ENVIRONMENTAL REVIEW TEAM REPORT

CORSINO SUBDIVISION

NAUGATUCK, CONNECTICUT

King's Mark

Resource Conservation & Development Area

CORSINO SUBDIVISION ENVIRONMENTAL REVIEW

Naugatuck, Connecticut

Prepared by the King's Mark Environmental Review Team
of the King's Mark Resource Conservation
and Development Area, Inc.

Wallingford, Connecticut

for the

Naugatuck Inland Wetlands Commission

MARCH 1986

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EXECUTIVE SUMMARY

This environmental review was the result of a request from the Naugatuck Inland Wetlands Commission. The King's Mark Environmental Review Team (ERT) was requested to assist the Borough in inventorying and assessing the quality and distribution of natural resources on a 54 acre site proposed for residential development. The proposed subdivision would encompass 86 house lots, totalling 15,000 square feet per lot.

The review process consisted of four phases: (1) inventory of the study site's natural resources; (2) assessment of these resources; (3) identification of resource development limitations and opportunities; and (4) presentation of planning guidelines.

The study site is characterized by mixed hardwood forests to open woodlands with an inland wetland community occupying approximately one-quarter of the site. Slopes range from gentle to very steep.

Through the inventory and assessment process, specific resources, areas of special concern, and development opportunities and limitations were identified. They fall into three general categories: (1) physical components; (2) biological resources; and (3) planning guidelines.

PHYSICAL COMPONENTS

Slopes within the site are variable, ranging from gentle to steep. There are, however, some very steep slopes in isolated areas.

The exact thickness of the till is unknown. However, according to the New Haven County Soil Survey, it is generally thin throughout most of the site. Deep pockets, perhaps 8 to 10 feet thick may be found in the area along the east side of "Cat Swamp."

The major geologic limitations on the site include: (1) areas where bedrock is at or near the surface of the ground; (2) very steep areas; and (3) the inland wetland in the central portion of the study area.

The availability of sewer lines to this property will eliminate the need for individual on-site septic systems. Based on visual observations and the aforementioned limitations, the study area would have a very low potential for on-site disposal.

The exact location of bedrock in relation to the ground surface may pose problems for the placement of sewer lines, electric/telephone lines, water lines or any other underground utility. Bedrock may be encountered at shallow depths throughout most of the property and blasting may be required to properly install utility lines.

Moderate to steeply sloping areas near lots 12-18 and 81-84 and other isolated areas may make the operation of heavy equipment difficult or hazardous. This may increase costs in developing the site and also present safety concerns to operators. Additionally, costly blasting and extensive filling would probably be required if these areas are to be developed. If development occurs in these areas, it is suggested that an erosion and sediment control plan be implemented during construction phases.

Development of the site will lead to at least some increases in runoff. The amount of the increase will depend upon the extent of development, the amount of impervious surfaces crested and the amount of vegetation removed. The added runoff could cause increased over land and stream channel erosion, especially in concentrated areas, and it may increase the peak flood flows of streams on the site. These problems can be ameliorated by formulating a storm water management plan for the subdivision.

The overall increase in runoff from the development is four percent or less. Because the density of the proposed subdivision is quite high, the increases in runoff could have potential for erosion. The potential for erosion due to concentrated runoff may be further increased by moderate to steep slopes on the site. In order to avoid this potential problem, a comprehensive erosion and sediment control plan will need to be developed for each phase of the proposed development.

Construction of roads and buildings on Charlton soils should be relatively easy. Excavations will not cut into bedrock; however, some large boulders may be encountered which may require blasting. Curtain drains may need to be installed to keep water from seeping into basements. Properly seeded and fertilized lawns should be easy to establish on these soils.

Roads, buildings and underground utilities will be extremely difficult to construct on the Hollis soils. Any excavations into the Hollis soils will require special construction equipment or

blasting. At least six inches of topsoil will be needed to cover exposed bedrock in order to establish lawns.

Roads, buildings and underground utilities will be extremely difficult to construct on Hollis Variant soils. Moving the many large boulders in these soils will require special construction equipment or blasting. Construction costs will be very high on all slopes greater than 15 percent. However, opportunities exist for creative landscaping. Stones and boulders should be planned into the final landscaping design or removed from the site. The texture of the soil material with the rocks removed will support the establishment of lawns and gardens.

