Native to Europe.

Robinia pseudoacacia L. "Black locust." Frequent. Subxeric to mesic woodlands, open thickets, fencerows, and disturbed areas throughout.

* ***Trifolium campestre*** Schreb. "Low hop-clover." Scarce. Fields, lawns, and pastures. Native to Europe. This and the following three species of clover were originally introduced into the U.S. as forage plants for livestock.

* ***Trifolium hybridum*** L. "Alsike clover." Rare. Lawns on north property only. Native to Europe.

* ***Trifolium pratense*** L. "Red clover." Occasional. Fields, pastures, lawns, and disturbed areas. Native to Europe.

* ***Trifolium repens*** L. "White clover." Frequent. Fields, pastures, lawns, and disturbed areas. Native to Europe.

* ***Vicia villosa*** Roth. "Hairy vetch." Scarce. Seepage areas and disturbed sites on north property only. Native to Europe. (Includes *V. dasycarpa* Ten.)

FAGACEAE (Beech Family)

Quercus macrocarpa Michx. "Bur oak." Scarce. Mesic calcareous woodlands primarily on south property.

Quercus muhlenbergii Englem. "Chinkapin oak." Occasional. Obligate calciphyte found on subxeric to mesic upland sites.

Quercus rubra L. "Northern red oak." Rare. Moist streamside and north-facing upland slope forest on north property only.

Quercus shumardi Buckl. "Shumard oak." Very rare. North-facing slope forest on north property only.

GERANIACEAE (Geranium Family)

* ***Erodium cicutarium*** (L.) L'Her. "Storksbill." Rare. Lawns, roadsides, and disturbed areas on north property only. Native to Europe.

Geranium carolinianum L. "Carolina cranesbill." Scarce. Fields, lawns, and disturbed sites scattered throughout.

HIPPOCASTANACEAE (Horse-chestnut Family)

Aesculus glabra Willd. "Ohio buckeye." Infrequent. Facultative calciphte occupying subxeric uplands and mesic lowlands. All parts of this tree are considered toxic to humans.

HYDROPHYLLACEAE (Waterleaf Family)

Phacelia purshii Buckl. "Miami mist." Occasional. Moist fields, pastures, and thickets primarily on south property. The common name commemorates the species' abundance in the Miami River drainage.

JUGLANDACEAE (Walnut Family)

Carya cordiformis (Wang.) K. Koch. "Bitternut hickory." Scarce. Moist hillsides and mesic lowland forests.

Carya ovata (P. Mill.) K. Koch. "Shagbark hickory." Very rare. North-facing slope forest on north property only.

Juglans nigra L. "Black walnut." Occasional. Moist upland and mesic lowland forests. Occasionally invading abandoned fields and forming nearly pure stands.

LAMIACEAE (Mint Family)

Clinopodium vulgare L. "Common basil." Rare. Dry open thickets. Native in part.

* *Glechoma hederacea* L. "Gill-over-the-ground." Scarce. Shaded riparian forests and moist woodland borders, primarily on south property. Native to Europe.

* *Lamium amplexicaule* L. "Henbit." Scarce. Fields, lawns, roadsides, and disturbed areas. Native to Europe.

* *Lamium purpureum* L. "Dead-nettle." Scarce. Fields, lawns, and disturbed areas. Native to Europe.

* *Nepeta cataria* L. "Catnip." Scarce. Moist woodland borders primarily in the vicinity of the Miami-Erie Canal. Native to Europe.

Prunella vulgaris L. "Heal-all." Infrequent. Fields, pastures, and woodland thickets.

Salvia lyrata L. "Lyre-leaved sage." Scarce. Well-drained fields, lawns, pastures, and open thickets.

Scutellaria ovata Hill. "Heart-leaved skullcap." Very rare. North-facing slope forest on north property only.

Stachys nuttallii Shuttlw. ex Benth. "Hairy hedge-nettle." Scarce. Moist fields and woodland borders, primarily on south property.

Stachys tenuifolia Small. "Hedge-nettle." Scarce. Moist fields and woodland borders in the vicinity of the Miami-Erie Canal on south property only.

Teucrium canadense L. "Wood-sage." Scarce. Woodland borders and riparian forests in vicinity of Miami-Erie Canal.

LYTHRACEAE (Loosestrife Family)

Cuphea viscosissima Jacq. "Clammy cuphea." Rare. Dry fields and open thickets on south property only.

MALVACEAE (Mallow Family)

* ***Abutilon theophrasti*** Medic. "Velvet leaf." Rare. Open disturbed habitats on north property only. Native to India.

* ***Hibiscus trionum*** L. "Flower-of-an-hour." Rare. Disturbed sites and roadsides on north property only. Native to Europe.

* ***Malva neglecta*** Walls. "Common mallow." Rare. Open riparian habitats and moist fields in vicinity of Miami-Erie Canal on south property. Native to Eurasia and north Africa.

MENISPERMACEAE (Moonseed Family)

Menispermum canadense L. "Moonseed." Rare. North-facing upland slope forest on north property only.

MORACEAE (Mulberry Family)

* ***Humulus japonicus*** Sieb. & Zucc. "Japanese hops." Very rare. Moist woodland border on south property in vicinity of Miami-Erie Canal. Native to eastern Asia.

* ***Maclura pomifera*** (Raf.) Schneid. "Osage-orange." Occasional. Riparian forests and moist woodland borders primarily on south property. Native to south-central U.S.

* ***Morus alba*** L. "White mulberry." Frequent. Strongly established in subxeric and mesic forests, thickets, and fencerows. Native to Asia.

Morus rubra L. "Red mulberry." Rare. Moist lowlands and stream terraces.

NYCTAGINACEAE (Four-O'clock Family)

Mirabilis nyctaginea (Michx.) MacM. "Four-o'clock." Rare. Moist woodland borders on south property only.

OLEACEAE (Olive Family)

Fraxinus americana L. "White ash." Common. Subxeric upland to moist lowland forests and thickets throughout.

Fraxinus pennsylvanica Marsh. "Green ash." Very rare. Riparian forest on south property only.

Fraxinus quadrangulata Michx. "Blue ash." Frequent. Obligate calciphyte reaching greatest abundance on south- and west-facing upland slopes.

* ***Ligustrum vulgare*** L. "Common privet." Scarce. Ornamental hedge species becoming established in moist or dry woodland borders and in open thickets. Native to Europe.

ONAGRACEAE (Evening Primrose Family)

Epilobium coloratum Biehler. "Willow-herb." Scarce. Open seepage areas, moist depressions, and streamsides. Found primarily on north property.

Gaura biennis L. "Biennial gaura." Very rare. Open disturbed habitats on north property.

Gaura parviflora Dougl. "Small-flowered gaura." Very rare. Moist open streambank on south property only. A species with more western affinities.

Oenothera biennis L. "Evening primrose." Occasional. Open fields, streamsides, and disturbed sites throughout.

OXALIDACEAE (Wood Sorrell Family)

Oxalis dillenii Jacq. "Yellow sorrell." Frequent. Fields, pastures, lawns, and disturbed areas throughout.

Oxalis stricta L. "Yellow wood sorrell." Infrequent. Scattered in fields, pastures, and lawns.

PAPAVERACEAE (Poppy Family)

Dicentra cucullaria (L.) Bernh. "Dutchman's breeches." Scarce. Rich north- and northwest-facing slopes and riparian terraces.

Sanguinaria canadensis L. "Bloodroot." Very rare. North-facing upland slope forest on north property only.

PHYTOLACCACEAE (Pokeweed Family)

Phytolacca americana L. "Pokeweed." Scarce. Woodland borders, forest openings, and disturbed habitats scattered throughout.

PLANTAGINACEAE (Plantain Family)

Plantago aristata Michx. "Bracted plantain." Rare. Dry gravel adjacent to roadsides and parking areas.

* *Plantago lanceolata* L. "English plantain." Common. Well-drained fields, pastures, lawns, and disturbed areas throughout. Native to Europe.

Plantago rugelii Dcne. "Broad-leaved plantain." Occasional. Lawns, fields, roadsides, and disturbed areas.

PLATANACEAE (Sycamore Family)

Platanus occidentalis L. "American sycamore." Scarce. Primarily in riparian woodlands, but occasionally becoming weakly established on less favorable sites.

POLYGONACEAE (Buckwheat Family)

Polygonum aviculare L. "Bird knotweed." Occasional. Lawns, roadsides, sidewalks, and other disturbed areas. Most abundant on north property.

Polygonum erectum L. "Tall knotweed." Scarce. Scattered in disturbed habitats throughout.

Polygonum lapathifolium L. "Smartweed." Rare. Moist open areas on north property only.

Polygonum pensylvanicum (L.) Small. "Pennsylvania smartweed." Infrequent. Moist ditches, depressions, and open streambanks.

* *Polygonum persicaria* L. "Lady's thumb." Infrequent. Moist seeps and depressions. Native to Europe.

Polygonum punctatum Ell. "Punctate smartweed." Infrequent. Open seeps, ditches, gravel bars, and pond margins.

Polygonum scandens L. "Climbing buckwheat." Occasional. Lawns, open thickets, and disturbed areas throughout.

* *Rumex acetosella* L. "Sheep-sorrel." Occasional. Fields, pastures, lawns, and disturbed areas throughout. Native to Europe.

* *Rumex crispus* L. "Curly dock." Occasional. Moist or dry open areas throughout. Most heavily concentrated in seepage areas on north property. Native to Europe.

* *Rumex obtusifolius* L. "Bitter dock." Scarce. Open seepage areas and moist woodland borders, primarily on north property. Native to Europe.

PORTULACACEAE (Purslane Family)

Claytonia virginica L. "Spring beauty." Infrequent. Mesic slope forests and shaded riparian terraces.

* *Portulaca oleracea* L. "Common purslane." Scarce. Scattered in lawns, roadsides, and other open disturbed sites on north property. Native to Europe.

PRIMULACEAE (Primrose Family)

* *Anagallis arvensis* L. "Scarlet pimpernel." Scarce. Dry fields, roadsides, and disturbed areas. Native to Europe.

* *Lysimachia nummularia* L. "Moneywort." Rare. Moist fields and open depressions. Nature to Europe.

RANUNCULACEAE (Buttercup Family)

Delphinium tricorne Michx. "Dwarf larkspur." Infrequent. Scattered throughout on moist, shaded hillsides, but most conspicuous on north-facing slopes with calcareous parent material at or close to the surface.

Ranunculus abortivus L. "Kidney-leaved buttercup." Scarce. Open or shaded mesic situations primarily on south property.

RHAMNACEAE (Buckthorn Family)

* *Rhamnus cathartica* L. "European buckthorn." Scarce. Riparian forests, moist thickets, and woodland borders. Native to Europe.

Rhamnus lanceolata Pursh. "Lance-leaved buckthorn." Rare. Obligate calciphyte found in open upland forests and thickets.

ROSACEAE (Rose Family)

Agrimonia pubescens Wallr. "Hairy agrimony." Rare. Moist shaded woodlands on south property only.

Crataegus crus-galli L. "Cock-spur hawthorn." Rare. Dry upland thickets and forest openings.

Crataegus mollis (Torr. & Gray) Scheele. "Soft hawthorn." Frequent. Moist or dry early successional woodlands and thickets throughout.

Geum canadense Jacq. "White avens." Occasional. Mesic to subxeric fields, pastures, thickets, and early successional woodlands.

Geum vernum (Raf.) Torr. & Gray. "Spring avens." Occasional. Mesic fields, pastures, thickets, and early successional woodlands.

Geum virginianum L. "Rough avens." Scarce. Mesic fields and thickets on south property only.

* *Malus pumila* P. Mill. "Apple." Rare. Scattered remnant of cultivation weakly adventive along woodland borders and fencerows. Native to Eurasia.

* *Potentilla recta* L. "Rough-fruited cinquefoil." Frequent. Fields, pastures, and disturbed areas throughout. Native to Europe.

* *Prunus avium* (L.) L. "Sweet cherry." Very rare. Escaped ornamental scarcely persisting in north-facing slope forests and woodland borders. Weakley adventive in open fields and along fence rows. Native to Eurasia.

Prunus serotina Ehrh. "Black cherry." Scarce. Moist or dry early successional forests, woodland borders, and fencerows throughout.

* *Pyracantha coccinea* M. Roemer. "Fiery thorn." Rare. Ornamental shrub becoming weakly established on dry sunny embankments on north property. Native to Eurasia.

* *Pyrus communis* L. "Pear." Rare. Upland forests and fencerows on north property. Remnant of cultivation and weakly adventive. Native to Eurasia.

* *Rosa canina* L. "Dog rose." Rare. Escape from cultivation and established in old fields, fencerows, and woodland borders of south property. Native to Europe.

* *Rosa multiflora* Thunb. ex Murr. "Multiflora rose." Occasional. Aggressively invading old fields, pastures, thickets, and woodland borders. Native to east Asia.

Rosa setigera Michx. "Prairie rose." Scarce. Old fields, fencerows, and woodland borders primarily on south property.

Rubus allegheniensis Porter ex Bailey. "Hairy blackberry." Infrequent. Subxeric to mesic fields, pastures, and woodland borders.

Rubus flagellaris Willd. "Northern dewberry." Scarce. Moist fields, pastures, and thickets.

* *Rubus laciniatus* Willd. "Cut-leaved blackberry." Very rare. Dry open embankments on north property only. Native to Europe.

Rubus occidentalis L. "Black raspberry." Scarce. Old fields and woodland borders primarily on south property.

RUBIACEAE (Madder Family)

Galium aparine L. "Bedstraw." Infrequent. Mesic fields, pastures, and early successional woodlands.

Galium circaezans Michx. "Wild licorice." Scarce. Moist shaded woodlands scattered throughout.

Galium triflorum Michx. "Fragrant bedstraw." Rare. Moist shaded woodlands on south property only.

RUTACEAE (Rue Family)

Ptelea trifoliata L. "Hop-tree." Very rare. Moist calcareous rock outcrop on north property only.

SALICACEAE (Willow Family)

Populus deltoides Bartr. ex Marsh. "Eastern cottonwood." Occasional. Riparian forests, mesic upland forests, and disturbed areas throughout. Scattered large superdominant trees in south property forests are likely old remnant pasture trees.

Salix exigua Nutt. "Sandbar willow." Scarce. Seepage slopes and drainage ditches on north property only.

* *Salix matsudana* Koidz. "Corkscrew willow." Very rare. Scattered saplings found along fencerows on south property represent propagules originating from seed blown in from planted ornamental trees. Specimens on Mound Site are, as of yet, sexually immature but exhibit the convoluted growth pattern typical of the species. Native to northeast Asia.

Salix nigra Marsh. "Black willow." Scarce. Riparian terraces, ravines, and woodland borders.

SAXIFRAGACEAE (Saxifrage Family)

Ribes cynosbati L. "Prickly gooseberry." Very rare. Moist woodland border on south property in vicinity of Miami-Erie Canal. Tentative identification based on sterile material.

SCROPHULARIACEAE (Figwort Family)

* *Chaenorrhinum minus* (L.) Lange. "Dwarf snapdragon." Scarce. Roadsides, parking areas, railroad sidings, and other disturbed sites on north property. Native to Europe.

* *Linaria vulgaris* P. Mill. "Butter and eggs." Rare. Garden species escaping into woodland borders and fencerows. Native to Europe.

Scrophularia marilandica L. "Figwort." Very rare. Moist woodland borders on south property only.

* *Verbascum blattaria* L. "Moth mullein." Occasional. Fields, pastures, lawns, and disturbed areas throughout. Both white and yellow flowering forms occur on site. Native to Europe.

* *Verbascum thapsus* L. "Common mullein." Scarce. Fields and pastures scattered throughout. Native to Europe.

Veronica anagallis-aquatica L. "Water speedwell." Scarce. Seepage areas, pond margins, and moist streambanks on north property only.

* *Veronica arvensis* L. "Corn speedwell." Frequent. Fields, lawns, pastures, and disturbed areas throughout. Native to Europe.

* *Veronica serpyllifolia* L. "Thyme-leaved speedwell." Infrequent. Scattered throughout in lawns and other disturbed sites. Native to Europe.

SIMAROUBACEAE (Quassia Family)

* ***Ailanthus altissima*** (P. Mill.) Swingle. "Tree-of-heaven." Rare. Invading woodland borders and open disturbed areas. Native to east Asia.

SOLANACEAE (Nightshade Family)

* ***Datura stramonium*** L. "Jimson weed." Rare. Disturbed areas and railroad siding on north property only. Seeds of this species are particularly poisonous to humans and livestock. Native to Asia.

* ***Lycopersicon esculentum*** P. Mill. "Tomato." Disturbed open areas and around sewage treatment facility on north property. Probably does not persist, but likely maintained from import of seed by Mound workers. Cultivated variety of tropical American ancestor.

Physalis heterophylla Nees. "Clammy ground-cherry." Scarce. Dry fields, pastures, and open thickets.

Physalis subglabrata Mackenzie & Bush. "Smooth ground-cherry." Scarce. Dry fields, pastures, and disturbed areas primarily on south property.

Solanum americanum P. Mill. "Nightshade." Rare. Moist thickets and woodland borders. Poisonous to humans.

Solanum carolinense L. "Horse nettle." Infrequent. Subxeric to mesic fields, pastures, and disturbed areas scattered throughout.

* ***Solanum dulcamara*** L. "Bittersweet." Scarce. Seepage areas and moist streambanks primarily on north property. Poisonous to humans. Native to Europe.

ULMACEAE (Elm Family)

Celtis occidentalis L. "Hackberry." Common. Subxeric to mesic calcareous woodlands and thickets throughout.

Ulmus americana L. "American elm." Common. Moist and dry woodlands throughout.

* ***Ulmus pumila*** L. "Siberian elm." Rare. Weakly adventive in fields, pastures, and along fencerows. Several mature trees remain in vicinity of old homesite on south property. Once popular shade tree native to east Asia.

Ulmus rubra Muhl. "Slippery elm." Scarce. Upland woods particularly on north property. The species is a facultative calciphyte.

URTICACEAE (Nettle Family)

Pilea pumila (L.) Gray. "Clearweed." Occasional. Moist shaded upland woods, lowland terraces, and riparian forests. Most abundant in vicinity of Miami-Erie Canal.

* ***Urtica dioica*** L. "Stinging nettle." Scarce. Moist woodland borders and forest openings, primarily on south property. Native to Eurasia.

VALERIANACEAE (Valerian Family)

Valerianella radiata (L.) Dufr. "Corn salad." Scarce. Moist fields, lawns, and pastures, especially on south property.

Valerianella umbilicata (Sullivant) Wood. "Lamb's-lettuce." Rare. Moist fields and woodland borders on south property only.

VERBENACEAE (Vervain Family)

Verbena simplex Lehm. "Narrow-leaved vervain." Very rare. Open seepage slopes and dry fields on north property only.

Verbena stricta Vent. "Hoary vervain." Very rare. Dry open embankment on north property only.

Verbena urticifolia L. "White vervain." Infrequent. Moist woodland borders and riparian terraces.

VIOLACEAE (Violet Family)

Viola sororia Willd. "Blue violet." Infrequent. Moist fields and woodlands, primarily on south property.

Viola striata Ait. "Creamy violet." Scarce. Moist woodland borders on south property.

VITACEAE (Grape Family)

Parthenocissus quinquefolia (L.) Planch. "Virginia creeper." Occasional. Subxeric to mesic forests, woodland borders, and thickets throughout.

Vitis vulpina L. "Frost grape." Occasional. Woodland borders, clearings, and open thickets throughout.

Table B.1. Summary of Plant Taxa at the Mound Site

Family	Genera	Species
PTERIDOPHYTA		
1. Aspleniaceae	1	1
2. Equisetaceae	1	1
3. Ophioglossaceae	1	1
Subtotal	3	3
GYMNOSPERMAE		
4. Cupressaceae	1	1
5. Pinaceae	1	2
Subtotal	2	3
ANGIOSPERMAE-MONOCOTYLEDONEAE		
6. Agavaceae	1	1
7. Alismaceae	1	1
8. Commelinaceae	1	1
9. Cyperaceae	4	17
10. Iridaceae	2	2
11. Juncaceae	1	5
12. Lemnaceae	1	1
13. Liliacae	7	8
14. Orchidaceae	1	1
15. Poaceae	30	52
16. Smilacaceae	1	1
17. Typhaceae	1	2
Subtotal	51	92
ANGIOSPERMAE-DICOTYLEDONEAE		
18. Acanthaceae	1	1
19. Aceraceae	1	5
20. Amaranthaceae	1	2
21. Anacardiaceae	2	3
22. Annonaceae	1	1
23. Apiaceae	8	8
24. Apocynaceae	1	1

Table B.1. (page 2 of 3)

Family	Genera	Species
25. Asclepiadaceae	2	3
26. Asteraceae	33	51
27. Balsaminaceae	1	1
28. Berberidaceae	2	2
29. Bignoniaceae	1	1
30. Boraginaceae	3	3
31. Brassicaceae	12	15
32. Campanulaceae	2	2
33. Caprifoliaceae	3	6
34. Caryophyllaceae	5	7
35. Celastraceae	2	4
36. Chenopodiaceae	2	2
37. Clusiaceae	1	2
38. Convolvulaceae	2	4
39. Cornaceae	1	1
40. Cucurbitaceae	1	1
41. Dispsacaceae	1	1
42. Elaeagnaceae	1	1
43. Euphorbiaceae	5	8
44. Fabaceae	12	16
45. Fagaceae	1	4
46. Geraniaceae	2	2
47. Hippocastanaceae	1	1
48. Hydrophyllaceae	1	1
49. Juglandaceae	2	3
50. Lamiaceae	9	11
51. Lythraceae	1	1
52. Malvaceae	3	3
53. Menispermaceae	3	4
54. Moraceae	2	3
55. Nyctaginaceae	1	1

Table B.1. (page 3 of 3)

Family	Genera	Species
56. Oleaceae	2	4
57. Onagraceae	3	4
58. Oxalidaceae	1	2
59. Papaveraceae	2	2
60. Phytolaccaceae	1	1
61. Plantaginaceae	1	3
62. Platanaceae	1	1
63. Polygonaceae	2	10
64. Portulacaceae	2	2
65. Primulaceae	2	2
66. Ranunculaceae	2	2
67. Rhamnaceae	1	2
68. Rosaceae	10	19
69. Rubiaceae	1	3
70. Rutaceae	1	1
71. Salicaceae	2	4
72. Saxifragaceae	1	1
73. Scrophulariaceae	5	8
74. Simaroubaceae	1	1
75. Solanaceae	4	7
76. Ulmaceae	2	4
77. Urticaceae	2	2
78. Valerianaceae	1	2
79. Verbenaceae	1	3
80. Violaceae	1	2
81. Vitaceae	2	2
Subtotal	186	278
Grand Total	**242**	**376**

Table B.2. Largest Families at the Mound Site and Representation within Each by Exotic Species

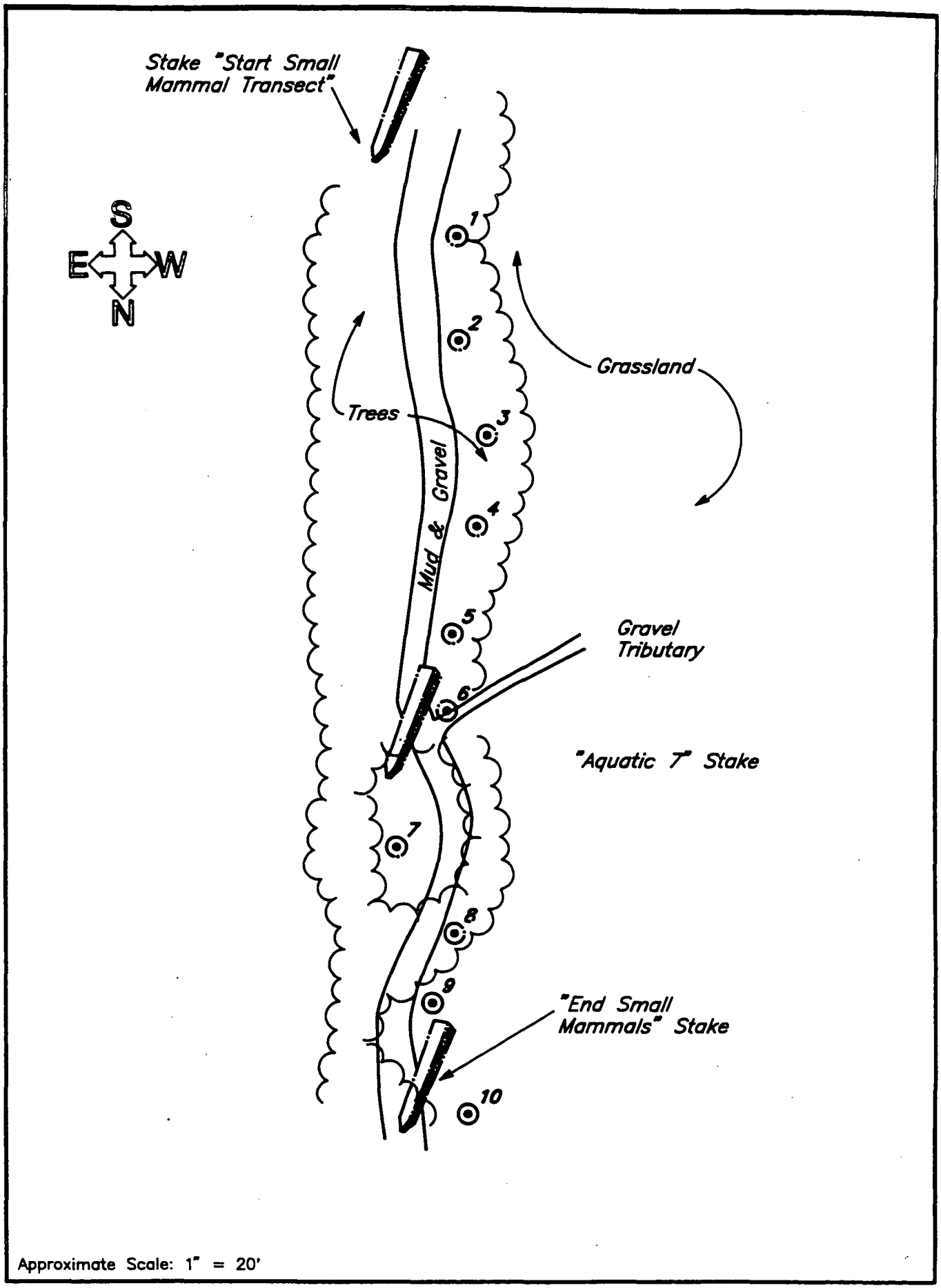
Family	Total Species	Exotic Species	Percent Exotic	Family	Total Species	Exotic Species	Percent Exotic
Poaceae	52	27	51.9	Convolvulaceae	4	3	75.0
Asteraceae	51	19	37.3	Fagaceae	4	0	0.0
Rosaceae	19	8	42.1	Moraceae	4	3	75.0
Cyperaceae	17	0	0.0	Oleaceae	4	1	25.0
Fabaceae	16	10	62.5	Onagraceae	4	0	0.0
Brassicaceae	15	12	80.0	Salicaceae	4	1	25.0
Lamiaceae	11	4	36.4	Ulmaceae	4	1	25.0
Polygonaceae	10	4	40.0	Anacardiaceae	3	0	0.0
Apiaceae	8	3	37.5	Asclepiadaceae	3	1	33.3
Euphorbiaceae	8	1	12.5	Boraginaceae	3	1	33.3
Liliaceae	8	4	50.0	Juglandaceae	3	0	0.0
Scrophulariaceae	8	6	75.0	Malvaceae	3	3	100.0
Caryophyllaceae	7	7	100.0	Plantaginaceae	3	1	33.3
Solanaceae	7	3	42.9	Rubiaceae	3	0	0.0
Caprifoliaceae	6	4	66.7	Verbenaceae	3	0	0.0
Aceraceae	5	1	20.0				
Juncaceae	5	0	0.0				
Celastraceae	4	2	50.0				

Table B.3. Largest Genera at the Mound Site and Representation within Each by Exotic Species

Genus	Total Species	Exotic Species	Percent Exotic	Genus	Total Species	Exotic Species	Percent Exotic
Carex	8	0	0.0	*Eupatorium*	3	0	0.0
Polygonum	7	1	14.3	*Franxinus*	3	0	0.0
Bromus	6	6	100.0	*Geum*	3	0	0.0
Acer	5	1	20.0	*Ipomea*	3	2	0.0
Aster	5	0	0.0	*Lactuca*	3	2	66.7
Juncus	5	0	0.0	*Muhlenbergia*	3	0	0.0
Poa	5	3	60.0	*Panicum*	3	0	0.0
Cyperus	4	0	0.0	*Plantago*	3	2	33.3
Lonicera	4	4	100.0	*Rosa*	3	2	66.7
Quercus	4	0	0.0	*Rumex*	3	1	33.3
Rubus	4	1	25.0	*Salix*	3	0	0.0
Trifolium	4	4	100.0	*Scirpus*	3	0	0.0
Cerastium	3	3	100.0	*Setaria*	3	3	100.0
Cirsium	3	2	66.7	*Solanum*	3	1	33.3
Elymus	3	0	0.0	*Ulmus*	3	1	33.3
Erigeron	3	0	0.0	*Verbena*	3	0	0.0
Euonymus	3	2	66.7	*Veronica*	3	2	66.7

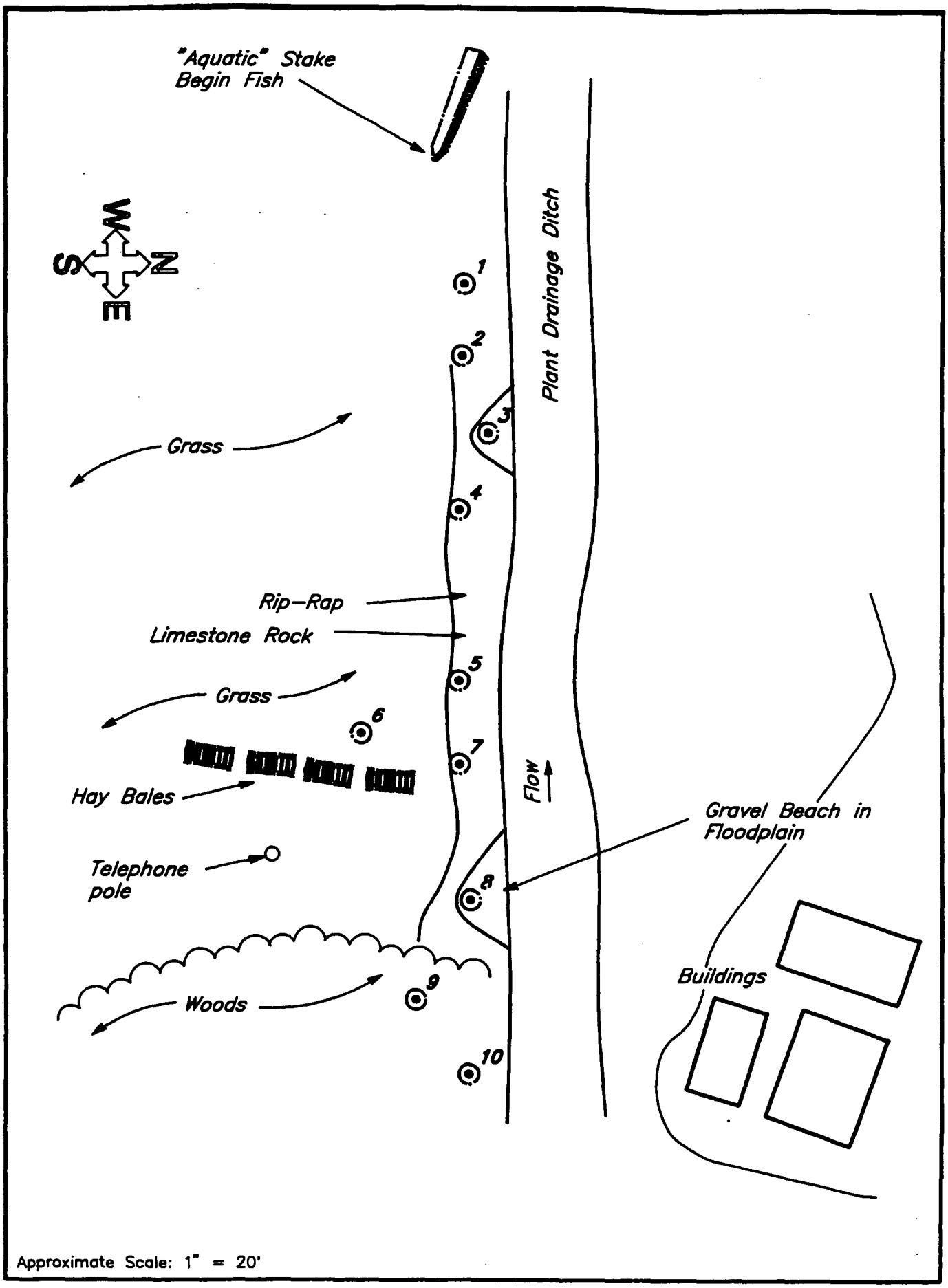
APPENDIX C

SMALL MAMMAL
TRAP AND HERPTILE DRIFT FENCE FIGURES



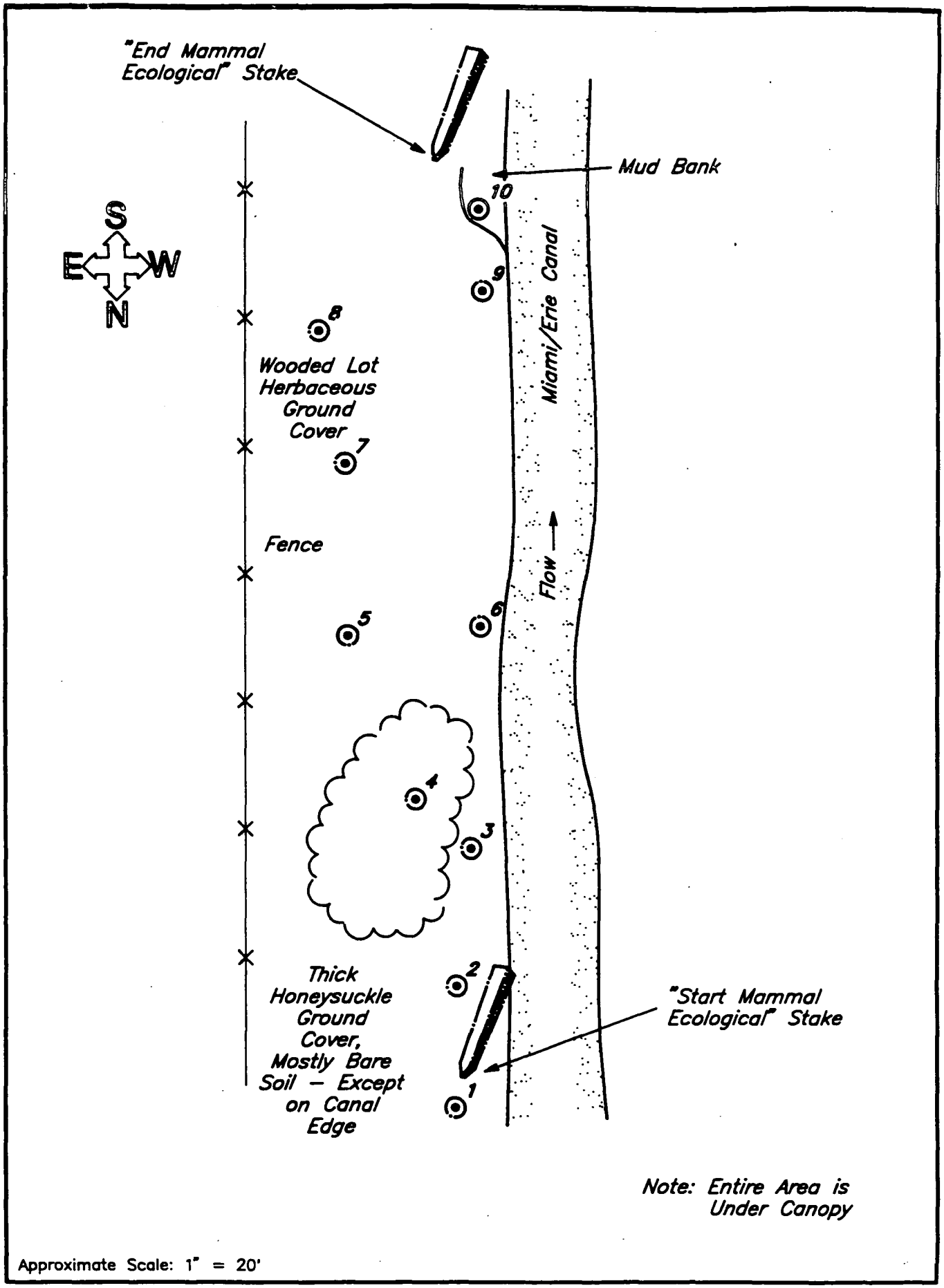
MOU-8 (1:28) 1/14/94

Figure C.1. Small mammal transect along Benner Branch (Benner Branch transect).



