2992

ECOLOGICAL ASSESSMENT AT THE FEED MATERIALS PRODUCTION CENTER CINCINNATI, OHIO SEPTEMBER 30, 1977

09/30/77

51
REPORT

[redacted]

Battelle
Columbus Laboratories

2992

Report

ECOLOGICAL ASSESSMENT AT THE
FEED MATERIALS PRODUCTION CENTER
CINCINNATI, OHIO

to

NATIONAL LEAD COMPANY OF OHIO

September 30, 1977

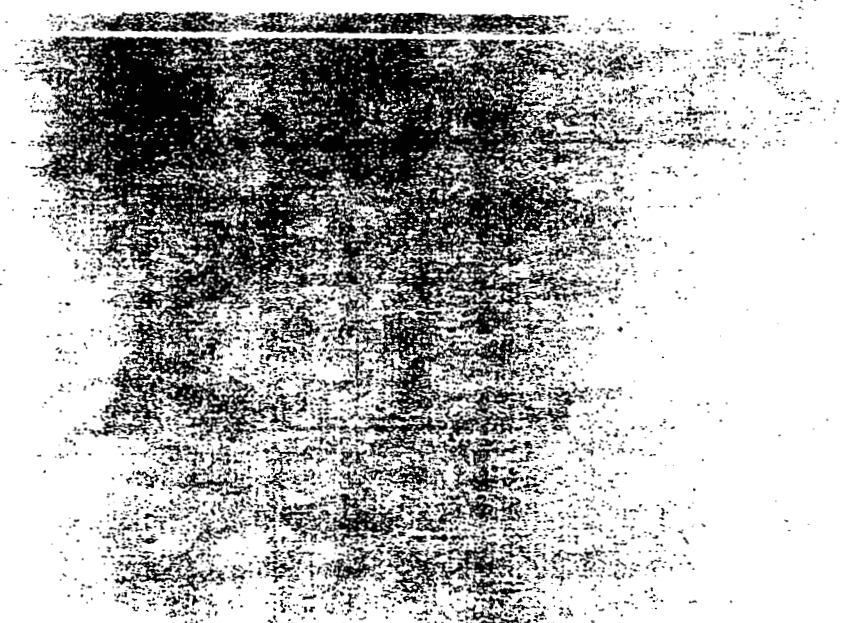

TABLE OF CONTENTS

2

TABLE OF CONTENTS
(Continued)

LIST OF FIGURES

FINAL REPORT

on

ECOLOGICAL ASSESSMENT OF THE
FEED MATERIALS PRODUCTION CENTER
CINCINNATI, OHIO

to

NATIONAL LEAD COMPANY OF OHIO

from

BATTELLE
Columbus Laboratories

August 25, 1977

INTRODUCTION

The Feed Materials Production Center (FMPC) is an industrial facility owned by the U.S. Energy Research and Development Administration (ERDA) and operated by National Lead Company of Ohio. It is located on a 422-hectare (1,050-acre) site in southwestern Ohio in Hamilton and Butler counties and is about 13 km (8 mi) southwest of Hamilton, Ohio. The site is just west of the Great Miami River which receives treated effluent from the plant and municipalities upriver. The area surrounding the plant is rural with primarily agricultural usage for dairy and beef cattle and farm and truck crops. Grain is the primary crop in the area used for agriculture. Portions of the FMPC site are used for grazing by dairy cattle while most of the remaining non-production areas of the site are mowed. A small intermittent stream (Paddy's Run) with forested bank dissects the western portion of the site.

TERRESTRIAL ECOLOGY

Soils

Soil associations at the FMPC site are primarily Fincastle-Xenia silt loams (Figure 1) (ODNR, 1966). These soils are light colored, medium acid, and moderately high in productivity when properly managed. Moisture-supplying capacity is moderate as is fertility and organic content. They have formed in 7-16 cm (18-40 in.) of loess over limy loam till of Wisconsin age. Fincastle soils have poor drainage; and, in areas where this soil is predominant, artificial drainage is required for moderate crop productivity. If artificial drainage is not used, the water table remains high for extended periods in winter and spring. Fincastle-Xenia soils cover large areas west of the FMPC.

Soils along Paddy's Run are categorized as Fox-Gennessee loams. These soils are light colored, high in productivity, and moderate in fertility and organic matter. Fox soils are slightly to medium acid, moderate in moisture supplying capacity, and well drained. They have formed in 9-16 cm (24-40 in.) of silty materials over sand and gravel on level areas of second bottoms. Genessee soils occur on first bottom. These are well drained, high in moisture-supplying capacity, and are subject to flooding (ODNR, 1966).

Soils in a small area on the north side of the site are classed as Russel-Xenia-Wynn (ODNR, 1969). The topography is sloping. These upland soils are light colored and medium acid. The soils have formed in 7-16 cm (18-40 in.) of wind-blown silty material on limy loam glacial till.

Soils in the Great Miami River flood plain are classified as Genessee silt loam and Genessee loam (ODNR, 1966). These soils are characterized by moderate permeability, deep root zone, and high available water capacity with slow runoff. They form valuable cropland and, because of good drainage, are easily worked in early spring while the upland Fincastle soils are still wet and muddy.

In other nearby areas of Hamilton and Butler counties, the predominant farm soils are the Russell, Xenia and Wynn types. A comparison of the agricultural value of these soils is given in Appendix A.

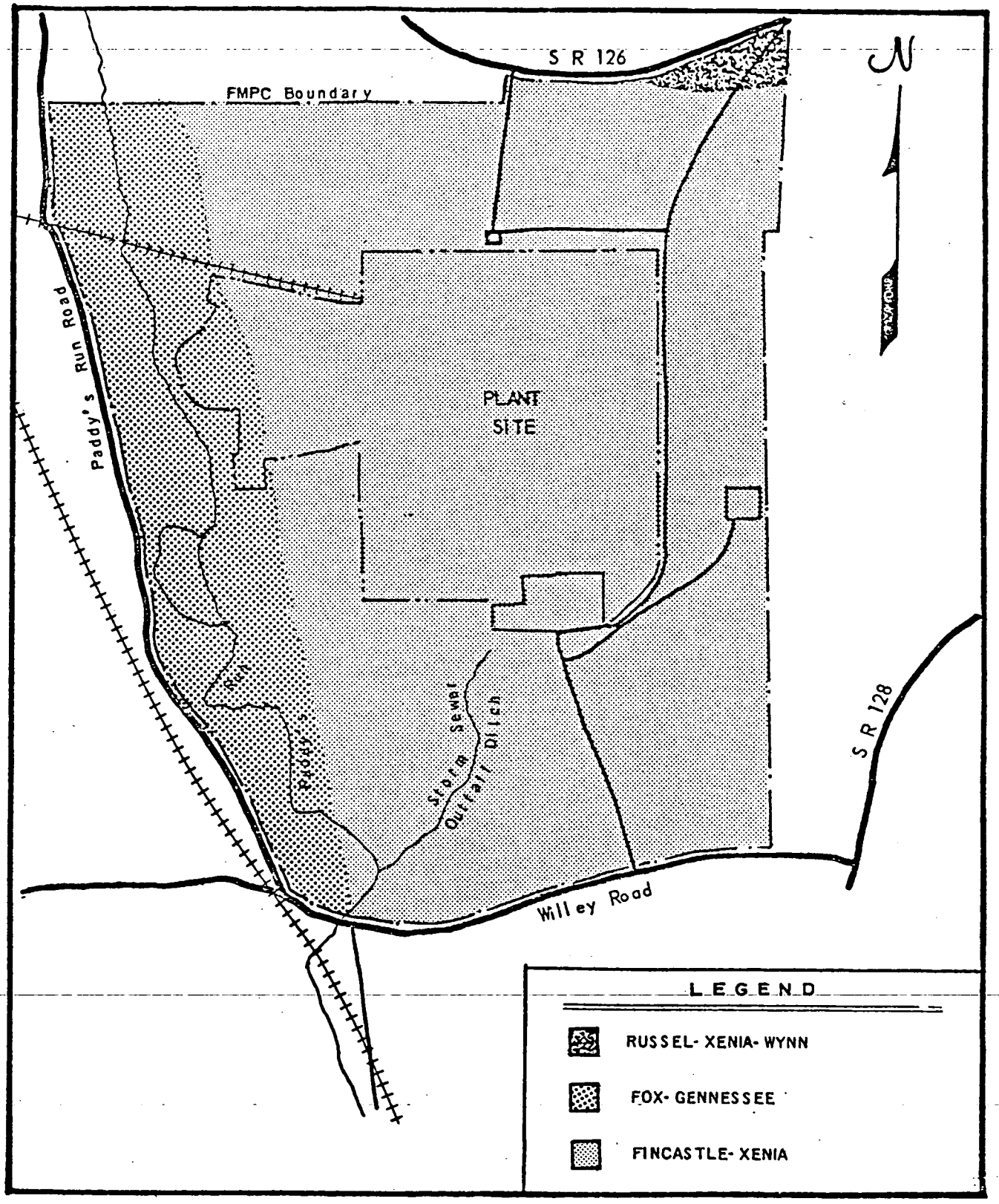

FIGURE 1. SOIL ASSOCIATIONS OCCURRING ON THE FMPC PLANT SITE.