Inland wetland soils hold very little potential for development and should be avoided where possible. Based on preliminary site plans, it appears that wetland soils on the site would be disturbed only minimally except for the road crossing (i.e., Autumn Ridge Road) in the south-central part of the study area.

Development potential is limited on Adrian and Palms soils because of their high water table. If drained, the organic surface layer will subside. This area should be left in its natural condition in order to continue to control storm water runoff.

Development on Leicester soils is limited by their high water table. Use of curtain drains is not an option since they would not have a drainage outlet. Frost heaving is a problem on these soils. Landscaping on these soils requires water tolerant plantings. These soils will become soft and muddy with prolonged foot traffic.

The sequence of major construction activities should be carefully planned and scheduled. This site lends itself very readily to the phasing of development on a section by section basis. This would minimize the amount of land being in an disturbed and unprotected condition at any one time.

The phasing and construction sequence for this project should be timed to coincide with vegetative seeding periods to allow maximum soil erosion control. It will be important to permanently seed down all disturbed areas immediately after final grades are reached. All disturbed areas that will not receive final grading for longer than 60 days, or after September 1, should be seeded using temporary vegetative measures or mulch at a rate of 90 pounds per 1,000 square feet.

Erosion and sediment control planning should pay particular attention to the designated open space/inland wetland in the central portion of this site. Soils mapped as Adrian, Palms or Muck in this area can be seriously damaged and even completely destroyed by sedimentation from construction activities if not adequately protected.

BIOLOGICAL RESOURCES

If development is imminent, it might be best to remove all of the poor quality trees now and allow the new homeowners to plant new

trees - trees which will be disease-free, strong and healthy. Even though this may well mean the removal of all of the dominant trees on the property, it is a prudent course of action to investigate.

As this area is developed there will be an immediate and long-term impacts on wildlife. The primary potential impact is direct loss of habitat due to roads, houses, driveways and sidewalks. Another potential impact is the change in habitat where forests are cleared for lawns and landscaping. A third potential impact is the increased human presence, vehicular traffic, and free roaming dogs and cats. This will drive less tolerant wildlife species away from the site, even though there has not been any change in existing wildlife habitat.

The inland wetlands on the site exhibit the following values: (1) provides wildlife habitat; (2) provides hydrologic functions; (3) maintains water quality; and (4) provides many recreational and educational opportunities.

Filling, modifying or constructing in wetlands may have adverse environmental impacts on valuable ecological functions. Altering the wetland may result in the loss of critical wildlife habitat.

PLANNING GUIDELINES

The proposed residential use of the study site is compatible with existing adjacent uses. While industrial development adjacent to single family residential may not initially appear compatible, Naugatuck's conscious siting and development controls in their industrial park will provide compatibility.

The proposed subdivision can meet all the zoning and subdivision requirements provided public water (preferably) or on-site wells and sewer connections are made possible. The 85-foot squares and interior lot layouts also meet the regulations.

Maintaining the 10 percent maximum grade may be difficult to achieve in the western loop portion and still create buildable lots without excessive cutting and filling. Rather than looping the road as now proposed, a series of three or four relatively short cul-de-sacs off the extension of Autumn Ridge Road might alleviate the siting problems.

Crestwood/Autumn Ridge Road and Gail/David Street access to Union City Road are capable of handling the increased capacity generated by the proposed developemnt. The intersection of Union City Road with Route 68 may need some relatively minor improvements to accommodate an acceptable level of service.

Definite public water supply and sewage disposal problems inhibit the development of this property. Without such tie-ins to municipal systems, significantly larger lots will have to be created to allow for both on-site wells and septic systems. The solution to these problems rests with Borough officials and the developer.

TABLE OF CONTENTS

		PAGE
ACKNOWLEDGEMENTS		ii
EXECUTIVE SUMMARY		iii
LIST OF TABLES		ix
LIST OF FIGURES		x
Chapter		
ONE:	INTRODUCTION	1
	Introduction	1
	Objectives of the ERT Study	2
	The Environmental Review Team Process	2
TWO:	PHYSICAL CHARACTERISTICS OF THE CORSINO PROPERTY	6
	Hydrogeology of the Corsino Property Subdivision	6
	Topography and Setting	6
	Geology	6
	Surficial Geology	7
	Bedrock Geology	11
	Geologic Development Concerns	11
	Hydrology	14
	Water Supply	19
	Soil Resources and Characteristics	20
	Introduction	23
	Inland Wetland Soils	23
	Non-Inland Wetland Soils	26
	Erosion and Sedimentation	29
THREE:	BIOLOGICAL CHARACTERISTICS OF THE CORSINO PROPERTY	31
	Forest and Vegetative Characteristics	31
	Stand Descriptions	31
	Discussion	32
	Wildlife Resources	35
	Wildlife Habitat Types	35
	Discussion	36
	Wetland Characteristics	39
	Wetland Values	40
	Wildlife Habitat	40
	Hydrology	42
	Water Quality	42
	Recreational, Educational and Aesthetic	43
	Potential Adverse Environmental Impacts	43
	Management Guidelines	44