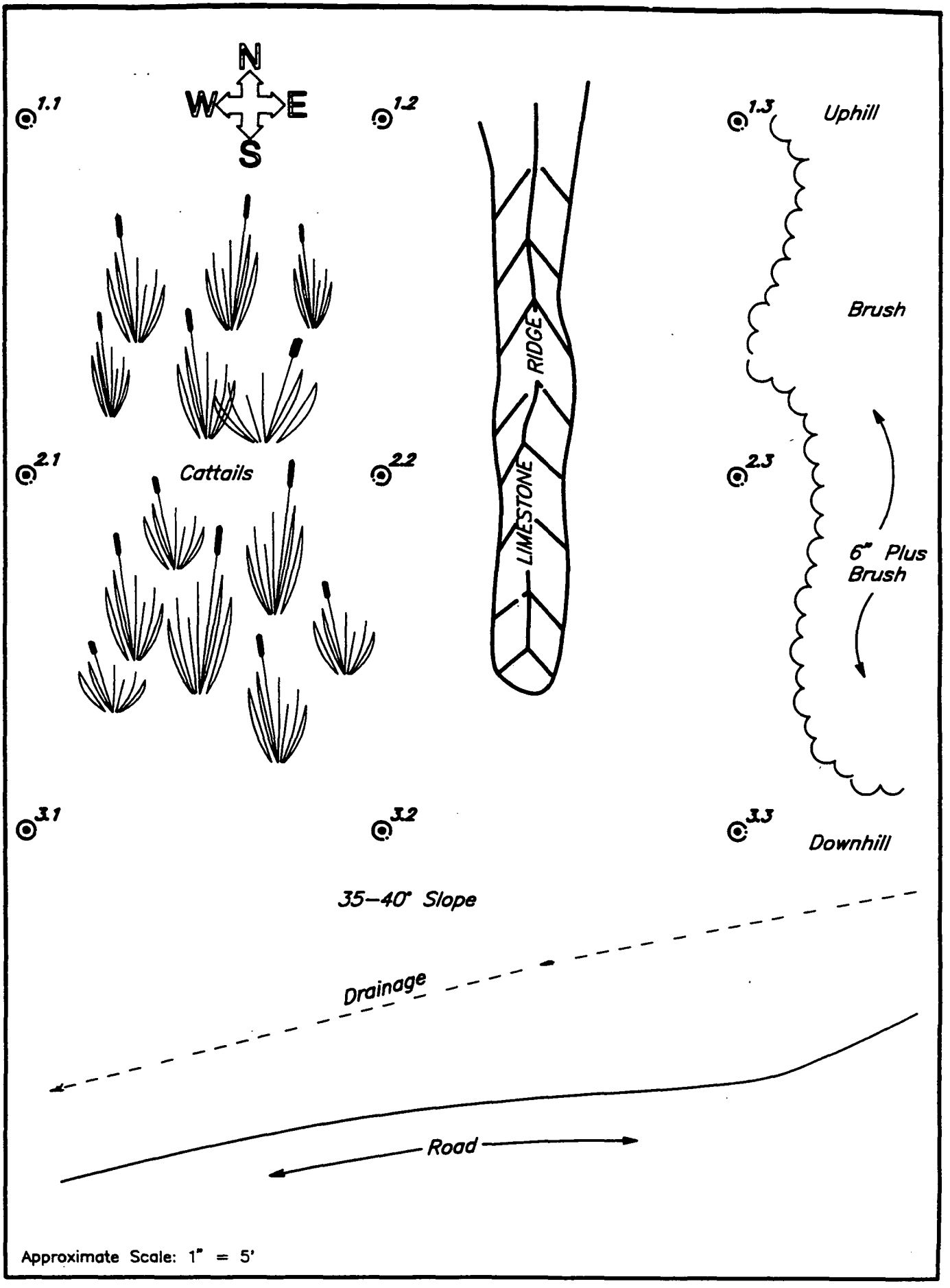
MOU-1 (1:28) 1/11/94

Figure C.2. Small mammal transect along Plant Drainage Ditch (Drainage Ditch transect).



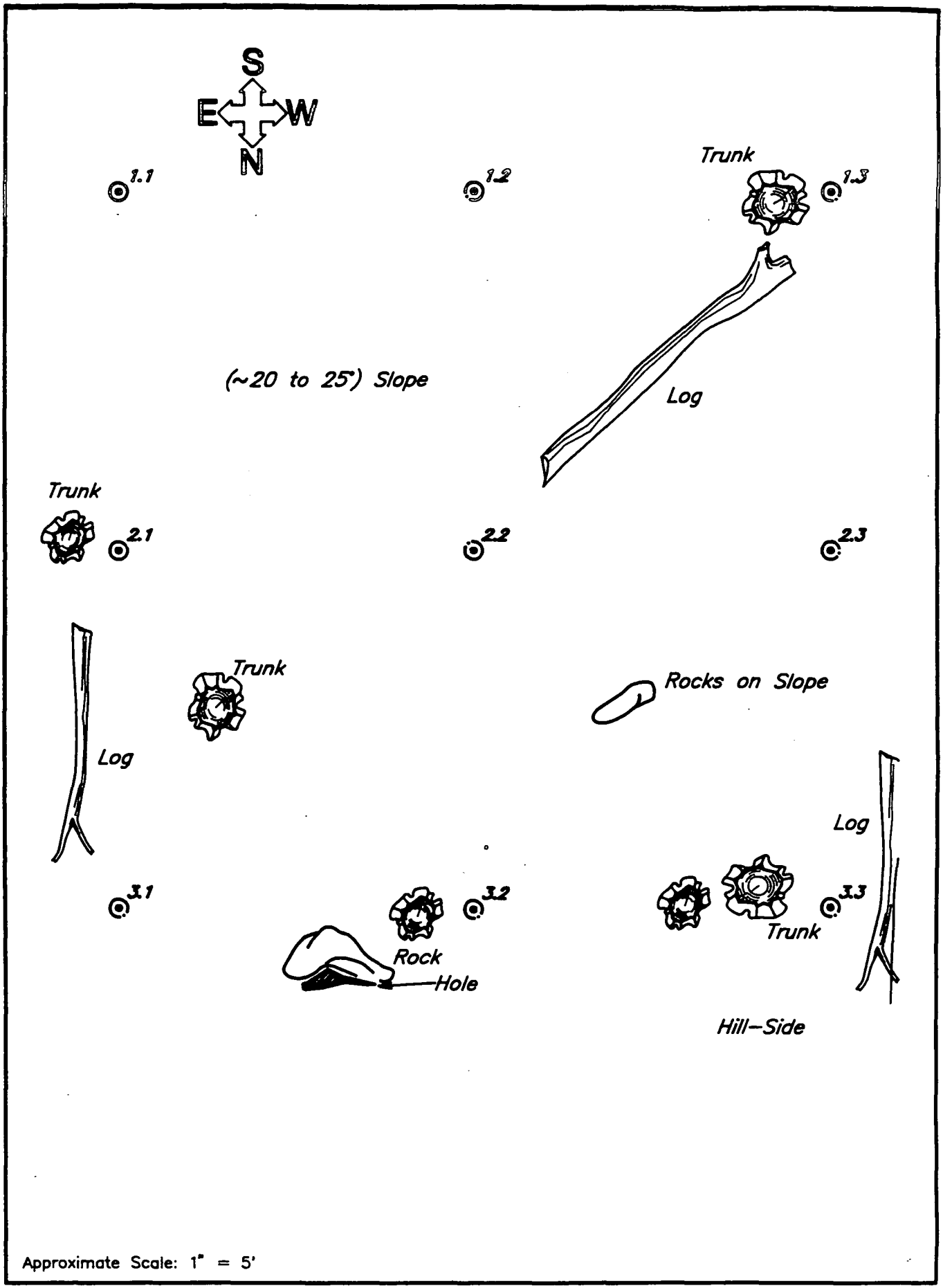
MOU-5 (1:28) 1/12/94

Figure C.3. Small mammal transect along Miami-Erie Canal (Miami-Erie Canal transect).



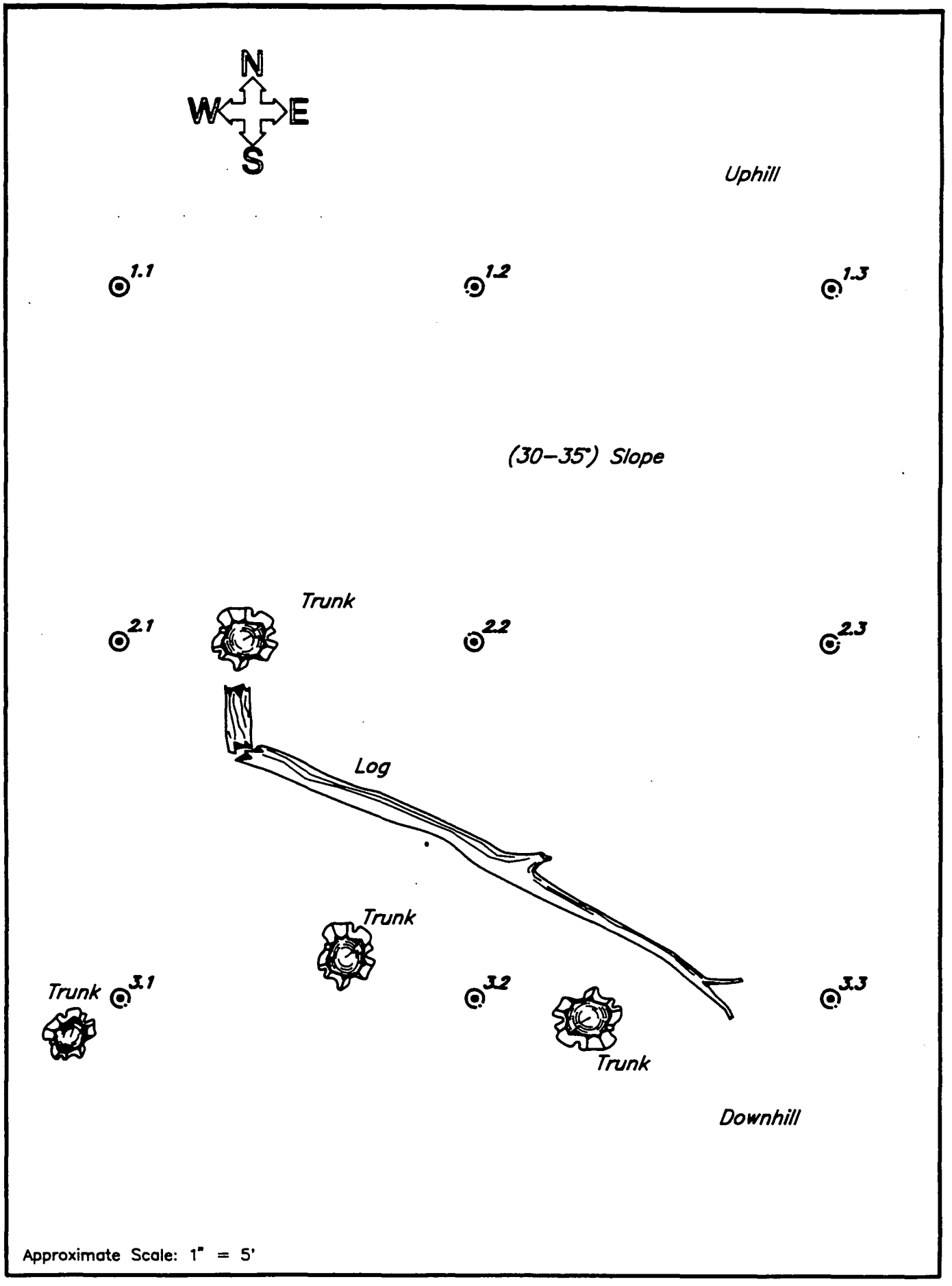
MOU-2 (1:5) 1/28/94

Figure C.4. Small mammal grid near base of Main Hill (Main Hill grid).



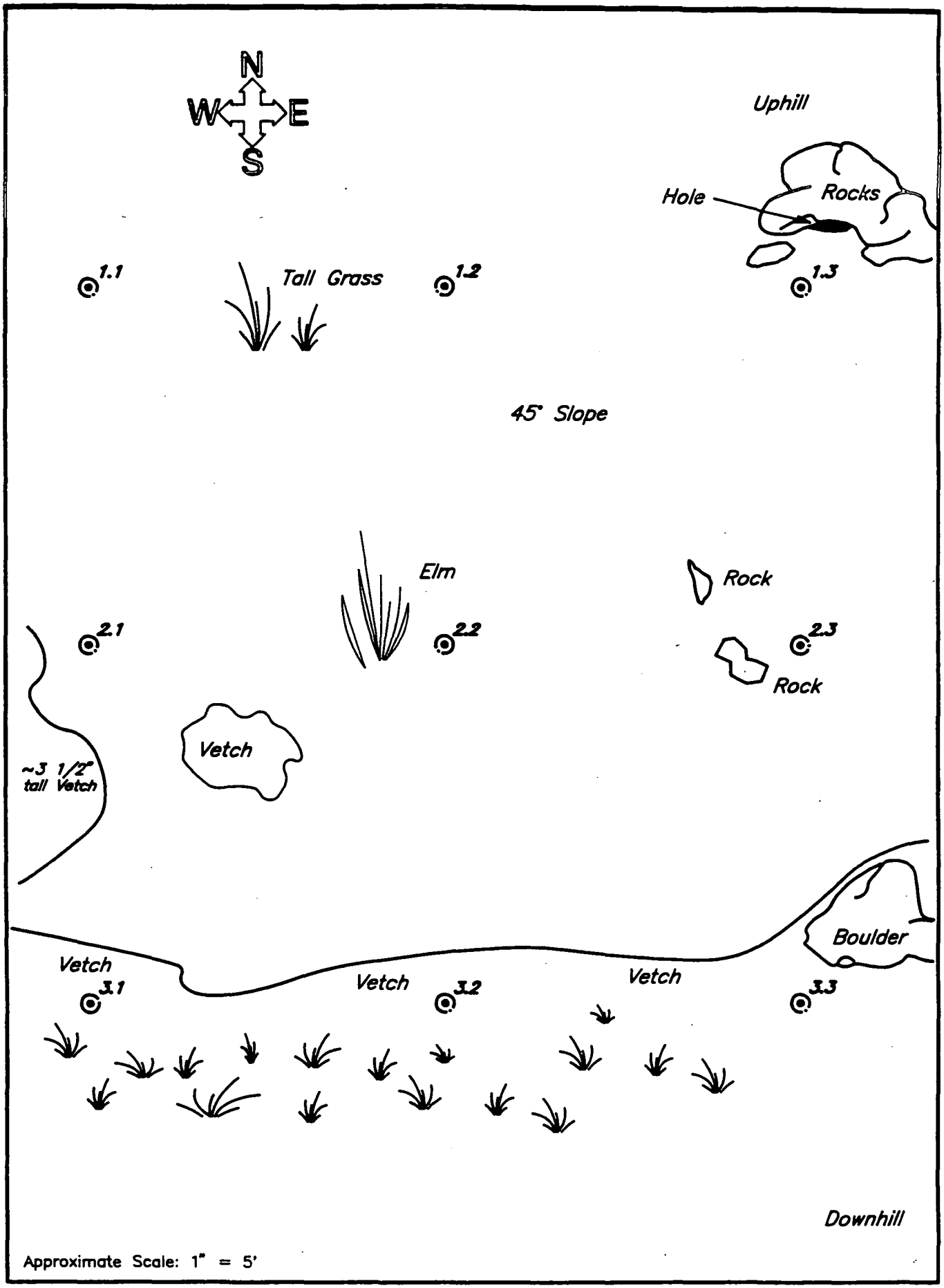
MOU-9 (1:5) 1/28/94

Figure C.5. Small mammal grid on northern slope of Main Hill (north slope grid).



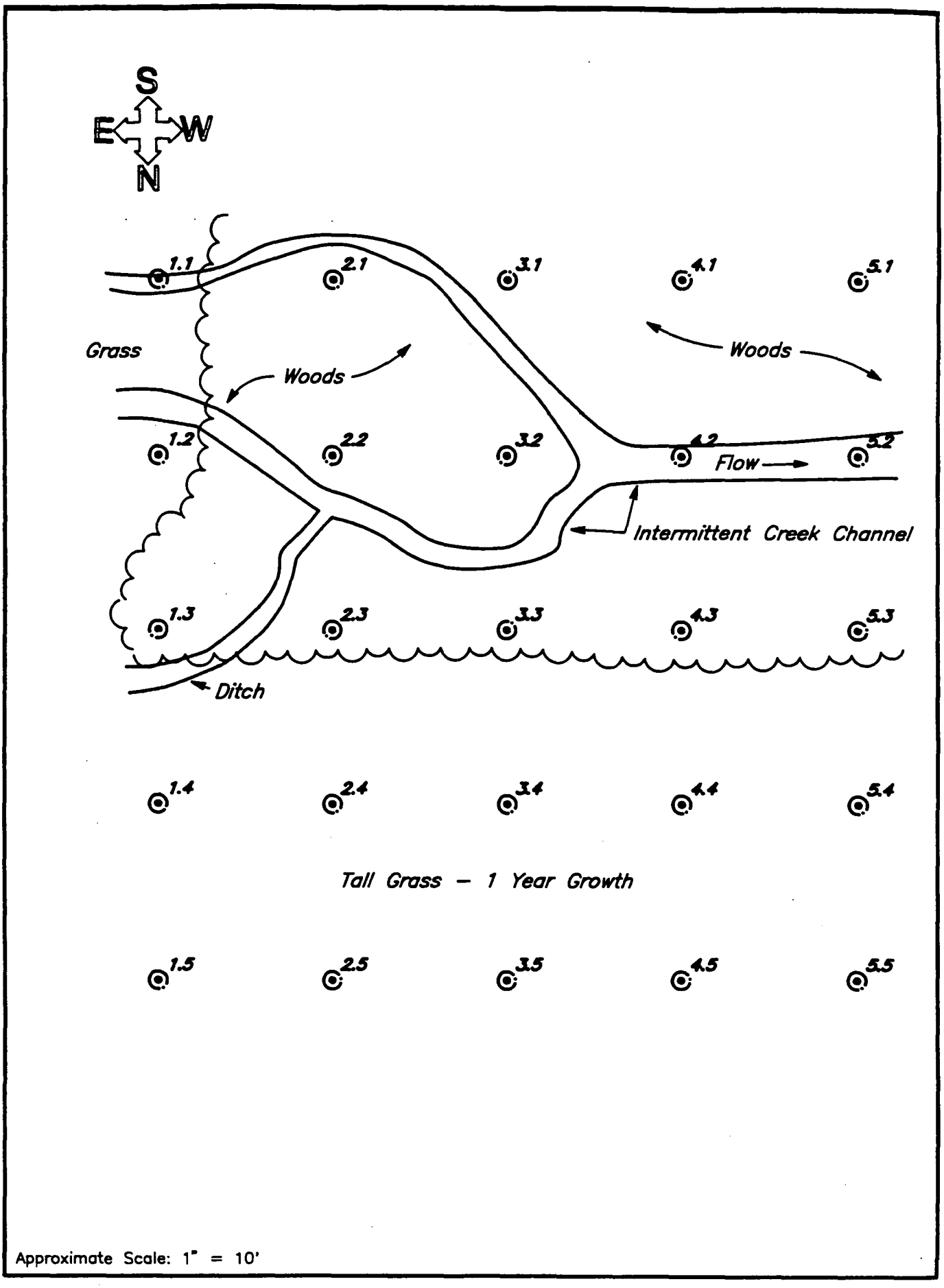
MOU-4 (1:5) 1/28/94

Figure C.6. Small mammal grid on wooded slope of SM/PP Hill (plutonium processing grid).



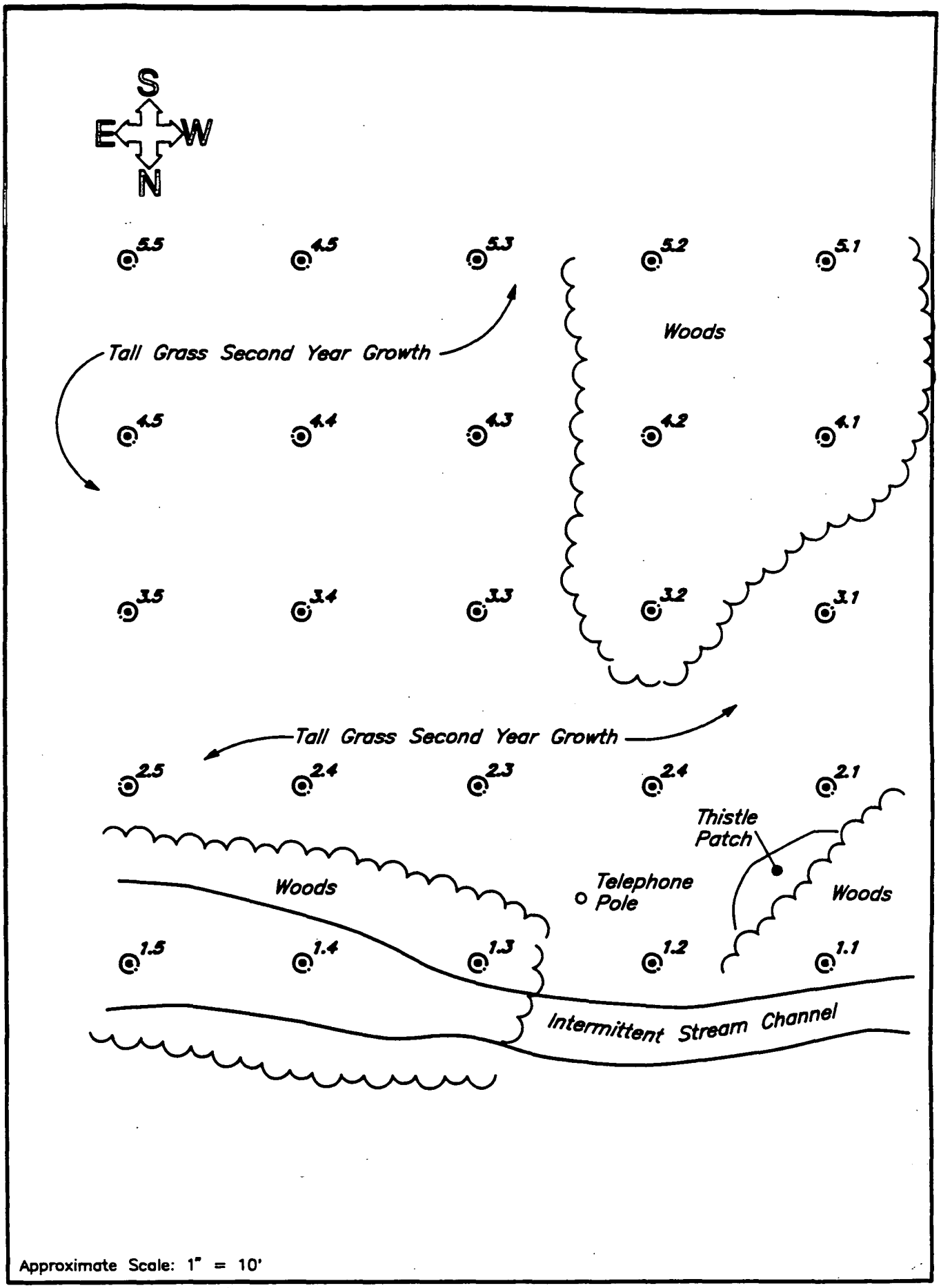
MOU-3 (1:5) 1/28/94

Figure C.7. Small mammal grid near crest of SM/PP Hill (scrub/shrub grid).



MOU-6 (1:10) 1/28/94

Figure C.8. Small mammal grid on South Property (south central grid).



MOU-7 (1:10) 1/28/94

Figure C.9. Small mammal grid on South Property (southwest grid).

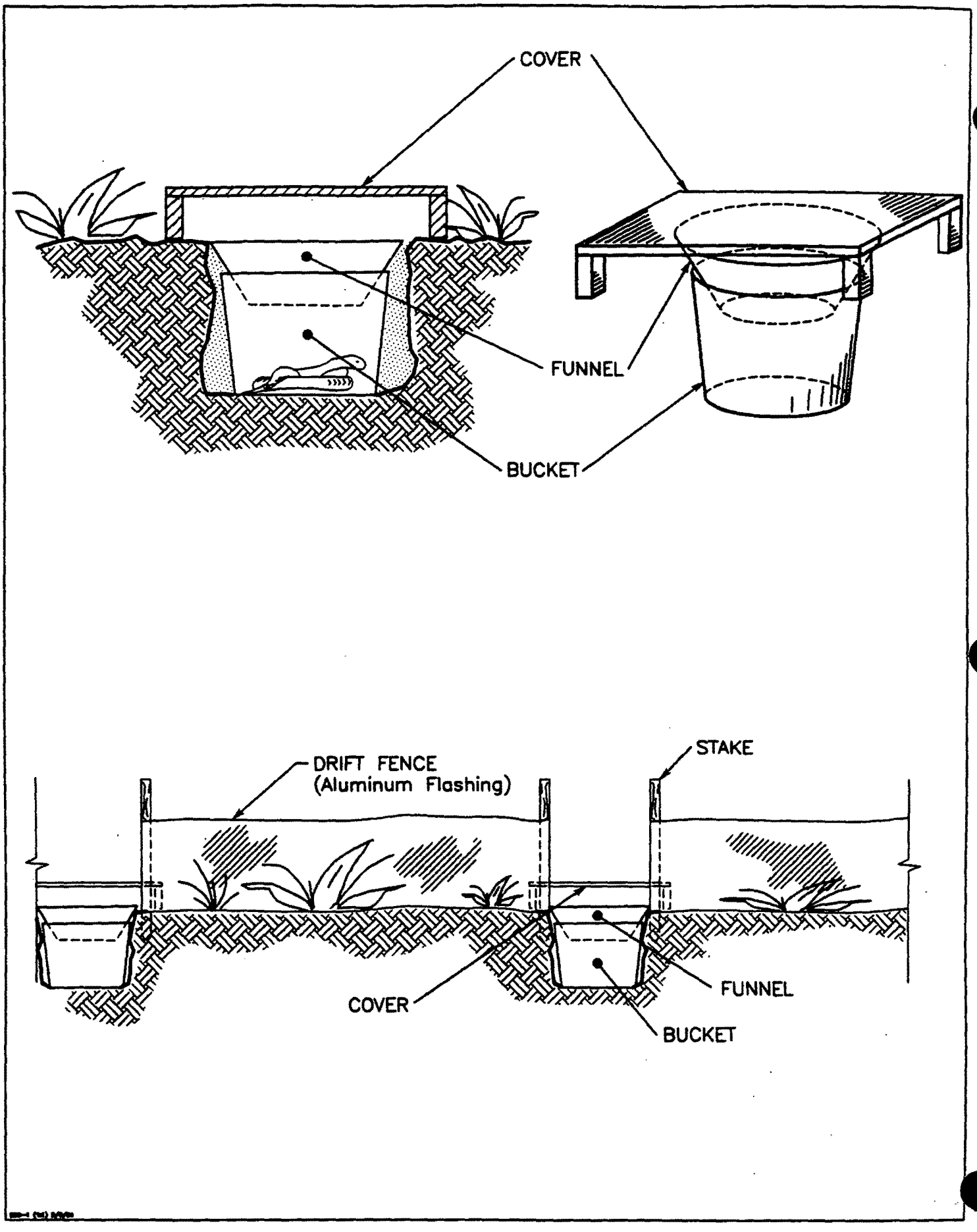


Figure C.10. Side view of typical drift fence.

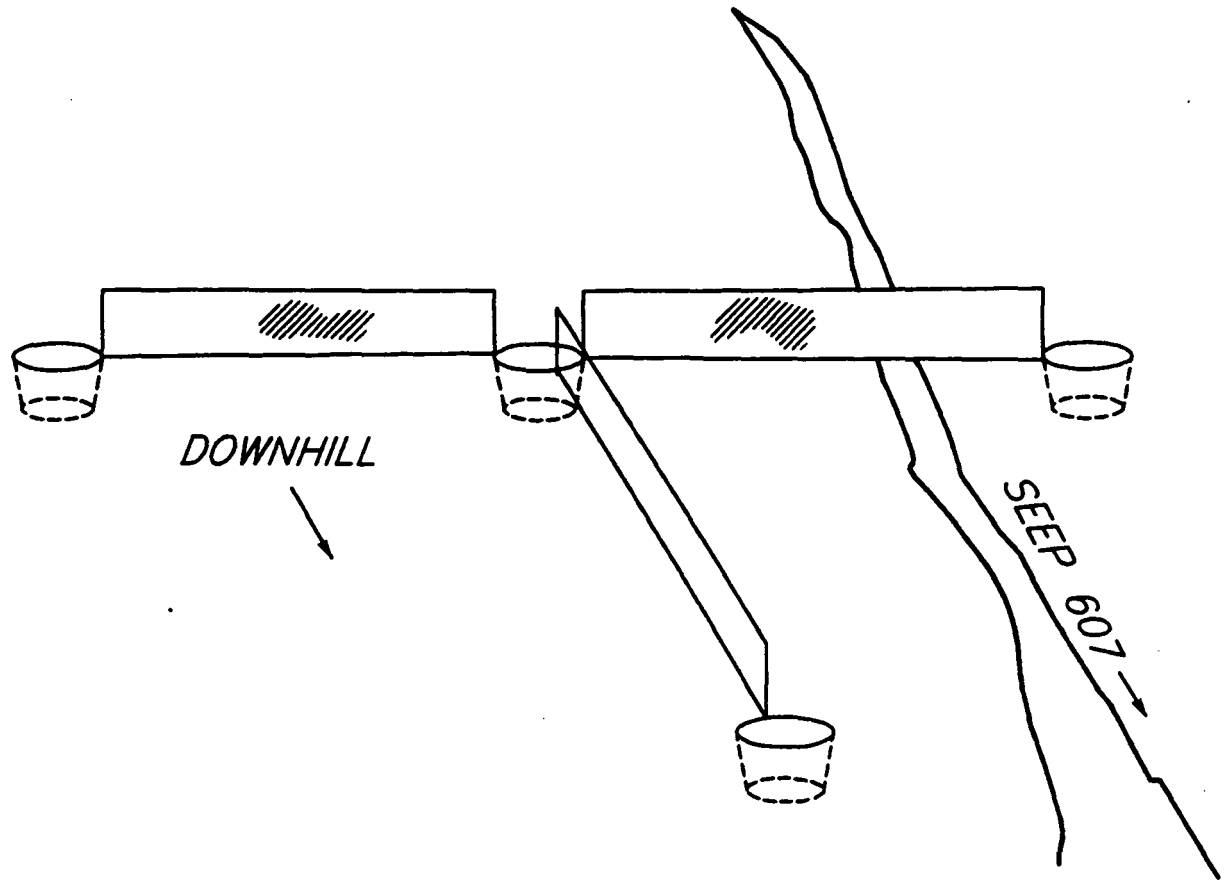


Figure C.11. Configuration of north slope drift fence.