Flora

The natural vegetation occurring in the region when the early settlers first came to the area was characterized as the Western Mesophytic Forest Region; the FMPC site lies within the Illinois Glaciation area of this region (Braun, 1950). There are very few remnants of the virgin forests in existence anywhere and none in the local area. The present day secondary forests of the region are characterized by a mosaic of forest types; there is no single climax species. The region has a wide variety of upland forest types and alluvial swamps (Wharton and Barbour, 1973). Drier slopes may display remnants of oak-ash-maple forests and have a luxurious herbaceous layer. American beech may form approximately 50 percent of the forest canopy with tulip tree, sugar maple, basswood, black walnut, and white oak as subdominants (Braun, 1950).

Vegetation growing on the site is typical of that normally occurring in this region under similar land-use practices. Four major vegetational communities occur on the FMPC site (Figure 2); these are grazed area (pasture) along the east, south and north sides, mowed area (pasture) along the northeast portions, wooded areas along the stream beds and on the north side and forb-shrub area near Paddy's Run and in the northwest portion. Herbaceous vegetation in the mowed and pasture areas is similar in composition, with fescue being the dominant species. As a result of grazing, the vegetation in the pasture area is normally maintained at a lower height and plant density is reduced. Scattered trees occur in the grazed areas. The mowed vegetation in the central portion of the site is more dense than in the pasture due to less compaction. Portions of the mowed areas outside the inner fence were planted with approximately 131,000 tree seedlings in 1972; white pine, Austrian pine, and Norway spruce were used (US ERDA, 1977). Grass is mowed to reduce competition among the seedlings, most of which are 30 cm (1 ft) or less tall.

Shrub areas have as common woody species black locust, box-elder, white ash, black cherry, and dogwood; other woody species present are listed in Appendix B, Table B-1. Common forbs in these areas were

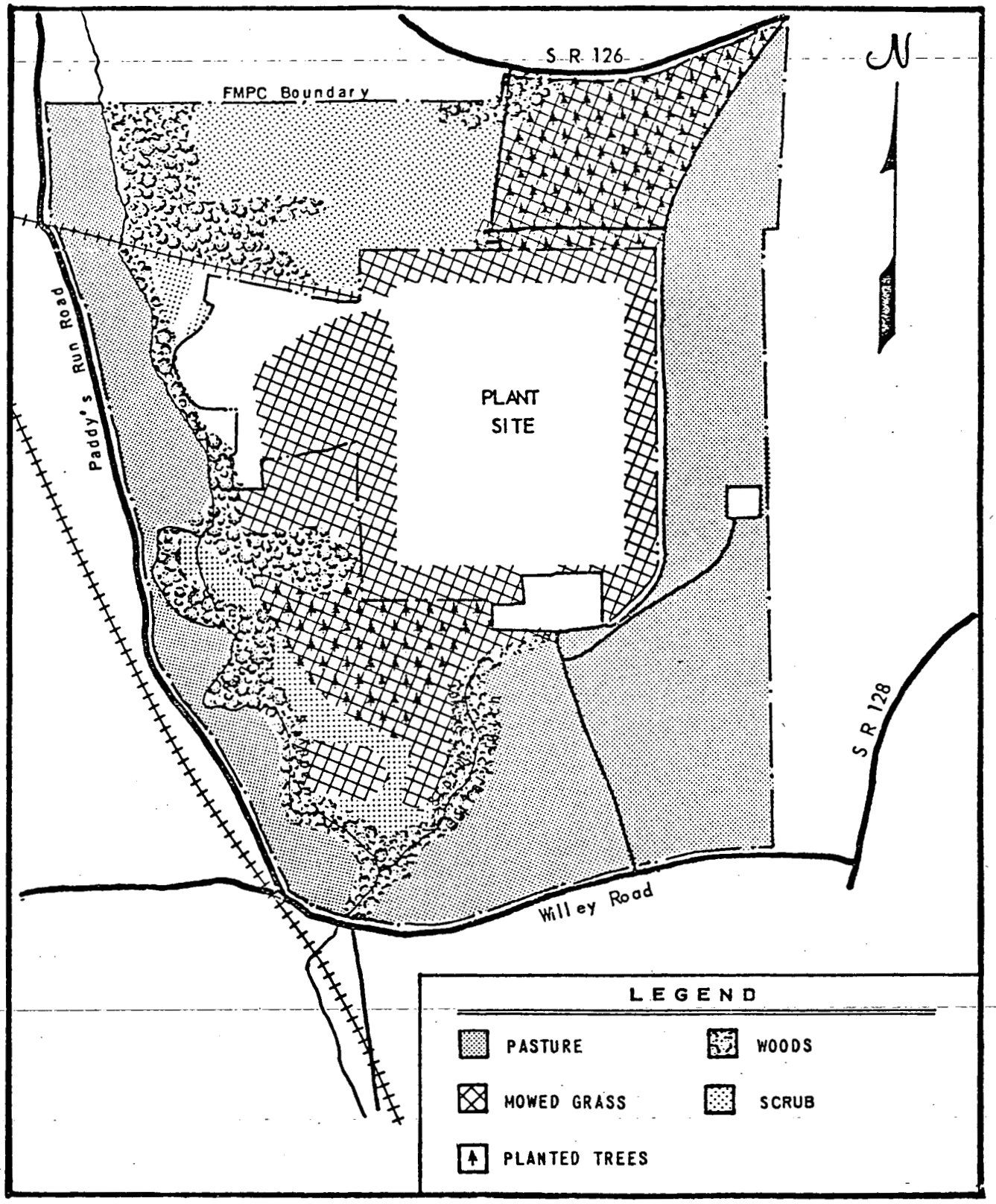

FIGURE 2. VEGETATION TYPES OCCURRING ON THE FMPC PLANT SITE.

goldenrod, Queen Anne's Lace, thistle, and teasel. A list of the herbaceous species observed on the site is presented in Appendix B, Table B-2.

Woodlands are of two types on the site: upland and riparian. Upland woods are generally dominated by white ash which commonly has the largest individuals. With the exception of the woods in the northeast portion of the site, most woodlands have very few large trees (i.e., greater than 38 cm or 15 in.). Most of the upland woods are dominated by trees with 8- 20 cm (3-8 in.) size class and have numerous species. Other common tree species in the uplands are black and sugar maples, black locust, black walnut, and Kentucky coffee tree.

Riparian woods occur in a narrow band along Paddy's Run and the storm sewer ditch. The dominant and most abundant species in this woodland type is the sycamore. Cottonwood is the second most abundant species. Other common species present include black willow, black locust, and boxelder.

The vegetation occurring on the FMPC site is typical of the Western Mesophytic forest region as typified by second growth forest dominance of sycamore and white ash. The small woodlots with open area and maintained grasslands are also typical of the region and the plant's operation appears to have had no impact upon the local flora except for the artificial introduction of exotic conifers for landscaping purposes.

Fauna

Mammals

Mammal populations at the Feed Materials Production Center are typical of those in southwestern Ohio where the land is generally open and subjected to agricultural practices. Systematic field reconnaisances for native mammals and their signs were conducted in all parts of the site outside of the production center fence during June 27-29, 1977. The most common species of native mammals on the site include white-tailed deer, eastern cottontail, fox squirrel, eastern chipmunk, woodchuck, and raccoon. A list of mammal species whose range include the site is given in Appendix C. Other species which have been observed on the site

include muskrat, mink, red fox and striped skunk (NLCO 1977). Most of the populations of native mammals are centered around the areas with trees and shrubs. These areas provide cover and denning areas for species which often range into other habitats during foraging activities. Deer cottontail and woodchuck in particular use the grassy areas for feeding. The deer population level in the area is low and is typical of this region of Ohio (ODNR, 1971); a regional exception is the Miami Whitewater Forest, a Hamilton County, Ohio, park 8 km (5 mi) southwest of the site, which serves as a wildlife sanctuary. Rabbit populations on the site are similar to those expected in the surrounding area or are slightly lower due to extensive mowing or grazing over much of the site. Average density is probably about two per hectare (less than one per acre) (ODNR, 1968a). Squirrels and chipmunks are found primarily in association with the woody vegetation. Southwestern Ohio is part of the primary range of fox squirrels in Ohio and they are common in the wooded areas of the site; gray squirrel populations are low in this region except in urban area (ODNR, 1968b). Raccoon and skunk are to be expected mainly in the wooded areas and along the streams but will range into the open fields in search of insects, fruits and other items for food. Mink and muskrat are associated with aquatic habitats. There is insufficient water present on the site to provide adequate habitat for either of these species and any observed would be transients.

Several species of small mammals are expected to occur on the site. A limited trapping program for these species was conducted in June 1977, but was rendered ineffective by inclement weather. Species expected to be common are white-footed mice in wooded and shrub areas and meadow voles in the mowed areas. Other species to be anticipated are the short-tailed shrew, prairie deer mouse, and meadow jumping mouse. Several species of bats can be expected to forage over the site and some may roost in trees on the site.

Population levels of wildlife species on the site appear to be normal for southwestern Ohio. The small size of the site reduces the likelihood of any high concentrations occuring; no species or group is conspicuously low or absent in any available habitat niches.