FOUR: LAND USE AND PLANNING CONSIDERATIONS 46

Existing Land Use 46
Naugatuck's Plan of Development 46
State/Regional/Waterbury Adopted Plans 47
Existing Zoning and Subdivision Regulations 48
Traffic and Access 49
Traffic Analysis 49
Trip Generation 49
Intersection Capacity Analysis 51
Infrastructure 53
Water Supply 53
Sewage Disposal 53
Storm Drainage 54
Conclusions 55

APPENDIX A: Soils Limitation Chart 57

APPENDIX B: Worksheets for Analysis of T-Intersections 59

APPENDIX C: Backyard Wildlife Management Guide 61

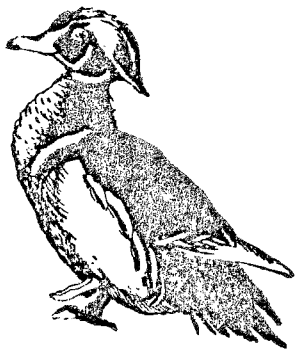
TABLES

1. Estimation of Runoff 18
2. Average Daily Traffic Counts 51
3. Level of Service Criteria for Unsignalized Intersections . 52
4. Soils Limitation Chart 57

FIGURES

1. Location of Study Site 3
2. Preliminary Site Plan 4
3. Topography 8
4. Surficial Geology 9
5. Bedrock Geology 12
6. Watershed Boundary 15
7. Distribution of Soils 25
8. Forest Types 33
9. Distribution of Wetland Vegetation 41
10. Zoning 50

INTRODUCTION



INTRODUCTION

Introduction

The Borough of Naugatuck Inland Wetlands Commission requested that an environmental review be conducted on a site proposed for a subdivision development. The subject site is located in the northeast corner of Naugatuck, near the Waterbury and Prospect town lines and just north of Route 68 in Naugatuck (Figure 1). Immediate access to the site is provided via David Street and Autumn Ridge Road.

The proposed site is approximately 54 acres in size with low to steep slopes. It is characterized by a mixed hardwood forest to open woodland, with an inland wetland community occupying about one-quarter of the site. This wetland is unique in having two outlets, one flowing north to Hopeville Pond Brook in Waterbury and south to Fulling Mill Brook. The wetland is dominated by sedges and numerous grasses with red maples scattered throughout the wetland. Open water is present on the site. Soils range from well drained to very wet and mucky.

The proposed site is surrounded by the following land uses: residential areas to the east and an industrial park to the west and south. There is limited open space directly north of the site. A natural gas transmission line traverses the southern edge of the site. The area is zoned R-15 or single-family residential with 15,000 square feet lots and PD-2 or a planned development district. The surrounding neighborhoods have on-site wells and are served by city sewers.

The preliminary site plan proposes the construction of 86 single-family house lots with the following dimensions: 85 foot square, 85 foot frontage and 15,000 square foot lots. Two existing streets, David Street and Autumn Ridge Road are proposed to be connected to provide access to the upper lots. A new road is also proposed to be constructed to provide access to the remaining lots (Figure 2).

Objectives of the ERT Study

The Inland Wetlands Commission was concerned with the possible environmental impact of the proposed development. Specifically, the ERT was asked to: (1) identify and evaluate the flora and fauna on the proposed site; (2) determine the physical suitability of the site for residential development; (3) assess the potential adverse effects the proposed development will have on existing natural resources on the site; and (4) identify techniques which could be implemented to mitigate any adverse environmental effects of the project.

The ERT Process

Through the efforts of the Naugatuck Inland Wetlands Commission, the developer and the King' Mark Environmental Review Team, this environmental review was conducted for the Borough. The review was not intended to compete with private consultants design plans for this site. Rather, it provided a natural resource data base allowing the Borough and the developer make informed decisions concerning the use of the proposed site.