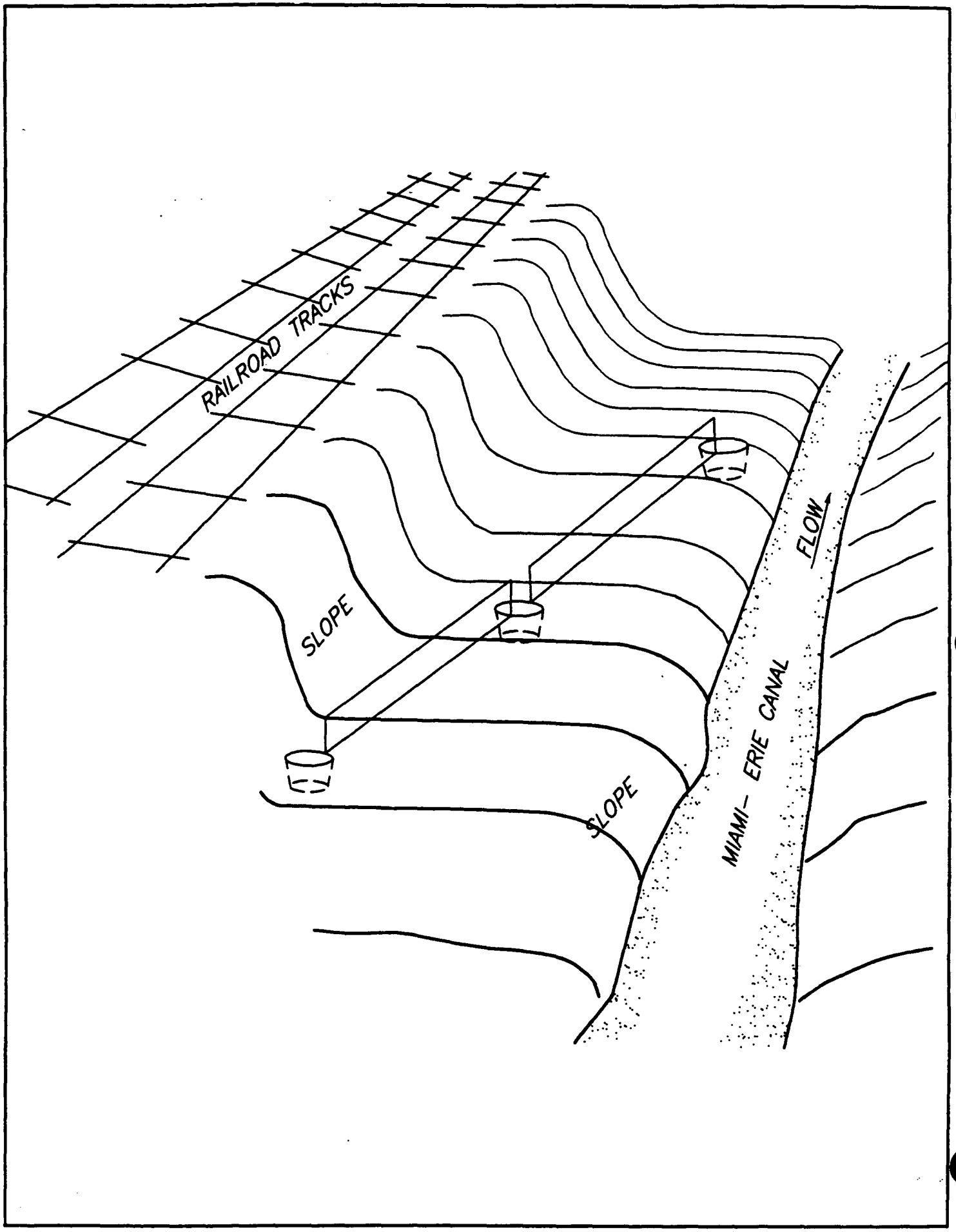


Figure C.12. Configuration of Miami-Erie Canal drift fence.

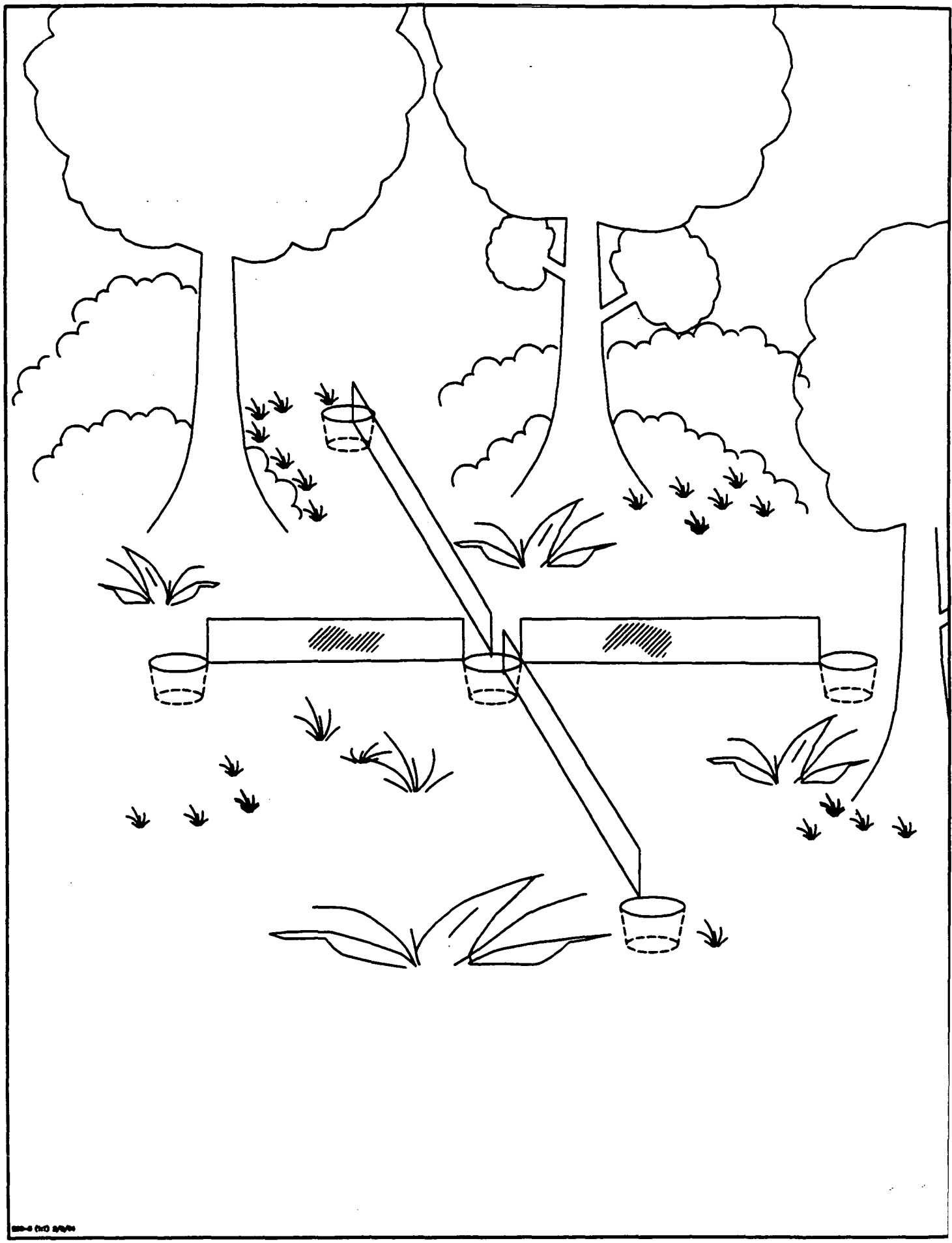


Figure C.13. Configuration of South Property drift fence.

APPENDIX D

ANNOTATED CHECKLIST OF BIRDS, MAMMALS, AND HERPTILES OF THE MOUND PLANT, MONTGOMERY COUNTY, OHIO

ANNOTATED CHECKLIST OF THE BIRDS, MAMMALS, AND HERPTILES OF THE MOUND PLANT, MONTGOMERY COUNTY,OHIO

CHECKLIST FORMAT

The following list of birds, mammals, and herptiles is a compilation of species collected or observed at the Mound Plant during the ecological characterization. Common and scientific nomenclature, phylogenetic sequencing, general physical descriptions, habitat preference, and distributional information were obtained from the following sources:

- Birds (Dayton Audubon Society 1984)
- Mammals (Burt and Grossenheider 1976; Davis 1974)
- Herptiles (Conant 1976).

Distributional information specific to the Mound Plant was synthesized from field data.

BIRDS

DOUBLE-CRESTED CORMORANT *Phalacrocorax auritus*

The double-crested cormorant is considered to be a rare migrant in the Dayton area. At the Mound Plant, this species was documented on several occasions when flocks of varying size were observed flying over the South Property during the fall survey.

GREAT BLUE HERON *Ardea herodias*

This species is considered to be an uncommon migrant and a rare winter resident. At the Mound Plant, this species was observed numerous times. An adult great blue heron was observed wading along the edge of the Overflow Pond during the spring, fall, and winter surveys.

GREEN-BACKED HERON *Butorides striatus*

During the spring and summer, the green-backed heron can be seen at just about any area around Dayton where there are water and fish, and is considered to be a common summer resident. Nesting birds have been found around Dayton, but it is not believed that this species nests at the Mound site. This species was observed wading along the edge of the Overflow Pond during the spring and summer survey periods.

CANADA GOOSE *Branta canadensis*

Considered to be a fairly common permanent resident in the Dayton area, this species is more commonly seen during migration in the spring and fall. At the Mound Plant, the Canada goose was seen during summer, fall, and winter. On several occasions during the summer and winter surveys, three groups of geese were seen flying over the Mound Plant, apparently just having come from the Great Miami River.

MALLARD *Anas platyrhynchos*

In the Dayton area, the mallard is a common migrant, locally common winter resident, and a fairly common breeder. In general, this species is able to live in close contact with humans. At the Mound Plant, two groups of young (26 individuals) were seen in the asphalt-lined pond during the summer sampling period. The hens probably had nested in the cattails at the northwest corner of the pond. Mallards were seen during all sampling periods.

TURKEY VULTURE *Cathartes aura*

The turkey vulture is a common migrant around Dayton, is a fairly common summer resident, and is rare in winter. There have been no nesting reports from the Dayton area for several years. The turkey vulture was seen at the Mound Plant only during the summer.

SHARP-SHINNED HAWK *Accipiter striatus*

This species is a rare migrant and a winter resident in the Dayton area. Sharp-shinned hawks were seen at the Mound Plant during the fall and winter.

COOPERS'S HAWK *Accipiter cooperii*

The Cooper's hawk is an uncommon permanent resident in the Dayton area and is often more commonly seen during migration. In past years, the Cooper's Hawk has been seen nesting in the Dayton area, but it is an uncommon nester in the area. This raptor was seen at the Mound site during the fall and winter.

RED-TAILED HAWK *Buteo jamaicensis*

This hawk is known to be nesting in several areas around Dayton and is considered to be a fairly common permanent resident. It is probably more numerous during winter as northern migrants move into the area. The red-tailed hawk was seen at Mound during the summer and winter.

ROUGH-LEGGED HAWK *Buteo lagopus*

In the Dayton area, this hawk is considered to be a rare-to-uncommon winter visitor that does not stay in one place very long. It was seen at Mound during the fall sampling period.

AMERICAN KESTREL *Falco sparverius*

The American kestrel is a common permanent resident in the Dayton area, and is generally more numerous in winter. At the Mound Plant, the kestrel was observed during the spring and summer and was probably nesting on or in the vicinity of the site. While the number of kestrels usually increases during the winter, none was observed at Mound during that season.

WILD TURKEY *Meleagras gallopavo*

In the Dayton area, the wild turkey was reportedly exterminated in the mid-1800s. During the summer sampling period, a female wild turkey with three or four poults was seen on Benner Road just east of the Mound site contractor's entrance. Although it was not seen on the site, suitable habitat exists on the South Property and there are no barriers to prevent wild turkeys from entering. This sighting is interesting because it indicates that the individuals previously stocked in southern Ohio are reproducing and apparently expanding their range.

KILLDEER *Charadrius vociferus*

Uncommon in winter, the killdeer is commonly seen around Dayton during the summer and is known to nest in other locations within the city. At the Mound Plant, killdeer with young were observed around the asphalt-lined pond and near Post 8 during the spring and summer sampling period.

SPOTTED SANDPIPER *Actitis macularia*

The spotted sandpiper is a common nester throughout Ohio. In the Dayton area, it is a summer resident and is more numerous during fall migration. At the Mound Plant, the spotted sandpiper was seen along the edges of the Overflow Pond during the spring and summer sampling periods; however, no evidence of nesting was found.

AMERICAN WOODCOCK *Scolopax minor*

The American woodcock in the Dayton area is a common migrant, a rare summer resident, and is very rare in winter. It has been reported to nest in the area in the past, but no recent nesting activity has been observed. At the Mound Plant, a solitary individual was found along an intermittent stream on the South Property during the summer and fall sampling periods. However, no evidence of nesting was found.

ROCK DOVE *Columbia livia*

The rock dove, also known as the pigeon, is common around the Dayton area. This dove was seen during all sampling periods, especially in the vicinity of the Main Hill and SM/PP Hill buildings, where it is suspected that it was nesting.

MOURNING DOVE *Zenaida macroura*

The mourning dove in the Dayton area is a common permanent resident, and is less common and locally distributed in the winter. The mourning dove was seen during all sampling periods at the Mound Plant and was suspected to be nesting on or in the vicinity of the site.

YELLOW-BILLED CUCKOO *Coccyzus americanus*

This species is known to nest around the Dayton area, but is considered to be an irregularly distributed breeding species. The yellow-billed cuckoo was only observed at the Mound Plant during the spring sampling period.

EASTERN SCREECH-OWL *Otus asio*

In the Dayton area, the eastern screech owl is a common permanent resident. At the Mound Plant, the occurrence of this species was confirmed on the evening of August 28, 1992, when an individual vocally responded to the broadcast of a screech owl call and flew to within a few feet of the individual holding the tape recorder. On October 15, 1992, a screech owl located in a woodland on the south side of Benner Road vocally responded to a tape of a screech owl call, but did not move closer to the individuals broadcasting the call.

GREAT HORNED OWL *Bubo virginianus*

The great horned owl is a common permanent resident around the Dayton area, but was not confirmed to be present at the Mound Plant site. On January 26, 1993, a taped great horned owl call was broadcast from the southwest corner of the North Property near the deep wells. A very faint response was heard from a great horned owl, but its exact location could not be determined.

BARRED OWL *Strix varia*

The barred owl is an uncommon to fairly common permanent resident in the Dayton area. At the Mound Plant, its presence was unconfirmed. On January 26, 1993, a taped barred owl call was broadcast from the southwest corner of the North Property near the deep wells. A barred owl was heard to respond from a distance but its exact location could not be determined.

COMMON NIGHTHAWK *Chordeiles minor*

In the Dayton area, the common nighthawk is a common summer resident, but is more numerous in the fall during migration. Numerous common nighthawks were seen at the Mound Plant on several consecutive days during the summer as they flew over a well-lighted area on the SM/PP Hill near Post 8.

CHIMNEY SWIFT *Chaetura pelagica*

This bird is commonly seen in Dayton during the summer and will nest in chimneys or smokestacks. It was seen at the Mound site during spring and summer and was thought to be nesting there.

RUBY-THROATED HUMMINGBIRD *Archilochus colubris*

This small bird is a fairly common summer resident and is known to nest in the Dayton area. This bird was seen at the Mound Plant during the summer.

BELTED KINGFISHER *Ceryle alcyon*

Belted kingfishers are known to nest around Dayton and are common permanent residents, although their numbers are reduced in the winter. At the Mound Plant, a single male of this species was seen during all sampling periods, almost always around the settling basins and the Overflow Pond. On October 13, 1992, a female belted kingfisher was observed leaving the Overflow Pond with a small fish.

NORTHERN FLICKER *Colaptes auratus*

Like the belted kingfishers, northern flickers are common permanent residents around the Dayton area, although their numbers are reduced in the winter. The northern flicker was seen during all sampling periods at the Mound site. The presence of numerous, circular openings to cavities in dead trees on the North and South properties is evidence that the species presumably nests on the site.

RED-BELLIED WOODPECKER *Melanerpes carolinus*

This woodpecker is a common and permanent resident around the Dayton area and is known to nest in residential areas. It was seen at Mound in spring and summer and likely nests on the site.

HAIRY WOODPECKER *Picoides villosus*

In the Dayton area, the hairy woodpecker is an uncommon, shy bird more often seen in the winter. Hairy woodpeckers were seen at the Mound Plant in the spring and winter.

DOWNY WOODPECKER *Picoides pubescens*

The downy woodpecker is a common permanent resident in the Dayton area and was observed at the Mound Plant during all sampling periods.

EASTERN KINGBIRD *Tyrannus tyrannus*

The eastern kingbird is fairly common in the summer around Dayton but is locally distributed. The Eastern Kingbird was seen at the Mound Plant only during spring sampling. This species is known to

nest in the Dayton area but likes to nest near fairly large bodies of water. It was not seen nesting at Mound.

EASTERN PHOEBE *Sayornis phoebe*

The number of nesting phoebes in the Dayton area has declined over the past years and the species is considered an uncommon summer resident. The eastern phoebe was only observed at the Mound site during spring sampling.

EASTERN WOOD-PEWEE *Contopus virens*

The wood-pewee nests in the vicinity of Dayton but was not suspected to have nested at Mound. This bird was seen during the spring sampling period.

TREE SWALLOW *Tachycineta bicolor*

The tree swallow is a common migrant and an uncommon summer resident in the Dayton area. This swallow was seen at Mound over the South Property in the summer.

NORTHERN ROUGH-WINGED SWALLOW *Stelgidopteryx serripennis*

The northern rough-winged swallow is a common summer resident and has been seen nesting in the Dayton area. This swallow was seen at Mound during the spring.

BARN SWALLOW *Hirundo rustica*

The barn swallow is a common summer resident around Dayton and was seen in the spring and summer at the Mound Plant.

PURPLE MARTIN *Progne subis*

In the Dayton area, the purple martin is a common summer resident that typically nests in apartment-style bird houses. At the Mound Plant, the purple martin was seen during summer sampling.

BLUE JAY *Cyanocitta cristata*

This common bird is a permanent resident in the Dayton area and was seen at the Mound Plant during all sampling periods.

AMERICAN CROW *Corvus brachyrhynchos*

The American crow is a common permanent resident, but the number of breeding individuals in the Dayton area has fallen over the past few years. Crows were seen during all sampling periods at Mound.

BLACK-CAPPED CHICKADEE *Parus atricapillus*

The black-capped chickadee, an irregular winter visitor in the Dayton area, is typically found in northern Ohio during the warmer months. At the Mound Plant, black-capped chickadees were seen with Carolina chickadees during the winter sampling period.

CAROLINA CHICKADEE *Parus carolinensis*

This chickadee breeds in the Dayton area and is a common permanent resident. It is presumed to nest at the Mound Plant and was seen during all sampling periods.

TUFTED TITMOUSE *Parus bicolor*

The tufted titmouse is a common permanent resident in the Dayton area and was seen at the Mound Plant in the spring and summer.

BROWN CREEPER *Certhia americana*

The brown creeper is a common migrant and winter resident. At the Mound Plant, this cryptic bird was seen during winter sampling.

HOUSE WREN *Troglodytes aedon*

In the Dayton area, the house wren is a common summer resident and is very rare in the winter. Several individuals were seen at the Mound Plant, mostly in the edges of Amur honeysuckle thickets on the SM/PP Hill during spring and summer sampling. On August 29, 1993, a western form of the house wren was seen just uphill from Building 22.

CAROLINA WREN *Thryothorus ludovicianus*

The Carolina wren is a common permanent resident in the Dayton area, although it was wiped out in the Dayton area in the late 1970s as a result of severe winters. Its numbers have been increasing and it was seen during all sampling periods at Mound.

NORTHERN MOCKINGBIRD *Mimus polyglottos*

This bird is common around towns and neighborhoods in the Dayton area and is a nester on the Mound site. The mockingbird was seen during all sampling periods.

GRAY CATBIRD *Dumetella carolinensis*

The gray catbird is a common summer resident around the Dayton area and is very rare in the winter. It was observed at the Mound Plant during the spring and summer sampling periods.

BROWN THRASHER *Toxostoma rufum*

In the Dayton area, the brown thrasher is a common summer resident and is very rare in winter. This bird was seen at Mound during the spring and summer and was a confirmed nester at the site.

AMERICAN ROBIN *Turdus migratorius*

This common bird can be seen with regularity around the Dayton area, even in the winter. It was seen at the Mound site during all sampling periods and was found nesting there. The Amur honeysuckle thickets on the SM/PP Hill were found to provide refuge during the winter for large numbers of this species.

EASTERN BLUEBIRD *Sialia sialis*

In the Dayton area, this bird was reduced in numbers by as much as 90 percent after the introduction of the European starling and the house sparrow. Local nest box programs have help this bird become stabilized. It was seen at the Mound site during the spring, but no indications of nesting were observed.

BLUE-GRAY GNATCATCHER *Polioptila caerulea*

This small bird is fairly common in the summer around the Dayton area. At the Mound Plant, blue-gray gnatcatchers were seen at Mound during spring and summer sampling, especially in the hawthorns near Benner Road on the South Property. It is known to nest in the Dayton area, but probably nests at the Mound Plant.

GOLDEN-CROWNED KINGLET *Regulus satrapa*

The golden-crowned kinglet is an uncommon migrant and rare winter resident in the Dayton area. This kinglet was seen in fall and winter at the Mound site, especially in the edge of woodlands near the crest of the SM/PP Hill.

RUBY-CROWNED KINGLET *Regulus calendula*

The ruby-crowned kinglet is a common migrant and is very rare in winter in the Dayton area. At the Mound Plant, this species was observed in the summer, fall, and winter.

CEDAR WAXWING *Bombycilla cedrorum*

This bird is seen on an irregular basis in the Dayton area. It is considered an uncommon summer resident, but is often abundant in migration. Cedar waxwings are sometimes common in winter. They were observed at the Mound site during the fall sampling period.

EUROPEAN STARLING *Sturnus vulgaris*

This extremely common bird is a permanent resident in the Dayton area. At the Mound Plant, it was seen during all sampling periods and was nesting at the site.

RED-EYED VIREO *Vireo olivaceus*

This bird is usually considered to be the most common nesting bird in eastern deciduous forests. In the Dayton area, it is a common summer resident. Red-eyed vireos were seen at the Mound Plant during spring and summer. It is known to nest in the area, but it was not seen nesting at the Mound site.

WARBLING VIREO *Vireo gilvus*

The warbling vireo is a common summer resident in the Dayton area. A single individual of this species was observed along the Miami-Erie Canal during the spring sampling period.

TENNESSEE WARBLER *Vermivora perigrina*

This transient bird is a common migrant in the Dayton area and, as expected, was observed at the Mound only during spring sampling.

YELLOW WARBLER *Dendroica petechia*

This brilliant bird is known to nest in the vicinity of the Mound Plant, but was only seen at the site during spring sampling.

YELLOW-RUMPED WARBLER *Dendroica coronata*

The yellow-rumped warbler is a common migrant in the Dayton area and is uncommon to rare in the winter. This warbler was seen at the Mound Plant during the fall sampling period.

BLACK-THROATED GREEN WARBLER *Dendroica virens*

This species is a common migrant in the Dayton area. The earliest known arrival of this species during fall migration was recorded on August 10, 1977. A single, immature individual of this species was observed along the crest of the SM/PP Hill on August 31, 1992.

CHESTNUT-SIDED WARBLER *Dendroica pensylvanica*

The chestnut-sided warbler is a common migrant in the Dayton area. The earliest known arrival of this species during fall migration was recorded on September 3, 1979. A single, immature individual of this species was observed in a woodland in the center of the South Property on August 29, 1992.

BAY-BREASTED WARBLER *Dendroica castanea*

This species is a common migrant in the Dayton area. A pair of bay-breasted warblers was observed on October 13, 1992, on the South Property in the woods along the Miami-Erie Canal.

COMMON YELLOWTHROAT *Geothylpis trichas*

This fairly common locally nesting warbler was seen on the South Property at the Mound Plant during the spring and summer. It is likely that these birds nest at the Mound site.

AMERICAN REDSTART *Setophaga ruticilla*

The Dayton area is within the breeding range of the American redstart, but there apparently are no nesting records of this species. At the Mound Plant, this species was observed during the spring sampling period.

HOUSE SPARROW *Passer domesticus*

This bird arrived in the Dayton area in the late 1800s and became well established there. It was seen at Mound during spring, fall, and summer and probably nested in or near the building on the Main and SM/PP Hills.

EASTERN MEADOWLARK *Sturnella magna*

The eastern meadowlark is a common summer resident in the Dayton area and is uncommon-to-rare in the winter. A small group of meadowlarks could be found throughout the spring, summer, and fall months in the sloping grassland on the South Property near the contractor's gate. Given the polygamous nature of the male member of the species, it is likely that the group consisted of one male and several females.

RED-WINGED BLACKBIRD *Agelaius phoeniceus*

This bird is considered to be one of the most abundant nesting birds in the Central Miami Valley and reportedly is uncommon or rare in winter. Thus, it is unusual that the red-winged blackbird was observed only during fall and winter sampling.

NORTHERN ORIOLE *Icterus galbula*

In the Dayton area, the northern oriole is a common summer resident and is accidental in winter. The northern oriole was seen at the Mound Plant during spring and summer and was observed tending a nest on the South Property.

COMMON GRACKLE *Quiscalus quiscula*

The common grackle is a common summer resident in the Dayton area and is rare to uncommon in the winter. This species was observed during spring, summer, and fall sampling.

BROWN-HEADED COWBIRD *Molothrus ater*

The brown-headed blackbird is a common summer resident in the Dayton area and is rare to uncommon in the winter. This parasitic species was only seen at the Mound Plant during spring sampling.

NORTHERN CARDINAL *Cardinalis cardinalis*

The northern cardinal is a common permanent resident in the Dayton area. At the Mound Plant, it could be found during all sampling periods wherever there was dense cover.

INDIGO BUNTING *Passerina cyanea*

This brilliant blue bird commonly nests in the Dayton area, but was not observed nesting at the Mound site. The indigo bunting was fairly abundant in field edges on the South Property during spring sampling.

HOUSE FINCH *Carpodacus mexicanus*

This now-common bird was first seen nesting around Dayton in 1981. Its numbers have been on the rise and it was seen during all sampling periods at the Mound site. House finches were especially abundant around buildings on the SM/PP Hill.

AMERICAN GOLDFINCH *Carduelis tristis*

The goldfinch is sometimes called the wild canary because of its brilliant yellow color. These birds commonly nest in the Dayton area and they were observed during all sampling periods at the Mound Plant.

RUFOUS-SIDED TOWHEE *Pipilo erythropthalmus*

In the Dayton area, the rufous-sided towhee is a common summer resident and is rare or uncommon in the winter. At the Mound Plant, the towhee was seen during the spring, summer, and fall.

DARK-EYED JUNCO *Junco hyemalis*

The dark-eyed junco is protected by the Ohio Department of Natural Resources under Section 1531.25 of the Ohio Revised Code as a State Endangered Species. It is presumed that the species is listed to protect a small breeding population in the northeast part of the state. During the winter, the dark-eyed junco is a common resident. At the Mound Plant, the species was observed during the fall and winter.

CHIPPING SPARROW *Spizella passerina*

The chipping sparrow is a common summer resident in the Dayton area and is rare in the winter. At the Mound Plant, the chipping sparrow was seen during the spring and summer.

FIELD SPARROW *Spizella pusilla*

The field sparrow is a common summer resident in the Dayton area and is rare in the winter. At the Mound Plant, this common sparrow was seen during spring, summer, and fall sampling.

WHITE-THROATED SPARROW *Zonotrichia albicollis*

The white-throated sparrow is a common migrant in the Dayton area and is fairly common in the winter. This sparrow was seen at the Mound Plant during the fall and winter sampling periods.

SWAMP SPARROW *Melospiza georgiana*

In the Dayton area, the swamp sparrow is a fairly common migrant and is uncommon to rare in the winter. The swamp sparrow was seen at the Mound Plant only during the fall sampling period.

SONG SPARROW *Melospiza melodia*

This common sparrow is easily seen year-round in the Dayton vicinity. It was seen on all sampling dates at Mound and was confirmed to be nesting there.

MAMMALS

OPOSSUM *Didelphis marsupialis*

The opossum is the only marsupial that occurs in North America. It is 610 to 1020 mm in length and is easily recognized by the presence of five toes on each foot. The inner toe of the hind foot is opposable and lacks a claw. The tail is scaly, mostly hairless, and prehensile. Opossums range in color from whitish-gray to nearly black. The species occurs throughout the eastern and extreme western United States. At the Mound Plant, opossums were found on both the North and South Property during spotlight surveys.

SHORT-TAILED SHREW *Blarina brevicauda*

The short-tailed shrew is a small insectivore 93 to 134 mm in length. It is dark gray to black with a pointed nose, tiny eyes, and concealed ears. As the name suggests, the tail is very short (19 to 30 mm). The only other species of shrew in the area that has a short tail is *Cryptotus parva*, the least shrew. Least shrews, however, are smaller (70 to 89 mm in length) and are cinnamon or gray in color. The short-tailed shrew is primarily nocturnal, but occasionally is active during the day. It prefers moist forests, but is found in brushy areas, along fencerows, and in pastures throughout the eastern

United States. At the Mound Plant, short-tailed shrews were collected from a seepage area at the base of the southern slope of the Main Hill and in the scrub/shrub vegetation community near the crest of the SM/PP Hill. Given the species' ability to exist in a wide variety of habitats, it is entirely likely that short-tailed shrews also occur on the South Property.

RACCOON *Procyon lotor*

The raccoon is a medium-sized carnivore with a length of 700 to 960 mm. The body is gray, with a conspicuous black mask across the eyes. The tail is bushy with alternating yellow and black rings. Raccoons prefer wooded areas, but any habitat near water may be utilized. It is primarily nocturnal, but is occasionally active during the day. Raccoons are widespread throughout North America. At the Mound Plant, a juvenile raccoon was found dead on Benner Road adjacent to the gate into the South Property on the morning of August 29, 1992. Tracks and scats of this species were observed on numerous occasions along the Miami-Erie Canal, Overflow Creek, and larger drainageways on the South Property, indicating that raccoons frequently occur within the Mound Plant boundaries.

GRAY FOX *Urocyon cinereoargenteus*

The gray fox is a medium-sized canid ranging from 800 to 1124 mm in length. The body is mainly gray with a white throat; the chest, flanks, legs, and feet are rusty-yellow. Within Ohio, the gray fox may be confused with the red fox (*Vulpes vulpes*) and the coyote (*Canis latrans*). The red fox is generally smaller (910 to 1040 mm in length), has black feet, and a white-tipped tail. The coyote is much larger, ranging 1090 to 1340 mm in length. The gray fox is primarily nocturnal, but is occasionally active during the day. It will inhabit wooded, brushy, or open terrain, and occur throughout the eastern and south-central United States. At the Mound Plant, the gray fox was seen on both the North and South Property on several occasions during spotlight surveys.

WOODCHUCK *Marmota monax*

The woodchuck, or groundhog, is a large rodent with a length of 418 to 665 mm. It is heavy-bodied and short-legged, with yellowish-brown to dark-brown upperparts. The underparts are paler, the feet are dark brown or black, and there is white around the nose. There are no other species of rodents in Ohio that could be mistaken for a woodchuck—even the juveniles can be distinguished by their massive bodies and short tails (110 to 230 cm). The woodchuck is primarily diurnal, being most active in the early morning and late afternoon. It prefers open areas near forest edges, fencerows, and roadsides, but is also present in deep forest throughout northern and north-central North America. Woodchucks are common at the Mound Plant, especially in fields and forest edges on the South Property and along the Miami-Erie Canal. Based on casual observations, the greatest concentration of groundhogs appeared to be in the field and adjacent areas in the northwest corner of the South Property.

EASTERN CHIPMUNK *Tamias striatus*

The eastern chipmunk is a medium-sized ground squirrel with the head and body measuring 127 to 152 mm and the tail 76 to 102 mm. The tail is bushy but flattened. The back has five dark stripes and two light-buffy stripes, with the stripes ending on a reddish rump; the facial stripes are prominent. Eastern chipmunks are primarily diurnal and tend to live in deciduous forests and brushy areas. They occur throughout the eastern United States. At the Mound Plant, eastern chipmunks were widely distributed within forested areas on the North and South Property, Miami-Erie Canal, and north slope of the Main Hill. Live trapping was not conducted along the forested riparian areas associated with the Overflow Creek, but the species is expected to be common there as well.