Livestock is pastured on approximately 131 ha (325 ac) of the site. All of the site used for pasture is grazed by dairy cattle except for one small area on the northwest portion which is grazed by about 20 beef cattle. Average annual milk production from the cattle pastured on the site is about 8400 kg/cow (18,500 lb.). This is considerably higher than the average for either Hamilton or Butler counties where the 1976 average were 4987 kg(11,000 lb.)/cow and 4475 kg(12,280 lb.)/cow, respectively (personal communication, Mark Evans, USDA Statistical Reporting Service, Columbus, Ohio).

Birds

Bird populations likely to occur on the National Lead Company property are both diverse in the number of species and continually changing with the seasons. In order to put these populations in perspective, it should be noted that there are 286 species of birds reported to occur during one or more seasons in Ohio (Trautman and Trautman, 1968), and about 250 of these species may be seen in the portion of southwestern Ohio encompassed by the Hamilton County Park District (Appendix D, Table D-1) (Austing and Imbrogno, 1976). The seasonal status, migratory arrival and departure dates, and relative abundance of these 250 species are available for comparison with bird species found on National Lead Company property. During the breeding season, the period of most stability in bird populations, there are records of 100 and 99 bird species nesting, respectively, in Butler and Hamilton counties (Hicks, 1935).

Since the breeding season is considered to be the most stable period for sampling bird populations, a reconnaissance of the avifauna on the National Lead Company property was conducted on June 27 and 28, 1977. Two types of survey techniques were employed in this brief reconnaissance. First, a modification of the U.S. Fish and Wildlife Services' roadside survey (Robbins and Van Velsen, 1969) was conducted at seven stops around the perimeter of the property (Figure 3) during the early morning of both days. Second, belt transects (1500 x 300 ft or 458 x 92 m) were hiked during mid-morning with two transects included in each of four habitat types identified on the site. Thus, the fol-

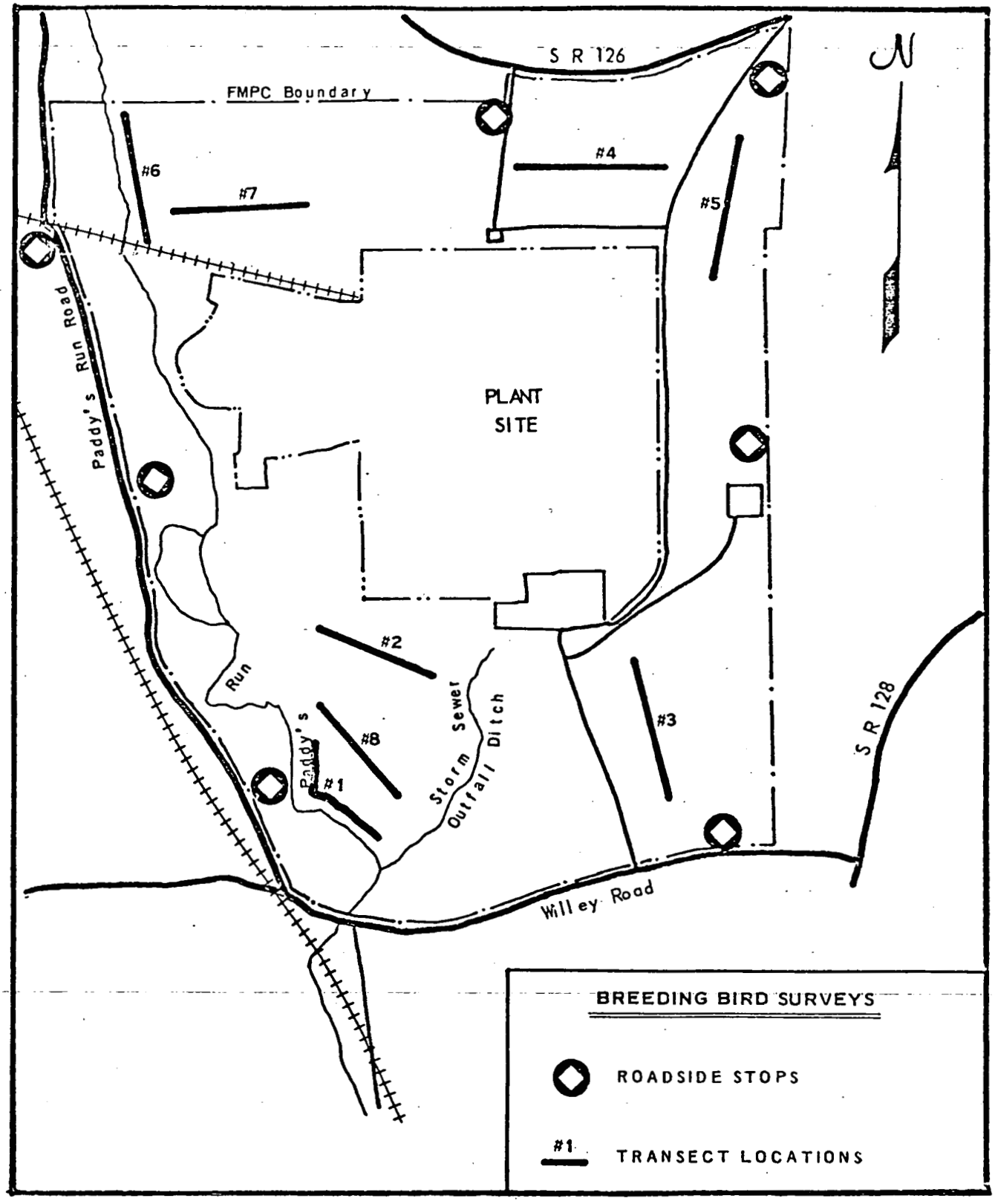

FIGURE 3. BREEDING BIRD SURVEY ROADSIDE STOPS AND FIELD TRANSECT LOCATIONS.

lowing discussion is a report of bird species likely to be nesting on the property but does not include potential migrants or winter residents. All common and scientific names follow the fifth AOU checklist (Wetmore, 1957) and its thirty-second supplement (Eisenmann, 1973).

The 2-day avifauna reconnaissance at the site during June resulted in the identification of 26 species of birds during the roadside survey and 39 species of birds during transect surveys (Appendix D, Tables D-2 and D-3). A total of 50 different species were recorded for both survey techniques combined, plus six additional species (American kestrel, spotted sandpiper, rock dove, eastern kingbird, great crested flycatcher, and eastern phoebe) which were seen on the site but not during a formal survey. Species judged to be very common based on the number observed during the roadside survey were the American robin, house sparrow, eastern meadowlark, and indigo bunting. Three species, the chimney swift, common flicker, and common grackle, were considerably less numerous than expected based on their relative abundance in the Hamilton County Park District (Austing and Imbrogno, 1976). Numbers of common grackles would undoubtedly have been higher if the area within the inner fence had been included in the survey; chimney swift numbers would have been higher during an evening survey.

Transect surveys indicated the most numerous birds associated with each of the four habitat types (Appendix D, Table D-3). The most abundant species recorded on grazed pasture transects were starlings and eastern meadowlarks. Grasshopper sparrows and eastern meadowlarks were the most prominent species in the weedy fields planted with small conifers. Fields overgrown with weeds, shrubs, and young trees supported relatively high numbers of gray catbirds, American goldfinch, and field sparrows. The mature riparian woods along Paddy's Run provided habitat for the greatest number of species (28). The starling was by far the most numerous species in this riparian habitat, but the woods along the stream also had fair numbers of common crows, cardinals, and indigo buntings.

One species, the grasshopper sparrow, was much more numerous in the weed-and-small-conifer transects than expected based on the abundance of that species in the Hamilton County Park District (Austing and Imbrogno, 1976). This species has shown recent decreases in populations throughout Ohio (Smith et al., 1973).

A few orchard orioles were observed in the weed-shrub-tree transects (Appendix D, Table D-3). This species is considered rare in Ohio (Smith et al., 1973) but is reportedly fairly common in the Hamilton County Park District (Austing and Imbrogno, 1976).

Reptiles and Amphibians

Reptile and amphibian (herpetile) populations on the site appear to be low due to grazing or mowing of much of the area. Most of these animals present will occur primarily in the woods, along the stream and the small pond on the south side. The only herpetiles observed were the box turtle near a wooded area and tadpoles in the small pond. Lists of reptiles and amphibians whose ranges include the site are given in Appendices E and F. Few turtles, except the box turtle, or salamanders are to be expected because of the dry upland habitat and the intermittent nature of the streams on site. Turtles are present in the Great Miami River. Species of amphibians one may expect to encounter on the site include American toad, Fowler's toad, spring peeper, green frog, leopard frog and pickerel frog. Snake expected to be present include the black snake, eastern garter snake, and northern water snake. There appears to be no reason to anticipate any unusual presence or absence of any reptile or amphibian species on the site, given the existing habitat conditions which are common for the region.

Threatened and Endangered Species

No species of vegetation included on the proposed federal list of endangered or threatened plants (USDI, 1976a) is known to exist on the FMPC site. Current land practices on the site (e.g., grazing and mowing) will act to reduce the likelihood of any occurring.

Three species of mammals classified as endangered by the Ohio (ODNR, 1974) and the United States (USDI, 1976b) governments have ranges which include the FMPC site. These are the bobcat, river otter, and Indiana bat. All three are listed by Ohio; only the Indiana bat is on

the U.S. endangered list. Neither the otter or the bobcat is to be expected in the region due to lack of suitable habitat. There is a slight possibility that the bat may at some time pass over the site during migratory or feeding activities. There are no suitable locations on the site for the bats to use as roosting or resting areas as they require caves.