The review process consisted of four phases: (1) inventory of

Figure 1

LOCATION OF STUDY SITE

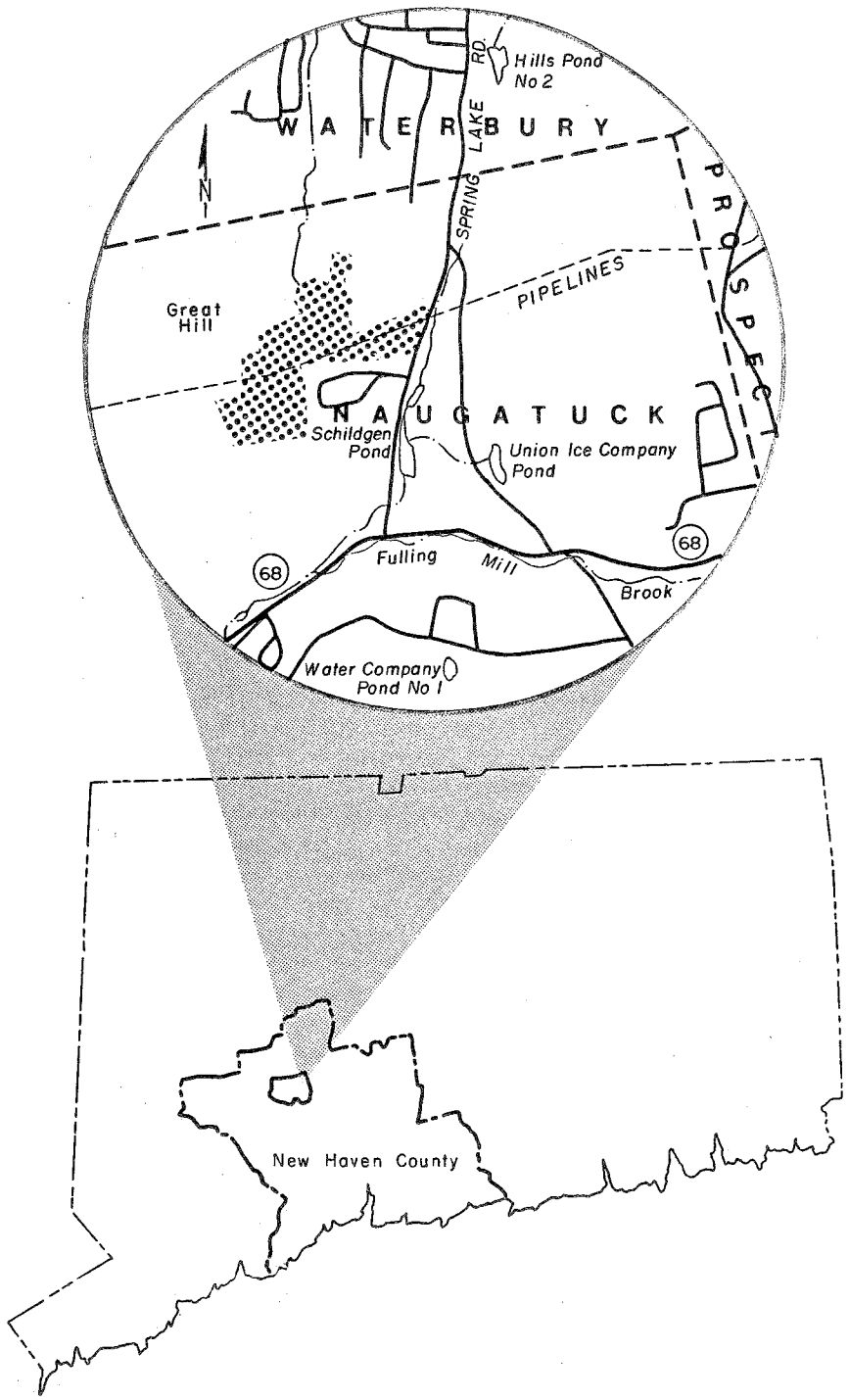


Figure 2

CORSINO SUBDIVISION PROPERTY

NAUGATUCK, CONNECTICUT

PRELIMINARY SITE PLAN

King's Mark Environmental Review Team

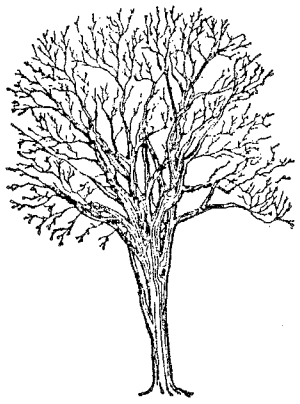
0 400'

the study sites's natural resources (collection of data); (2) assessment of these resources (analysis of data); (3) identification of natural resource capabilites; and (4) presentation of planning and development guidelines.