EASTERN GRAY SQUIRREL *Sciurus carolinensis*

The eastern gray squirrel is a large tree squirrel (430 to 500 mm in length) that is gray to brownish-gray above with white underparts, but melanism and albinism are not uncommon. The tail is bushy and bordered with white-tipped hairs. The two other species of tree squirrels in Ohio, *Sciurus niger* (eastern fox squirrel) and *Tamiasciurus husonicus* (red squirrel), are differentiated from the gray squirrel by size and coloration—fox squirrels are larger (510 to 565 mm in length) and have yellowish to orange underparts and tail hairs. Red squirrels are much smaller (280 to 355 mm in length) with yellow or red upperparts and white underparts. Eastern gray squirrels are strictly diurnal and prefer oak-hickory forests. They occur throughout the eastern United States. At the Mound Plant, eastern gray squirrels are common in all forested areas on the North and South Property, Miami-Erie Canal, north slope of the Main Hill, and Overflow Creek.

EASTERN FOX SQUIRREL *Sciurus niger*

The eastern fox squirrel is a large tree squirrel that has gray upperparts with some yellow or orange hairs and yellow or orange underparts. The tail is bushy and bordered with yellow-tipped hairs. Melanism in this species is rare. The fox squirrel can be distinguished from the other species of tree squirrels in the area by its size and coloration. Eastern fox squirrels are strictly diurnal, preferring scattered oak, hickory, and walnut trees, but can be found in both hardwood and pine forests throughout the eastern United States. At the Mound Plant, an eastern fox squirrel was observed at two locations on the South Property.

PRAIRIE DEER MOUSE *Peromyscus maniculatus*

The prairie deer mouse is a small member of the white-footed mouse group (*Peromyscus* spp.) with a total length of 122 to 229 mm. The body length ranges 71 to 102 mm in length, with the tail 51 to 127 mm. Color varies from pale grayish-buff to deep reddish-brown. The tail is always bicolored (gray above, white below) and ears are white-edged. *P. maniculatus* and *P. leucopus* are very difficult to distinguish. Most adults can be distinguished based on tail length and total length—*P. maniculatus*

have tail length less than 60 mm and a total length less than 155 mm, while *P. leucopus* tend to exceed these measurements. Another similar species is *Reithrodontomys humulis*, the harvest mouse. *Reithrodontomys* are readily recognized by the presence of grooved upper incisors. *P. maniculatus* are nocturnal and tend to live in open grassy areas, although they may also be found in wooded areas. They occur throughout North America.

WHITE-FOOTED MOUSE *Peromyscus leucopus*

The white-footed mouse is very similar in appearance and habitat to *P. maniculatus*. The total length ranges 152 to 209 mm, with the tail measuring 61 to 102 mm. The body color is pale to rich reddish-brown above, with white belly and feet. The tail is not distinctly bicolored, although some individuals may have some bicoloration. *Peromyscus leucopus* tend to live in brushy wooded areas, but are also sometimes found in open areas. They occur throughout the United States east of the Rocky Mountains. During the ecological characterization at the Mound Plant, the small mammal team was unable to differentiate consistently between the deer mouse and the white-footed mouse. Consequently, all *Peromyscus* were grouped as a single taxon.

MEADOW VOLE *Microtus pennsylvanicus*

Meadow voles are small rodents (172 to 259 mm in length) that usually have long, soft fur that usually is dull chestnut-brown above, and silvery-gray below. The ears are small, as are the eyes, and the tail is short (32 to 63 mm). The meadow vole is difficult to distinguish from the prairie vole, and can sometimes be separated from the latter by its longer tail and silvery belly fur. However, tooth pattern is the only reliable character. Meadow voles inhabit low moist areas or high grasslands with rank growths of vegetation and also occur near streams, lakes, and open swamps. The meadow vole occurs throughout most of northern north America, including all of Ohio. At the Mound Plant, a single meadow vole was captured in a live trap set in the spring at Seep 602 on the lower slope of the Main Hill.

HOUSE MOUSE *Mus musculus*

This nocturnal mouse was introduced from the Old World via the ships of the earliest settlers. With a total length of 130 to 198 mm and tail length of 63 to 102 mm, this mouse is easily recognized by its pointed nose and long scaly, nearly naked tail. It is typically found in buildings, but will also live in fields, marshes, and grassy stream banks. House mice are widespread throughout North America. At the Mound Plant, a single house mouse was captured in the spring in a live trap at Seep 602.

MEADOW JUMPING MOUSE *Zapus hudsonius*

Meadow jumping mice are small rodents (188 to 250 mm in length) characterized by enlarged hind legs and an extremely long tail (112 to 144 mm). The body is yellow to orange along the sides, with a

broad dark band running the length of the back; the underparts are white; and the upper incisors are grooved. The only jumping mouse which may be confused for *Z. hudsonius* is *Napaeozapus insignus* (woodland jumping mouse), which occurs in northeastern Ohio. The woodland jumping mouse has a white tip on the tail. The meadow jumping mouse is nocturnal and prefers grassy marshes, lakeside weeds, and moist open forests. It occurs throughout north-central North America, including all of Ohio. At the Mound Plant, a single meadow jumping mouse was collected in a herptile drift fence bucket deployed along the Miami-Erie Canal adjacent to the South Property.

WHITE-TAILED DEER *Odocoileus virginianus*

The white-tailed deer is the most common large deer in eastern North America and is characterized by its teeth, which lack upper incisors, and its hooves. The antlers of males consist of a main beam with prongs. The white-tailed deer measures 1600 to 2150 mm in length and is reddish-tan in summer and bluish-gray in winter. The tail is long (255 to 360 mm) and white on the underside. White-tailed deer occur throughout most of North America and may occupy forested, brushy, and open areas. At the Mound Plant, the white-tailed deer was observed on the South Property and along the Miami-Erie Canal; it was not found on the North Property, north slope of the Main Hill, or along the Overflow Creek. Unlike the North Property, which contains a fenced barrier, access to the two latter sites is unencumbered. An occasional animal could, therefore, be expected on this site.

EASTERN COTTONTAIL *Sylvilagus floridanus*

The eastern cottontail is a small rabbit (375 to 490 mm in length) with relatively large ears and a coat color varying from buffy-brown or reddish- to dark-gray. There are no other sympatric species of rabbit occurring in the vicinity of the Mound Plant. This rabbit species occurs throughout the central and eastern United States, except northern New England. Occurring throughout Ohio, the generally nocturnal eastern cottontail inhabits a variety of habitats, including open fields, upland thickets, woodlands, and swamps. At the Mound Plant, eastern cottontails were encountered throughout the North and South Property and along the Miami-Erie Canal.

STRIPED SKUNK *Mephitis mephitis*

The striped skunk is a large mustelid (540 to 760 mm in length, 200 to 280 tail length) with a bushy tail and a contrasting black and white pattern. Although extremely variable, the coat usually has a black base color with a thin white stripe going down the nose that diverges into two wide parallel stripes down the back and onto the tail. Individuals with only limited amounts of white fur, however, are not uncommon. The spotted skunk, *Spilogale putorius*, is not found in the vicinity of the Mound Plant; thus, there is no other mammal in the study area for which the striped skunk could be mistaken. The striped skunk occurs throughout the United States and is widespread in Ohio. This essentially nocturnal mammal inhabits a wide variety of habitats from open fields to deep woodlands. During the

ecological characterization of the Mound Plant, the striped skunk was encountered only on the South Property but probably occurs on the North Property and other areas.

HERPTILES

RED-BACKED SALAMANDER *Plethodon cinereus*

This uniformly dark-gray to black salamander ranges in size from 5.7 to 9.2 cm. The pigmentation is composed of equal parts of black and white specks on the belly with less white on the dorsum. In Ohio, the only similar sympatric species is the ravine salamander, *Plethodon richmondi*, which has a significantly more elongated body and a uniform belly color. The red-backed salamander commonly occurs throughout the northern United States and into southern Canada and is widespread in Ohio. Typically a woodland species, *Plethodon cinereus* occurs in areas with adequate moisture and cover. In the Mound ecological survey, the moist north slope site provided the best habitat in the study area. A few specimens were uncovered in other areas that provided adequate moisture and cover. After emerging from its winter retreat under large logs and rocks, *Plethodon cinereus* can be found in significant numbers under the relatively largest cover objects in the area. Dispersal to smaller cover occurs later in the summer as food becomes limited.

AMERICAN TOAD *Bufo americanus*

This abundant toad species has a size range of 5.1 to 8.9 cm. A typical toad, the American toad, can be distinguished from a similar species, *Bufo fowleri*, by having only one or two large warts per dorsal dark spot versus several smaller uniform warts. The American toad occurs throughout the eastern United States and Canada and is widespread in Ohio. To reproduce, the toad requires little more than a pool of water and is readily found anywhere from woodlands to open fields. In the Mound ecological survey, the toads were found in wooded slopes in two quadrates and under railroad debris below the north slope site.

BULLFROG *Rana catesbeiana*

The largest frog in the United States, the bullfrog ranges in size from 9 to 15 cm. This frog can be distinguished from most other ranids in the area by an absence of spots on the dorsum. The green frog, *Rana clamitans*, lacks spots but has prominent dorsolateral folds that *Rana catesbeiana* does not. The wood frog, *Rana sylvatica*, also lacks spots but has a prominent dark mask that is lacking in the bullfrog. The bullfrog is found throughout the central and eastern United States, with introductions throughout the west. Bullfrogs occur throughout Ohio in lakes, ponds, and in the slack water of streams. In the Mound ecological assessment, adult and larval bullfrogs were found wherever bodies of water were permanent. Specimens were also heard in drainage ditches along the roads within the site.

SNAPPING TURTLE *Chelydra serpentina*

This well-known turtle (20 to 30 cm) has a large head, a ridged carapace, and a long laterally saw-toothed tail. Other turtles that occur in the area do not have long tails. The snapping turtle is found throughout the central and eastern United States and throughout Ohio. Any permanent body of water can hold snapping turtles. One specimen was sighted in the Overflow Pond and a recently killed specimen was found on Dayton-Cincinnati Pike in the vicinity of the confluence of the Overflow Creek and the Miami-Erie Canal.

EASTERN BOX TURTLE *Terrapene carolina*

This common terrestrial turtle has a carapace length of 11 to 15 cm. The high domelike carapace, truncate feet, and hinged plastron distinguish it from the other local turtle species. The turtle occurs throughout the eastern and south-central United States and throughout Ohio. Box turtles typically inhabit open woodlands, but are often found in fields. Box turtles were found on the South Property and on the north slope of the Main Hill near Seep 607. Several dried carapaces were found on the railroad tracks adjacent to the north slope and around the Miami-Erie Canal.

BLUE RACER *Coluber constrictor*

This elongated slender snake (91 to 152 cm) has smooth scales, a sharp supraorbital ridge, and a white chin. The rat snake, *Elaphe obsoleta*, has a heavier body, quadrangular belly scales, and keeled mid-dorsal scales. The racer is found throughout the eastern and central United States and occurs throughout Ohio. Racers inhabit open woodlands, fields, and riparian habitats. At the Mound Plant, a blue racer was observed on the South Property in an ecotonal area between a woodland and clear-cut band.

RAT SNAKE *Elaphe obsoleta*

This common snake attains the length of 107 to 183 cm. As an adult, it exhibits a plain dark-gray to black color, often with traces of a blotched pattern. The dorsal scales are weakly keeled and the belly scales quadrangular in shape. The belly is mottled or checkered in pattern. The somewhat similar species, *Coluber constrictor*, is contrasted above. The rat snake occurs throughout the central and eastern United States and is widespread in Ohio. This species is found in a wide variety of habitats, from wooded areas to open sandy plains. These snakes often invade man-made dwellings in search of food and cover. Because of their tolerance of man, they often stay in areas commonly occupied or visited by humans. During the ecological assessment, specimens of *Elaphe obsoleta* were found primarily in wooded slopes on the SM/PP Hill and on the South Property. One individual was caught and released in the same wooded slope two times within a 3-day period.

NORTHERN WATER SNAKE *Nerodia sipedon*

This snake is a moderately long (61 to 107 cm) tan to gray-brown snake with reddish crossbands on the neck and alternating dorsal and lateral blotches thereafter. The dorsal scales are well-keeled and the belly has two rows of irregular crescents. Within the Mound area, there are no other similar water snakes. The northern water snake occurs throughout the central and eastern United States and is widespread in Ohio. The species inhabits most permanent bodies of water, but is found readily in streams and rivers. At the Mound Plant, a northern water snake was caught in the Miami-Erie Canal at the confluence with the Plant Drainage Ditch.

QUEEN SNAKE *Regina septemvittata*

This slender aquatic snake, which grows to be 38 to 61 cm, has a broad light-brown mid-dorsal stripe bordered with lateral yellow stripes. The belly is marked with four dark stripes. Garter snakes (*Thamnophis*) also have dorsal stripes but have a thin light mid-dorsal stripe that queen snakes do not. Garter snakes also have single anal plates while queen snakes have a divided one. Queen snakes occur throughout the eastern United States except in the coastal plains of Virginia, North Carolina, South Carolina, Georgia, and Florida. This species occurs throughout Ohio in small-to-medium sized creeks and rivers, but is occasionally found in slack water areas of large rivers. The one specimen found at the Mound Plant was in the Miami-Erie Canal at the confluence with the Plant Drainage Ditch.

BROWN SNAKE *Storeria dekayi*

This short (23 to 33 cm) light-brown snake has a broad indistinct pale stripe boarded by dark spots or slashes. The belly color is white or pinkish and the dorsal scales are strongly keeled. There are no other similar sympatric species in the study area. Brown snakes are found throughout the central and eastern United States and throughout Ohio. This snake species occurs in a wide variety of habitats, from open fields and woodlands to rocky ravines. This secretive snake is most commonly found beneath logs, rocks, and other debris. In the northern United States, this snake is often called a "ground rattler" and is commonly killed. At the Mound Plant, a road-kill specimen was found on Dayton-Cincinnati Pike in the vicinity of the confluence of the Overflow Creek and the Miami-Erie Canal.

APPENDIX E

BIRD SURVEY DATA

Table E-1. Summary of Bird Transect Observations, Mound Plant, Montgomery County, Ohio

Transect	Season	AM/PM	Number of Individuals		Number of Species	
			Total	Average[a]	Total	Average[b]
1A	Spring	AM	132	66	27	14
		PM	30	30	14	14
	Summer	AM	90	30	15	15
		PM	23	23	9	9
	Fall	AM	107	36	14	5
		PM	34	34	7	7
	Winter	AM	36	12	12	4
		PM	6	6	2	2
1B	Spring	AM	104	52	23	12
		PM	21	21	10	10
	Summer	AM	227	76	10	5
		PM	32	32	7	7
	Fall	AM	285	95	16	5
		PM	22	22	6	6
	Winter	AM	30	10	13	4
		PM	3	3	2	2
2A	Spring	AM	82	41	24	12
		PM	35	35	18	18
	Summer	AM	93	31	18	6
		PM	24	24	10	10
	Fall	AM	205	68	14	5
		PM	45	45	7	7
	Winter	AM	31	10	9	3
		PM	2	2	2	2
2B	Spring	AM	82	41	25	13
		PM	104	104	14	14
	Summer	AM	79	26	23	8
		PM	8	8	4	4
	Fall	AM	198	66	15	5
		PM	74	74	9	9
	Winter	AM	19	6	8	3
		PM	1	1	1	1
3X	Spring	AM	51	26	23	12
		PM	13	13	6	6
	Summer	AM	17	9	10	5
		PM	31	16	13	7
	Fall	AM	42	14	12	4
		PM	25	25	4	4
	Winter	AM	26	13	11	6
		PM	48	16	10	3

Table E-1. (page 2 of 3)

Transect	Season	AM/PM	Number of Individuals		Number of Species	
			Total	Average[a]	Total	Average[b]
4A	Spring	AM	27	14	11	6
		PM	40	40	17	17
	Summer	AM	23	8	10	3
		PM	6	6	3	3
	Fall	AM	34	11	7	2
		PM	11	7	3	2
	Winter	AM	7	4	7	4
		PM	17	9	5	3
4B	Spring	AM	29	29	11	11
		PM	35	18	12	6
	Summer	AM	41	14	17	6
		PM	2	2	2	2
	Fall	AM	35	12	8	3
		PM	54	27	10	5
	Winter	AM	12	6	5	3
		PM	13	7	4	2
5A	Spring	AM	39	39	17	17
		PM	66	33	19	10
	Summer	AM	62	21	12	4
		PM	4	4	4	4
	Fall	AM	585	195	11	4
		PM	10	10	5	5
	Winter	AM	37	19	9	5
		PM	19	6	6	2
5B	Spring	AM	26	26	12	12
		PM	49	25	10	5
	Summer	AM	77	26	11	4
		PM	11	11	3	3
	Fall	AM	172	57	6	2
		PM	23	23	5	5
	Winter	AM	16	8	5	3
		PM	27	9	9	3
6X	Spring	AM	25	25	12	12
		PM	33	17	12	6
	Summer	AM	69	23	10	3
		PM	4	4	3	3
	Fall	AM	87	29	12	4
		PM	27	27	5	5
	Winter	AM	16	8	5	3
		PM	11	4	3	1

Table E-1. (page 3 of 3)

Transect	Season	AM/PM	Number of Individuals		Number of Species	
			Total	Average[a]	Total	Average[b]
7X	Spring	AM	22	22	15	15
		PM	22	11	10	5
	Summer	AM	89	30	17	6
		PM	11	11	4	4
	Fall	AM	56	19	5	2
		PM	7	7	2	2
	Winter	AM	13	6.5	8	4
		PM	64	21	7	2

[a]Average number of individuals = $\frac{\text{total number of individuals}}{\text{number of times transect was surveyed}}$

[b]Average number of species = $\frac{\text{total number of species}}{\text{number of times transect was surveyed}}$

Table E-2. Total and Average Number of Individuals and Bird Species by Transect and Time of Day, Mound Plant, Montgomery County, Ohio

Transect	AM/PM	Number of Individuals		Number of Species		
		Total	Average	Maximum	Minimum	Average
1A	AM	365	91	27	12	17
	PM	93	23	14	2	8
1B	AM	646	162	23	10	16
	PM	78	20	10	2	6
2A	AM	411	103	24	9	16
	PM	106	27	18	2	9
2B	AM	378	95	25	8	18
	PM	187	47	14	1	7
3X	AM	136	34	23	10	14
	PM	117	29	13	4	8
4A	AM	91	23	11	7	9
	PM	74	19	17	3	7
4B	AM	117	29	17	5	10
	PM	104	26	12	2	7
5A	AM	723	181	17	9	12
	PM	99	25	19	4	9
5B	AM	291	73	12	5	9
	PM	110	28	10	3	7
6X	AM	197	49	12	5	10
	PM	75	19	12	3	6
7X	AM	180	45	17	5	11
	PM	104	26	10	2	6

Table E-3. Total and Average Number of Individuals and Bird Species By Transect and Season, Mound Plant, Montgomery County, Ohio

Transect	Season	Number of Individuals		Number of Species		
		Total	Average	Maximum	Minimum	Average
1A	Spring	162	54	27	14	21
	Summer	113	28	15	9	13
	Fall	141	35	14	7	11
	Winter	42	11	12	2	7
	All Seasons Combined	**458**	**31**	-	-	**13**
1B	Spring	125	42	23	10	17
	Summer	259	65	10	7	9
	Fall	307	77	16	6	11
	Winter	33	8	13	2	8
	All Seasons Combined	**724**	**48**	-	-	**11**
2A	Spring	117	39	24	18	21
	Summer	117	29	18	10	14
	Fall	250	63	14	7	11
	Winter	33	8	9	2	6
	All Seasons Combined	**517**	**34**	-	-	**13**
2B	Spring	186	62	25	14	20
	Summer	87	22	23	4	14
	Fall	272	68	15	9	13
	Winter	20	5	8	1	5
	All Seasons Combined	**565**	**38**	-	-	**12**
3X	Spring	64	21	23	6	15
	Summer	48	12	13	10	13
	Fall	67	17	12	4	8
	Winter	74	15	11	10	11
	All Seasons Combined	**253**	**16**	-	-	**11**

Table E-3. (page 2 of 3)

Transect	Season	Number of Individuals		Number of Species		
		Total	Average	Maximum	Minimum	Average
4A	Spring	67	22	17	11	14
	Summer	29	7	10	3	7
	Fall	45	9	7	3	5
	Winter	24	6	7	5	6
	All Seasons Combined	**165**	**10**	-	-	**8**
4B	Spring	64	21	12	11	12
	Summer	43	11	17	2	10
	Fall	89	18	10	8	9
	Winter	25	6	5	4	5
	All Seasons Combined	**221**	**14**	-	-	**9**
5A	Spring	105	35	19	17	18
	Summer	66	17	12	4	8
	Fall	595	149	11	5	8
	Winter	56	11	9	6	8
	All Seasons Combined	**822**	**51**	-	-	**10**
5B	Spring	75	25	12	10	11
	Summer	88	22	11	3	7
	Fall	195	49	6	5	6
	Winter	43	9	9	5	7
	All Seasons Combined	**401**	**25**	-	-	**8**
6X	Spring	58	19	12	12	12
	Summer	73	18	10	3	7
	Fall	114	29	12	5	9
	Winter	27	5	5	3	4
	All Seasons Combined	**272**	**17**	-	-	**8**

Table E-3. (page 3 of 3)

Transect	Season	Number of Individuals		Number of Species		
		Total	Average	Maximum	Minimum	Average
7X	Spring	44	15	15	10	13
	Summer	100	25	17	4	11
	Fall	63	16	5	2	4
	Winter	77	15	8	7	8
	All Seasons Combined	284	18	-	-	9

Table E-4. Summary Data for the Ten Most Common Birds at the Mound Plant, Montgomery County, Ohio

Species	Transect	Spring	Summer	Fall	Winter	Total
American Robin	1A	7	2	58	0	67
	1B	6	168	174	1	349
	2A	9	19	132	11	171
	2B	8	10	145	3	166
	3X	7	3	15	9	34
	4A	14	3	22	1	40
	4B	8	11	16	1	36
	5A	7	3	525	0	535
	5B	9	2	95	6	112
	6X	9	16	63	0	88
	7X	5	7	16	44	72
	TOTALS	**89**	**244**	**1,261**	**76**	**1,670**
European Starling	1A	12	39	54	9	114
	1B	38	4	13	6	61
	2A	12	0	0	0	12
	2B	74	0	35	4	113
	3X	4	1	6	12	23
	4A	9	2	0	1	12
	4B	8	0	9	9	26
	5A	11	9	42	13	75
	5B	25	57	76	10	168
	6X	7	20	3	2	32
	7X	2	5	37	3	47
	TOTALS	**202**	**137**	**275**	**69**	**683**
Northern Cardinal	1A	6	0	2	7	15
	1B	8	3	3	7	21
	2A	12	6	5	6	29
	2B	9	13	4	1	27
	3X	9	2	6	5	22
	4A	5	5	4	3	17
	4B	7	6	3	2	18
	5A	2	1	1	2	6
	5B	3	4	2	0	9
	6X	8	13	5	14	40
	7X	6	6	3	0	15
	TOTALS	**75**	**59**	**38**	**47**	**219**

Table E-4. (page 2 of 4)

Species	Transect	Spring	Summer	Fall	Winter	Total
American Goldfinch	1A	16	21	2	0	39
	1B	6	45	7	1	59
	2A	6	14	3	0	23
	2B	11	6	23	0	40
	3X	3	1	0	1	5
	4A	3	5	0	0	8
	4B	1	5	4	1	11
	5A	2	2	6	1	11
	5B	0	1	0	0	1
	6X	2	3	0	0	5
	7X	1	1	0	0	2
	TOTALS	51	104	45	4	204
Carolina Chickadee	1A	5	1	0	0	6
	1B	2	2	3	2	9
	2A	3	9	8	6	26
	2B	1	4	7	7	19
	3X	1	0	4	5	10
	4A	8	1	2	4	15
	4B	8	2	2	3	15
	5A	0	0	0	0	0
	5B	0	0	0	0	0
	6X	0	0	10	8	18
	7X	6	16	0	14	36
	TOTALS	34	35	36	49	154
House Finch	1A	21	6	2	0	29
	1B	6	1	0	3	10
	2A	10	1	0	0	11
	2B	3	3	6	1	13
	3X	2	17	1	0	20
	4A	3	0	9	0	12
	4B	0	1	1	0	2
	5A	0	0	0	0	0
	5B	0	0	3	0	3
	6X	1	11	7	1	20
	7X	8	16	0	1	25
	TOTALS	54	56	29	6	145

Table E-4. (page 3 of 4)

Species	Transect	Spring	Summer	Fall	Winter	Total
Mourning Dove	1A	3	10	1	2	16
	1B	2	3	0	2	7
	2A	9	6	6	0	21
	2B	1	4	0	0	5
	3X	4	2	0	0	6
	4A	1	1	0	1	3
	4B	3	3	1	1	8
	5A	4	2	1	1	8
	5B	3	12	13	4	32
	6X	2	4	0	0	6
	7X	2	24	3	1	30
	TOTALS	34	71	25	12	142
Red-Winged Blackbird	1A	26	0	2	0	28
	1B	16	0	0	0	16
	2A	7	0	1	0	8
	2B	2	0	0	0	2
	3X	0	0	18	0	18
	4A	2	0	0	0	2
	4B	0	0	43	0	43
	5A	6	0	0	0	6
	5B	3	0	0	0	3
	6X	1	0	0	0	1
	7X	0	0	0	0	0
	TOTALS	63	0	64	0	127
Song Sparrow	1A	9	4	2	1	16
	1B	8	4	3	2	17
	2A	4	0	0	1	5
	2B	6	2	0	0	8
	3X	1	0	3	7	11
	4A	1	1	0	0	2
	4B	4	0	0	0	4
	5A	4	3	3	6	16
	5B	10	3	3	8	24
	6X	7	0	1	1	9
	7X	1	0	0	0	1
	TOTALS	55	17	15	26	113

Table E-4. (page 4 of 4)

Species	Transect	Spring	Summer	Fall	Winter	Total
Common Grackle	1A	5	0	0	0	5
	1B	2	0	50	0	52
	2A	2	0	0	0	2
	2B	11	1	0	0	12
	3X	4	1	1	0	6
	4A	2	2	0	0	4
	4B	12	2	0	0	14
	5A	1	1	0	0	2
	5B	2	0	0	0	2
	6X	4	1	1	0	6
	7X	0	0	0	0	0
	TOTALS	45	8	52	0	105

Table E-5. Transect Results for All Species by Habitat and and Season

Transect Habitat Type:	Season	1A,1B Mesic/Subxeric Grassland Total	2A, 2B, 7X Slope Forest Total	6X, 3X Scrub-Scrub Forest Edge Total	4A, 4B Riparian Total	5A, 5B Industrial/Open Waterway Total
Carolina Chickadee	Spring	7	10	1	16	0
	Summer	3	29	0	3	0
	Fall	3	15	14	4	0
	Winter	2	27	13	7	0
	All Seasons Combined	**15**	**81**	**28**	**30**	**0**
Northern Cardinal	Spring	14	27	17	12	5
	Summer	3	25	15	11	5
	Fall	5	12	11	7	3
	Winter	14	7	19	5	2
	All Seasons Combined	**36**	**71**	**62**	**35**	**15**
American Goldfinch	Spring	22	18	5	4	2
	Summer	66	21	4	10	3
	Fall	9	26	0	4	6
	Winter	1	0	1	1	1
	All Seasons Combined	**98**	**65**	**10**	**19**	**12**
Common Grackle	Spring	7	13	8	14	3
	Summer	0	1	2	4	1
	Fall	50	0	2	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**57**	**14**	**12**	**18**	**4**
House Finch	Spring	27	21	3	3	0
	Summer	7	20	28	1	0
	Fall	2	6	8	10	3
	Winter	3	2	1	0	0
	All Seasons Combined	**39**	**49**	**40**	**14**	**3**
Mourning Dove	Spring	5	12	6	4	7
	Summer	13	34	6	4	14
	Fall	1	9	0	1	14
	Winter	4	1	0	2	5
	All Seasons Combined	**23**	**56**	**12**	**11**	**40**
American Robin	Spring	13	22	16	22	16
	Summer	170	36	19	14	5
	Fall	232	293	78	38	620
	Winter	1	58	9	2	6
	All Seasons Combined	**416**	**409**	**122**	**76**	**647**

Table E-5. (page 2 of 12)

Transect Habitat Type:	Season	1A,1B Mesic/Subxeric Grassland Total	2A, 2B, 7X Slope Forest Total	6X, 3X Scrub-Scrub Forest Edge Total	4A, 4B Riparian Total	5A, 5B Industrial/Open Waterway Total
Red-Winged Blackbird	Spring	42	9	1	2	9
	Summer	0	0	0	0	0
	Fall	2	1	18	43	0
	Winter	0	0	0	0	0
	All Seasons Combined	**44**	**10**	**19**	**45**	**9**
Blue Jay	Spring	1	16	3	0	0
	Summer	0	22	8	1	0
	Fall	8	3	3	3	1
	Winter	3	1	1	0	0
	All Seasons Combined	**12**	**42**	**15**	**4**	**1**
Black-Throated Green Warbler	Spring	0	0	0	0	0
	Summer	0	1	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**1**	**0**	**0**	**0**
Song Sparrow	Spring	17	11	8	5	14
	Summer	8	2	0	1	6
	Fall	5	0	4	0	6
	Winter	3	1	8	0	14
	All Seasons Combined	**33**	**14**	**20**	**6**	**40**
European Starling	Spring	40	98	11	17	36
	Summer	43	5	21	2	66
	Fall	67	72	9	9	118
	Winter	15	7	14	10	23
	All Seasons Combined	**165**	**182**	**55**	**38**	**243**
Accipiter sp.	Spring	0	0	0	0	0
	Summer	0	0	0	0	0
	Fall	0	1	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**1**	**0**	**0**	**0**
Brown Creeper	Spring	0	0	0	0	0
	Summer	0	0	0	0	0
	Fall	0	0	0	0	0
	Winter	0	1	0	0	0
	All Seasons Combined	**0**	**1**	**0**	**0**	**0**

Table E-5. (page 3 of 12)

Transect Habitat Type:	Season	1A,1B Mesic/Subxeric Grassland Total	2A, 2B, 7X Slope Forest Total	6X, 3X Scrub-Scrub Forest Edge Total	4A, 4B Riparian Total	5A, 5B Industrial/Open Waterway Total
Barn Swallow	Spring	0	0	3	0	0
	Summer	0	0	0	2	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**0**	**3**	**2**	**0**
Bay-Breasted Warbler	Spring	0	0	0	0	0
	Summer	0	0	0	0	0
	Fall	2	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**2**	**0**	**0**	**0**	**0**
Black-Capped Chickadee	Spring	0	0	0	0	0
	Summer	0	0	0	0	0
	Fall	4	1	0	0	0
	Winter	0	0	1	0	0
	All Seasons Combined	**4**	**1**	**1**	**0**	**0**
Blue-Gray Gnatcatcher	Spring	4	1	0	0	0
	Summer	0	3	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**4**	**4**	**0**	**0**	**0**
Canada Goose	Spring	0	0	0	0	0
	Summer	13	31	0	0	31
	Fall	0	0	0	0	0
	Winter	2	0	12	10	0
	All Seasons Combined	**15**	**31**	**12**	**10**	**31**
Cooper's Hawk	Spring	0	0	0	0	0
	Summer	0	0	0	0	0
	Fall	0	1	0	0	0
	Winter	0	1	0	0	0
	All Seasons Combined	**0**	**2**	**0**	**0**	**0**
Chipping Sparrow	Spring	2	3	1	3	0
	Summer	0	0	0	2	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**2**	**3**	**1**	**5**	**0**

Table E-5. (page 4 of 12)

Transect Habitat Type:	Season	1A,1B Mesic/Subxeric Grassland Total	2A, 2B, 7X Slope Forest Total	6X, 3X Scrub-Scrub Forest Edge Total	4A, 4B Riparian Total	5A, 5B Industrial/Open Waterway Total
Chimney Swift	Spring	2	7	7	5	5
	Summer	1	4	2	1	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**3**	**11**	**9**	**6**	**5**
Cedar Waxwing	Spring	0	0	0	0	0
	Summer	0	0	0	0	0
	Fall	30	47	2	1	0
	Winter	0	0	0	0	0
	All Seasons Combined	**30**	**47**	**2**	**1**	**0**
Gray Catbird	Spring	2	0	1	1	0
	Summer	1	4	0	2	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**3**	**4**	**1**	**3**	**0**
Carolina Wren	Spring	2	7	3	1	0
	Summer	0	10	4	1	0
	Fall	6	4	3	4	0
	Winter	4	2	1	0	0
	All Seasons Combined	**12**	**23**	**11**	**6**	**0**
Double-Crested Cormorant	Spring	0	0	0	0	0
	Summer	0	0	0	0	0
	Fall	0	60	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**60**	**0**	**0**	**0**
Brown-Headed Cowbird	Spring	3	7	0	0	2
	Summer	0	0	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**3**	**7**	**0**	**0**	**2**
American Crow	Spring	1	2	5	0	1
	Summer	2	10	0	0	0
	Fall	0	3	1	3	2
	Winter	0	4	1	0	3
	All Seasons Combined	**3**	**19**	**7**	**3**	**6**