No federal or state threatened or endangered bird species were observed on the site during the 2 days of surveys in June. In fact, habitats available on the property are not suitable as breeding or overwintering habitat for any of the federally threatened or endangered bird species known to occur in Ohio. Although only remotely possible, one or more of the seven species of birds considered endangered in Ohio (Ohio Department of National Resources, 1974) could stop briefly on the property during migration. One of these seven species, the upland sandpiper, is a bird of open pastures that has been rarely seen during the summer in the Hamilton County Park District (Austing and Imbrogno, 1976) and could possibly occur in the pastures on the site.

AQUATIC ECOLOGY

A survey of the aquatic biota of the streams in the area of the National Lead Company facility was made July 5-7, 1977. Fish and benthic macroinvertebrate communities were sampled both in Paddy's Run, a small intermittent stream which flows through the plant property, and in the Great Miami River upstream and downstream of the plant outfall. Locations of the sampling areas are shown in Figure 4. Descriptions of the locations are presented in Appendix G.

Benthic Macroinvertebrates

Paddy's Run

Results of the analysis of Surber samples from Paddy's Run are presented in Appendix H. A total of 19 species was collected from the upstream portion of this stream. (The water level was low at the time of

sampling. Most of the stream bed on plant property was dry.) The dominant organism was a caddisfly larva, Cheumatopsyche sp. Relatively large numbers of caddisflies, Hydropsyche sp. and Chimarra sp., were also present in the collections. The remainder of the samples were comprised of mainly six species of midge larvae, a mayfly larva, Baetis sp., two types of water beetles, and a species of crayfish. Species diversities, calculated according to the Shannon Weaver index, were not very high. These values fall within the range indicative of intermediate stream quality (Wilhm, 1970).

Great Miami River

Benthic macroinvertebrate data from collections made in the Great Miami River are presented in Appendix H.

Surber samples were taken over three types of substrate. The riffle areas in the river supported lush growths of aquatic macrophytes. Samples were taken over Cladophora beds and over sand-gravel at all three locations. The third sample was taken over one of several available plant types—Potamogeton crispus (curly pondweed), Potamogeton sp. (another type of pondweed), and Myriophyllum sp. (water milfoil).

In all cases, samples taken over the plant-covered substrates contained larger numbers of individuals. Potamogeton spp. and Myriophyllum sp. appeared to support slightly more organisms than did the Cladaphora.

Collections made upstream and downstream of the plant outfall appeared very similar in numbers of species, species composition, and species diversity. A total of 19 species were collected. Thirteen species were collected upstream of the plant outfall; 18 species were collected downstream. The dominant organisms in all collections were caddisfly and midge larvae. Five species were collected downstream which were not found upstream. However, these organisms were collected in very small numbers.

Species diversities at both upstream and downstream locations are within ranges indicative of intermediate to good biological quality (Wilhm, 1970). Other benthic studies suggest that the River environment, as a whole, tends to be of marginal to distressed quality between Dayton, Ohio, and the Ohio River (Conn, 1973).

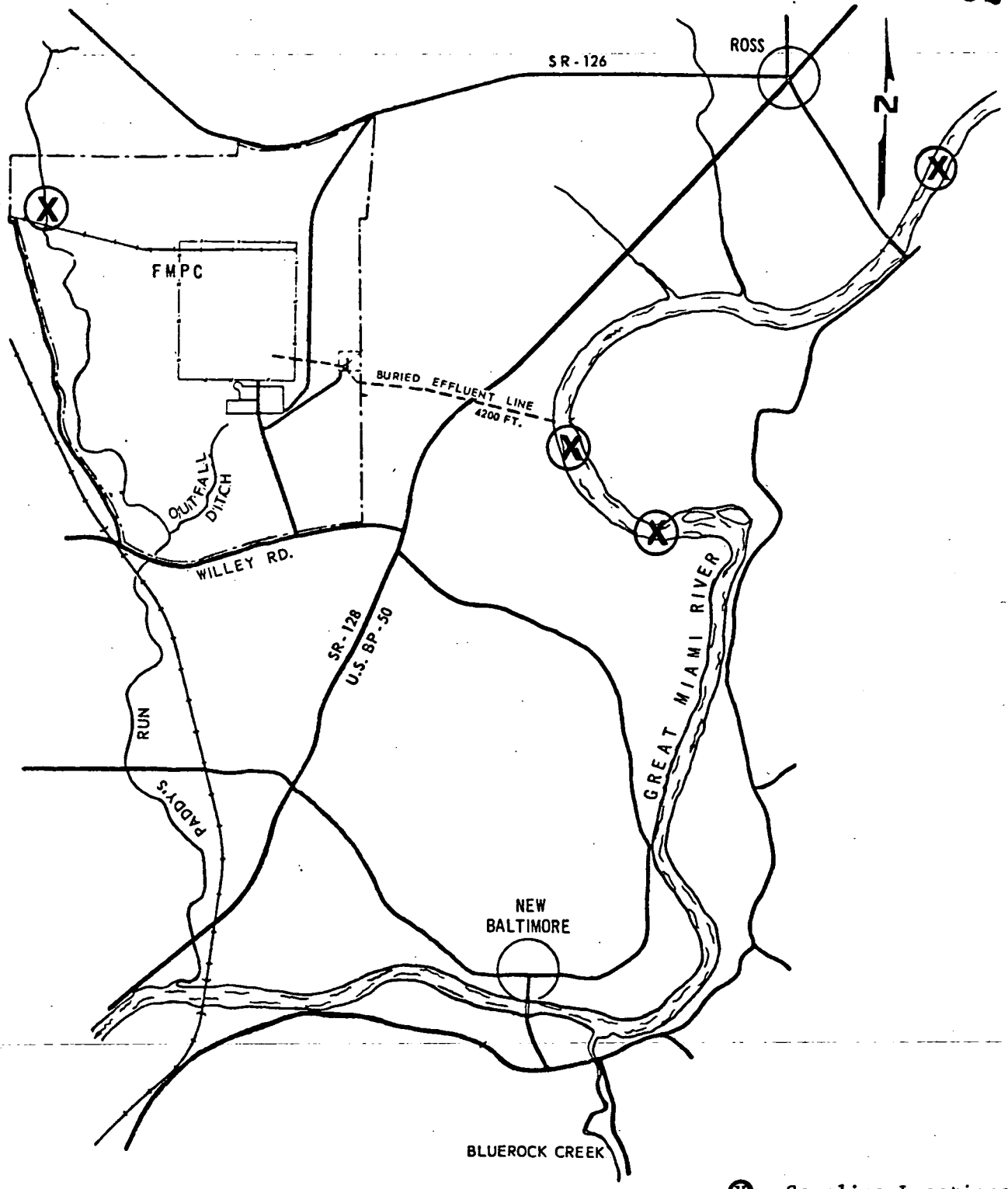

FIGURE 4. AQUATIC BIOTA SAMPLING LOCATIONS IN THE VICINITY OF THE FMPC PLANT SITE.

Based on these limited data, it appears that there is no measureable effect from the FMPC plant outfall on the aquatic macroinvertebrate community of the Great Miami River.

Fishes

Fish were collected from Paddy's Run and the Great Miami River using seines (4 ft x 6 ft) and electro-shocking equipment. Riffle areas were sampled with seines and pools were sampled with the electro-fishing gear. Fishes were collected, identified, and counted in the field. A few small specimens were returned to the lab for identification.

Paddy's Run

Much of Paddy's Run was dry during the sampling trip. The area below the railroad bridge had intermittent flow and became dry several hundred meters downstream from this bridge. No water was present from that point to near the confluence with the Great Miami River.

Fish collections contained a total of nine species of fish. A list of these species and the relative abundance of each based on seining collections is presented in Appendix I. The two dominant species, creek chub and organgethroat darter, were collected in large numbers. The presence of large numbers of fish and the occurrence of a variety of species indicates that Paddy's Run is a fairly clean water stream. The presence of grazing cattle may alter stream morphology somewhat and add excessive nutrients; however, these conditions do not appear to impact the fish populations in this area of the stream.

Great Miami River

Fish collections were made from one large pool area and one riffle area upstream and downstream of the plant discharge. Pools were electro-fished and riffles were seined.

Fish collections from the Great Miami River contained 16 species; 14 were collected upstream and 15 downstream. A list of the fish species

collected is presented in Appendix I. The river carpsucker was found upstream but not downstream; however, only two specimens were collected. Similarly, the two species (longnose gar and orangethroat darter) collected downstream and not upstream were each represented by a single specimen.

Fish populations in both these areas were quite similar. The spotfin shiner was the dominant forage fish in upstream and downstream areas. The green sunfish and bluegill were the only sport fish collected but occurred in both zones sampled.

While similar species and numbers of fishes were collected above and below the plant discharge, the near total absence of darters (a clean water riffle species) and sport fish (bass, catfish, bullhead and sunfish) indicates the Great Miami River has been environmentally stressed. This is in agreement with a study which found low populations of sport and clean water species in the River south of Dayton (The Miami Conservancy Dist., 1969). The large, wide riffle areas should be inhabited by several darter species (Trautman, 1957). The turbid water and siltation over the bottom substrates may have an adverse effect on darter populations in this area. The lack of cover, such as dead trees, brush, rock outages, and undercut banks, may explain the absence of sport fish in this area.