The data collection phase involved both literature and field research. Mapped data, technical reports or town plans were perused and specific information concerning the site was collected. Field review and inspection of the site proved to be a most valuable component of this phase. The emphasis of the field review was on the exchange of ideas, concerns and alternatives. Being on site also allowed Team members to check and confirm mapped information and identify other resources.

Once the Team members had assimulated an adequate data base, it was then necessary to analyze and interpret their findings. The results of this analysis enabled the Team members to arrive at an informed assessment of the site's natural resource development opportunities and limitations.

PHYSICAL CHARACTERISTICS



PHYSICAL CHARACTERISTICS OF THE CORSINO SUBDIVISION

Topography and Setting

The Corsino Property Subdivision, located in the northeast corner of the Borough of Naugatuck, near the Waterbury and Prospect town lines and just north of Route 68, is approximately 54 acres in size. Immediate access to the site is provided via David Street and Autumn Ridge Road.

The site, characterized by a 12-acre scrub/shrub inland wetland, referred to locally as "Cat Swamp" is flanked on both sides by relatively thin till-covered hills such as Great Hill. Slopes within the site are variable, ranging from gentle to steep. There are also some very steep slopes in isolated areas.

The surface level of "Cat Swamp," approximately 400 feet above mean sea level represents the lowest elevation on the site. Highest elevations on the site, located in the southeast corner exceed 540 feet above mean sea level (Figure 3).

The major stream on the site is the northern outlet stream for "Cat Swamp." At least two small, seasonal drainage channels draining into "Cat Swamp" are visible in the western sections of the study area.

Geology

The proposed 86-lot subdivision is located entirely within the Waterbury topographic quadrangle. A bedrock map has been published for the quadrangle. There is no surficial geology map available for the quadrangle.

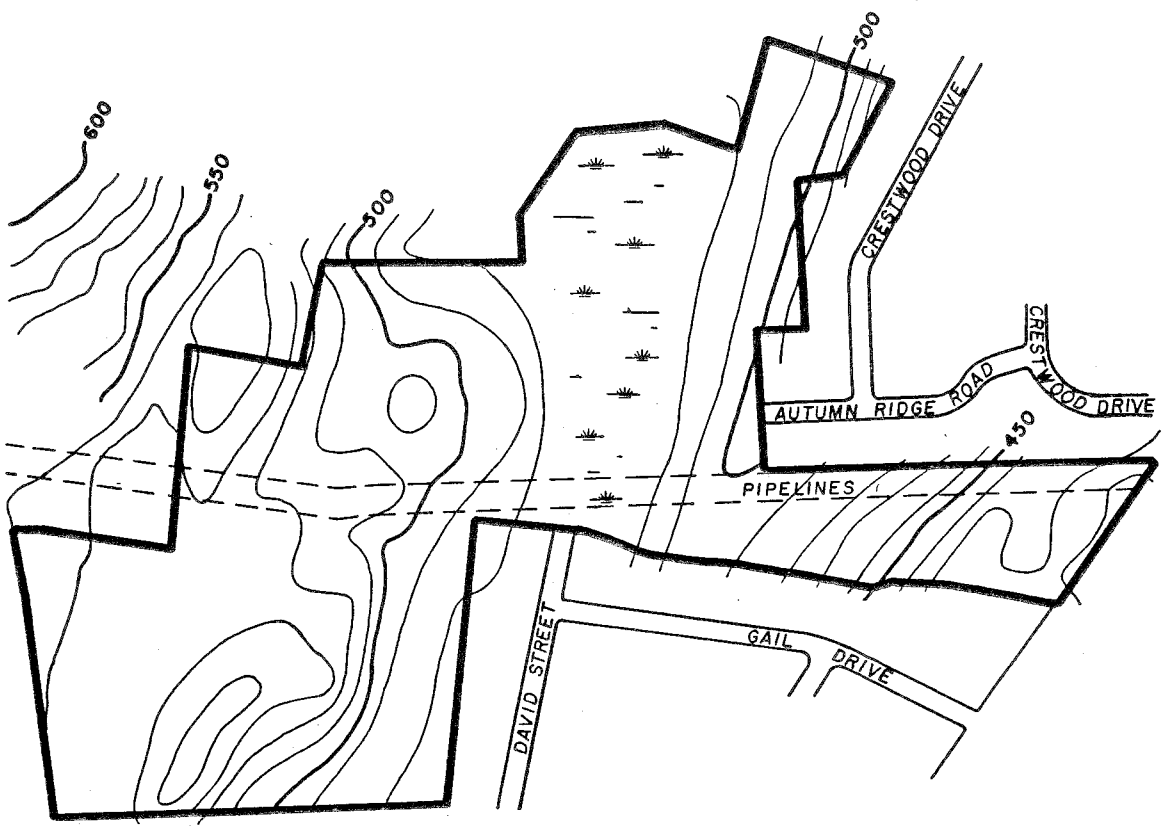
The 12-acre scrub/shrub inland wetland in the central part of the study area is flanked on both sides by portions of a geologic feature called a rock-cored drumlin. These relatively large hills are elongated in shape and tend to run in a north to south-southeast direction. The upland portion of the hills are covered by a relatively thin blanket of glacial sediment called till. The till, consisting of a non-sorted, non-stratified mixture of rock particles of varying shapes and sizes were deposited directly by glacier ice as it moved across the hills from the north to the south-southeast. The till was deposited without substantial re-working by glacier meltwater streams. Numerous surface boulders and cobbles are visible in the upland sections of the site. The presence of these medium to large boulders or stones is common and often characterizes till covered upland areas in the state. Great Hill, northwest of the study area, is a good example of a drumlin.