Table E-5. (page 5 of 12)

Transect Habitat Type:	Season	1A,1B Mesic/Subxeric Grassland Total	2A, 2B, 7X Slope Forest Total	6X, 3X Scrub-Scrub Forest Edge Total	4A, 4B Riparian Total	5A, 5B Industrial/Open Waterway Total
Chestnut-Sided Warbler	Spring	0	0	0	0	0
	Summer	0	1	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**1**	**0**	**0**	**0**
Downy Woodpecker	Spring	1	0	0	0	0
	Summer	0	2	3	2	1
	Fall	1	4	0	1	0
	Winter	3	7	2	1	4
	All Seasons Combined	**5**	**13**	**5**	**4**	**5**
Empidonax sp.	Spring	0	0	0	0	0
	Summer	0	0	0	1	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**0**	**0**	**1**	**0**
Field Sparrow	Spring	6	10	2	0	0
	Summer	3	14	1	0	0
	Fall	0	0	1	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**9**	**24**	**4**	**0**	**0**
Finch sp.	Spring	0	0	0	0	0
	Summer	0	0	0	0	0
	Fall	0	0	10	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**0**	**10**	**0**	**0**
Northern Flicker	Spring	3	1	1	0	1
	Summer	0	5	0	0	0
	Fall	1	5	0	1	1
	Winter	0	0	0	0	1
	All Seasons Combined	**4**	**11**	**1**	**1**	**3**
Green Heron	Spring	1	0	0	2	3
	Summer	0	0	0	0	7
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**1**	**0**	**0**	**2**	**10**

Table E-5. (page 6 of 12)

Transect Habitat Type:	Season	1A,1B Mesic/Subxeric Grassland Total	2A, 2B, 7X Slope Forest Total	6X, 3X Scrub-Scrub Forest Edge Total	4A, 4B Riparian Total	5A, 5B Industrial/Open Waterway Total
Great-Blue Heron	Spring	1	0	0	0	0
	Summer	0	0	0	0	0
	Fall	0	0	0	0	1
	Winter	0	0	1	0	0
	All Seasons Combined	**1**	**0**	**1**	**0**	**1**
Golden-Crowned Kinglet	Spring	0	0	0	0	0
	Summer	0	0	0	0	0
	Fall	3	1	3	0	0
	Winter	0	7	0	0	0
	All Seasons Combined	**3**	**8**	**3**	**0**	**0**
House Sparrow	Spring	4	1	0	2	0
	Summer	1	0	0	5	0
	Fall	0	0	0	5	0
	Winter	0	0	0	0	0
	All Seasons Combined	**5**	**1**	**0**	**12**	**0**
Hairy Woodpecker	Spring	0	0	1	0	1
	Summer	0	0	0	0	0
	Fall	0	0	0	0	0
	Winter	1	0	0	0	0
	All Seasons Combined	**1**	**0**	**1**	**0**	**1**
House Wren	Spring	1	6	0	6	0
	Summer	0	1	1	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**1**	**7**	**1**	**6**	**0**
Indigo Bunting	Spring	4	10	5	4	2
	Summer	0	0	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**4**	**10**	**5**	**4**	**2**
Dark-Eyed Junco	Spring	0	0	0	0	0
	Summer	0	0	0	0	0
	Fall	0	2	0	0	0
	Winter	14	2	6	0	0
	All Seasons Combined	**14**	**4**	**6**	**0**	**0**

Table E-5. (page 7 of 12)

Transect Habitat Type:	Season	1A,1B Mesic/Subxeric Grassland	2A, 2B, 7X Slope Forest	6X, 3X Scrub-Scrub Forest Edge	4A, 4B Riparian	5A, 5B Industrial/Open Waterway
		Total	Total	Total	Total	Total
American Kestrel	Spring	0	0	2	0	4
	Summer	0	0	1	0	1
	Fall	0	0	0	0	0
	Winter	1	0	0	0	1
	All Seasons Combined	**1**	**0**	**3**	**0**	**6**
Killdeer	Spring	0	0	1	0	18
	Summer	0	0	0	1	6
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**0**	**1**	**1**	**24**
Eastern Kingbird	Spring	0	2	0	0	2
	Summer	0	0	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**2**	**0**	**0**	**2**
Belted Kingfisher	Spring	1	0	0	0	1
	Summer	0	0	0	1	6
	Fall	0	0	0	0	5
	Winter	0	0	1	1	6
	All Seasons Combined	**1**	**0**	**1**	**2**	**18**
Yellow-Rumped Warbler	Spring	0	0	0	0	0
	Summer	0	0	0	0	0
	Fall	7	0	3	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**7**	**0**	**3**	**0**	**0**
Mallard	Spring	1	2	0	0	25
	Summer	0	1	0	0	0
	Fall	0	0	0	0	7
	Winter	0	0	0	2	13
	All Seasons Combined	**1**	**3**	**0**	**2**	**45**
Eastern Meadowlark	Spring	26	15	3	0	1
	Summer	19	1	0	0	0
	Fall	3	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**48**	**16**	**3**	**0**	**1**

Table E-5. (page 8 of 12)

Transect Habitat Type:	Season	1A,1B Mesic/Subxeric Grassland Total	2A, 2B, 7X Slope Forest Total	6X, 3X Scrub-Scrub Forest Edge Total	4A, 4B Riparian Total	5A, 5B Industrial/Open Waterway Total
Northern Oriole	Spring	1	4	0	4	0
	Summer	1	1	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**2**	**5**	**0**	**4**	**0**
Northern Mockingbird	Spring	4	1	1	0	0
	Summer	17	2	2	0	0
	Fall	1	0	0	0	0
	Winter	3	0	0	0	0
	All Seasons Combined	**25**	**3**	**3**	**0**	**0**
Purple Martin	Spring	0	0	0	0	0
	Summer	1	6	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**1**	**6**	**0**	**0**	**0**
Eastern Wood-Pewee	Spring	0	2	0	0	0
	Summer	0	0	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**2**	**0**	**0**	**0**
Rock Dove	Spring	0	2	1	0	1
	Summer	0	0	0	2	0
	Fall	0	0	5	0	4
	Winter	0	0	0	0	5
	All Seasons Combined	**0**	**2**	**6**	**2**	**10**
Red-Bellied Woodpecker	Spring	0	1	0	0	0
	Summer	0	1	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**2**	**0**	**0**	**0**
Ruby-Crowned Kinglet	Spring	0	0	0	0	0
	Summer	0	1	0	0	0
	Fall	0	1	2	0	0
	Winter	0	1	1	1	0
	All Seasons Combined	**0**	**3**	**3**	**1**	**0**

Table E-5. (page 9 of 12)

Transect Habitat Type:	Season	1A,1B Mesic/Subxeric Grassland Total	2A, 2B, 7X Slope Forest Total	6X, 3X Scrub-Scrub Forest Edge Total	4A, 4B Riparian Total	5A, 5B Industrial/Open Waterway Total
Red-Eyed Vireo	Spring	1	1	1	0	0
	Summer	0	1	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**1**	**2**	**1**	**0**	**0**
American Redstart	Spring	0	0	1	0	0
	Summer	0	0	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**0**	**1**	**0**	**0**
Rough-Legged Hawk	Spring	0	0	0	0	0
	Summer	0	0	0	0	0
	Fall	0	2	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**2**	**0**	**0**	**0**
Red-Tailed Hawk	Spring	0	0	0	0	0
	Summer	0	1	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	1	0	0
	All Seasons Combined	**0**	**1**	**1**	**0**	**0**
Ruby-Throat Hummingbird	Spring	0	0	0	0	0
	Summer	0	0	1	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**0**	**1**	**0**	**0**
N. Rough-Winged Swallow	Spring	2	1	3	1	3
	Summer	0	0	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**2**	**1**	**3**	**1**	**3**
Spotted Sandpiper	Spring	0	0	0	0	3
	Summer	0	0	0	0	1
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**0**	**0**	**0**	**4**

Table E-5. (page 10 of 12)

Transect Habitat Type:	Season	1A,1B Mesic/Subxeric Grassland Total	2A, 2B, 7X Slope Forest Total	6X, 3X Scrub-Scrub Forest Edge Total	4A, 4B Riparian Total	5A, 5B Industrial/Open Waterway Total
Sparrow sp.	Spring	4	1	0	0	0
	Summer	2	0	0	0	1
	Fall	1	7	0	0	1
	Winter	0	0	0	0	0
	All Seasons Combined	**7**	**8**	**0**	**0**	**2**
Sharp-Shinned Hawk	Spring	0	0	0	0	0
	Summer	0	0	0	0	0
	Fall	1	0	0	0	0
	Winter	0	3	0	0	0
	All Seasons Combined	**1**	**3**	**0**	**0**	**0**
Swamp Sparrow	Spring	0	0	0	0	0
	Summer	0	0	0	0	0
	Fall	0	0	1	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**0**	**1**	**0**	**0**
Tree Swallow	Spring	0	0	0	0	0
	Summer	0	1	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**1**	**0**	**0**	**0**
Turkey Vulture	Spring	0	0	0	0	0
	Summer	0	1	1	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**1**	**1**	**0**	**0**
Brown Thrasher	Spring	2	1	0	0	0
	Summer	0	1	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**2**	**2**	**0**	**0**	**0**
Tufted Titmouse	Spring	0	1	0	2	0
	Summer	0	2	1	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**3**	**1**	**2**	**0**

Table E-5. (page 11 of 12)

Transect Habitat Type:	Season	1A,1B Mesic/Subxeric Grassland Total	2A, 2B, 7X Slope Forest Total	6X, 3X Scrub-Scrub Forest Edge Total	4A, 4B Riparian Total	5A, 5B Industrial/Open Waterway Total
Rufous-Sided Towhee	Spring	0	5	2	0	0
	Summer	2	2	1	1	0
	Fall	1	1	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**3**	**8**	**3**	**1**	**0**
Warbling Vireo	Spring	0	0	0	1	0
	Summer	0	0	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**0**	**0**	**1**	**0**
American Woodcock	Spring	0	0	0	0	0
	Summer	0	0	0	0	0
	Fall	0	2	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**2**	**0**	**0**	**0**
Wren sp.	Spring	0	1	0	0	0
	Summer	0	0	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**1**	**0**	**0**	**0**
White-Throated Sparrow	Spring	0	0	0	0	0
	Summer	0	0	0	0	0
	Fall	2	0	2	0	0
	Winter	1	0	10	6	10
	All Seasons Combined	**3**	**0**	**12**	**6**	**10**
Yellow Warbler	Spring	1	0	0	0	1
	Summer	0	0	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**1**	**0**	**0**	**0**	**1**
Yellow-Billed Cuckoo	Spring	0	1	0	0	0
	Summer	0	0	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	**0**	**1**	**0**	**0**	**0**

Table E-5. (page 12 of 12)

Transect Habitat Type:	Season	1A,1B Mesic/Subxeric Grassland	2A, 2B, 7X Slope Forest	6X, 3X Scrub-Scrub Forest Edge	4A, 4B Riparian	5A, 5B Industrial/Open Waterway
		Total	Total	Total	Total	Total
Common Yellowthroat	Spring	1	3	0	0	0
	Summer	0	1	0	0	0
	Fall	0	0	0	0	0
	Winter	0	0	0	0	0
	All Seasons Combined	1	4	0	0	0
	Total Spring	276	356	123	131	166
	Total Summer	376	304	121	72	154
	Total Fall	447	579	180	134	792
	Total Winter	75	132	103	48	94
	GRAND TOTAL	1,174	1,371	527	385	1,206

Table E-6. Occurrence of Raptors by Transect, Season, and Time of Day at the Mound Plant, Montgomery County, Ohio

FCAAB Species	Transect	Season	AM/PM	Number of Individuals
	1A	Winter	AM	1
American Kestrel	3B	Spring	PM	1
	5A	Spring	AM	1
	5A	Spring	PM	1
	5A	Winter	PM	1
	5B	Summer	AM	1
	5B	Spring	AM	1
	6X	Summer	AM	1
	6X	Spring	PM	1
	Total			9
Cooper's Hawk	2A	Fall	AM	1
	2A	Winter	AM	1
	Total			2
Rough-Legged Hawk	2A	Fall	AM	1
	2B	Fall	AM	1
	Total			2
Red-Tailed Hawk	2A	Summer	PM	1
	3X	Winter	AM	1
	Total			2
Sharp-Shinned Hawk	1B	Fall	AM	1
	2A	Winter	PM	2
	7X	Winter	PM	1
	Total			4
Accipiter sp.	2A	Fall	AM	1
	Total			1
Turkey Vulture	2B	Summer	AM	1
	3X	Summer	PM	1
	Total			2

APPENDIX F

MAMMAL TRAPPING DATA

Table F-1. Number of Trap Observations by Sampling Location, Season, and Time of Day

	Spring			Summer			Fall			Total		
Grid/Transect[a]	M[b]	A[c]	E[d]	M	A	E	M	A	E	M	A	E
BB	50	50	50	40	50	30	50	50	50	140	150	130
DD	50	50	50	40	50	30	50	50	50	140	150	130
ME	50	50	50	40	50	30	50	50	50	140	150	130
MH	45	45	45	36	45	27	45	45	45	126	135	117
NS	45	45	45	36	45	27	**	**	**	81	90	72
PP	45	45	45	36	45	27	45	45	45	126	135	117
SS	45	45	45	36	45	27	45	45	45	126	135	117
SC	125	125	125	100	100	100	125	125	125	350	350	350
SW	125	125	125	100	100	100	125	125	125	351	350	350
Subtotal	580	580	580	464	530	398	535	535	535	1,580	1,645	1,513
Total	1,740			1,392			1,605			4,738		

[a] BB = Benner Branch Transect
DD = Drainage Ditch Transect
ME = Miami-Erie Canal Transect
MH = Main Hill, Small Grid
NS = North Slope, Small Grid
PP = Plutonium Processing, Small Grid
SS = Scrub/Shrub, Small Grid
SC = South Central, Large
SW = Southwest, Large Grid

[b] M = Morning
[c] A = Afternoon
[d] E = Evening
** = No trap observations

Table F-2. Number of Traps Sprung Without Animal Capture by Sampling Location, Season, and Time of Day

	Spring			Summer			Fall			Total		
Grid/Transect[a]	M[b]	A[c]	E[d]	M	A	E	M	A	E	M	A	E
BB	32	0	0	15	0	0	13	1	0	60	1	0
DD	27	0	0	14	1	1	13	0	0	54	1	1
ME	42	18	8	34	2	2	2	0	0	77	20	10
MH	0	0	0	3	0	0	3	1	0	6	1	0
NS	43	34	31	17	7	2	**	**	**	60	41	33
PP	13	12	13	31	5	1	44	24	2	88	41	16
SS	1	1	0	13	0	0	16	0	0	30	1	0
SC	111	20	5	57	1	0	51	4	0	219	25	5
SW	113	10	19	82	4	5	18	2	3	213	16	27
Subtotal	381	95	76	266	20	11	160	32	5	807	147	92
Total	552			298			197			1,047		

[a] BB = Benner Branch Transect
DD = Drainage Ditch Transect
ME = Miami-Erie Canal Transect
MH = Main Hill, Small Grid
NS = North Slope, Small Grid
PP = Plutonium Processing, Small Grid
SS = Scrub/Shrub, Small Grid
SC = South Central, Large Grid
SW = Southwest, Large Grid
[b] M = Morning
[c] A = Afternoon
[d] E = Evening
** = No trap observations

Table F-3. Number of Traps Robbed But Not Sprung by Sampling Location, Season, and Time of Day

	Spring			Summer			Fall			Total		
Grid/Transect[a]	M[b]	A[c]	E[d]	M	A	E	M	A	E	M	A	E
BB	3	0	0	9	0	3	4	0	0	16	0	3
DD	4	0	0	7	3	1	2	0	0	13	3	1
ME	8	8	0	2	9	8	0	0	0	10	17	8
MH	0	0	0	1	0	0	5	0	0	6	0	0
NS	1	2	3	8	24	8	**	**	**	9	26	11
PP	18	1	4	2	8	2	1	3	0	21	12	6
SS	1	0	0	14	3	0	7	0	0	22	3	0
SC	2	11	2	9	2	4	8	0	0	19	13	6
SW	10	11	0	6	9	5	8	0	2	24	20	7
Subtotal	47	33	9	58	58	31	35	3	2	140	94	42
Total	**89**			**147**			**40**			**276**		

[a] BB = Benner Branch Transect
DD = Drainage Ditch Transect
ME = Miami-Erie Canal Transect
MH = Main Hill, Small Grid
NS = North Slope, Small Grid
PP = Plutonium Processing, Small Grid
SS = Scrub/Shrub, Small Grid
SC = South Central, Large Grid
SW = Southwest, Large Grid
[b] M = Morning
[c] A = Afternoon
[d] E = Evening
** = No trap observations

Table F-4. Number of Mammals Captured by Sampling Location, Season, and Time of Day

Grid/Transect[a]	Spring			Summer			Fall			Total		
	M[b]	A[c]	E[d]	M	A	E	M	A	E	M	A	E
BB	6	1	0	4	0	0	4	0	0	14	1	0
DD	11	0	0	5	0	0	4	0	0	20	0	0
ME	0	9	6	4	0	0	10	0	0	23	0	6
MH	3	0	0	6	1	0	17	1	1	26	2	1
NS	1	0	0	7	5	5	**	**	**	8	5	5
PP	8	3	1	1	0	0	0	0	0	9	3	1
SS	8	1	0	8	0	0	7	0	0	23	1	0
SC	3	0	0	3	2	0	0	0	0	6	2	0
SW	0	3	3	2	2	1	6	0	0	8	5	4
Subtotal	40	17	10	40	10	6	48	1	1	137	19	17
Total	**67**			**56**			**50**			**173**		

[a] BB = Benner Branch Transect
DD = Drainage Ditch Transect
ME = Miami-Erie Canal Transect
MH = Main Hill, Small Grid
NS = North Slope, Small Grid
PP = Plutonium Processing, Small Grid
SS = Scrub/Shrub, Small Grid
SC = South Central, Large Grid
SW = Southwest, Large Grid
[b] M = Morning
[c] A = Afternoon
[d] E = Evening
** = No trap observations

F-5. Summary of Trapping Effort at Mound Plant, Montgomery County, Ohio

	Spring	Summer	Fall	Total
No. of Observations	1,740	1,392	1,606	4,738
No. of Traps Sprung Without Capture	552	298	197	1,047
No. of Traps Robbed but not Sprung	89	147	40	278
Total No. of Mammals Caught	67	56	50	173
No. of Visits[a]	708	501	287	1,498
Capture Rate (%)[b]	9.5	11.2	17.4	11.5
Visitation Rate (%)[c]	40.7	36.0	17.9	28.0
Success Rate (%)[d]	3.9	4.0	3.1	3.7
No. of *Tamias* Caught	25	15	0	40
No. of *Peromyscus* Caught	39	41	43	123
No. of *Mus* Caught	1	0	0	1
No. of *Blarina* Caught	1	0	7	8
No. of *Microtus* Caught	1	0	0	1
No. of *Tamias* that escaped before weighing	2	1	0	3
No. of *Tamias* recaptured	1	2	0	3
No. of *Peromyscus* that escaped before weighing	1	2	0	3
No. of *Peromyscus* recaptured	0	4	0	4

[a]A visit was considered to be a trap in which the bait had been removed (robbed) and the trap door remained open; a trap in which the trap door was shut but no animal captured; or a trap in which an animal was captured.
[b]Capture Rate = (No. of Captures)/(No. of Visits) * 100
[c]Visitation Rate = (No. of Visits)/(No. of Observations) * 100
[d]Success Rate = (No. of Captures)/(No. of Observations) * 100

APPENDIX G

SUMMARY OF THE QUALITATIVE HABITAT EVALUATION INDEX

APPENDIX G

SUMMARY OF THE QUALITATIVE HABITAT EVALUATION INDEX

Physical habitats of streams at the Mound Plant were evaluated and quantified by the Qualitative Habitat Evaluation Index (QHEI). The QHEI was developed by the Ohio Environmental Protection Agency (OEPA) to assess the quality and quantity of fish habitats in permanent Ohio streams of varying size. Regional QHEI values were established so that the OEPA can predict whether habitat is a limiting factor influencing a fish population. QHEI is generally used in conjunction with the Index of Biotic Integrity (IBI). The IBI has been adapted by the OEPA as a method for evaluating the overall fish community condition. The IBI is based on 12 structural attributes and functional characteristics (OEPA 1987). The IBI was never intended to be applied to drainages less than 1 sq mi, such as the stream system that includes the Plant Drainage Ditch, Miami-Erie Canal, and the Overflow Creek. Nonetheless, these indices, in conjunction with the QHEI, provide a relative indication of the health of the streams at the Mound Plant.

A QHEI site description sheet was prepared for each of six permanent stream sampling locations examined during the ecological characterization. Although the QHEI was not designed to evaluate intermittent streams, a QHEI sheet was also prepared for each of the two sampling locations on intermittent streams (Benner Branch and East Fork). The QHEI sheets for the aquatic surveys are included in this appendix.

All but one of the QHEI values calculated for the Mound sampling locations (Table J-1) were below the range of values (58-76) calculated by the OEPA for headwater streams (<20 sq mi drainage) within the Eastern Corn Belt Plains Region (OEPA 1988). However, the Plant Drainage Ditch, Miami-Erie Canal, and Overflow Creek have been channelized and, in their calculations for this region, the OEPA did not include channelized headwater streams. When compared to state-wide values for channelized headwater streams (Modified Warmwater Habitat, or MWH), all of the permanent stream sampling locations at the Mound Plant produced values not only within the OEPA MWH range (38-56), but within the upper 25 percent of these values (>48).

Therefore, based on the QHEI results, there is sufficient quantity and quality of habitats in the Drainage Ditch, Miami-Erie Canal, and Overflow Creek to support fish and macroinvertebrate populations. Further, the fish and macroinvertebrate populations found in these stream reaches should produce IBI values consistent with IBI values from other Warmwater Habitat streams in the ECBP region.

Figure V-4-5. Front side of the Ohio EPA Site Description Sheet for evaluating the geographical and physical characteristics of fish sampling locations. This is used to record information for the calculation of the Qualitative Habitat Evaluation Index (QHEI).

Ohio EPA Site Description Sheet - Fish **QHEI SCORE: 38**

Stream East Fork of Beaver Branch RM ____ Date 6/9/92 River Code ____

Location EF in text and tables; 6 on plate Crew G Kauffman, C. Skelton

1] SUBSTRATE (Check ONLY Two substrate TYPE BOXES; Check all types present): **SUBSTRATE SCORE: 12**

TYPE	POOL	RIFFLE		POOL	RIFFLE
☐ ☐-BLDER /SLABS[10]	____	____	☐ ☐-GRAVEL [7]	____	____
☐ ☐-BOULDER [9]	____	____	☐ ☐-SAND [6]	____	____
☐ ☒-COBBLE [8]	____	____	☐ ☐-BEDROCK[5]	____	____
☐ ☒-HARDPAN [4]	____	____	☐ ☐-DETRITUS[3]	____	____
☐ ☐-MUCK [2]	____	____	☐ ☐-ARTIFIC.[0]	____	____

TOTAL NUMBER OF SUBSTRATE TYPES: ☒ > 4 [2] ☐ — <= 4 [0] ☐-COAL FINES [-2]

NOTE: (Ignore sludge that originates from point-sources; score is based on natural substrates)

COMMENTS ____

Substrate Origin (Check all): ☐-LIMESTONE [1] ☐-RIP/RAP [0] ☐-TILLS [1] ☐-HARDPAN [0] ☒-SANDSTONE [0] ☐-SHALE [-1]

Silt Cover (Check One): ☐-SILT HEAVY [-2] ☐-SILT MODERATE [-1] ☒-SILT NORMAL [0] ☐-SILT FREE [1]

Extent Of Embeddiness (Check One): ☒-EXTENSIVE [-2] ☐-MODERATE[-1] ☐-LOW[0] ☐-NONE[1]

COVER SCORE: 2

2] INSTREAM COVER

TYPE (Check All That Apply)

☐-UNDERCUT BANKS [1] ☐-DEEP POOLS [2] ☐-OXBOWS [1]
☐-OVERHANGING VEGETATION [1] ☐-ROOTWADS [1] ☐-AQUATIC MACROPHYTES [1]
☐-SHALLOWS (IN SLOW WATER) [1] ☒-BOULDERS [1] ☐-LOGS OR WOODY DEBRIS [1]

AMOUNT (Check ONLY One or check 2 and AVERAGE)

☐-EXTENSIVE > 75% [11]
☐-MODERATE 25-75% [7]
☐-SPARSE 5-25% [3]
☒-NEARLY ABSENT < 5%[1]

COMMENTS: ____

CHANNEL: 12

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATIONS/OTHER	
☐-HIGH [4]	☐-EXCELLENT [7]	☒-NONE [6]	☒-HIGH [3]	☐-SNAGGING	☐-IMPOUND.
☐-MODERATE [3]	☐-GOOD [5]	☐-RECOVERED [4]	☐-MODERATE [2]	☐-RELOCATION	☐-ISLANDS
☒-LOW [2]	☐-FAIR [3]	☐-RECOVERING [3]	☐-LOW [1]	☐-CANOPY REMOVAL	☐-LEVEED
☐-NONE [1]	☒-POOR [1]	☐-RECENT OR NO RECOVERY [1]		☐-DREDGING	☐-BANK SHAPING
				☐-ONE SIDE CHANNEL MODIFICATIONS	

COMMENTS: ____

RIPARIAN: 10

4] RIPARIAN ZONE AND BANK EROSION - (check ONE box per bank or check 2 and AVERAGE per bank)

"River Right Looking Downstream"

RIPARIAN WIDTH L R (Per Bank)	EROSION/RUNOFF - FLOOD PLAIN QUALITY L R (Most Predominant Per Bank)	L R (Per Bank)	BANK EROSION
☐ ☒-WIDE>50m [4]	☒ ☒-FOREST, SWAMP [3]	☐ ☐-URBAN OR INDUSTRIAL[0]	☒ ☒-NONE OR LITTLE [3]
☐ ☐-MODERATE 10-50 [3]	☐ ☐-OPEN PASTURE/ ROWCROP[0]	☐ ☐-SHRUB OR OLD FIELD[2]	☐ ☐-MODERATE [2]
☐ ☐-NARROW 5-10m [2]	☐ ☐- RESID.,PARK,NEW FIELD [1]	☐ ☐-CONSERV. TILLAGE [1]	☐ ☐-HEAVY OR SEVERE[1]
☐ ☐-VERY NARROW 1-5m [1]	☐ ☐-FENCED PASTURE [1]	☐ ☐-MINING/CONSTRUCTION [0]	
☐ ☐-NONE[0]			

COMMENTS: ____

POOL: -2

POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1)	MORPHOLOGY (Check 1)	POOL/RUN/RIFFLE CURRENT VELOCITY (Check All That Apply)	
☐ >1m [6]	☐-POOL WIDTH > RIFFLE WIDTH [2]	☐-TORRENTIAL[-1]	☐-EDDIES[1]
☐ 0.7-1m [4]	☐-POOL WIDTH = RIFFLE WIDTH [1]	☐-FAST[1]	☐-INTERSTITIAL[-1]
☐ 0.4-0.7m [2]	☐-POOL WIDTH < RIFFLE W. [0]	☐-MODERATE [1]	☒-INTERMITTENT[-2]
☐ < 0.4m [1]		☐-SLOW [1]	
☒ <0.2m [Pool = 0]			

☐-NO POOL[0]

COMMENTS: ____

RIFFLE: 0

RIFFLE/RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN EMBEDDEDNESS	
☐ - GENERALLY >10 cm,MAX>50 [4]	☐-STABLE (e.g.,Cobble, Boulder) [2]	☐-EXTENSIVE [-1]	☐-MODERATE[0]
☐ - GENERALLY >10 cm,MAX<50 [3]	☐-MOD. STABLE (e.g.,Pea Gravel) [1]	☐-LOW. [1]	☐-NONE[2]
☐ - GENERALLY 5-10 cm [1]	☐-UNSTABLE (Gravel,Sand) [0]		
☐ - GENERALLY < 5 cm [Riffle = 0]			

☐-NO RIFFLE[0]

COMMENTS none

GRADIENT: 4

6] Gradient (feet/mile): 200 + %POOL: 100 %RIFFLE: ____ %RUN: ____

EPA 4520

Figure V-4-5. Front side of the Ohio EPA Site Description Sheet for evaluating the geographical and physical characteristics of fish sampling locations. This is used to record information for the calculation of the Qualitative Habitat Evaluation Index (QHEI).

Ohio EPA Site Description Sheet - Fish — **QHEI SCORE: 32**

Stream: Banner Branch — RM: ____ Date: 6/9/92 — River Code: ____

Location: BB in text and tables; 7 on plate. — Crew: E Kaufman, C Skelton

1] SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Check all types present): **SUBSTRATE SCORE: 11**

TYPE	POOL	RIFFLE	POOL	RIFFLE	SUBSTRATE QUALITY
☐ ☐-BLDER /SLABS [10]	____	☐ ☒-GRAVEL [7]	____	____	Substrate Origin (Check all)
☐ ☐-BOULDER [9]	____	☐ ☐-SAND [6]	____	____	☐-LIMESTONE [1] ☐-RIP/RAP [0]
☐ ☒-COBBLE [8]	____	☐ ☐-BEDROCK [5]	____	____	☐-TILLS [1] ☐-HARDPAN [0]
☐ ☒-HARDPAN [4]	____	☐ ☐-DETRITUS [3]	____	____	☒-SANDSTONE [0]
☐ ☐-MUCK [2]	____	☐ ☐-ARTIFIC. [0]	____	____	☐-SHALE [-1]

Silt Cover (Check One): ☐-SILT HEAVY [-2] ☐-SILT MODERATE [-1] ☐-SILT NORMAL [0] ☐-SILT FREE [1]

Extent Of Embeddness (Check One): ☒-EXTENSIVE [-2] ☐-MODERATE [-1] ☐-LOW [0] ☐-NONE [1]

TOTAL NUMBER OF SUBSTRATE TYPES: ☒-> 4 [2] ☐-<= 4 [0] ☐-COAL FINES [-2]

NOTE: (Ignore sludge that originates from point-sources; score is based on natural substrates)

COMMENTS: ____

2] INSTREAM COVER — **COVER SCORE: 1**

TYPE (Check All That Apply)

☐-UNDERCUT BANKS [1] ☐-DEEP POOLS [2] ☐-OXBOWS [1]
☐-OVERHANGING VEGETATION [1] ☐-ROOTWADS [1] ☐-AQUATIC MACROPHYTES [1]
☐-SHALLOWS (IN SLOW WATER) [1] ☐-BOULDERS [1] ☐-LOGS OR WOODY DEBRIS [1]

AMOUNT (Check ONLY One or check 2 and AVERAGE)

☐-EXTENSIVE > 75% [11]
☐-MODERATE 25-75% [7]
☐-SPARSE 5-25% [3]
☒-NEARLY ABSENT < 5% [1]

COMMENTS: ____

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE) — **CHANNEL: 13**

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATIONS/OTHER	
☐-HIGH [4]	☐-EXCELLENT [7]	☒-NONE [6]	☒-HIGH [3]	☐-SNAGGING	☐-IMPOUND.
☒-MODERATE [3]	☐-GOOD [5]	☐-RECOVERED [4]	☐-MODERATE [2]	☐-RELOCATION	☐-ISLANDS
☐-LOW [2]	☐-FAIR [3]	☐-RECOVERING [3]	☐-LOW [1]	☐-CANOPY REMOVAL	☐-LEVEED
☐-NONE [1]	☒-POOR [1]	☐-RECENT OR NO RECOVERY [1]		☐-DREDGING	☐-BANK SHAPING
				☐-ONE SIDE CHANNEL MODIFICATIONS	

COMMENTS: ____

4] RIPARIAN ZONE AND BANK EROSION - (check ONE box per bank or check 2 and AVERAGE per bank) — **RIPARIAN: 5**

River Right Looking Downstream

RIPARIAN WIDTH (L R) (Per Bank)	EROSION/RUNOFF - FLOOD PLAIN QUALITY (L R) (Most Predominant Per Bank)	(L R) (Per Bank)	BANK EROSION
☐ ☐-WIDE > 50m [4]	☐ ☐-FOREST, SWAMP [3]	☐ ☐-URBAN OR INDUSTRIAL [0]	☐ ☐-NONE OR LITTLE [3]
☐ ☐-MODERATE 10-50 [3]	☐ ☐-OPEN PASTURE/ ROWCROP [0]	☒ ☒-SHRUB OR OLD FIELD [2]	☒ ☒-MODERATE [2]
☐ ☐-NARROW 5-10m [2]	☐ ☐-RESID., PARK, NEW FIELD [1]	☐ ☐-CONSERV. TILLAGE [1]	☐ ☐-HEAVY OR SEVERE [1]
☒ ☒-VERY NARROW 1-5m [1]	☐ ☐-FENCED PASTURE [1]	☐ ☐-MINING/CONSTRUCTION [0]	
☐ ☐-NONE [0]			

COMMENTS: ____

POOL/GLIDE AND RIFFLE/RUN QUALITY — **POOL: -2**

MAX. DEPTH (Check 1)	MORPHOLOGY (Check 1)	POOL/RUN/RIFFLE CURRENT VELOCITY (Check All That Apply)	
☐-> 1m [6]			
☐-0.7-1m [4]	☐-POOL WIDTH > RIFFLE WIDTH [2]	☐-TORRENTIAL [-1]	☐-EDDIES [1]
☐-0.4-0.7m [2]	☐-POOL WIDTH = RIFFLE WIDTH [1]	☐-FAST [1]	☐-INTERSTITIAL [-1]
☐-< 0.4m [1]	☐-POOL WIDTH < RIFFLE W. [0]	☐-MODERATE [1]	☒-INTERMITTENT [-2]
☒-<0.2m [Pool = 0]		☐-SLOW [1]	

☐-NO POOL [0]

COMMENTS: ____

RIFFLE: 0

RIFFLE/RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN EMBEDDEDNESS	
☐-GENERALLY > 10 cm, MAX > 50 [4]	☐-STABLE (e.g., Cobble, Boulder) [2]	☐-EXTENSIVE [-1]	☐-MODERATE [0]
☐-GENERALLY > 10 cm, MAX < 50 [3]	☐-MOD. STABLE (e.g., Pea Gravel) [1]	☐-LOW. [1]	☐-NONE [2]
☐-GENERALLY 5-10 cm [1]	☐-UNSTABLE (Gravel, Sand) [0]		
☐-GENERALLY < 5 cm [Riffle = 0]			

☐-NO RIFFLE [0]

COMMENTS: none — **GRADIENT: 4**

6] Gradient (feet/mile): 200+ — %POOL: 100 — %RIFFLE: ____ — %RUN: ____

EPA 4520

Figure V-4-5. Front side of the Ohio EPA Site Description Sheet for evaluating the geographical and physical characteristics of fish sampling locations. This is used to record information for the calculation of the Qualitative Habitat Evaluation Index (QHEI).