No detectable effect on the fish populations of the Great Miami River was observed due to the discharge of plant wastewater based on these preliminary investigations.

Threatened and Endangered Species

No threatened or endangered species of fish on either the federal (USDI, 1976b) or state (ODNR, 1974) lists are known or expected to occur on the FMPC site or in the local stretches of the Great Miami River due to the intermittent nature of Paddy's Run and to the degraded state of the river.

SUMMARY AND CONCLUSIONS

The ecological communities on the FMPC site are typical of those found in the region where there are similar land-use practices.

The site is underlaid primarily with Fincastle-Xenia silt loam. The vegetation cover is predominantly grass, part of which is grazed by cattle; small conifers have been planted in portions of the mowed area. Wooded areas occur mainly near the intermittent stream, Paddy's Run. Two basic types of woodland communities occur on the site: upland forests dominated by white ash and riparian forests dominated by sycamores. The most common wild mammals present are the eastern cottontail, fox squirrels, and chipmunks. Dairy cattle grazing on the site have milk production considerably above the average for the surrounding area. The most common breeding birds on the site are starlings, eastern meadowlark, and grasshopper sparrows. Grasshopper sparrows are normally uncommon. Fish and benthic invertebrates collected from Paddy's Run indicate that the intermittent stream is of good to high quality in areas of permanent water; chubs and darters, clean water fish species, were dominant. Fish and benthos from the Great Miami River suggest that the river is of low to good quality and stressed both above and below the FMPC outfall. No threatened or endangered species are present on the site.

Operation of the Feed Materials Production Center plant does not appear to have any adverse effect upon the existing ecological communities, but current land-use practices on the plant site may have beneficial impacts upon grasshopper sparrow populations.

LITERATURE CITED

Austing, G. R., and D. A. Imbrogno. 1976. Birds of the Hamilton County Park District. The Board of Park Commissioners, Hamilton County Park District, Cincinnati, Ohio. 52 pp.

Barbour, R. W., and W. H. Davis. 1974. Mammals of Kentucky. The University Press of Kentucky, Lexington, Kentucky. 322 pp.

Braun, E. L. 1950. Deciduous forests of eastern North America. Hafner Press, New York, New York. 596 pp.

Burt, W. H., and R. P. Glossenheider. 1976. A field guide to the mammals. 3rd ed. Houghton Mifflin Co., Boston, Mass. 289 pp.

Conant, R. 1975. A field guide to reptiles and amphibians of eastern and central North America. 2nd ed. Houghton Mifflin Co., Boston, Mass. 429 pp.

Conn, C. C. 1973. Biological survey of the Great Miami River. The Miami Conservancy District, Dayton, Ohio. 50 pp.

Eisenmann, E., Chairman, Committee on Classification and Nomenclature. 1973. Thirty-second supplement to the American Ornithologists' Union check-list of North American birds. The Auk 90(2): 411-419.

Hicks, L. E. 1935. Distribution of the breeding birds of Ohio. Ohio Biol. Surv., Bull. 32, 6(3): 125-190.

McElroy, T. P., Jr. 1974. The habitat guide to birding. Alfred A. Knopf, New York, New York. 257 pp.

National Lead Company of Ohio. 1977. Study of radioactive waste storage areas at the Feed Materials Production Center. NLCO-1143 (special) U.S. ERDA Contract No. EY-76-C-05-1156. 77 pp.

Nixon, C. M., D. A. Watts, and J. M. Keener. 1972. Non-game species -- amphibians and reptiles. Ohio Department of Natural Resources, Division of Wildlife inservice publication 71. 18 pp.

Ohio Department of Natural Resources. 1966. General soil map of Hamilton County. 2 pp.

Ohio Department of Natural Resources. 1968a. Cottontail rabbit in Ohio. Division of Wildlife publication 93. 2 pp.

Ohio Department of Natural Resources. 1968b. Squirrels in Ohio. Division of Wildlife publication 95. 2 pp.

Ohio Department of Natural Resources. 1969. General soil map of Butler County. 1 p.

Ohio Department of Natural Resources. 1971. White-tailed deer in Ohio. Division of Wildlife publication 101. 2 pp.

Ohio Department of Natural Resources. 1974. Endangered wild animals in Ohio. Division of Wildlife publication 316. 3 pp.

Robbins, C. S., and W. T. Van Velzen. 1969. The breeding bird survey, 1967 and 1968. U.S. Dept. Int., Fish and Wildl. Serv., Washington, D.C. Spec. Sci. Rept.-Wildl. No. 124. 107 pp.

Shannon, C. E., and W. Weaver. 1963. The mathematical theory of communication. University of Illinois Press, Urbana, Illinois.

Smith, H. G., R. K. Burnard, E. E. Good, and J. M. Keener. 1973. Rare and endangered vertebrates of Ohio. Ohio. J. Sci. 73(5): 257-271.

The Miami Conservancy District. 1969. Regional water quality management program--Fish survey of The Miami River. Tech. note 4. Dayton, Ohio. 9 pp.

Thompson, T. 1974. Checklist of the birds of Ohio. Columbus Audubon Society, Columbus, Ohio. 8 pp.

Trautman, M. B. 1957. The fishes of Ohio. The Ohio State University Press, Columbus, Ohio.

Trautman, M. B., and M. A. Trautman. 1968. Annotated list of the birds of Ohio. Ohio J. Sci. 68(5): 257-332.

U.S. Department of the Interior, Fish and Wildlife Service. 1976a. Endangered and threatened species-plants. Federal Register 41(117): 24524-24572.

U.S. Department of the Interior, Fish and Wildlife Service. 1976b. Endangered and threatened wildlife and plants. Federal Register 41(208): 47180-47198.

U.S. Energy Research and Development Administration. 1977. Study of radioactive waste storage areas at the Feed Materials Production Center. NLCO-1143 (special). National Lead Company of Ohio, Cincinnati, Ohio. 77 pp.

Wetmore, A., Chairman, Committee on Classification and Nomenclature. 1957. Check-list of North American birds. 5th ed. American Ornithologists' Union, Washington, D.C. 691 pp.

Wharton, M. E., and R. W. Barbour. 1973. Trees and shrubs of Kentucky. The University Press of Kentucky, Lexington, Kentucky. 582 pp.

Wilhm, J. L. 1970. Range of diversity index in benthic macroinvertebrate populations. J. Wat. Poll. Control Fed. 42: 221-223.

APPENDIX A

AGRICULTURAL EVALUATION OF SOILS

AGRICULTURAL EVALUATION OF SOILS IN THE VICINITY OF THE FMPC PLANT

Soil	Yield Potential								Truck Crop Suitability
	Corn		Soybean		Wheat		Hay		
	(bu/ac)	(m^3/ha)	(bu/ac)	(m^3/ha)	(bu/ac)	(m^3/ha)	(ton/ac)	(ton/ha)	
Russell	105	9.0	36	3.1	40	3.4	4.5	10.1	Good
Xenia	105	9.0	36	3.1	40	3.4	4.5	10.1	Good
Wynn	95	8.2	30	2.6	35	3.0	3.5	7.8	Very Poor
Fincastle	105	9.0	40	3.4	40	3.4	4.0	9.0	Fair
Fox	120	10.3	35	3.0	45	3.9	5.0	11.2	Good
Gennessee	130	11.2	50	4.3	55	4.7	6.0	13.4	Good

Source: USERDA, 1977.

A-2

APPENDIX B

VEGETATION ON THE FMPC SITE

APPENDIX B

TABLE B-1. TREE AND SHRUB SPECIES OBSERVED ON THE FMPC SITE

Common Name	Scientific Name
White Pine	Pinus strobus
Austrian Pine	Pinus nigra
Norway Spruce	Picea excelsa
Eastern Red Cedar	Juniperus virginiana
Black Willow	Salix nigra
Cottonwood	Populus deltoides
Black Walnut	Juglans nigra
Shagbark Hickory	Carya ovata
Pignut Hickory	Carya glabra
Gray Birch	Betula populifolia
Chinkapin Oak	Quercus muehlenbergii
White Oak	Quercus alba
Swamp White Oak	Quercus michauxii
Northern Red Oak	Quercus rubra
Shumard Oak	Quercus shumardii
Shingle Oak	Quercus imbricaria
American Elm	Ulmus americana
Slippery Elm	Ulmus rubra
Rock Elm	Ulmus thomasii
Hackberry	Celtis occidentalis
Pawpaw	Asimina triloba
American Sycamore	Platanus occidentalis
Black Cherry	Prunus serotina
Eastern Redbud	Cercis canadensis
Kentucky Coffee Tree	Gymnocladus dioicus
Honey Locust	Gleditsia triacanthos
Black Locust	Robinia pseudoacacia
Ailanthus	Ailanthus altissima
Sumac	Rhus sp.
Sugar Maple	Acer saccharum
Black Maple	Acer nigrum
Silver Maple	Acer saccharinum
Boxelder	Acer negundo
Buckeye	Aesculus sp.
Gray-stemmed Dogwood	Cornus racemosa
Roughleaf Dogwood	Cornus drummondii
White Ash	Fraxinus americana