Surficial Geology

The exact thickness of the till on the site is unknown. However, according to the New Haven County Soil Survey, it is generally thin throughout most of the site. Deep pockets, perhaps 8 to 10 feet thick may be found in the area along the east side of "Cat Swamp." The soil type Charlton (CrC) is characterized by deep pockets of soil.

Swamp deposits are another type of sediment found in the study area. These deposits consisting of silt, sand, clay and organic matter were deposited in the basin occupying the central part of the site. The sediments mentioned above filled the basin, after the

Figure 3



CORSINO SUBDIVISION PROPERTY

NAUGATUCK, CONNECTICUT

TOPOGRAPHY

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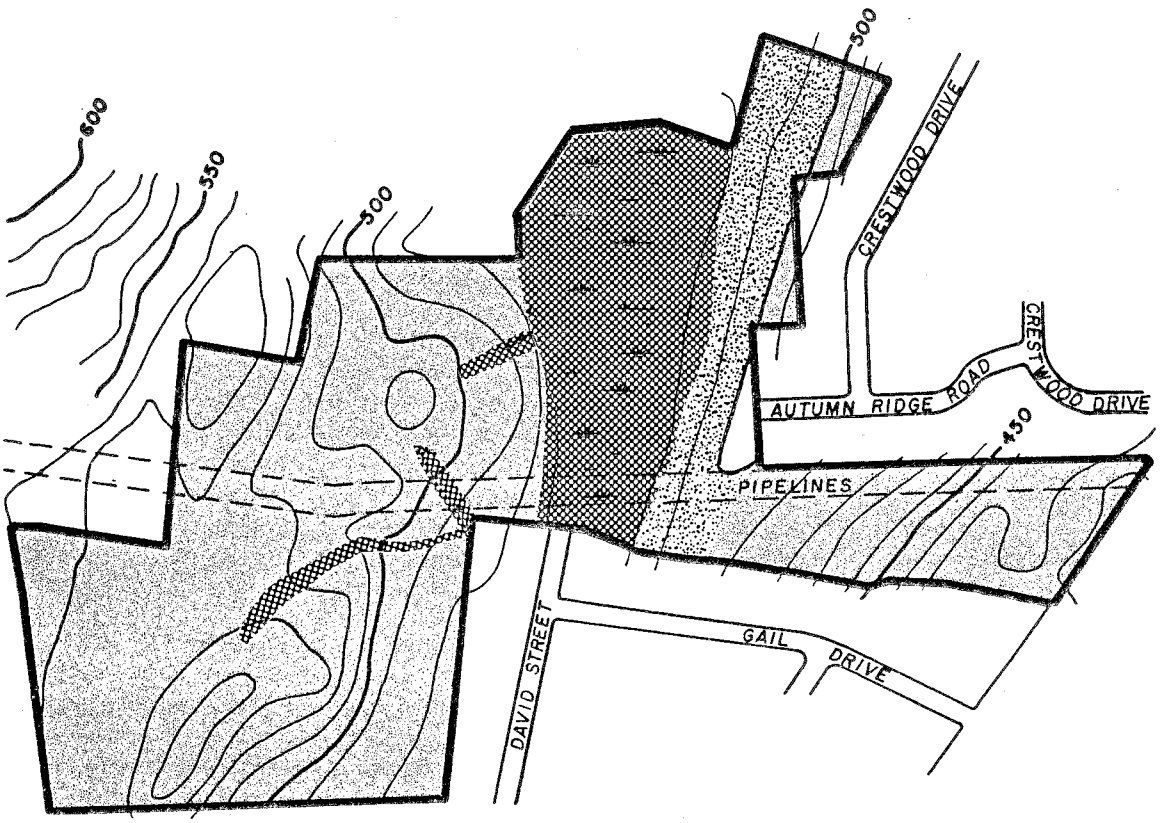
Figure 4