Ohio EPA Site Description Sheet - Fish **QHEI SCORE: 53**

Stream Plant Drainage Ditch RM ____ Date ____ River Code ____

Location DDJ in feet and riffles - 5 on plate Crew: G Kaufman C Skelton

1] SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Check all types present); **SUBSTRATE SCORE: 15**

TYPE	POOL	RIFFLE		POOL	RIFFLE
☐ ☐-BLDER /SLABS[10]			☐ ☒-GRAVEL [7]		
☐ ☐-BOULDER [9]			☐ ☐-SAND [6]		
☐ ☒-COBBLE [8]			☐ ☐-BEDROCK[5]		
☐ ☐-HARDPAN [4]			☐ ☐-DETRITUS[3]		
☐ ☐-MUCK [2]			☐ ☐-ARTIFIC.[0]		

TOTAL NUMBER OF SUBSTRATE TYPES: ☒ > 4 [2] ☐ — <= 4 [0] ☐-COAL FINES [-2]

NOTE: (Ignore sludge that originates from point-sources; score is based on natural substrates)

COMMENTS ____

Substrate Origin (Check all): ☐-LIMESTONE [1] ☐-RIP/RAP [0] ☐-TILLS [1] ☐-HARDPAN [0] ☒-SANDSTONE [0] ☐-SHALE [-1]

Silt Cover (Check One): ☐-SILT HEAVY [-2] ☐-SILT MODERATE [-1] ☒-SILT NORMAL [0] ☐-SILT FREE [1]

Extent Of Embeddiness (Check One): ☐—EXTENSIVE [-2] ☒—MODERATE[-1] ☐—LOW[0] ☐—NONE[1]

2] INSTREAM COVER **COVER SCORE: 7**

TYPE (Check All That Apply)

☐ -UNDERCUT BANKS [1]
☐ -OVERHANGING VEGETATION [1]
☒ -SHALLOWS (IN SLOW WATER) [1]
☒ -DEEP POOLS [2]
☐ -ROOTWADS [1]
☒ -BOULDERS [1]
☐ -OXBOWS [1]
☐ -AQUATIC MACROPHYTES [1]
☐ -LOGS OR WOODY DEBRIS [1]

AMOUNT (Check ONLY One or check 2 and AVERAGE)

☐ - EXTENSIVE > 75% [11]
☐ - MODERATE 25-75% [7]
☒ - SPARSE 5-25% [3]
☐ - NEARLY ABSENT < 5%[1]

COMMENTS: ____

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE) **CHANNEL: 12**

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATIONS/OTHER	
☐ - HIGH [4]	☐ - EXCELLENT [7]	☐ - NONE [6]	☐ - HIGH [3]	☐ - SNAGGING	☐ - IMPOUND.
☐ - MODERATE [3]	☒ - GOOD [5]	☐ - RECOVERED [4]	☒ - MODERATE [2]	☐ - RELOCATION	☐ - ISLANDS
☒ - LOW [2]	☐ - FAIR [3]	☒ - RECOVERING [3]	☐ - LOW [1]	☐ - CANOPY REMOVAL	☐ - LEVEED
☐ - NONE [1]	☐ - POOR [1]	☐ - RECENT OR NO RECOVERY [1]		☐ - DREDGING	☐ - BANK SHAPING
				☐ - ONE SIDE CHANNEL MODIFICATIONS	

COMMENTS: ____

4] RIPARIAN ZONE AND BANK EROSION - (check ONE box per bank or check 2 and AVERAGE per bank) **RIPARIAN: 7**

"River Right Looking Downstream"

RIPARIAN WIDTH L R (Per Bank)	EROSION/RUNOFF - FLOOD PLAIN QUALITY L R (Most Predominant Per Bank)	L R (Per Bank)	BANK EROSION
☐ ☐-WIDE>50m [4]	☐ ☐-FOREST, SWAMP [3]	☐ ☐-URBAN OR INDUSTRIAL[0]	☒ ☒-NONE OR LITTLE [3]
☐ ☐-MODERATE 10-50 [3]	☐ ☐-OPEN PASTURE/ ROWCROP[0]	☒ ☐-SHRUB OR OLD FIELD[2]	☐ ☐-MODERATE [2]
☒ ☒-NARROW 5-10m [2]	☐ ☒-RESID.,PARK,NEW FIELD [1]	☐ ☐-CONSERV. TILLAGE [1]	☐ ☐-HEAVY OR SEVERE[1]
☐ ☐-VERY NARROW 1-5m [1]	☐ ☐-FENCED PASTURE [1]	☐ ☐-MINING/CONSTRUCTION [0]	
☐ ☐-NONE[0]			

COMMENTS: ____

POOL/GLIDE AND RIFFLE/RUN QUALITY **POOL: 5**

MAX. DEPTH (Check 1)	MORPHOLOGY (Check 1)	POOL/RUN/RIFFLE CURRENT VELOCITY (Check All That Apply)	
☐ - >1m [6]	☐ -POOL WIDTH > RIFFLE WIDTH [2]	☐ -TORRENTIAL[-1]	☐ -EDDIES[1]
☐ - 0.7-1m [4]	☒ -POOL WIDTH = RIFFLE WIDTH [1]	☒ -FAST[1]	☐ -INTERSTITIAL[-1]
☒ 0.4-0.7m [2]	☐ -POOL WIDTH < RIFFLE W. [0]	☒ -MODERATE [1]	☐ -INTERMITTENT[-2]
☐ - < 0.4m [1]		☐ -SLOW [1]	
☐ —<0.2m [Pool = 0]			

☐ - NO POOL[0]

COMMENTS: ____

RIFFLE: 3

RIFFLE/RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN EMBEDDEDNESS
☐ - GENERALLY >10 cm,MAX>50 [4]	☒ STABLE (e.g.,Cobble, Boulder) [2]	☐ - EXTENSIVE [-1] ☒ MODERATE[0]
☐ - GENERALLY >10 cm,MAX<50 [3]	☐ - MOD. STABLE (e.g.,Pea Gravel) [1]	☐ - LOW. [1] ☐ - NONE[2]
☒ - GENERALLY 5-10 cm [1]	☐ - UNSTABLE (Gravel,Sand) [0]	☐ - NO RIFFLE[0]
☐ - GENERALLY < 5 cm [Riffle = 0]		

COMMENTS ____

GRADIENT: 4

6] Gradient (feet/mile): 60 %POOL: 50 %RIFFLE: 50 %RUN: ____

EPA 4520

Figure V-4-5. Front side of the Ohio EPA Site Description Sheet for evaluating the geographical and physical characteristics of fish sampling locations. This is used to record information for the calculation of the Qualitative Habitat Evaluation Index (QHEI).

Ohio EPA Site Description Sheet - Fish — **QHEI SCORE: 60**

Stream: Plant Drainage Ditch RM: ____ Date: 9/22/93 River Code: ____

Location: DD2 in text and tables; 4 on Plate Crew: G Dinkins, G Kaufman

1) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Check all types present); **SUBSTRATE SCORE: 13**

TYPE	POOL	RIFFLE	TYPE	POOL	RIFFLE
☐ ☐-BLDER /SLABS[10]	____	☒ ☒-GRAVEL [7]			
☐ ☐-BOULDER [9]	____	____ ☐ ☐-SAND [6]			
☐ ☒-COBBLE [8]	____	____ ☐ ☐-BEDROCK[5]			
☐ ☐-HARDPAN [4]	____	____ ☐ ☐-DETRITUS[3]			
☐ ☐-MUCK [2]	____	____ ☐ ☐-ARTIFIC.[0]			

Substrate Origin (Check all): ☐-LIMESTONE [1] ☐-RIP/RAP [0] ☐-HARDPAN [0] ☐-TILLS [1] ☒-SANDSTONE [0] ☐-SHALE [-1]

Silt Cover (Check One): ☐-SILT HEAVY [-2] ☒-SILT MODERATE [-1] ☐-SILT NORMAL [0] ☐-SILT FREE [1]

Extent Of Embeddness (Check One): ☐—EXTENSIVE [-2] ☒—MODERATE[-1] ☐—LOW[0] ☐—NONE[1]

TOTAL NUMBER OF SUBSTRATE TYPES: ☒ > 4 [2] ☐— <= 4 [0] ☐-COAL FINES [-2]

NOTE: (Ignore sludge that originates from point-sources; score is based on natural substrates)

COMMENTS ____

2) INSTREAM COVER — **COVER SCORE: 13**

TYPE (Check All That Apply): ☐-UNDERCUT BANKS [1] ☒-DEEP POOLS [2] ☐-OXBOWS [1] ☒-OVERHANGING VEGETATION [1] ☒-ROOTWADS [1] ☐-AQUATIC MACROPHYTES [1] ☒-SHALLOWS (IN SLOW WATER) [1] ☒-BOULDERS [1] ☐-LOGS OR WOODY DEBRIS [1]

AMOUNT (Check ONLY One or check 2 and AVERAGE): ☐-EXTENSIVE > 75% [11] ☒-MODERATE 25-75% [7] ☐-SPARSE 5-25% [3] ☐-NEARLY ABSENT < 5% [1]

COMMENTS: ____

3) CHANNEL MORPHOLOGY: (Check ONLY One PER Catagory OR check 2 and AVERAGE) — **CHANNEL: 12**

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATIONS/OTHER	
☐ - HIGH [4]	☐ - EXCELLENT [7]	☐ - NONE [6]	☐ - HIGH [3]	☐ - SNAGGING	☐ - IMPOUND.
☐ - MODERATE [3]	☒ - GOOD [5]	☐ - RECOVERED [4]	☒ - MODERATE [2]	☐ - RELOCATION	☐ - ISLANDS
☒ - LOW [2]	☐ - FAIR [3]	☒ - RECOVERING [3]	☐ - LOW [1]	☐ - CANOPY REMOVAL	☐ - LEVEED
☐ - NONE [1]	☐ - POOR [1]	☐ - RECENT OR NO RECOVERY [1]		☐ - DREDGING	☐ - BANK SHAPING
				☐ - ONE SIDE CHANNEL MODIFICATIONS	

COMMENTS: ____

4) RIPARIAN ZONE AND BANK EROSION - (check ONE box per bank or check 2 and AVERAGE per bank) — **RIPARIAN: 7**

"River Right Looking Downstream"

RIPARIAN WIDTH (L R) (Per Bank)	EROSION/RUNOFF - FLOOD PLAIN QUALITY (L R) (Most Predominant Per Bank)	(L R) (Per Bank)	BANK EROSION
☐ ☐-WIDE>50m [4]	☐ ☒-FOREST, SWAMP [3]	☐ ☒-URBAN OR INDUSTRIAL[0]	☐ ☒-NONE OR LITTLE [3]
☐ ☐-MODERATE 10-50 [3]	☐ ☐-OPEN PASTURE/ ROWCROP[0]	☐ ☒-SHRUB OR OLD FIELD[2]	☐ ☐-MODERATE [2]
☐ ☒-NARROW 5-10m [2]	☐ ☐- RESID.,PARK,NEW FIELD [1]	☐ ☐-CONSERV. TILLAGE [1]	☐ ☐-HEAVY OR SEVERE[1]
☐ ☐-VERY NARROW 1-5m [1]	☐ ☐-FENCED PASTURE [1]	☐ ☐-MINING/CONSTRUCTION [0]	
☐ ☐-NONE[0]			

COMMENTS: ____

POOL/GLIDE AND RIFFLE/RUN QUALITY — **POOL: 6**

MAX DEPTH (Check 1)	MORPHOLOGY (Check 1)	POOL/RUN/RIFFLE CURRENT VELOCITY (Check All That Apply)	
☐ - >1m [8]	☐-POOL WIDTH > RIFFLE WIDTH [2]	☐-TORRENTIAL[-1]	☐-EDDIES[1]
☐ - 0.7-1m [4]	☒-POOL WIDTH = RIFFLE WIDTH [1]	☒-FAST[1]	☐-INTERSTITIAL[-1]
☒ - 0.4-0.7m [2]	☐-POOL WIDTH < RIFFLE W. [0]	☒-MODERATE [1]	☐-INTERMITTENT[-2]
☐ - < 0.4m [1]		☒-SLOW [1]	
☐ —<0.2m [Pool = 0]			

☐ NO POOL[0]

COMMENTS: ____

RIFFLE: 3

RIFFLE/RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN EMBEDDEDNESS	
☐ - GENERALLY >10 cm,MAX>50 [4]	☒-STABLE (e.g.,Cobble, Boulder) [2]	☐-EXTENSIVE [-1]	☒-MODERATE[0]
☐ - GENERALLY >10 cm,MAX<50 [3]	☐-MOD. STABLE (e.g.,Pea Gravel) [1]	☐-LOW. [1]	☐-NONE[2]
☒ - GENERALLY 5-10 cm [1]	☐-UNSTABLE (Gravel,Sand) [0]		
☐ - GENERALLY < 5 cm [Riffle = 0]			

☐-NO RIFFLE[0]

COMMENTS ____ **GRADIENT: 6**

6) Gradient (feet/mile): 60 %POOL: 40 %RIFFLE: 50 %RUN: 10

EPA 4520

Figure V-4-5. Front side of the Ohio EPA Site Description Sheet for evaluating the geographical and physical characteristics of fish sampling locations. This is used to record information for the calculation of the Qualitative Habitat Evaluation Index (QHEI).

Ohio EPA Site Description Sheet - Fish — **QHEI SCORE: 52**

Stream: Miami-Erie Canal RM: ____ Date: 6/11/92 River Code: ____

Location: MEI in text and tables; 1 on Plate Crew: C. Kaufman, C. Skelton

1] SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Check all types present): — **SUBSTRATE SCORE: 12**

TYPE	POOL	RIFFLE	TYPE	POOL	RIFFLE
☐ ☐-BLDER /SLABS[10]	____	☒-GRAVEL [7]			
☐ ☐-BOULDER [9]	____	☐-SAND [6]			
☐ ☒-COBBLE [8]	____	☐-BEDROCK[5]			
☐ ☐-HARDPAN [4]	____	☒-DETRITUS[3]			
☐ ☐-MUCK [2]	____	☐-ARTIFIC.[0]			

TOTAL NUMBER OF SUBSTRATE TYPES: ☒ > 4 [2] ☐ <= 4 [0] ☐-COAL FINES [-2]

NOTE: (Ignore sludge that originates from point-sources; score is based on natural substrates)

COMMENTS: ____

Substrate Origin (Check all): ☐-LIMESTONE [1] ☐-RIP/RAP [0] ☐-HARDPAN [0] ☐-TILLS [1] ☒-SANDSTONE [0] ☐-SHALE [-1]

Silt Cover (Check One): ☐-SILT HEAVY [-2] ☒-SILT MODERATE [-1] ☐-SILT NORMAL [0] ☐-SILT FREE [1]

Extent Of Embeddiness (Check One): ☐-EXTENSIVE [-2] ☒-MODERATE[-1] ☐-LOW[0] ☐-NONE[1]

COVER SCORE: 6

2] INSTREAM COVER

TYPE (Check All That Apply): ☒-UNDERCUT BANKS [1] ☒-OVERHANGING VEGETATION [1] ☒-SHALLOWS (IN SLOW WATER) [1] ☐-DEEP POOLS [2] ☐-ROOTWADS [1] ☐-BOULDERS [1] ☐-OXBOWS [1] ☐-AQUATIC MACROPHYTES [1] ☐-LOGS OR WOODY DEBRIS [1]

AMOUNT (Check ONLY One or check 2 and AVERAGE): ☐-EXTENSIVE > 75% [11] ☐-MODERATE 25-75% [7] ☒-SPARSE 5-25% [3] ☐-NEARLY ABSENT < 5%[1]

COMMENTS: ____

CHANNEL: 11

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATIONS/OTHER	
☐ - HIGH [4]	☐ - EXCELLENT [7]	☐ - NONE [6]	☐ - HIGH [3]	☐ - SNAGGING	☐ - IMPOUND.
☐ - MODERATE [3]	☒ - GOOD [5]	☐ - RECOVERED [4]	☒ - MODERATE [2]	☐ - RELOCATION	☐ - ISLANDS
☐ - LOW [2]	☐ - FAIR [3]	☒ - RECOVERING [3]	☐ - LOW [1]	☐ - CANOPY REMOVAL	☐ - LEVEED
☒ - NONE [1]	☐ - POOR [1]	☐ - RECENT OR NO RECOVERY [1]		☐ - DREDGING	☐ - BANK SHAPING
				☐ - ONE SIDE CHANNEL MODIFICATIONS	

COMMENTS: ____

RIPARIAN: 7

4] RIPARIAN ZONE AND BANK EROSION - (check ONE box per bank or check 2 and AVERAGE per bank)

"River Right Looking Downstream"

RIPARIAN WIDTH (L R Per Bank)	EROSION/RUNOFF - FLOOD PLAIN QUALITY (L R Most Predominant Per Bank) (L R Per Bank)	BANK EROSION
☐ ☐-WIDE>50m [4]	☐ ☐-FOREST, SWAMP [3]	☒ ☒-NONE OR LITTLE [3]
☐ ☐-MODERATE 10-50 [3]	☐ ☐-OPEN PASTURE/ ROWCROP[0]	☐ ☐-MODERATE [2]
☐ ☒-NARROW 5-10m [2]	☐ ☐- RESID.,PARK,NEW FIELD [1]	☐ ☐-HEAVY OR SEVERE[1]
☒ ☐-VERY NARROW 1-5m [1]	☐ ☐-FENCED PASTURE [1]	
☐ ☐-NONE[0]	☐ ☐-URBAN OR INDUSTRIAL[0]	
	☒ ☒-SHRUB OR OLD FIELD[2]	
	☐ ☐-CONSERV. TILLAGE [1]	
	☐ ☐-MINING/CONSTRUCTION [0]	

COMMENTS: ____

POOL: 4

POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1)	MORPHOLOGY (Check 1)	POOL/RUN/RIFFLE CURRENT VELOCITY (Check All That Apply)	
☐ - >1m [6]		☐-TORRENTIAL[-1]	☐-EDDIES[1]
☐ - 0.7-1m [4]	☐-POOL WIDTH > RIFFLE WIDTH [2]	☐-FAST[1]	☐-INTERSTITIAL[-1]
☐ - 0.4-0.7m [2]	☒-POOL WIDTH = RIFFLE WIDTH [1]	☒-MODERATE [1]	☐-INTERMITTENT[-2]
☒ - < 0.4m [1]	☐-POOL WIDTH < RIFFLE W. [0]	☒-SLOW [1]	
☐ - <0.2m [Pool = 0]			

☐ - NO POOL[0]

COMMENTS: ____

RIFFLE: 2

RIFFLE/RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN EMBEDDEDNESS	
☐ - GENERALLY > 10 cm,MAX>50 [4]	☒-STABLE (e.g.,Cobble, Boulder) [2]	☐-EXTENSIVE [-1]	☒-MODERATE[0]
☐ - GENERALLY > 10 cm,MAX<50 [3]	☐-MOD. STABLE (e.g.,Pea Gravel) [1]	☐-LOW. [1]	☐-NONE[2]
☒ - GENERALLY 5-10 cm [1]	☒-UNSTABLE (Gravel,Sand) [0]		
☐ - GENERALLY < 5 cm [Riffle = 0]			

☐ - NO RIFFLE[0]

COMMENTS ____

GRADIENT: 10

6] Gradient (feet/mile): 25 %POOL: 20 %RIFFLE: 50 %RUN: 30

EPA 4520

Figure V-4-5. Front side of the Ohio EPA Site Description Sheet for evaluating the geographical and physical characteristics of fish sampling locations. This is used to record information for the calculation of the Qualitative Habitat Evaluation Index (QHEI).

Ohio EPA Site Description Sheet - Fish **QHEI SCORE: 50**

Stream Miami-Erie Canal RM ____ Date 6/11/92 River Code ____

Location MES in text and tables; Zion Plate Crew G. Kaufman, C Skelton

1) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Check all types present);

TYPE	POOL	RIFFLE		POOL	RIFFLE
☐ ☐-BLDER /SLABS[10]	____	____	☐ ☒-GRAVEL [7]	____	____
☐ ☐-BOULDER [9]	____	____	☐ ☒-SAND [6]	____	____
☐ ☒-COBBLE [8]	____	____	☐ ☐-BEDROCK[5]	____	____
☐ ☐-HARDPAN [4]	____	____	☐ ☒-DETRITUS[3]	____	____
☐ ☐-MUCK [2]	____	____	☐ ☐-ARTIFIC.[0]	____	____

TOTAL NUMBER OF SUBSTRATE TYPES: ☒ > 4 [2] ☐ — <= 4 [0] ☐-COAL FINES [-2]

NOTE: (Ignore sludge that originates from point-sources; score is based on natural substrates)

COMMENTS ____

SUBSTRATE SCORE: 12

SUBSTRATE QUALITY

Substrate Origin (Check all)
☐-LIMESTONE [1] ☐-RIP/RAP [0] ☐-HARDPAN [0] ☐-TILLS [1] ☐-SANDSTONE [0] ☐-SHALE [-1]

Silt Cover (Check One)
☐-SILT HEAVY [-2] ☒-SILT MODERATE [-1] ☐-SILT NORMAL [0] ☐-SILT FREE [1]

Extent Of Embeddiness (Check One)
☐—EXTENSIVE [-2] ☒—MODERATE[-1] ☐—LOW[0] ☐—NONE[1]

2) INSTREAM COVER

TYPE (Check All That Apply)
☐-UNDERCUT BANKS [1] ☐-DEEP POOLS [2] ☐-OXBOWS [1]
☐-OVERHANGING VEGETATION [1] ☐-ROOTWADS [1] ☐-AQUATIC MACROPHYTES [1]
☒-SHALLOWS (IN SLOW WATER) [1] ☐-BOULDERS [1] ☒-LOGS OR WOODY DEBRIS [1]

COVER SCORE: 15

AMOUNT (Check ONLY One or check 2 and AVERAGE)
☐-EXTENSIVE > 75% [11]
☐-MODERATE 25-75% [7]
☒-SPARSE 5-25% [3]
☐-NEARLY ABSENT < 5%[1]

COMMENTS: ____

3) CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

CHANNEL: 9

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATIONS/OTHER	
☐-HIGH [4]	☐-EXCELLENT [7]	☐-NONE [6]	☐-HIGH [3]	☐-SNAGGING	☐-IMPOUND.
☐-MODERATE [3]	☐-GOOD [5]	☐-RECOVERED [4]	☒-MODERATE [2]	☐-RELOCATION	☐-ISLANDS
☐-LOW [2]	☒-FAIR [3]	☒-RECOVERING [3]	☐-LOW [1]	☐-CANOPY REMOVAL	☐-LEVEED
☒-NONE [1]	☐-POOR [1]	☐-RECENT OR NO RECOVERY [1]		☐-DREDGING	☐-BANK SHAPING
				☐-ONE SIDE CHANNEL MODIFICATIONS	

COMMENTS: ____

4) RIPARIAN ZONE AND BANK EROSION - (check ONE box per bank or check 2 and AVERAGE per bank)

RIPARIAN: 8

"River Right Looking Downstream"

RIPARIAN WIDTH L R (Per Bank)	EROSION/RUNOFF - FLOOD PLAIN QUALITY L R (Most Predominant Per Bank)	L R (Per Bank)	BANK EROSION
☐ ☐-WIDE>50m [4]	☒ ☐-FOREST, SWAMP [3]	☐ ☐-URBAN OR INDUSTRIAL[0]	☐ ☒-NONE OR LITTLE [3]
☒ ☐-MODERATE 10-50 [3]	☐ ☐-OPEN PASTURE/ ROWCROP[0]	☐ ☒-SHRUB OR OLD FIELD[2]	☐ ☐-MODERATE [2]
☐ ☐-NARROW 5-10m [2]	☐ ☐- RESID.,PARK,NEW FIELD [1]	☐ ☐-CONSERV. TILLAGE [1]	☐ ☐-HEAVY OR SEVERE[1]
☐ ☒-VERY NARROW 1-5m [1]	☐ ☐-FENCED PASTURE [1]	☐ ☐-MINING/CONSTRUCTION [0]	
☐ ☐-NONE[0]			

COMMENTS: ____

POOL/GLIDE AND RIFFLE/RUN QUALITY

POOL: 4

MAX. DEPTH (Check 1)
☐-> 1m [6]
☐-0.7-1m [4]
☐-0.4-0.7m [2]
☒-< 0.4m [1]
☐—<0.2m [Pool = 0]

MORPHOLOGY (Check 1)
☐-POOL WIDTH > RIFFLE WIDTH [2]
☒-POOL WIDTH = RIFFLE WIDTH [1]
☐-POOL WIDTH < RIFFLE W. [0]

POOL/RUN/RIFFLE CURRENT VELOCITY (Check All That Apply)
☐-TORRENTIAL[-1] ☐-EDDIES[1]
☐-FAST[1] ☐-INTERSTITIAL[-1]
☒-MODERATE [1] ☐-INTERMITTENT[-2]
☒-SLOW [1]

☐-NO POOL[0]

COMMENTS: ____

RIFFLE: 2

RIFFLE/RUN DEPTH
☐-GENERALLY >10 cm,MAX>50 [4]
☐-GENERALLY >10 cm,MAX<50 [3]
☒-GENERALLY 5-10 cm [1]
☐-GENERALLY < 5 cm [Riffle = 0]

RIFFLE/RUN SUBSTRATE
☒-STABLE (e.g.,Cobble, Boulder) [2]
☐-MOD. STABLE (e.g.,Pea Gravel) [1]
☒-UNSTABLE (Gravel,Sand) [0]

RIFFLE/RUN EMBEDDEDNESS
☐-EXTENSIVE [-1] ☒-MODERATE[0]
☐-LOW. [1] ☐-NONE[2]

☐-NO RIFFLE[0]

COMMENTS ____

GRADIENT: 10

6) Gradient (feet/mile): 25 %POOL: 30 %RIFFLE: 50 %RUN: 20

EPA 4520

Figure V-4-5. Front side of the Ohio EPA Site Description Sheet for evaluating the geographical and physical characteristics of fish sampling locations. This is used to record information for the calculation of the Qualitative Habitat Evaluation Index (QHEI).

Ohio EPA Site Description Sheet - Fish — **QHEI SCORE: 51**

Stream: Overflow Creek — RM: ____ Date: 6/14/92 — River Code: ____

Location: OC1 in text and tables; 3 on Plate — Crew: C. Kaufman, C. Skelton

1] SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Check all types present): — **SUBSTRATE SCORE: 13**

TYPE	POOL	RIFFLE	TYPE	POOL	RIFFLE
☐ ☐-BLDER /SLABS [10]	____	____	☐ ☒-GRAVEL [7]	____	____
☐ ☐-BOULDER [9]	____	____	☐ ☒-SAND [6]	____	____
☐ ☒-COBBLE [8]	____	____	☐ ☐-BEDROCK [5]	____	____
☐ ☐-HARDPAN [4]	____	____	☐ ☒-DETRITUS [3]	____	____
☐ ☐-MUCK [2]	____	____	☐ ☐-ARTIFIC. [0]	____	____

TOTAL NUMBER OF SUBSTRATE TYPES: ☒ > 4 [2] ☐ — <= 4 [0] ☐-COAL FINES [-2]

NOTE: (ignore sludge that originates from point-sources; score is based on natural substrates)

COMMENTS: ____

Substrate Origin (Check all): ☐-LIMESTONE [1] ☐-RIP/RAP [0] ☐-TILLS [1] ☐-HARDPAN [0] ☒-SANDSTONE [0] ☐-SHALE [-1]

Silt Cover (Check One): ☐-SILT HEAVY [-2] ☐-SILT MODERATE [-1] ☐-SILT NORMAL [0] ☐-SILT FREE [1]

Extent Of Embeddiness (Check One): ☐—EXTENSIVE [-2] ☒—MODERATE [-1] ☐—LOW [0] ☐—NONE [1]

2] INSTREAM COVER — **COVER SCORE: 5**

TYPE (Check All That Apply):
- ☐-UNDERCUT BANKS [1]
- ☐-OVERHANGING VEGETATION [1]
- ☒-SHALLOWS (IN SLOW WATER) [1]
- ☐-DEEP POOLS [2]
- ☐-ROOTWADS [1]
- ☐-BOULDERS [1]
- ☐-OXBOWS [1]
- ☐-AQUATIC MACROPHYTES [1]
- ☒-LOGS OR WOODY DEBRIS [1]

AMOUNT (Check ONLY One or check 2 and AVERAGE):
- ☐ - EXTENSIVE > 75% [11]
- ☐ - MODERATE 25-75% [7]
- ☒ - SPARSE 5-25% [3]
- ☐ - NEARLY ABSENT < 5% [1]

COMMENTS: ____

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE) — **CHANNEL: 11**

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATIONS/OTHER	
☐ - HIGH [4]	☐ - EXCELLENT [7]	☐ - NONE [6]	☐ - HIGH [3]	☐ - SNAGGING	☐ - IMPOUND.
☐ - MODERATE [3]	☒ - GOOD [5]	☐ - RECOVERED [4]	☒ - MODERATE [2]	☐ - RELOCATION	☐ - ISLANDS
☐ - LOW [2]	☐ - FAIR [3]	☒ - RECOVERING [3]	☐ - LOW [1]	☐ - CANOPY REMOVAL	☐ - LEVEED
☒ - NONE [1]	☐ - POOR [1]	☐ - RECENT OR NO RECOVERY [1]		☐ - DREDGING	☐ - BANK SHAPING
				☐ - ONE SIDE CHANNEL MODIFICATIONS	

COMMENTS: ____

4] RIPARIAN ZONE AND BANK EROSION - (check ONE box per bank or check 2 and AVERAGE per bank) — **RIPARIAN: 6**

"River Right Looking Downstream"

RIPARIAN WIDTH (L R) (Per Bank)	EROSION/RUNOFF - FLOOD PLAIN QUALITY (L R) (Most Predominant Per Bank)	(L R) (Per Bank)	BANK EROSION
☐ ☐-WIDE > 50m [4]	☐ ☐-FOREST, SWAMP [3]	☐ ☐-URBAN OR INDUSTRIAL [0]	☒ ☒-NONE OR LITTLE [3]
☐ ☐-MODERATE 10-50 [3]	☒ ☐-OPEN PASTURE/ ROWCROP [0]	☒ ☒-SHRUB OR OLD FIELD [2]	☐ ☐-MODERATE [2]
☐ ☒-NARROW 5-10m [2]	☐ ☐- RESID., PARK, NEW FIELD [1]	☐ ☐-CONSERV. TILLAGE [1]	☐ ☐-HEAVY OR SEVERE [1]
☒ ☐-VERY NARROW 1-5m [1]	☐ ☐-FENCED PASTURE [1]	☐ ☐-MINING/CONSTRUCTION [0]	
☐ ☐-NONE [0]			

COMMENTS: ____

POOL/GLIDE AND RIFFLE/RUN QUALITY — **POOL: 4**

MAX. DEPTH (Check 1)	MORPHOLOGY (Check 1)	POOL/RUN/RIFFLE CURRENT VELOCITY (Check All That Apply)	
☐ - >1m [6]			
☐ - 0.7-1m [4]	☐-POOL WIDTH > RIFFLE WIDTH [2]	☐-TORRENTIAL [-1]	☐-EDDIES [1]
☐ - 0.4-0.7m [2]	☒-POOL WIDTH = RIFFLE WIDTH [1]	☐-FAST [1]	☐-INTERSTITIAL [-1]
☒ - < 0.4m [1]	☐-POOL WIDTH < RIFFLE W. [0]	☒-MODERATE [1]	☐-INTERMITTENT [-2]
☐ — <0.2m [Pool = 0]		☒-SLOW [1]	

☐ - NO POOL [0]

COMMENTS: ____

RIFFLE: 2

RIFFLE/RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN EMBEDDEDNESS	
☐ - GENERALLY > 10 cm, MAX > 50 [4]	☒-STABLE (e.g., Cobble, Boulder) [2]	☐-EXTENSIVE [-1]	☒-MODERATE [0]
☐ - GENERALLY > 10 cm, MAX < 50 [3]	☐-MOD. STABLE (e.g., Pea Gravel) [1]	☐-LOW. [1]	☐-NONE [2]
☒ - GENERALLY 5-10 cm [1]	☒-UNSTABLE (Gravel, Sand) [0]		
☐ - GENERALLY < 5 cm (Riffle = 0)			

☐-NO RIFFLE [0]

COMMENTS: ____

GRADIENT: 10

6] Gradient (feet/mile): 25 — %POOL: 20 — %RIFFLE: 50 — %RUN: 30

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Figure V-4-5. Front side of the Ohio EPA Site Description Sheet for evaluating the geographical and physical characteristics of fish sampling locations. This is used to record information for the calculation of the Qualitative Habitat Evaluation Index (QHEI).