TABLE B-2. HERBACEOUS VEGETATION OBSERVED ON THE FMPC SITE, JULY 1977

Common Name	Scientific Name
Fescue	Festuca sp.
Asparagus	Asparagus officinalis
Curly Dock	Rumex crispus
Pigweed	Chenopodium sp.
Pokeweed	Phytolacca americana
Blackberry	Rubus sp.
Red Clover	Trifolium pratense
Poison Ivy	Rhus radicanus
Grape	Vitis rotundifolia
Queen Anne's Lace	Daucus carota
Golden Alexander	Taenidia integerrima
Cow Parsnip	Heracleum lanatum
Milkweed	Asclepias sp.
Morning Glory	Ipomoea purpurea
Plantain	Plantago sp.
Elderberry	Sambucus canadensis
Teasil	Dipsacus sylvestris
Ragweed	Ambrosia artemisiifolia
Chicory	Cichorium intybus
Thistle	Carduus sp.
Joe-pye-weed	Eupatorium sp.
Daisy Fleabane	Erigeron annuus
Goldenrod	Solidago sp.
Compass Plant	Silphinium laciniatum
Black-eyed Susan	Rudbeckia hirta

APPENDIX C

MAMMALS OF THE
FMPC SITE

MAMMALS WHOSE RANGE INCLUDES
THE FEED MATERIALS PRODUCTION CENTER

Opossum[1]	Didelphis virginiana
Masked shrew	Sorex cinereus
Short-tailed shrew	Blarina brevicauda
Least shrew	Cryptotis parva
Eastern mole	Scalopus aquaticus
Little brown myotis	Myotis lucifugus
Keen's myotis	Myotis keenii
Indiana myotis[2,3]	Myotis sodalis
Silver-haired bat	Lasionycteris noctivagaus
Eastern pipistrelle	Pipistrellus subflavus
Big brown bat	Eptesicus fuscus
Red bat	Lasiurus borealis
Hoary bat	Lasiurus cinereus
Evening bat	Nycticeius humeralis
Eastern cottontail[1]	Sylvilagus floridanus
Eastern chipmunk[1]	Tamias striatus
Woodchuck[1]	Marmota monax
Gray squirrel[1]	Sciurus carolinensis
Fox squirrel[1]	Sciurus niger
Southern flying squirrel	Glaucomys volans
Beaver	Castor canadensis
Eastern harvest mouse	Reithrodontomys humulis
Prairie deer mouse	Peromyscus maniculatus bairdii
White-footed mouse	Peromyscus leucopus
Meadow vole	Microtus pennsylvanicus
Prairie vole	Microtus ochrogaster
Pine vole	Microtus pinetorum
Muskrat[1]	Ondatra zibethicus
Southern bog lemming	Synaptomys cooperi
House mouse	Mus musculus

MAMMALS WHOSE RANGE INCLUDES
THE FEED MATERIALS PRODUCTION CENTER
(Continued)

Norway rat	Rattus norvegicus
Meadow jumping mouse	Zapus hudsonius
Red fox[1]	Vulpes vulpes
Gray fox	Uracyon cineroargenteus
Raccoon[1]	Procyon lotor
Long-tailed weasel	Mustela frenata
Mink[1]	Mustela vison
Striped skunk[1]	Mephitis mephitis
River otter[2]	Lontra canadensis
Bobcat[2]	Lynx rufus
White-tailed deer[1]	Odocoileus virginianus

Sources: Barbour and Davis, 1974; Burt and Grossenheider, 1976.

[1]Observed on the site.

[2]Listed as Endangered by State of Ohio.

[3]Listed as Endangered by U.S. Fish and Wildlife Service.

APPENDIX D

BIRDS OF THE
FMPC SITE

TABLE D-1. BIRDS OF SOUTHWESTERN OHIO

Common Loon	Black Vulture
Red-throated Loon	Goshawk
Holboell's Grebe	Sharp-shinned Hawk
Horned Grebe	Cooper's Hawk
Pied-billed Grebe	Red-tailed Hawk
White Pelican	Red-shouldered Hawk
Double-crested Cormorant	Broad-winged Hawk
Great Blue Heron	Rough-legged Hawk
Great Egret	Golden Eagle
Snowy Egret	Bald Eagle
Little Blue Heron	Marsh Hawk
Green Heron	Osprey
Black-crowned Night Heron	Peregrine Falcon
Yellow-crowned Night Heron	Merlin
American Bittern	American Kestrel
Least Bittern	Ruffed Grouse
Mute Swan	Bob-white
Whistling Swan	Ring-necked Pheasant
Canada Goose	Sandhill Crane
American Brant	King Rail
White-fronted Goose	Virginia Rail
Snow Goose	Sora
Mallard	Florida Gallinule
Black Duck	American Coot
Gadwall	Piping Plover
Pintail	Semipalmated Plover
Green-winged Teal	Killdeer
Blue-winged Teal	Golden Plover
American Wigeon	Black-bellied Plover
Northern Shoveller	Ruddy Turnstone
Wood Duck	American Woodcock
Redhead	Common Snipe
Ring-necked Duck	Upland Plover
Canvasback	Spotted Sandpiper
Greater Scaup Duck	Solitary Sandpiper
Lesser Scaup Duck	Greater Yellowlegs
American Goldeneye	Lesser Yellowlegs
Bufflehead	Pectoral Sandpiper
Oldsquaw	White-rumped Sandpiper
White-winged Scoter	Baird's Sandpiper
Ruddy Duck	Least Sandpiper
Hooded Merganser	Red-backed Sandpiper
American Merganser	Eastern Dowitcher
Red-breasted Merganser	Stilt Sandpiper
Turkey Vulture	Semiplamated Sandpiper

TABLE D-1. (Continued)

Western Sandpiper	Bank Swallow
Buff-breasted Sandpiper	Rough-winged Swallow
Herring Gull	Barn Swallow
Ring-billed Gull	Cliff Swallow
Bonaparte's Gull	Purple Martin
Forster's Tern	Blue Jay
Common Tern	Crow
Least Tern	Carolina Chickadee
Caspian Tern	Tufted Titmouse
Black Tern	White-breasted Nuthatch
Rock Dove	Red-breasted Nuthatch
Mourning Dove	Brown Creeper
Yellow-billed Cuckoo	House Wren
Black-billed Cuckoo	Winter Wren
Barn Owl	Bewick's Wren
Screech Owl	Carolina Wren
Great Horned Owl	Long-billed Marsh Wren
Snowy Owl	Short-billed Marsh Wren
Barred Owl	Mockingbird
Long-eared Owl	Gray Catbird
Short-eared Owl	Brown Thrasher
Saw-whet Owl	American Robin
Whip-poor-will	Wood Thrush
Nighthawk	Hermit Thrush
Chimney Swift	Swainson's Thrush
Ruby-throated Hummingbird	Gray-cheeked Thrush
Belted Kingfisher	Veery
Common Flicker	Bluebird
Pileated Woodpecker	Blue-gray Gnatcatcher
Red-bellied Woodpecker	Golden-crowned Kinglet
Red-headed Woodpecker	Ruby-crowned Kinglet
Yellow-bellied Sapsucker	American Pipit
Hairy Woodpecker	Cedar Waxwing
Downy Woodpecker	Loggerhead Shrike
Eastern Eingbird	Starling
Crested Flycatcher	White-eyed Vireo
Phoebe	Yellow-throated Vireo
Yellow-bellied Flycatcher	Blue-headed Vireo
Acadian Flycatcher	Red-eyed Vireo
Alder Flycatcher	Philadelphia Vireo
Least Flycatcher	Warbling Vireo
Wood Pewee	Black and White Warbler
Olive-sided Flycatcher	Prothonotary Warbler
Horned Lark	Worm-eating Warbler
Tree Swallow	Golden-winged Warbler

TABLE D-1. (Continued)

Blue-winged Warbler	Red-winged Blackbird
Tennessee Warbler	Orchard Oriole
Orange-crowned Warbler	Northern Oriole
Nashville Warbler	Rusty Blackbird
Northern Parula Warbler	Common Grackle
Yellow Warbler	Cowbird
Magnolia Warbler	Scarlet Tanager
Cape May Warbler	Summer Tanager
Black-throated Blue Warbler	Cardinal
Yellow-rumped Warbler	Rose-breasted Grosbeak
Black-throated Green Warbler	Indigo Bunting
Cerulean Warbler	Dickcissel
Blackburnian Warbler	Evening Grosbeak
Yellow-throated Warbler	Purple Finch
Chestnut-sided Warbler	Common Redpoll
Bay-breasted Warbler	Pine Siskin
Black-poll Warbler	Goldfinch
Pine Warbler	Red Crossbill
Prairie Warbler	White-winged Crossbill
Palm Warbler	Rufous-sided Towhee
Ovenbird	Savannah Sparrow
Northern Water-thrush	Grasshopper Sparrow
Louisiana Water-thrush	Henslow's Sparrow
Kentucky Warbler	Vesper Sparrow
Connecticut Warbler	Bachman's Sparrow
Mourning Warbler	Dark-eyed Junco
Northern Yellow-throat	Tree Sparrow
Yellow-breasted Chat	Chipping Sparrow
Hooded Warbler	Field Sparrow
Wilson's Warbler	White-crowned Sparrow
Canada Warbler	White-throated Sparrow
American Redstart	Fox Sparrow
House Sparrow	Lincoln's Sparrow
Bobolink	Swamp Sparrow
Eastern Meadowlark	Song Sparrow
Western Meadowlark	Snow Bunting
Yellow-headed Blackbird	