SHALLOW TILL AREAS LESS THAN 5 FEET

AREAS WHERE TILL DEPOSITS MAY BE 5 - 10 FEET THICK

REGULATED INLAND WETLAND SOILS (APPROXIMATE)

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NAUGATUCK, CONNECTICUT

SURFICIAL GEOLOGY

King's Mark Environmental Review Team

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glacier retreated from the region. These soils, delineated as AA or Adrian soils (see Figure 7) are protected under Connecticut's Inland Wetland and Watercourses Act (Connecticut General Statutes, P. A. 155, Sections 22a-36 through 22a-45). The inland wetland on the site performs many hydrologic and ecologic functions such as reducing runoff, maintaining water quality, and providing habitat for threatened or endangered plant and wildlife species.

Filling, modifying or constructing in wetlands may have adverse environmental impacts on the valuable functions mentioned above. Altering the wetland may result in the loss of critical wildlife habitat. Inland wetland soils hold very little potential for development and should be avoided where possible. Based on preliminary site plans, it appears that wetland soils on the site would be disturbed only minimally except for the road crossing (i.e., Autumn Ridge Road) in the south-central part of the study area.

Nevertheless, any activity significantly modifying or disturbing a wetland community will require a permit from the Borough and may be subject to public hearings. It should be emphasized that there are seasonally wet areas paralleling intermittent drainage channels in the western part of the study area. These are also regulated inland wetland areas.

Finally, wetlands on the site should be field checked and flagged by a certified soil scientist to accurately define wetland boundaries. Once the soils are delineated, the flagged boundaries should be superimposed on the proposed subdivision site plan. This will aid heavy equipment operators and contractors working on the site.

Bedrock Geology

The bedrock geology underlying the Corsino Property Subdivision is classified as the Waterbury Formation. This consists of very old, highly deformed crystalline, metamorphic rocks geologically altered by great heat and pressure. They are generally described as gray to dark gray, fine to medium-grained "schists" and "gneisses" (Figure 5).