Ohio EPA Site Description Sheet - Fish **QHEI SCORE: 50**

Stream: Overflow Creek RM: ____ Date: 6/13/92 River Code: ____

Location: OC.2 in text and tables; 11 on Plate Crew: G Kaufman, C Skelton

1] SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Check all types present); **SUBSTRATE SCORE: 6**

TYPE	POOL	RIFFLE		POOL	RIFFLE	SUBSTRATE QUALITY
☐ ☐-BLDER /SLABS [10]			☐ ☒-GRAVEL [7]			Substrate Origin (Check all)
☐ ☐-BOULDER [9]			☐ ☒-SAND [6]			☐-LIMESTONE [1] ☐-RIP/RAP [0]
☐ ☐-COBBLE [8]			☐ ☐-BEDROCK [5]			☐-TILLS [1] ☐-HARDPAN [0]
☐ ☐-HARDPAN [4]			☐ ☐-DETRITUS [3]			☒-SANDSTONE [0]
☐ ☒-MUCK [2]			☐ ☐-ARTIFIC. [0]			☐-SHALE [-1]

TOTAL NUMBER OF SUBSTRATE TYPES: ☐ > 4 [2] ☒ <= 4 [0] ☐-COAL FINES [-2]

NOTE: (Ignore sludge that originates from point-sources; score is based on natural substrates)

COMMENTS: ____

Silt Cover (Check One): ☐-SILT HEAVY [-2] ☐-SILT MODERATE [-1] ☐-SILT NORMAL [0] ☐-SILT FREE [1]

Extent Of Embeddiness (Check One): ☐—EXTENSIVE [-2] ☒—MODERATE [-1] ☐—LOW [0] ☐—NONE [1]

COVER SCORE: 13

2] INSTREAM COVER

TYPE (Check All That Apply)

☒-UNDERCUT BANKS [1] ☒-DEEP POOLS [2] ☐-OXBOWS [1]
☒-OVERHANGING VEGETATION [1] ☐-ROOTWADS [1] ☐-AQUATIC MACROPHYTES [1]
☒-SHALLOWS (IN SLOW WATER) [1] ☐-BOULDERS [1] ☒-LOGS OR WOODY DEBRIS [1]

AMOUNT (Check ONLY One or check 2 and AVERAGE)
☐-EXTENSIVE > 75% [11]
☒-MODERATE 25-75% [7]
☐-SPARSE 5-25% [3]
☐-NEARLY ABSENT < 5% [1]

COMMENTS: ____

CHANNEL: 6

3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATIONS/OTHER	
☐-HIGH [4]	☐-EXCELLENT [7]	☐-NONE [6]	☐-HIGH [3]	☐-SNAGGING	☐-IMPOUND.
☐-MODERATE [3]	☐-GOOD [5]	☐-RECOVERED [4]	☐-MODERATE [2]	☐-RELOCATION	☐-ISLANDS
☐-LOW [2]	☐-FAIR [3]	☒-RECOVERING [3]	☒-LOW [1]	☐-CANOPY REMOVAL	☐-LEVEED
☒-NONE [1]	☒-POOR [1]	☐-RECENT OR NO RECOVERY [1]		☐-DREDGING	☐-BANK SHAPING
				☐-ONE SIDE CHANNEL MODIFICATIONS	

COMMENTS: ____

RIPARIAN: 7

4] RIPARIAN ZONE AND BANK EROSION - (check ONE box per bank or check 2 and AVERAGE per bank)
River Right Looking Downstream

RIPARIAN WIDTH L R (Per Bank)	EROSION/RUNOFF - FLOOD PLAIN QUALITY L R (Most Predominant Per Bank)	L R (Per Bank)	BANK EROSION
☐ ☐-WIDE > 50m [4]	☒ ☒-FOREST, SWAMP [3]	☐ ☐-URBAN OR INDUSTRIAL [0]	☐ ☐-NONE OR LITTLE [3]
☐ ☐-MODERATE 10-50 [3]	☐ ☐-OPEN PASTURE/ ROWCROP [0]	☒ ☒-SHRUB OR OLD FIELD [2]	☒ ☒-MODERATE [2]
☒ ☒-NARROW 5-10m [2]	☐ ☐- RESID.,PARK,NEW FIELD [1]	☐ ☐-CONSERV. TILLAGE [1]	☐ ☐-HEAVY OR SEVERE [1]
☐ ☐-VERY NARROW 1-5m [1]	☐ ☐-FENCED PASTURE [1]	☐ ☐-MINING/CONSTRUCTION [0]	
☐ ☐-NONE [0]			

COMMENTS: ____

POOL: 8

POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1)	MORPHOLOGY (Check 1)	POOL/RUN/RIFFLE CURRENT VELOCITY (Check All That Apply)	
☒-> 1m [6]			
☐-0.7-1m [4]	☐-POOL WIDTH > RIFFLE WIDTH [2]	☐-TORRENTIAL [-1]	☐-EDDIES [1]
☐-0.4-0.7m [2]	☒-POOL WIDTH = RIFFLE WIDTH [1]	☐-FAST [1]	☐-INTERSTITIAL [-1]
☐-< 0.4m [1]	☐-POOL WIDTH < RIFFLE W. [0]	☐-MODERATE [1]	☐-INTERMITTENT [-2]
☐—<0.2m [Pool = 0]		☒-SLOW [1]	

☐-NO POOL [0]

COMMENTS: ____

RIFFLE: 0

RIFFLE/RUN DEPTH	RIFFLE/RUN SUBSTRATE	RIFFLE/RUN EMBEDDEDNESS	
☐-GENERALLY >10 cm,MAX>50 [4]	☐-STABLE (e.g.,Cobble, Boulder) [2]	☐-EXTENSIVE [-1]	☐-MODERATE [0]
☐-GENERALLY >10 cm,MAX<50 [3]	☐-MOD. STABLE (e.g.,Pea Gravel) [1]	☐-LOW. [1]	☐-NONE [2]
☐-GENERALLY 5-10 cm [1]	☐-UNSTABLE (Gravel,Sand) [0]		
☐-GENERALLY < 5 cm [Riffle = 0]			

☐-NO RIFFLE [0]

COMMENTS: none

GRADIENT: 10

6] Gradient (feet/mile): 25 %POOL: 100 %RIFFLE: ____ %RUN: ____

EPA 4520

APPENDIX H

DISCUSSION OF STREAM SAMPLING LOCATIONS AND PLACEMENT OF HESTER-DENDY ARTIFICIAL SUBSTRATES

A small stream system that flows into the Great Miami River was examined as part of the ecological characterization of the Mound Plant. This stream system originates on the North Property and is fed by an intermittent tributary emanating from the South Property. Four distinct stream reaches in this system were sampled for fish and macroinvertebrates. These were the Plant Drainage Ditch, the Miami-Erie Canal, tributaries to the Miami-Erie Canal on the South Property, and the Overflow Creek.

Except during heavy rainfall, the surface flow in this system originates in the Plant Drainage Ditch. During the study, surface flow was not observed in the canal upstream from the confluence with the Plant Drainage Ditch, nor entering the canal from Benner Branch.

From its origin, the upstream section of the Plant Drainage Ditch (DDI) enters the Settling Basins. The flow in this section is permanent, deep and fast enough to allow benthic sampling with Hester-Dendy artificial substrates. Although the natural substrate was deep enough to completely submerge the Hester-Dendy sampling devices, two of the substrate devices became buried in sand during the spring 1992 deployment and collected no organisms. One device became buried in the fall 1993 survey and collected only a third the number of organisms collected by the other two devices during the same deployment. Fish were also collected in both seasons from this section (from the Settling Basins to a plunge pool below a log jam approximately 200 ft upstream).

Immediately after discharging from the Settling Basins, the stream continues down the Plant Drainage Ditch and enters a 20-ft-wide cement railroad culvert. After the culvert, the stream flows west under a small bridge and enters a small pool. The pool, created by a weir, is about 50 ft long and 2 ft deep. Immediately downstream from the weir, the stream enters the Miami-Erie Canal.

Fish and macroinvertebrates were sampled from between the weir and the railroad culvert (DD2) in both the spring of 1992 and the fall of 1993. In 1992, Hester-Dendy substrates were placed in the pool of the weir. In 1993, the habitat of that location was considered inappropriate for Hester-Dendy sampling because there was no flow and the substrate was silt (Table III.37). Instead, in 1993 artificial substrates were placed upstream near the mouth of the railroad culvert in more run-like habitat. Fish were collected in both seasons from the entire stream length between the weir and the railroad culvert (approximately 150 ft).

After entering the Miami-Erie Canal, the stream flows in a straight channel south approximately 2,500 ft. From this point, flow no longer continues south along the canal channel but, after flowing over a second weir along the west bank of the canal, enters the Overflow Creek. The canal is usually inundated another 50 ft south by the creek weir, but has no flow. Benner Branch enters the canal from the east, approximately 450 ft upstream from the creek, near a railroad trestle.

Fish and macroinvertebrates were collected near both ends of the canal section in both the spring of 1992 and the fall of 1993. Throughout the section, the channel is fairly wide and shallow, the run habitats are several inches deep, and the natural substrate is conducive for the deployment of Hester-Dendy artificial substrates.

Hester-Dendy substrates were deployed in the upstream end of the section (ME1) approximately 400 ft downstream from the Drainage Ditch weir in 1992 and 100 ft downstream from that weir in 1993. Fish were collected from an upstream section of the canal that extended from the Drainage Ditch weir 500 ft downstream.

At the downstream end of the canal section (ME2), artificial substrates were deployed 50 ft and 100 ft upstream from the creek weir in the spring of 1992 and the fall of 1993, respectively. In both seasons, fish were collected from the lower end of the downstream canal section. This reach included the inundation south of the creek weir and upstream 450 ft from the creek weir to the embayment at the mouth of Benner Branch.

The Overflow Creek flows from the downstream weir on the Miami-Erie Canal southwest approximately 2,250 ft to empty into the Great Miami River. Immediately downstream from the creek weir, the stream flows through a cement culvert under the Dayton-Cincinnati Pike. Downstream from the cement culvert, the channelized creek flows parallel to a railroad approximately 600 ft to a culvert passing a sewage treatment plant.

Fish and macroinvertebrates were sampled from the upstream section of the Overflow Creek (OC1). Fish were collected from a 500-ft-long section from the sewage plant culvert upstream to a point approximately 100 ft downstream from the Dayton-Cincinnati Pike. In both surveys, Hester-Dendy artificial substrates were deployed at a location 100 ft upstream from the sewage plant culvert. In the fall survey, during the interim between deployment and retrieval of the artificial substrates, a debris dam formed in the culvert, inundating the Hester-Dendy position to a depth of over 3 ft, with no flow.

At the lowermost sampling location on the Overflow Creek (OC2), the artificial substrates were deployed approximately 150 ft upstream of the confluence with the Great Miami River. In this reach, stream flow and water level are affected by a dam, located approximately 2.5 mi downstream on the Great Miami River. This dam occasionally inundates the lower reach of the Overflow Creek. When the Hester-Dendy devices were deployed in the fall survey, the creek was only a few inches deep and had measurable flow. When the artificial substrates were retrieved 6 weeks later, the channel was inundated several feet deep and had no measurable flow.

APPENDIX I

SPECIFIC METHODS FOR ANALYZING BENTHIC MACROINVERTEBRATE DATA

APPENDIX I

SPECIFIC METHODS FOR ANALYZING BENTHIC MACROINVERTEBRATE DATA

Statistical Techniques

Parametric analyses of variance (F-tests), were used to determine the significance of differences in the numbers of organisms and taxa between groups of samples collected at different locations. The F-test analysis of variance is a general test with a wider application than other parametric statistical comparisons (e.g., T-test). It is generally more efficient than non-parametric tests for detecting departures from the null hypothesis. The F-test is generally preferred because of its direct relationship to simple laws of probability. It is considered to be indispensable and the most powerful statistical test available (Sokal and Rohlf 1969).

Where unequal variances were indicated by Bartlett's test of homogeneity, the fourth-root transformation has been found, when dealing with macrobenthic data, to stabilize variance and lead to the satisfaction of the assumptions of parametric analysis more often than other suggested transformations (Downing 1979).

Diversity Index

The Shannon diversity index was chosen for application with macrobenthic data. This index is relatively insensitive to rare species, whose presence may be more random than an indication of physical and/or chemical differences in the environment. It works well for generic level identification, which is frequently the best economically possible identification level. It is designed to be used with samples of a community rather than a complete community count (Washington 1984).

The Shannon index is the measure of diversity most often used in community ecology and macrobenthic surveys in particular. More people are familiar with the Shannon index than any other diversity index and its use is highly recommended (Ludwig and Reynolds 1988). The wide use of the Shannon index has allowed its values to become associated with specific water conditions:

- 0 to 1 — substantial pollution
- 1 to 3 — moderate pollution
- 3 to 5 — clean water (Washington 1984).

Weber (EPA 1973) states that Shannon diversity values greater than 3.3 indicate "good" water quality, whereas lower values can indicate degraded environments.

Shared Taxa Similarity Index

Jaccard's similarity index was chosen for use with macrobenthic data. This index considers only the number of taxa represented at each of two compared locations and the number of those taxa represented at both locations. The numbers of individuals of each taxa are not considered. Forty-three different shared taxa similarity indices have been reviewed with respect to 13 criteria. Of the three indices that satisfied all 13 criteria, Jaccard's index was found to be less biased at small sample sizes. This is an important feature when dealing with macrobenthic samples, where small sample sizes are frequently encountered. Jaccard's index is highly recommended (Ludwig and Reynolds 1988).

Numerical Dominance Similarity Index

The Percent Similarity index was chosen for use with macrobenthic data. This index considers the number of taxa represented at each of two compared locations, the number of those taxa represented at both locations, and the number of individuals representing those taxa at each location. Calculations are independent of both sample size and diversity. This index is highly recommended (Ludwig and Reynolds 1988).

Biotic Index

The Hilsenhoff biotic index was chosen for use with macrobenthic data. This index has been developed exclusively for macrobenthic invertebrates. Each taxon is assigned a value from 0 to 5, representing its tolerance primarily to reduced dissolved-oxygen concentrations, 0 indicating intolerance and 5 indicating extreme tolerance to even anoxic conditions. More macrobenthic invertebrates have been assigned values for this index than for any other biotic index (Hilsenhoff 1982, 1987, 1988; EPA 1990).

The Hilsenhoff biotic index has been shown to be sensitive to changes in the macrobenthic community resulting from increased organic content or nutrient loading. Responses to heated discharges, heavy metals, and other substances (such as PCBs) may also be detected by the index, but their effects on the index have not been evaluated (Hilsenhoff 1982).

Evaluation of Water Quality Using Biotic Index Values of Samples Collected Between October and May		
Biotic Index	**Water Quality**	**Degree of Organic Pollution**
0.00-1.75	Excellent	No organic pollution
1.76-2.25	Very Good	Possible slight organic pollution
2.26-2.75	Good	Some organic pollution
2.76-3.50	Fair	Significant organic pollution
3.51-4.25	Poor	Very significant organic pollution
4.26-5.00	Very Poor	Severe organic pollution

Hilsenhoff biotic indices calculated for data collected between June and August should be corrected by subtracting 0.6 to compare to samples collected between October and May and for the evaluation of water quality.

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APPENDIX J

ANNOTATED CHECKLIST OF THE FISHES OF MOUND PLANT, MONTGOMERY COUNTY, OHIO

APPENDIX J
ANNOTATED CHECKLIST OF THE FISHES OF MOUND PLANT, MONTGOMERY COUNTY, OHIO

CHECKLIST FORMAT

The following list of fishes is a compilation of species collected at the Mound Plant during the ecological characterization. Common and scientific nomenclature and phylogenetic sequencing follow Robins, et al. (1991). General physical descriptions, habitat preference, and distributional information were obtained from Pflieger (1975) and Trautman (1981).

Distributional information specific to the Mound Plant was taken from the field data.

Gizzard Shad *Dorosoma cepedianum*

This typical shad has a laterally compressed body (36 to 46 centimeters [cm] total length [TL]), a well-keeled belly, and an overhanging snout. The scaled keel on the belly differentiates this family from all other sympatric species of fishes. The gizzard shad occurs throughout the central and eastern United States and is found throughout Ohio. Although often found in small- to medium-sized streams, the gizzard shad reaches highest abundances in lakes and large, turbid, low-gradient streams and rivers. At the Mound Plant, gizzard shads were found in the Overflow Creek below the confluence with the Miami-Erie Canal.

Stoneroller *Campostoma anomalum*

This slender to stout minnow has small eyes and short rounded fins, and reaches a length of 5 to 15 cm TL. Unlike other minnow species in the area, stonerollers possess a shelf-like cartilaginous extension in the lower jaw that is separated from the lip by a groove. The stoneroller occurs throughout the central United States and is widespread in Ohio. Populations occur in moderate- to high-gradient gravel bottom streams and are restricted to riffle areas at lower gradients. At the Mound Plant, stonerollers were encountered in the Overflow Creek below the confluence with the Miami-Erie Canal.

Spotfin Shiner *Cyprinella spiloptera*

This moderately slender, slab-sided minnow reaches a length of 5 to 10 cm TL. Members of this genus have diamond-shaped scales and dark pigmentation on the posterior membranes of the dorsal fin. No other minnow species of this genus occurs in the study area. The spotfin shiner occurs throughout the northeastern United States and is found throughout Ohio. This minnow inhabits clear, moderate- to high-gradient, medium-sized streams. Gravelled riffles in moderate to swift current tend to be the

preferred habitat of this species. At the Mound Plant, spotfin shiners were encountered in the Overflow Creek below the confluence with the Miami-Erie Canal.

Carp *Cyprinus carpio*

The carp is a heavy-bodied barbelled minnow with a long-based dorsal fin and serrated spines in the dorsal and anal fins. The only other minnow with a long dorsal fin base that is potentially sympatric, *Carassius auratus*, does not possess barbels. The carp occurs throughout the United States and is widespread in Ohio. This minnow occurs most abundantly in large streams, natural lakes, and reservoirs, but is occasionally found in pools in smaller streams. At the Mound Plant, carp were encountered in the Overflow Creek below the confluence with the Miami-Erie Canal.

Striped Shiner *Luxilus chrysocephalus*

This silvery slab-sided minnow reaches a length of 8 to 18 cm TL. Members of this genus possess tall, thin anterior lateral line scales that distinguish them from other cyprinids. The striped shiner occurs throughout the east-central United States and is widespread in Ohio. This species tends to inhabit clear gravelled bottom streams, and is generally intolerant of high turbidity. At the Mound Plant, the striped shiner was encountered in the Overflow Creek below the confluence with the Miami-Erie Canal.

Golden Shiner *Notemigonus chrysoleucas*

This deep-bodied, slab-sided minnow (8 to 18 cm TL) is unique among minnows for having a naked keel from the pelvic fin to the anus and for a greatly depressed lateral line. These characteristics differentiate the golden shiner from all other sympatric cyprinids. This minnow occurs throughout the central and eastern United States and is found throughout Ohio. Golden shiners generally occur in slack water areas of streams and in lakes and ponds. Although this shiner is sometimes found in turbid waters, the greatest numbers are found in clear, vegetated water. At the Mound Plant, golden shiners were encountered in the Overflow Creek below the confluence with the Miami-Erie Canal.

Bluntnose Minnow *Pimephales notatus*

This slender minnow (4 to 9 cm TL) has a rounded snout and short rounded fins. Species of this genus have crowded anterior scales, a broad flattened predorsal dorsum, and a short thick predorsal spine. The only potentially sympatric sister species, *P. promelas*, lacks the basicaudal spot that *P. notatus* has, and has an incomplete lateral line. The bluntnose minnow occurs throughout the central and northeastern United States and is widespread in Ohio. This minnow is found in a variety of habitats, but does best in the slack water of medium- to large-sized streams. The bluntnose minnow was found at the Mound Plant in the Overflow Creek below the confluence with the Miami-Erie Canal.

Blacknose Dace *Rhinichthys atratulus*

This elongate minnow (5 to 10 cm TL) has a small eye, an elongate snout, and barbels at the posterior end of the upper jaw. This minnow is easy to distinguish from other sympatric minnow species because it lacks a groove between the upper jaw and snout. No other barbelled minnow in the area has this characteristic. The blacknose dace occurs throughout the northeastern United States and is widespread in Ohio. This minnow inhabits moderate- to high-gradient streams with sand and gravel bottoms. At the Mound Plant, blacknose dace were encountered in the Miami-Erie Canal just downstream of the Plant Drainage Ditch, and in the Overflow Creek below the confluence with the Miami-Erie Canal.

Creek Chub *Semotilus atromaculatus*

This cylindrical elongate minnow (8 to 20 cm TL) has crowded predorsal scales and a small fleshy barbel in the groove above the upper lip, just ahead of the corner of the mouth. This chub also tends to have a prominent dark spot at the anterior base of the dorsal fin. The somewhat similar bluntnose minnow, *Pimephales notatus,* never possesses a barbel in that position. The creek chub occurs throughout north-central and eastern North America and is widespread in Ohio. This hardy minnow has highest abundances in creeks and small streams with moderate to high gradients. At the Mound Plant, *Semotilus atromaculatus* were found in the Miami-Erie Canal just downstream of the Plant Drainage Ditch, and in the vicinity of the confluence with the Overflow Creek. This minnow was also found in the Overflow Creek below the confluence with the Miami-Erie Canal, and in the Plant Drainage Ditch downstream from the retention basins.

White Sucker *Catostomus commersoni*

The white sucker is characterized by its elongate body (25 to 51 cm TL), short dorsal fin, pimpled lips, and crowded pre-dorsal scales. The suckers are differentiated from most minnows by having ten (rarely nine) principal dorsal fin rays versus eight in minnows. Carp, *Cyprinus carpio*, and goldfish, *Carassius auratus*, have long dorsal fin bases with more elements, but have serrated dorsal anal fin spines that suckers do not. The white sucker occurs throughout northeastern North America and is widespread in Ohio. Although found in varying-sized lotic systems, *Catostomus commersoni* is most abundant in small- to medium-sized streams with gravelled bottoms and defined riffles. At the Mound Plant, white suckers were encountered in the Overflow Creek just below, and at the confluence with, the Miami-Erie Canal.

Black Bullhead *Ameiurus melas*

A very common northern catfish, the black bullhead reaches 11 to 31 cm TL. This catfish can be differentiated from other potentially sympatric catfish species by having a squared tail, dark medial chin barbels, an unmottled lateral body pattern, and contrasting pigmentation between the rays and

membranes in the fins. The black bullhead occurs throughout the central United States and is widespread in Ohio. This fish inhabits a wide variety of habitats, but is most abundant in areas with little flow, high turbidity, and silt on the bottom. At the Mound Plant, black bullheads were encountered in the Overflow Creek below the confluence with the Miami-Erie Canal.

Mosquitofish *Gambusia affinis*

This stout, livebearing fish (4 to 6 cm TL) has an upturned snout and a dark teardrop marking under the eye. Males have a modified anal fin (gonopodium) used as an intromittent organ. No other livebearing species were found in the study area. The mosquitofish occurs throughout the southcentral and eastern United States, and occurs very spottedly within Ohio. The greatest abundances are found in some of the bordering tributaries to Lake Erie. These fish inhabit slackwater streams, ponds, and ditches where the water is clearest and there is rooted vegetation. At the Mound Plant, *Gambusia affinis* was encountered in the Miami-Erie Canal just downstream of the Plant Drainage Ditch, in the Miami-Erie Canal at the confluence of the Overflow Creek, and at the mouth of the Overflow Creek.

Green Sunfish *Lepomis cyanellus*

This common sunfish has an elongate body (6 to 19 cm TL), a large mouth, long gill rakers, and typically has dark spots at the posterior base of the dorsal and anal fins. The pectoral fins are short and rounded. This combination of characteristics differentiates it from all other sympatric sunfish species. The green sunfish occurs throughout the central and southcentral United States, and is widespread in Ohio. This extremely abundant fish occurs in small- to medium-sized streams, and can tolerate extreme fluctuations in temperature and dissolved-oxygen concentrations. The fish also does well in reservoirs, natural lakes, and oxbows. At the Mound Plant, green sunfish were found at almost every aquatic sampling location where fish were found, i.e., in the Miami-Erie Canal, Overflow Creek, Plant Drainage Ditch, Overflow Pond, and Retention Basins. In addition, hybrids between *Lepomis cyanellus* and bluegills, *Lepomis macrochirus*, were encountered in the Overflow Creek below the confluence with the Miami-Erie Canal.

Orangespotted Sunfish *Lepomis humilis*

This small sunfish (4 to 9 cm TL) is characterized by a flexible rear margin on the gill cover, long pectoral fins, and long gill rakers on the first arch. This combination of characteristics differentiates the orangespotted sunfish from other sympatric sunfish species. This sunfish occurs throughout the central and southcentral United States, and is common throughout western Ohio. The orangespotted sunfish occurs in turbid, low-gradient streams and lakes. This species was encountered at the mouth of the Overflow Creek during the aborted fall 1992 sampling effort.

Bluegill *Lepomis macrochirus*

This common deep-bodied sunfish ranges in length from 9 to 26 cm TL. The bluegill is characterized by a small mouth, long pointed pectoral fins, long gill rakers, and by a spot in the posterior base of the soft dorsal fin. This combination of characteristics differentiates *Lepomis macrochirus* from other sympatric sunfish at the Mound Plant. The bluegill occurs throughout the central and eastern United States, and is widespread in Ohio. Although found in a variety of aquatic habitats, bluegill populations reach highest abundances in slow or non-flowing waters. Conditions in ponds or small impoundments often result in prolific reproduction that leads to significant dwarfing. At the Mound Plant, *Lepomis macrochirus* was encountered in the Overflow Creek at and below the confluence with the Miami-Erie Canal, and in the South Pond of the Miamisburg Park.

Long-ear Sunfish *Lepomis megalotis*

This moderately sized (6 to 18 cm TL) slab-sided sunfish, like the orange-spotted sunfish, has a flexible margin on the opercle. This characteristic, along with short pectoral fins, short gill rakers, and a generally elongated, white-bordered opercle flap, will separate the long-ear sunfish from other sympatric sunfish species. This sunfish occurs throughout much of the east-central United States and is widespread in Ohio. This sunfish typically inhabits clear, moderately flowing streams with sandy or rocky bottoms. Although found in rivers and reservoirs, this species is more typical of smaller streams. At the Mound Plant, *Lepomis megalotis* was encountered in the Overflow Creek at and below the confluence with the Miami-Erie Canal.

Largemouth Bass *Micropterus salmoides*

This elongate large-mouthed sunfish ranges in size from 25 to 51 cm TL. The elongate body reliably separates this genus from the true sunfishes (*Lepomis*). The lateral stripe, triangular spinous dorsal fin, and toothless tongue differentiate the largemouth bass from other potentially sympatric black basses (*Micropterus*). The largemouth bass occurs throughout the central and eastern United States, and is widespread in Ohio. Although typically found in still-water habitats, this bass can occupy a wide variety of habitats, from permanent pools in streams to large reservoirs. Substrates of occupied waters range from soft clay and organic debris to gravel. At the Mound Plant, largemouth bass were encountered in the Overflow Creek below the confluence with the Miami-Erie Canal, and in the South Pond of the Miamisburg Park.

Black Crappie *Pomoxis nigromaculatus*

Members of this genus can be differentiated from other centrarchids by possessing seven or eight dorsal fin spines and six to eight anal fin spines. The black crappie possesses a deep, slab-sided body (13 to 31 cm TL) with a large mouth and specks or blotches on the sides. This fish can be separated from the white crappie, *P. annularis*, by having seven or eight dorsal spines versus six, and specks on

the sides versus vertical bars. The black crappie also has a relatively longer dorsal fin base than that of the white crappie. This species occurs throughout the central and eastern United States and is widespread in Ohio. A slackwater species, *P. nigromaculatus* occurs in ponds, lakes, and low-gradient streams with sandy or mucky substrates. At the Mound Plant, black crappie were encountered in the South Pond of the Miamisburg Park.

Yellow Perch *Perca flavescens*

The yellow perch is a moderately deep-bodied, slab-sided fish (11 to 31 cm TL) with six to eight regularly spaced dark bars across the back and sides. No other sympatric fish species fits this description. The yellow perch occurs throughout central and northeastern North America and occurs spottedly throughout Ohio. This species occurs in highest abundances in clear, low-gradient bodies of water with rooted vegetation. At the Mound Plant, this fish was collected in the Overflow Creek below the confluence with the Miami-Erie Canal.

APPENDIX K

AVERAGE WEIGHT AND CAPTURE EFFICIENCY FOR FISH SPECIES COLLECTED AT THE MOUND PLANT, MONTGOMERY COUNTY, OHIO

Table K.1. Results of Fish Sampling at Mound Plant, Montgomery County, Ohio, June 1992 and September 1993

Species	Station ME1									
	Spring 1992					Fall 1993				
	No. of Indiv.	Avg. Wt. (gr)	C.P.U.[a] Pass 1	C.P.U. Pass 2	P[b]	No. of Indiv.	Avg. Wt. (gr)	C.P.U. Pass 1	C.P.U. Pass 2	P
Dorosoma cepedianum										
Campostoma anomalum										
Cyprinella spiloptera										
Cyprinus carpio										
Luxilus chrysocephalus										
Notemigonus chrysoleucas										
Pimephales notatus										
Rhinichthys atratulus						1	2.3	0.07	0	1.00
Semotilus atromaculatus						1	6.2	0.07	0	1.00
Gambusia affinis	13	0.8	0.35	0.08	0.92	1	0.1	0.07	0.27	-2.00
Catostomus commersoni										
Lepomis cyanellus	330	16.5	7.15	7.25	0.64					
L. macrochirus										
L. megalotis										
L. humilis										
Micropterus salmoides										
Pomoxis nigromaculatus										
Perca flavescens										
Ameirus melas										

[a]C.P.U. = Catch Per Unit Effort.
[b]Estimated Capture Probability.

Table K.1. (page 2 of 9)

Species	Station ME2									
	Spring 1992					Fall 1993				
	No. of Indiv.	Avg. Wt. (gr)	C.P.U.[a] Pass 1	C.P.U. Pass 2	P[b]	No. of Indiv.	Avg. Wt. (gr)	C.P.U. Pass 1	C.P.U. Pass 2	P
Dorosoma cepedianum										
Campostoma anomalum										
Cyprinella spiloptera										
Cyprinus carpio										
Luxilus chrysocephalus										
Notemigonus chrysoleucas										
Pimephales notatus										
Rhinichthys atratulus										
Semotilus atromaculatus						2	4.0	0.07	0.07	0
Gambusia affinis	2	0.8	0.13	0	1.00	2	1.0	0.07	0.07	0
Catostomus commersoni										
Lepomis cyanellus	3	10.4	0.13	0.09	0.50	17	7.2	1.00	0.13	0.87
L. macrochirus										
L. megalotis										
L. humilis										
Micropterus salmoides										
Pomoxis nigromaculatus										
Perca flavescens										
Ameirus melas										

[a]C.P.U. = Catch Per Unit Effort.
[b]Estimated Capture Probability.

Table K.1. (page 3 of 9)

Species	Station OC1									
	Spring 1992					Fall 1993				
	No. of Indiv.	Avg. Wt. (gr)	C.P.U.[a] Pass 1	C.P.U. Pass 2	P[b]	No. of Indiv.	Avg. Wt. (gr)	C.P.U. Pass 1	C.P.U. Pass 2	P
Dorosoma cepedianum	2	22.6	0.02	0.03	0	5	3.6	0.20	0.07	0.75
Campostoma anomalum	2	4.1	0.04	0	1.00					
Cyprinella spiloptera	1	1.4	0.02	0	1.00	2	3.8	0.05	0.07	0
Cyprinus carpio						1	6.5	0.05	0	1.00
Luxilus chrysocephalus						7	1.5	0.10	0.33	-1.50
Notemigonus chrysoleucas	13	10.0	0.29	0	1.00					
Pimephales notatus	2	6.9	0.02	0.03	0	3	3.6	0.05	0.13	-1.00
Rhinichthys atratulus	3	3.3	0.06	0	1.00					
Semotilus atromaculatus	35	12.1	0.64	0.21	0.79	7	4.4	0.25	0.13	0.60
Gambusia affinis										
Catostomus commersoni						4	4.2	0.10	0.13	0
Lepomis cyanellus	96	8.4	1.73	0.62	0.77	36	5.9	1.10	0.93	0.36
L. macrochirus	32	10.9	0.58	0.21	0.77	6	33.7	0.10	0.27	-1.00
L. megalotis										
L. humilis										
Micropterus salmoides						9	3.1	0.30	0.20	0.50
Pomoxis nigromaculatus										
Perca flavescens						1	2.9	0.05	0	1.00
Ameirus melas	2	36.9	0.02	0.03	0					
L. cyanellus x macrochirus	7	8.9	0	0.24	1.00					

[a]C.P.U. = Catch Per Unit Effort.
[b]Estimated Capture Probability.