TABLE D-2. AVIAN ROADSIDE SURVEY DATA FROM THE SITE PERIMETER COMPARED TO ABUNDANCE OF SPECIES IN SOUTHWESTERN OHIO

Common Name	Roadside Survey (2-Morning Totals)[a]	Southwestern Ohio (summer)[b]
Red-tailed Hawk	Uncommon (2)	Fairly Common
Bobwhite	Common (11)	Common
Killdeer	Fairly Common (5)	Common
Mourning Dove	Common (15)	Very Common
Yellow-billed Cuckoo	Uncommon (2)	Fairly Common
Common Nighthawk[c]	Uncommon (2)	Common
Chimney Swift[c]	Rare (1)	Very Common
Common Flicker	Uncommon (2)	Very Common
Red-bellied Woodpecker	Uncommon (3)	Common
Downy Woodpecker	Uncommon (2)	Common
Eastern Wood Pewee	Uncommon (2)	Common
Blue Jay	Fairly Common (5)	Very Common
Common Crow	Fairly Common (7)	Very Common
American Robin	Very Common (19)	Very Common
Starling	Fairly Common (9)	Very Common
Common Yellowthroat	Uncommon (2)	Common
House Sparrow	Very Common (18)	Very Common
Eastern Meadowlark	Very Common (21)	Very Common
Red-winged Blackbird	Fairly Common (9)	Very Common
Common Grackle	Uncommon (3)	Very Common
Cardinal	Fairly Common (7)	Very Common
Indigo Bunting	Very Common (17)	Very Common
American Goldfinch	Fairly Common (5)	Very Common
Rufous-sided Towhee	Common (11)	Common
Field Sparrow	Fairly Common (7)	Very Common
Song Sparrow	Common (13)	Very Common

(a) Based on number recorded at seven roadside survey stops during a 5-minute count period at each stop: Very Common = 16+, Common = 11-15, Fairly Common = 5-10, Uncommon = 2 4, and Rare = 1.

(b) After Austing and Imbrogno (1976).

(c) Probably would have been more numerous during an evening survey.

TABLE D-3. HABITAT TRANSECT DATA FROM THE SITE PROPERTY[a] COMPARED TO ABUNDANCE IN SIMILAR SOUTHWESTERN OHIO HABITATS[b]

Common Name	Grazed Pasture		Weeds & Small Conifers		Weed-Shrub-Tree		Mature Riparian Woods	
	Site[a]	SW[b] Ohio	Site[a]	SW[b] Ohio	Site[a]	SW[b] Ohio	Site[a]	SW[b] Ohio
Green Heron	--	--	--	--	--	--	U(1)	C
Red-tailed Hawk	U(1)	FC	--	FC	--	--	U(1)	FC
Bobwhite	--	C	FC(2)	C	--	C	U(1)	C
Mourning Dove	FC(2)	VC	--	VC	U(1)	VC	C(4)	VC
Yellow-billed Cuckoo	--	--	--	--	--	FC	FC(3)	FC
Chimney Swift[c]	--	VC	--	VC	FC(2)	VC	--	--
Belted Kingfisher	--	--	--	--	--	--	FC(2	FC
Common Flicker	--	--	--	--	U(1)	VC	FC(3)	VC
Red-bellied Woodpecker	--	--	--	--	U(1)	C	U(1)	C
Downy Woodpecker	--	--	--	--	U(1)	C	C(4)	C
Eastern Wood Pewee	--	--	--	--	--	--	C(4)	C
Rough-winged Swallow	--	U	U(1)	U	--	--	C(4)	U
Barn Swallow	--	VC	FC(3)	VC	--	--	--	VC
Blue Jay	--	--	--	--	--	--	C(4)	VC
Common Crow	--	VC	--	VC	--	--	C(9)	VC
Carolina Chickadee	--	--	--	--	C(4)	VC	C(5)	VC
Tufted Titmouse	--	--	--	--	--	VC	C(5)	VC
Mockingbird	--	--	--	--	U(1)	C	--	--
Gray Catbird	--	--	--	--	VC(12)	A	--	--
American Robin	--	VC	--	--	C(9)	VC	FC(3)	VC
Wood Thrush	--	--	--	--	--	--	C(4)	C
Blue-gray Gnatcatcher	--	--	--	--	U(1)	C	--	C
Starling	VC(11)	VC	U(1)	VC	--	VC	VC(20)	VC
Red-eyed Vireo	--	--	--	--	--	--	FC(2)	VC
Common Yellowthroat	--	--	--	--	FC(3)	C	--	--
Yellow-breasted Chat	--	--	--	--	FC(3)	C	--	--
Eastern Meadowlark	VC(12)	VC	VC(17)	VC	--	--	U(1)	--

TABLE D-3. (Continued)

Common Name	Grazed Pasture		Weeds & Small Conifers		Weed-Shrub-Tree		Mature Riparian Woods	
	Site[a]	SW[b] Ohio	Site[a]	SW[b] Ohio	Site[a]	SW[b] Ohio	Site[a]	SW[b] Ohio
Red-winged Blackbird	--	VC	C(4)	VC	--	VC	U(1)	VC
Orchard Oriole	--	--	--	--	FC(3)	FC	--	FC
Brown-headed Cowbird	--	--	--	--	C(4)	VC	FC(2)	VC
Scarlet Tanager	--	--	--	--	--	--	U(1)	FC
Cardinal	--	--	--	--	FC(3)	VC	C(8)	VC
Indigo Bunting	--	--	--	--	FC(2)	VC	C(6)	VC
American Goldfinch	--	VC	U(1)	VC	C(9)	VC	U(1)	VC
Rufous-sided Towhee	--	--	--	--	FC(3)	C	FC(3)	C
Savannah Sparrow	FC(2)	VR	U(1)	VR	--	--	--	--
Grasshopper Sparrow	--	VR	VC(14)	VR	--	--	--	--
Field Sparrow	--	VC	--	VC	C(10)	VC	--	--
Song Sparrow	--	VC	U(1)	VC	C(4)	VC	U(1)	VC

(a) The number in parentheses indicates the number of birds recorded along two 1500 x 300-foot transects in each habitat type during June 27 and 28, 1977. Symbols for relative abundance are as follows: U = Uncommon to Rate = 1, FC = Fairly Common = 2-3, C = Common = 4-10, VC = Very Common - 11+.

(b) Summertime abundance in the Hamilton County Parks as given by Austing and Imbrogno (1976) where VR = Very Rare, U = Uncommon, FC = Fairly Common, C = Common, and VC = Very Common. Habitat association(s) as suggested by McElroy (1974), Thomson (1974), and Austing and Imbrogno (1976) includes both feeding and nesting habitats.

(c) Probably would have been more numerous during an evening survey.

APPENDIX E

REPTILES OF THE
FMPC SITE

REPTILES WHOSE RANGE INCLUDES
THE FEED MATERIALS PRODUCTION CENTER

Common snapping turtle	Chelydra serpentina
Stinkpot	Sternotherus odoratus
Map turtle	Graptemys geographica
Midland painted turtle	Chrysemys picta
Box turtle	Terrapene carolina
Smooth softshell	Trionyx muticus
Spiny softshell	Trionyx spiniferus
Northern Fence Lizard	Scleroporus undulatus
Five-lined skink	Eumeces faciatus
Broad-headed skink	Eumeces laticeps
Northern water snake	Natrix sipedon
Queen snake	Natrix septemvittata
Eastern garter snake	Thamnophis sirtalis
Eastern ribbon snake	Thamnophis sauritus
Northern brown snake	Storeaia dekayi dekayi
Midland brown snake	Storeaia dekayi wrightorum
Eastern hognose	Heterodon platyrhinos
Midwest worm snake	Carphophis amoenus
Northern ringneck snake	Diadophis punctatus
Rough green snake	Opheodrys aestivus
Smooth green snake	Opheodrys vernalis
Black racer	Coluber constrictor constrictor
Blue racer	Coluber constricter foxi
Black rat snake	Elaphe obsoleta
Eastern milk snake	Lampropeltis triangulum
Eastern earth snake	Virginia valeriae
Copperhead	Agkistrodon contrortrix

Sources: Conant, 1975; Nixon et al., 1972.

APPENDIX F

AMPHIBIANS OF THE
FMPC SITE

AMPHIBIANS WHOSE RANGE INCLUDES
THE FEED MATERIALS PRODUCTION CENTER

Mudpuppy	Necturus maculosus
Red-spotted newt	Notophthalmus viridescens
Small-mouthed salamander	Ambystoma texanum
Eastern tiger salamander	Ambystoma tigrinum
Jefferson salamander	Ambystoma jeffersonianum
Silvery salamander	Ambystoma platineum
Spotted salamander	Ambystoma maculatum
Marbled salamander	Ambystoma opacum
Dusky salamander	Desmognathus fuscus
Slimy slamander	Plethodon glutinosus
Ravine salamander	Plethodon richmondi
Redbacked salamander	Plethodon cinereus
Four-toed salamander	Hemidactylium scutatum
Two-lined salamander	Eurycea bislineata
Long-tailed salamander	Eurycea longicauda
Cave salamander	Eurycea lucifuga
American toad	Bufo americanus
Fowler's toad	Bufo woodhousei
Spring peeper	Hyla crucifer
Gray treefrog	Hyla versicolor; H. chrysocelis
Western chorus frog	Pseudacris triseriata
Blanchard's cricket frog	Acris crepitans
Green frog	Rana clamitans
Bullfrog	Rana catesbeiana
Northern leopard frog	Rana pipens
Pickerel frog	Rana palustris
Wood frog	Rana sylvatica

Sources: Conant, 1975; Nixon, et al., 1972.