Table K.1. (page 4 of 9)

Species	Station OC2									
	Spring 1992					Fall 1993				
	No. of Indiv.	Avg. Wt. (gr)	C.P.U.[a] Pass 1	C.P.U. Pass 2	P[b]	No. of Indiv.	Avg. Wt. (gr)	C.P.U. Pass 1	C.P.U. Pass 2	P
Dorosoma cepedianum										
Campostoma anomalum										
Cyprinella spiloptera	2	4.0	0.07	0.07	0					
Cyprinus carpio										
Luxilus chrysocephalus										
Notemigonus chrysoleucas										
Pimephales notatus										
Rhinichthys atratulus										
Semotilus atromaculatus										
Gambusia affinis	6	0.5	0.21	0.20	0					
Catostomus commersoni	6	0.3	0.07	0.33	-4.00	2	240.2	0.20	0	1.00
Lepomis cyanellus	118	2.5	4.71	3.47	0.21	1	16.9	0.20	0	1.00
L. macrochirus						1	2.0	0.20	0	1.00
L. megalotis						6	14.2	0.60	0	1.00
L. humilis	13	7.25	0.93	0	1.00					
Micropterus salmoides										
Pomoxis nigromaculatus										
Perca flavescens										
Ameirus melas										

[a]C.P.U. = Catch Per Unit Effort.
[b]Estimated Capture Probability.

Table K.1. (page 5 of 9)

Species	Station DD1									
	Spring 1992					Fall 1993				
	No. of Indiv.	Avg. Wt. (gr)	C.P.U.[a] Pass 1	C.P.U. Pass 2	P[b]	No. of Indiv.	Avg. Wt. (gr)	C.P.U. Pass 1	C.P.U. Pass 2	P
Dorosoma cepedianum										
Campostoma anomalum										
Cyprinella spiloptera										
Cyprinus carpio										
Luxilus chrysocephalus										
Notemigonus chrysoleucas										
Pimephales notatus										
Rhinichthys atratulus										
Semotilus atromaculatus										
Gambusia affinis										
Catostomus commersoni										
Lepomis cyanellus	71	7.6	4.4	2.7	0.39	1	U[c]	0.10	0	1.00
L. macrochirus										
L. megalotis										
L. humilis										
Micropterus salmoides										
Pomoxis nigromaculatus										
Perca flavescens										
Ameirus melas										

[a]C.P.U. = Catch Per Unit Effort.
[b]Estimated Capture Probability.
[c]U = Unknown.

Table K.1. (page 6 of 9)

Species	Station DD2									
	Spring 1992					Fall 1993				
	No. of Indiv.	Avg. Wt. (gr)	C.P.U.[a] Pass 1	C.P.U. Pass 2	P[b]	No. of Indiv.	Avg. Wt. (gr)	C.P.U. Pass 1	C.P.U. Pass 2	P
Dorosoma cepedianum										
Campostoma anomalum										
Cyprinella spiloptera										
Cyprinus carpio										
Luxilus chrysocephalus										
Notemigonus chrysoleucas										
Pimephales notatus										
Rhinichthys atratulus										
Semotilus atromaculatus						2	4.3	0.05	0.05	0
Gambusia affinis										
Catostomus commersoni										
Lepomis cyanellus	537	8.0	23.86	20.30	0.39	60	10.0	2.15	0.85	0.60
L. macrochirus										
L. megalotis										
L. humilis										
Micropterus salmoides										
Pomoxis nigromaculatus										
Perca flavescens										
Ameirus melas										

[a]C.P.U. = Catch Per Unit Effort.
[b]Estimated Capture Probability.

Table K.1. (page 7 of 9)

Species	Station SP									
	Spring 1992					Fall 1993				
	No. of Indiv.	Avg. Wt. (gr)	C.P.U.[a] Pass 1	C.P.U. Pass 2	P[b]	No. of Indiv.	Avg. Wt. (gr)	C.P.U. Pass 1	C.P.U. Pass 2	P
Dorosoma cepedianum										
Campostoma anomalum										
Cyprinella spiloptera										
Cyprinus carpio										
Luxilus chrysocephalus										
Notemigonus chrysoleucas										
Pimephales notatus										
Rhinichthys atratulus										
Semotilus atromaculatus										
Gambusia affinis										
Catostomus commersoni										
Lepomis cyanellus										
L. macrochirus	1	24.6	0.03	-	-	1	17.5	0.04		
L. megalotis										
L. humilis										
Micropterus salmoides	2	216.5	0.05	-	-	1	2.6	0.04		
Pomoxis nigromaculatus						1	48.8	0.04		
Perca flavescens										
Ameirus melas										

[a]C.P.U. = Catch Per Unit Effort.
[b]Estimated Capture Probability.

Table K.1. (page 8 of 9)

Species	Station OP									
	Spring 1992					Fall 1993				
	No. of Indiv.	Avg. Wt. (gr)	C.P.U.[a] Pass 1	C.P.U. Pass 2	P[b]	No. of Indiv.	Avg. Wt. (gr)	C.P.U. Pass 1	C.P.U. Pass 2	P
Dorosoma cepedianum										
Campostoma anomalum										
Cyprinella spiloptera										
Cyprinus carpio										
Luxilus chrysocephalus										
Notemigonus chrysoleucas										
Pimephales notatus										
Rhinichthys atratulus										
Semotilus atromaculatus										
Gambusia affinis										
Catostomus commersoni										
Lepomis cyanellus	218	13.1	14.53	-	-	87	6.8	3.48	-	-
L. macrochirus										
L. megalotis										
L. humilis										
Micropterus salmoides	2	216.5	0.05	-	-	1	2.6	0.04		
Pomoxis nigromaculatus						1	48.8	0.04		
Perca flavescens										
Ameirus melas										

[a]C.P.U. = Catch Per Unit Effort.
[b]Estimated Capture Probability.

Table K.1. (page 9 of 9)

Species	Station RB									
	Spring 1992					Fall 1993				
	No. of Indiv.	Avg. Wt. (gr)	C.P.U.[a] Pass 1	C.P.U. Pass 2	P[b]	No. of Indiv.	Avg. Wt. (gr)	C.P.U. Pass 1	C.P.U. Pass 2	P
Dorosoma cepedianum										
Campostoma anomalum										
Cyprinella spiloptera										
Cyprinus carpio										
Luxilus chrysocephalus										
Notemigonus chrysoleucas										
Pimephales notatus										
Rhinichthys atratulus										
Semotilus atromaculatus										
Gambusia affinis										
Catostomus commersoni										
Lepomis cyanellus	101	10.6	4.04	-	-	18	8.41	0.69	-	-
L. macrochirus										
L. megalotis										
L. humilis										
Micropterus salmoides										
Pomoxis nigromaculatus										
Perca flavescens										
Ameirus melas										

[a]C.P.U. = Catch Per Unit Effort.
[b]Estimated Capture Probability.

APPENDIX L

LISTS OF MACROINVERTEBRATES COLLECTED FROM STREAMS AND PONDS AT THE MOUND PLANT, MONTGOMERY COUNTY, OHIO

Table L.1. List of Macroinvertebrates Collected in the Streams at the Mound Plant, Montgomery County, Ohio June 1992 and November 1993

Species	Surber Collections(1)				Hester-Dendy Collections(2)											
	Spring		Fall		Spring						Fall					
Stations	EF	BB	EF	BB	DD1	DD2	ME1	ME2	OC1	OC2	DD1	DD2	ME1	ME2	OC1	OC2
PLATYHELMINTHES																
Turbellaria																
Tricladida																
Planariidae																
Cura foremanii	0	0	1	5	0	0	0	0	0	0	0	0	0	0	0	0
Dugesia tigrina	0	0	0	0	0	0	0	0	0	0	0	45	29	151	3	0
Dugesia sp.	0	0	0	0	0	1	0	10	3	0	0	0	0	0	0	0
NEMATODA	0	0	0	0	0	2	64	11	1	25	0	0	0	5	5	0
ANNELIDA																
Oligochaeta																
Haplotaxida																
Enchytraeidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	11
Lumbricidae	0	0	3	3	2	0	0	2	0	0	0	0	1	0	0	0
Naididae	0	0	0	0	0	0	0	0	3	0	0	0	0	0	2	11
Dero digitata	0	0	0	0	0	0	0	0	0	23	0	0	0	0	0	0
Dero sp.	0	0	0	2	0	0	0	0	0	0	0	4298	328	0	9	125
Nais sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45
Nais bretscheri	0	0	0	0	0	0	0	0	0	0	5	36	0	0	0	0
Nais communis	0	0	0	0	2	643	90	0	0	0	0	0	0	0	0	0
Paranais sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	484	12	0
Salavina appendiculata	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Stylaria lacustris	0	0	0	0	1	39	12	0	0	1	0	0	0	0	0	0
Tubificidae w.h.c.	0	8	0	0	0	4	0	0	1	0	0	0	559	5	2	0
Tubificidae w.o.h.c.	10	0	171	9	0	0	0	0	1	0	0	0	0	76	16	119
Limnodrilus hoffmeisteri	0	0	0	0	0	0	0	1	0	6	0	0	0	0	0	0

Table L.1. (page 2 of 8)

Species	Surber Collections(1)				Hester-Dendy Collections(2)											
	Spring		Fall		Spring						Fall					
Stations	EF	BB	EF	BB	DD1	DD2	ME1	ME2	OC1	OC2	DD1	DD2	ME1	ME2	OC1	OC2
Limnodrilus sp.	0	0	2	0	0	0	0	0	0	0	0	0	0	16	0	27
Lumbriculida																
Lumbriculidae	0	0	0	0	0	0	0	0	0	0	0	0	29	11	0	0
Lumbriculus sp.	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
ARTHROPODA																
Crustacea																
Cladocera																
Daphnidae																
Ceriodaphnia quadrangula	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Ostracoda	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Cyclopoida	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
Isopoda																
Asellidae																
Caecidotea sp.	1	1	11	0	0	0	0	0	0	0	0	0	0	0	0	0
Lirceus fontinalis	0	0	0	0	0	0	0	2	4	1	0	0	0	0	0	0
Lirceus sp.	121	616	290	217	0	0	0	0	0	0	0	0	0	0	0	0
Amphipoda																
Crangonyctidae																
Crangonyx sp.	0	2	44	0	0	0	0	0	0	0	0	0	0	0	0	0
Insecta																
Collembola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
Ephemeroptera																
Baetidae																
Baetis sp.	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Callibaetis sp.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Centroptilum sp.	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

Table L.1. (page 3 of 8)

Species	Surber Collections(1)				Hester-Dendy Collections(2)											
	Spring		Fall		Spring						Fall					
Stations	EF	BB	EF	BB	DD1	DD2	ME1	ME2	OC1	OC2	DD1	DD2	ME1	ME2	OC1	OC2
Caenidae																
Caenis sp.	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	1
Heptogeniidae																
Stenacron sp.	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Tricorythidae																
Tricorythodes sp.	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Odonata																
Aeshnidae																
Boyeria vinosa	0	0	0	0	0	0	4	1	0	0	0	0	0	0	0	0
Calopterygidae																
Calopteryx sp.	0	0	0	0	0	0	1	0	0	0	0	0	68	2	1	0
Coenagrionidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Argia sp.	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3
Enallagma sp.	0	0	0	0	0	2	1	2	0	0	0	21	5	0	0	0
Plecoptera	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Nemouridae																
Amphinemura delosa	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Capniidae	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Perlidae																
Perlesta placida	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0
Heteroptera																
Gerridae																
Gerris sp.	0	0	0	0	1	0	0	2	2	0	0	0	0	0	0	0
Veliidae																
Microvelia sp.	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0
Megaloptera																

Table L.1. (page 4 of 8)

Species	Surber Collections(1)				Hester-Dendy Collections(2)											
	Spring		Fall		Spring						Fall					
Stations	EF	BB	EF	BB	DD1	DD2	ME1	ME2	OC1	OC2	DD1	DD2	ME1	ME2	OC1	OC2
Sialidae																
Sialis sp.	0	0	0	0	0	0	1	2	3	0	0	0	4	0	0	0
Trichoptera																
Rhyacophilidae																
Rhyacophila sp.	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydropsychidae	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
Cheumatopsyche sp.	0	1	0	0	0	5	26	39	13	0	1	337	483	112	2	0
Hydropsyche sp.	0	0	0	0	0	0	2	0	0	0	0	60	0	1	0	0
Hydropsyche betteni sp. gp.	0	0	0	0	2	7	0	0	0	0	0	127	213	2	0	0
Limnephiliidae																
Neophylax sp.	25	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polycentropodidae																
Cyrnellus sp.	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Coleoptera																
Curculionidae	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrophilidae																
Berosus sp.	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0
Laccophilus faciatus	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Haliplidae																
Peltodytes sp.	0	0	0	0	0	0	3	2	1	0	0	0	0	0	0	0
Dytiscidae	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agabus sp.	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0
Hydroporus sp.	0	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Hygrotus sp.	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0
Hydaticus sp.	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Uvarus sp.	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table L.1. (page 5 of 8)

Species	Surber Collections(1)				Hester-Dendy Collections(2)											
	Spring		Fall		Spring						Fall					
Stations	EF	BB	EF	BB	DD1	DD2	ME1	ME2	OC1	OC2	DD1	DD2	ME1	ME2	OC1	OC2
Elmidae																
Macronychus glabratus	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stenelmis sp.	0	0	0	0	0	0	0	0	8	0	0	0	4	0	3	0
Optioservus sp.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Psephenidae																
Ectopria nervosa	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0
Ectopria sp.	0	0	0	1	0	0	0	0	0	0	0	0	24	0	0	0
Diptera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Musidae	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ceratopogonidae																
Bezzia sp.	0	10	0	0	0	2	0	0	0	2	0	0	4	0	0	11
Chironomidae	7	6	0	0	0	15	28	2	3	29	37	3	4	0	0	4
Ablabesmyia mallochi	0	0	0	0	0	4	1	1	5	33	0	0	0	0	0	0
Chaetocladius sp.	0	107	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chironomus sp.	0	0	1	1	0	7	10	1	1	0	1	0	1	0	7	92
Cladotanytarsus sp.	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
Conchapelopia sp.	4	3	0	0	8	462	220	18	12	11	0	0	0	0	0	0
Corynoneura sp.	0	0	0	0	0	0	3	9	2	0	0	0	1	0	0	0
Crictopus fulvus	0	0	0	0	0	0	3	0	6	0	0	0	0	0	0	0
Cricotopus tremulus	2	12	0	0	2	0	5	0	0	0	0	0	0	1	0	0
Crictopus trifascia	0	0	0	0	0	11	4	1	0	0	0	0	0	0	0	0
Cricotopus sp.	0	0	0	0	0	0	0	0	0	0	392	156	37	0	0	0
Cryptochironomus sp.	0	0	0	0	0	0	0	0	0	17	0	0	0	0	3	0
Diamesa sp.	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dicrotendipes sp.	0	0	1	0	1	58	23	0	4	38	1	23	1	0	0	9
Eukiefferiella claripennis	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table L.1. (page 6 of 8)

Species	Surber Collections(1)				Hester-Dendy Collections(2)											
	Spring		Fall		Spring						Fall					
Stations	EF	BB	EF	BB	DD1	DD2	ME1	ME2	OC1	OC2	DD1	DD2	ME1	ME2	OC1	OC2
Glyptotendipes lobiferus	0	0	0	0	1	98	42	0	1	1227	0	0	0	0	0	0
Glyptotendipes sp.	0	0	0	5	0	0	0	0	0	0	6	93	0	0	0	1870
Hydrobaenus sp.	0	0	0	0	0	0	0	0	0	0	0	7	4	0	0	5
Limnophyes sp.	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Microtendipes sp.	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0
Nanocladius sp.	0	0	0	0	0	149	86	14	8	6	0	0	0	0	1	0
Nilothauma sp.	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0
Orthocladius sp.	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Parachironomus sp.	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0
Paralimnophyes sp.	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0
Parametriocnemus lundbecki	15	213	0	0	0	1	7	1	0	0	0	0	0	0	2	0
Paratanytarsus dissimilis	0	0	0	0	0	2	3	1	0	3	0	0	0	0	0	0
Paratendipes sp.	0	0	0	0	1	6	21	2	33	63	0	0	8	0	44	0
Phaenopsectra sp.	0	0	0	0	0	0	0	0	0	0	0	5	0	0	3	41
Polypedilum illinoense	0	0	0	0	0	3	12	28	7	7	0	0	0	0	0	0
Polypedilum sp.	12	0	0	0	0	0	0	0	0	0	0	0	2	0	18	21
Procladius sp.	0	0	0	0	0	1	0	0	0	6	0	0	0	0	0	99
Pseudochironomus sp.	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0
Rheotanytarsus sp.	0	0	0	0	0	0	2	0	1	3	0	49	12	0	8	141
Smittia sp.	21	5	0	0	0	0	0	0	0	0	0	0	0	0	0	
Stenochironomus sp.	0	0	0	0	0	0	24	0	0	0	0	0	0	0	0	0
Stictochironomas devinctus	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0
Tanypus sp.	0	0	0	0	0	0	40	0	0	0	0	0	20	0	0	0
Tanytarsus sp.	1	0	0	0	0	19	0	0	2	16	0	18	0	0	23	6
Thienemanniella xena	0	0	0	0	0	0	6	14	0	0	0	0	0	0	0	0
Thienemannimyia sp. gp.	0	0	1	0	0	0	0	0	0	0	70	189	488	2	10	0

Table L.1. (page 7 of 8)

Species	Surber Collections(1)				Hester-Dendy Collections(2)											
	Spring		Fall		Spring						Fall					
Stations	EF	BB	EF	BB	DD1	DD2	ME1	ME2	OC1	OC2	DD1	DD2	ME1	ME2	OC1	OC2
Tribelos sp.	0	0	0	0	0	0	0	0	0	0	0	0	18	0	2	0
Tvetenia discloripes	0	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zavelimyia sinuosa	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Empididae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hemerodromia sp.	0	0	0	0	2	1	0	0	0	0	0	4	0	0	0	0
Psychodidae	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0
Pericoma sp.	2	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Simuliidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Simulium sp.	0	0	0	0	9	0	5	2	0	0	4	0	4	0	0	0
Stratiomyidae	1	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0
Culicidae																
Anopheles sp.	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Tabanidae																
Chrysops sp.	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Tipulidae	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Erioptera sp.	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hexatoma sp.	3	2	0	0	0	0	0	0	0	0	0	0	4	0	0	0
Limnophila sp.	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pseudolimnophila sp.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Tipula sp.	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1	0
Syrphidae	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
MOLLUSCA																
Gastropoda																
Ancylidae																
Ferrissia rivularis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Physidae																

Table L.1. (page 8 of 8)

Species	Surber Collections(1)				Hester-Dendy Collections(2)											
	Spring		Fall		Spring						Fall					
Stations	EF	BB	EF	BB	DD1	DD2	ME1	ME2	OC1	OC2	DD1	DD2	ME1	ME2	OC1	OC2
Physella sp.	0	0	0	0	0	19	10	21	1	0	0	9	16	59	2	1
Bivalvia																
Sphaeriidae																
Musculium transversum	0	0	0	0	0	0	0	16	6	1	0	0	0	627	1	0
Total No. of Organisms	230	1103	531	248	43	1577	766	209	137	1542	536	5496	2386	1555	185	2645
Total No. of Taxa	18	32	12	12	15	31	35	30	30	31	13	20	33	16	26	22

[a]Surber collections consisted of three 1-ft^2 samples each; qualitative sampling was included in spring collections but not in fall.
[b]Hester-Dendy collections consisted of three artificial substrate devices as described by the OEPA and one qualitative sample each.

Table L.2. List of Macroinvertebrates Collected in the ponds at the Mound Plant, Montgomery County, Ohio June 1992 and November 1993

Species	Ekman Dredge Collections[a]								Biotic Index[b]
	Spring				Fall				
Stations	SP	OP	SB	AP	SP	OP	SB	AP	
PLATYHELMINTHES									
Turbellaria									
Tricladida									
Planariidae									
Dugesia sp.	1	0	77	0	0	0	0	0	4
ANNELIDA									
Oligochaeta									
Haplotaxida									
Naididae									
Dero sp.	0	0	0	0	18	0	52	12	3
Tubificidae w.h.c.	0	0	0	26	19	85	764	781	3
Tubificidae w.o.h.c.	55	630	477	0	876	22	93	0	3
Limnodrilus sp.	1	76	177	3	19	4	88	0	5
ARTHROPODA									
Crustacea									
Cladocera									
Daphnidae									
Ceriodaphnia quadrangula	0	0	0	0	0	0	0	2425	NA
Ostracoda	0	0	0	0	0	0	0	8	NA
Insecta									
Ephemeroptera									
Baetidae									
Callibaetis sp.	0	0	0	0	0	0	0	262	3
Centroptilum	0	0	22	4	0	0	0	0	1
Caenidae									

Table L.2. (page 2 of 4)

Species	Ekman Dredge Collections[a]								Biotic Index[b]
	Spring				Fall				
Stations	SP	OP	SB	AP	SP	OP	SB	AP	
Caenis sp.	0	0	0	0	1	0	0	0	3
Odonata									
Cordalidae	1	0	0	0	0	0	0	0	5
Coenagrionidae									
Argia sp.	0	0	0	0	0	0	1	0	2
Enallagma sp.	7	1	12	11	3	0	12	168	3
Libellulidae									
Tramea sp.	0	0	0	0	0	0	0	1	4
Heteroptera									
Gerridae									
Gerris	0	0	1	1	0	0	0	0	NA
Trepobates	1	0	1	0	0	0	0	0	NA
Belostomatidae									
Belostoma	0	0	0	1	0	0	0	0	4
Corixidae	0	0	0	0	0	7	0	57	NA
Mesoveliidae									
Mesovelia	2	0	0	0	0	0	0	0	3
Coleoptera									
Hydrophilidae									
Berosus sp.	1	0	0	0	0	0	0	0	NA
Tropisternus	1	0	0	0	0	0	0	0	4
Elmidae									
Stenelmis sp.	0	0	0	0	0	0	0	4	3
Diptera									
Ceratopogonidae									
Bezzia sp.	3	11	40	2	79	2	21	9	3

Table L.2. (page 3 of 4)

Species	Ekman Dredge Collections[a]								Biotic Index[b]
	Spring				Fall				
Stations	SP	OP	SB	AP	SP	OP	SB	AP	
Chaoboridae									
Chaoborus punctipennis	0	0	0	0	3	3	0	0	4
Chironomidae	2	0	0	1	0	2	0	17	3
Axarus sp.	0	0	0	0	0	3	0	0	3
Chironomus sp.	0	125	202	327	6	461	572	1614	5
Cladopelma sp.	0	0	0	0	5	0	0	0	4
Clinotanypus sp.	0	0	1	0	0	0	0	0	3
Cricotopus sp.	0	0	14	1	1	0	1	0	4
Conchapelopia sp.	0	0	1	0	0	0	0	0	3
Dicrotendipes sp.	0	2	11	0	1	0	52	0	4
Glyptotendipes sp.	0	0	2	0	0	0	3	7930	5
Parachironomus sp.	0	0	2	0	0	0	0	0	4
Paracladopelma sp.	6	0	2	0	0	0	0	0	3
Phaenopsectra sp.	0	0	0	0	0	0	3	0	4
Polypedilum sp.	0	4	0	1	0	0	0	0	3
Procladius sp.	0	3	1	4	26	43	25	1149	4
Pseudochironomus sp.	0	0	0	0	2	0	0	0	2
Rheotanytarsus sp.	0	0	0	0	0	0	64	0	3
Tanypus sp.	4	2	4	6	1	38	331	4	4
Tanytarsus sp.	5	0	24	4	0	0	39	36	3
Odontomyia sp.	0	0	1	0	0	0	0	0	3
MOLLUSCA									
Gastropoda									
Ancylidae									
Ferrissia rivularis	0	0	0	0	0	0	0	8	1
Physidae									

Table L.2. (page 4 of 4)

Species	Ekman Dredge Collections[a]								Biotic Index[b]
	Spring				Fall				
Stations	SP	OP	SB	AP	SP	OP	SB	AP	
Physella sp.	8	0	10	0	0	0	80	4	4
Total No. of Organisms	98	854	1082	392	1060	670	2201	14489	
Total No. of Species	16	9	21	16	15	11	17	18	

[a]Collections consist of three 0.25-ft^2 samples and one qualitative sample each.
[b]Biotic Index Value (See Appendix I).

ER PROGRAM

MOUND PLANT

Miamisburg, Ohio

Plate 1

Habitats of the Mound Plant

Prepared for

Ecological Characterization Report
March 1994

1981 magnetic north declination at center of plant. Magnetic north is 3 degrees west of true north. Declination between state plane (grid) north is 1.13 degrees west of true north.

Plant coordinate system is Ohio State Plane
Horizontal - Modified North American Datum 1927
Vertical - Modified National Geodetic Vertical Datum 1929
Basis of survey - Montgomery County Survey 83-88

Legend

	Paved Roadway
	Unpaved Roadway
	Railroad
	Seasonal waterways
	Fences
	Mound Plant Boundary
L	Maintained lawn
S/S	Scrub/shrub
D	Disturbed
W	Wetlands/perennial waterways
SF1	High gradient upland forests dominated by North and West aspects
SF2	Low gradient upland forests dominated by South and West aspects
SF2a	Vegetationally the same as SF2 but with lower topographic position, nearly level, and associated with seasonal drainages
Gm	Mesic Grasslands
Gx	Subxeric Grasslands
RF	Riparian Forests
E	Exposed rock
P/B	Paved lot or building

NOTES:

1. The electronic base map data file was obtained by WESTON from Woolpert Consultants, Inc., Dayton, Ohio. The data were photogrammetrically compiled from aerial photography dated 12/08/85.

2. WESTON converted MOUND plant coordinates to Ohio State Plane Coordinates using an algorithm provided by Oak Ridge National Laboratory, Grand Junction Project Office.

3. Area west of Dayton-Cincinnati Pike was digitized from a hand drafted map, dated 3/12/86 from Monsanto Research Corp.

0 100 200 400 600 800 1000
Scale in Feet

WESTON
MANAGERS DESIGNERS/CONSULTANTS
6501 Americas Parkway, N.E.
SUITE 800
ALBUQUERQUE, NM 87110
PHONE: (505) 884-5050

j:\DGN\MOUNDB\M1018.DGN
032994

ER PROGRAM

MOUND PLANT

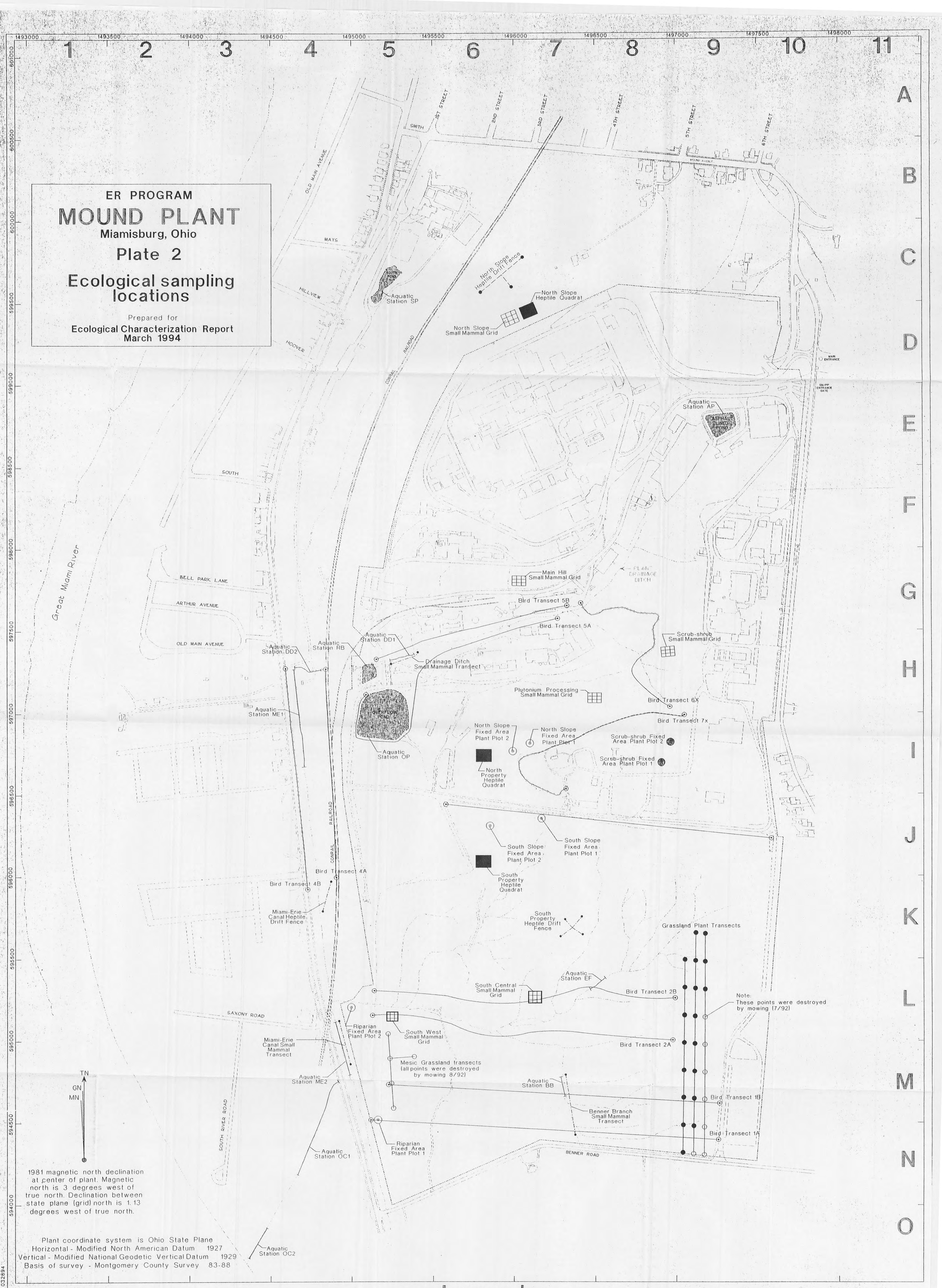
Miamisburg, Ohio

Plate 2

Ecological sampling locations

Prepared for

Ecological Characterization Report
March 1994



Legend

- Paved Roadway
- Unpaved Roadway
- Railroad
- Water
- Mound Plant Boundary
- Small mammal grid (25 traps)
- Small mammal grid (9 traps)
- Herptile Quad.
- Aquatic sampling (stream)
- Aquatic sampling (pond or basin)
- Small mammal transect (10 traps)
- Bird transect
- Grassland plant transect
- Herptile drift fence
- Fixed area plant plot
- Sampling point destroyed by mowing

NOTES:

1. The electronic base map data file was obtained by WESTON from Woolpert Consultants, Inc., Dayton, Ohio. The data were photogrammetrically compiled from aerial photography dated 12/08/85.

2. WESTON converted MOUND plant coordinates to Ohio State Plane Coordinates using an algorithm provided by Oak Ridge National Laboratory, Grand Junction Project Office.

3. Area west of Dayton-Cincinnati Pike was digitized from a hand drafted map, dated 3/12/86 from Monsanto Research Corp.

0 100 200 400 600 800 1000
Scale in Feet

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ER PROGRAM

MOUND PLANT

Miamisburg, Ohio

Plate 3
Spotlight Survey Routes

Prepared for
Ecological Characterization Report
March 1994

1 2 3 4 5 6 7 8 9 10 11

A B C D E F G H I J K L M N O

1493000 1493500 1494000 1494500 1495000 1495500 1496000 1496500 1497000 1497500 1498000

599500 599000 598500 598000 597500 597000 596500 596000 595500 595000 594500 594000

1ST STREET
2ND STREET
3RD STREET
4TH STREET
5TH STREET
6TH STREET
SMITH
OLD MAIN AVENUE
MAYS
SOUTH POND
HILLVIEW
HOOVER
RAILROAD
CONRAIL
MAIN ENTRANCE
SM/PP ENTRANCE GATE
North Property Loop
ASPHALT LINED POND
SOUTH
Great Miami River
BELL PARK LANE
ARTHUR AVENUE
OLD MAIN AVENUE
OVERFLOW POND
SAXONY ROAD
SOUTH RIVER ROAD
BENNER ROAD
Contractors Entrance
South Property Loop

TN
GN
MN

1981 magnetic north declination at center of plant. Magnetic north is 3 degrees west of true north. Declination between state plane (grid) north is 1.13 degrees west of true north.

Plant coordinate system is Ohio State Plane
Horizontal - Modified North American Datum 1927
Vertical - Modified National Geodetic Vertical Datum 1929
Basis of survey - Montgomery County Survey 83-88

0 100 200 400 600 800 1000
Scale in Feet

Legend

Structures
Paved Roadway
Unpaved Roadway
Railroad
Water
Fences
Retaining Wall
Mound Plant Boundary

Spotlight survey route

(9) Area where nocturnal wildlife was observed. Number indicates location discussed in text

NOTES:

1. The electronic base map data file was obtained by WESTON from Woolpert Consultants, Inc., Dayton, Ohio. The data were photogrammetrically compiled from aerial photography dated 12/08/85.

2. WESTON converted MOUND plant coordinates to Ohio State Plane Coordinates using an algorithm provided by Oak Ridge National Laboratory, Grand Junction Project Office.

3. Area west of Dayton-Cincinnati Pike was digitized from a hand drafted map, dated 3/12/86 from Monsanto Research Corp.

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