APPENDIX G

AQUATIC SAMPLING LOCATIONS

TABLE G-1. AQUATIC BIOTA SAMPLING SITE LOCATIONS AND DESCRIPTIONS

Site Location	Description
Paddy's Run upstream from railroad crossing NE of the plant site	This portion of stream has good riffle-pool development. Pools were up to 20 m long, 3 m wide, and 11 m deep. Substrates in the pools were rubble-cobble with some silt covering. Riffle areas were 1 m long, 2 m wide, and 2-10 cm deep. Substrates were rubble-cobble-gravel with some silt covering. The stream flowed through a cattle grazing area. Trees along the banks included locust, oak, sycamore, maple, box elder, hackberry, redbud, and elm. These trees provided partial shading of the stream. A short distance downstream (several hundred meters), the stream bed was dry. The stream was dry for most of its length. Only a short distance near the mouth had water.
Great Miami River upstream from the plant discharge	The river has long, wide pools or runs in this portion. Width varies between 100-500 m; maximum depth was approximately 1-1/2 m. Shoreline substrate was cobble-gravel with occasional rubble sized rocks. Few trees along the shore provided little or no shade. Shorelines were free of brush and debris. The riffle sampled near Ross was 60-70 m wide and 3-20 cm deep. Open canopy was due to the lack of trees near the stream's edge. Abundant aquatic macrophytes were present. A wide flood plan several times wider than the stream was evident at this site. Water was moderately turbid.
Great Miami River downstream approximately 1/4 mi from the plant discharge	This portion of the river has long, wide pools with a maximum depth of 1-2 m. Riffle area sampled was approximately 100 m wide and 10 m long. Depth varied between 10-20 cm where samples were collected. Maximum depth in the riffle was 1.5 m. Substrate in both riffle and pool areas was generally pebble-cobble with occasional rubble-sized rocks. A layer of silt covered the substrate in the pools. Riffle areas have extensive growths of aquatic macrophytes. Water was moderately turbid.
Great Miami River downstream approximately 1/2 mi from plant discharge	This portion of the river had a wide deep pool with a deep, fast riffle area downstream. The pool was up to 1.5 m deep with pebble-cobble substrate in general. Silt covered much of the bottom. The riffle sampled was 125 m wide and 0.2-1.0 m deep. Riffle area was much longer than the other two riffles sampled. Substrate was gravel-cobble with occasional rubble-boulder size rocks in the deeper areas. Aquatic macrophytes were present in the shallower areas of the riffle. Little shading was evident due to the width of the river bed. Water was moderately turbid.

APPENDIX H

BENTHIC INVERTEBRATES FROM
THE FMPC SITE

TABLE H-2. BENTHIC MACROINVERTEBRATES (NUMBER/FT^2) COLLECTED FROM THE GREATER MIAMI RIVER WITH A SURBER SAMPLER IN THE VICINITY OF THE NATIONAL LEAD COMPANY PROCESS WATER DISCHARGE, JULY 6, 1977

	Upstream			Downstream 0.5 mi.			Downstream 1.0 mi.		
	1(a)	2(b)	3(c)	1(a)	2(b)	3(c)	1(a)	2(b)	3(c)
DIPTERA									
Chironomidae									
Polypedilum sp.	1	72	24	-	32	112	8	64	72
Cricotopus sp.	2	124	48	-	24	32	16	108	104
Pentaneura sp.	9	80	88	32	160	144	24	68	32
Psectrocladius sp.	-	-	-	-	-	-	-	32	8
Simuliidae									
Simulium sp.	-	8	192	8	8	112	8	-	176
Empididae									
sp.	-	-	-	-	-	-	-	-	8
EPHEMEROPTERA									
Baetidae									
Baetis sp.	13	188	176	240	88	-	16	12	16
Caenis sp.	-	-	-	-	-	-	-	4	-
TRICHOPTERA									
Hydropsychidae									
Hydropsyche sp.	41	80	120	160	400	464	124	156	168
Cheumatopsyche sp.	6	12	32	8	-	16	8	-	-
Pupae	50	-	160	24	64	16	24	16	56
Hydroptilidae									
Agraylea sp.	-	4	-	-	16	-	-	32	-
COLEOPTERA									
Elmidae									
Stenelimis sp.	-	-	-	-	8	-	4	-	-

TABLE H-2. (Continued)

	Upstream			Downstream 0.5 mi.			Downstream 1.0 mi.		
	1(a)	2(b)	3(c)	1(a)	2(b)	3(c)	1(a)	2(b)	3(c)
PELECYPODA									
Sphaeriidae									
Sphaerium sp.	-	-	-	40	8	-	-	20	40
GASTROPODA									
Physidae									
Physa sp.	1	4	-	-	-	16	-	20	8
Ancylidae									
Ferrissia sp.	-	-	-	8	-	-	-	-	8
DECAPODA									
Astacidae									
Orconectes sp.	-	2	1	-	-	-	-	-	-
OLIGOCHAETA									
sp.	4	28	48	40	-	-	-	20	24
HIRUDINEA (Leeches)									
sp.	-	-	8	40	24	32	4	4	-
Total Number of Individuals	127	602	897	600	832	944	236	556	720
Total Number of Species	9	11	11	10	11	9	10	13	13
Species Diversity	2.23	2.66	2.93	2.48	2.37	2.28	2.38	3.06	3.01

(a) No vegetation over substrate.

(b) *Cladophora* sp. covering substrate.

(c) Aquatic macrophyte covering substrate.

TABLE H-1. - BENTHIC MACROINVERTEBRATES (NUMBER/FT^2) COLLECTED FROM PADDY'S RUN WITH A SURBER SAMPLER AT THE VICINITY OF THE NATIONAL LEAD COMPANY FACILITY, JULY 6, 1977

	1	2	3
DIPTERA			
Chironomidae			
Micropsectra sp.	7	2	2
Microtendipes sp.	3	3	8
Polypedilum sp.	6	3	8
Cricotopus sp.	3	1	4
Pentaneura sp.	-	1	2
Chironomus (*Dicrotendipes*) sp.	-	-	2
Tipulidae			
Hexatoma sp.	2	2	8
Empididae			
sp.	3	3	-
EPHEMEROPTERA			
Baetidae			
Baetis sp.	5	8	8
TRICHOPTERA			
Hydropsychidae			
Hydropsyche sp.	88	91	80
Cheumatopsyche sp.	260	135	320
Helicopsychidae			
Helicopsyche sp.	4	4	14
Hydroptilidae			
Agraylea sp.	-	3	6
Philoptamidae			
Chimarra sp.	14	17	74
COLEOPTERA			
Elmidae			
Stenelmis sp.	12	8	30
Psephenidae			
Psephenus herricki	1	-	-
HEMIPTERA			
Veliidae			
Microvelia sp.	-	-	2

TABLE H-1. (Continued)

	1	2	3
PELECYPODA			
Sphaeriidae			
Sphaerium sp.	1	-	-
DECAPODA			
Astacidae			
Orconectes sp.	1	-	2
Total Number of Individuals	410	281	570
Total Number of Species	15	14	16
Species Diversity	1.80	2.10	2.21

APPENDIX I

FISH FROM THE FMPC SITE

TABLE I-1. RELATIVE ABUNDANCE OF FISH SPECIES COLLECTED FROM PADDY'S RUN AT THE FMPC FACILITY, JULY 6, 1977

Species	Relative Abundance
Semotilus atromaculatus, Creek chub	Dominant
Notropis chrysocephalus, Striped shiner	Common
Pimephales notatus, Bluntnose minnow	Sparse
Ericymba buccata, Silverjaw minnow	Sparse
Campostoma anomalum, Stoneroller minnow	Common
Catostomus commersoni, White sucker	Sparse
Etheostoma nigrum, Johnny darter	Sparse
Etheostoma flabellare, Barred fantail darter	Common
Etheostoma spectabile, Orangethoat darter	Dominant

TABLE I-2. FISH SPECIES COLLECTED UPSTREAM AND DOWNSTREAM OF THE FMPC FACILITY DISCHARGE TO THE GREAT MIAMI RIVER, JULY 6-7, 1977

	Upstream	Downstream
Lepisosteus osseus, Longnose gar	X	X
Dorosoma cepedianum, Gizzard Shad	X	X
Alosa chrysochloris, Skipjack herring	X	X
Carpiodes cyprinus, Quillback carpsucker	X	X
Carpiodes carpio, River carpsucker	X	
Cyprinus carpio, Carp	X	X
Carassius auratus, Goldfish	X	X
Semotilus atromaculatus, Creek chub	X	X
Notropis chrysocephalus, Striped shiner	X	X
Notropis spilopterus, Spotfin shiner	X	X
Notropis atherinoides, Emerald shiner	X	X
Notropis stramineus, Sand shiner	X	X
Campostoma anomalum, Stoneroller minnow	X	X
Lepomis cyanellus, Green sunfish	X	X
Lepomis macrochirus, Bluegill	X	X
Etheostoma spectabile, Orangethroat darter		X