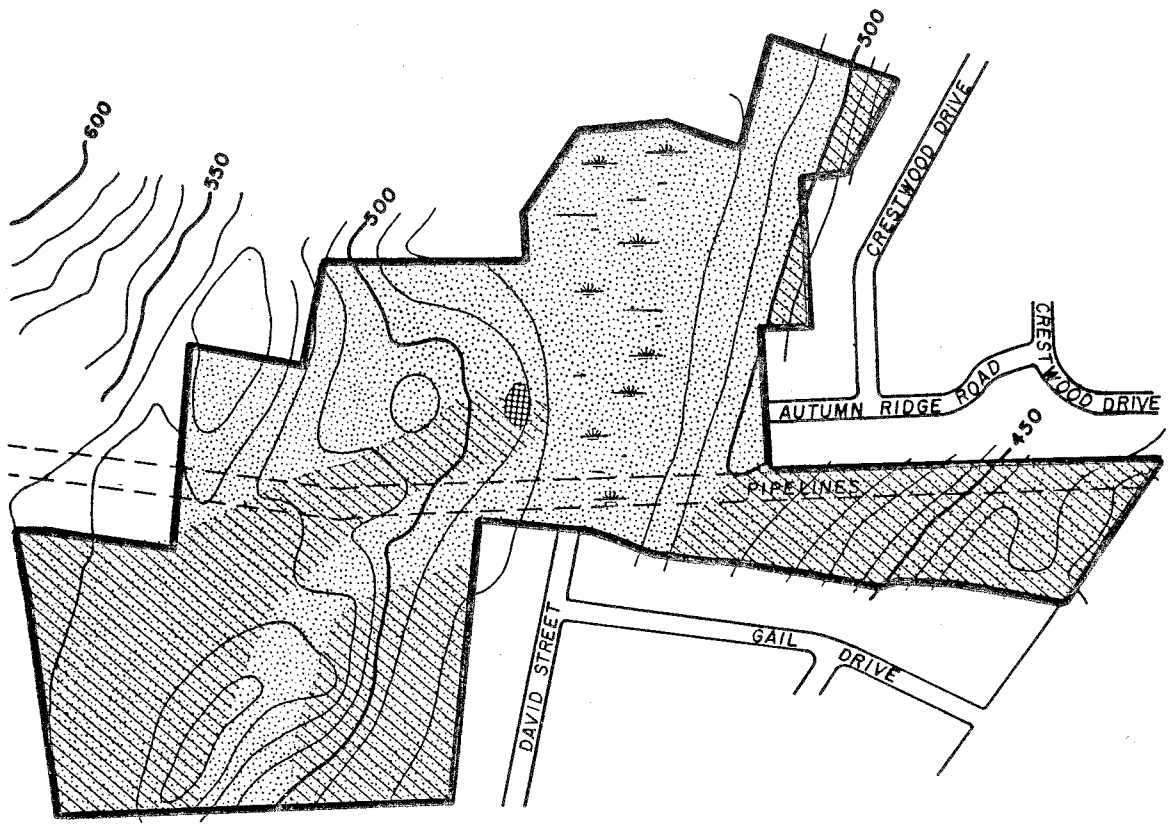
The "schists" are rocks rich in mica (muscovite and biotite) minerals. They also contain noticeable amounts of quartz. These rocks are distinguished by the alignment of platy or flaky minerals such as muscovite or biotite. This characteristic alignment allows the rock to split into thin slabs. "Gneisses" are rocks with platy or flaky minerals alternating in thin layers with more rounded minerals. This mineral arrangement gives the rock a banded appearance.

Differences in the texture and/or mineralogy of these rocks should not have a direct impact on the potential of site for the proposed subdivision. It should be stressed that the underlying bedrock may affect the quantity of water withdrawn from any bedrock wells drilled on the site (see Water Supply).

Geologic Development Concerns

The major geologic limitations on the site with respect to the proposed subdivision include: (1) areas where bedrock is at or near the surface of the ground; (2) very steep areas; and, (3) the inland wetland in the central portion of the study area. The availability of sewer lines to this property will eliminate the need for

Figure 5



WATERBURY FORMATION

OUTCROP

AREAS WHERE BEDROCK MAY BE ENCOUNTERED AT SHALLOW DEPTHS

CORSINO SUBDIVISION PROPERTY

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BEDROCK GEOLOGY

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individual on-site septic systems. Based on visual observations and the aforementioned limitations, the study area would have a very low potential for on-site disposal.

The exact location of bedrock in relation to the ground surface may pose problems for the placement of sewer lines, electric/telephone lines, water lines or any other underground utility. Bedrock may be encountered at shallow depths throughout most of the property and blasting may be required to properly install utility lines.

Moderate to steeply sloping areas near lots 12-18 and 81-84 and other isolated areas may make the operation of heavy equipment difficult or hazardous. This may increase costs in developing the site and also present safety concerns to operators such as heavy equipment rolling over. Additionally, costly blasting and extensive filling would probably be required if these areas are to be developed. If development occurs in these areas, it is suggested that an erosion and sediment control plan be implemented during construction phases. This is discussed in more detail later in the report.

As mentioned earlier, wetlands will need to be crossed by extending Autumn Ridge Road to David Street. Depending on desired house location, additional crossings of seasonally wet soils by driveways may also be required.

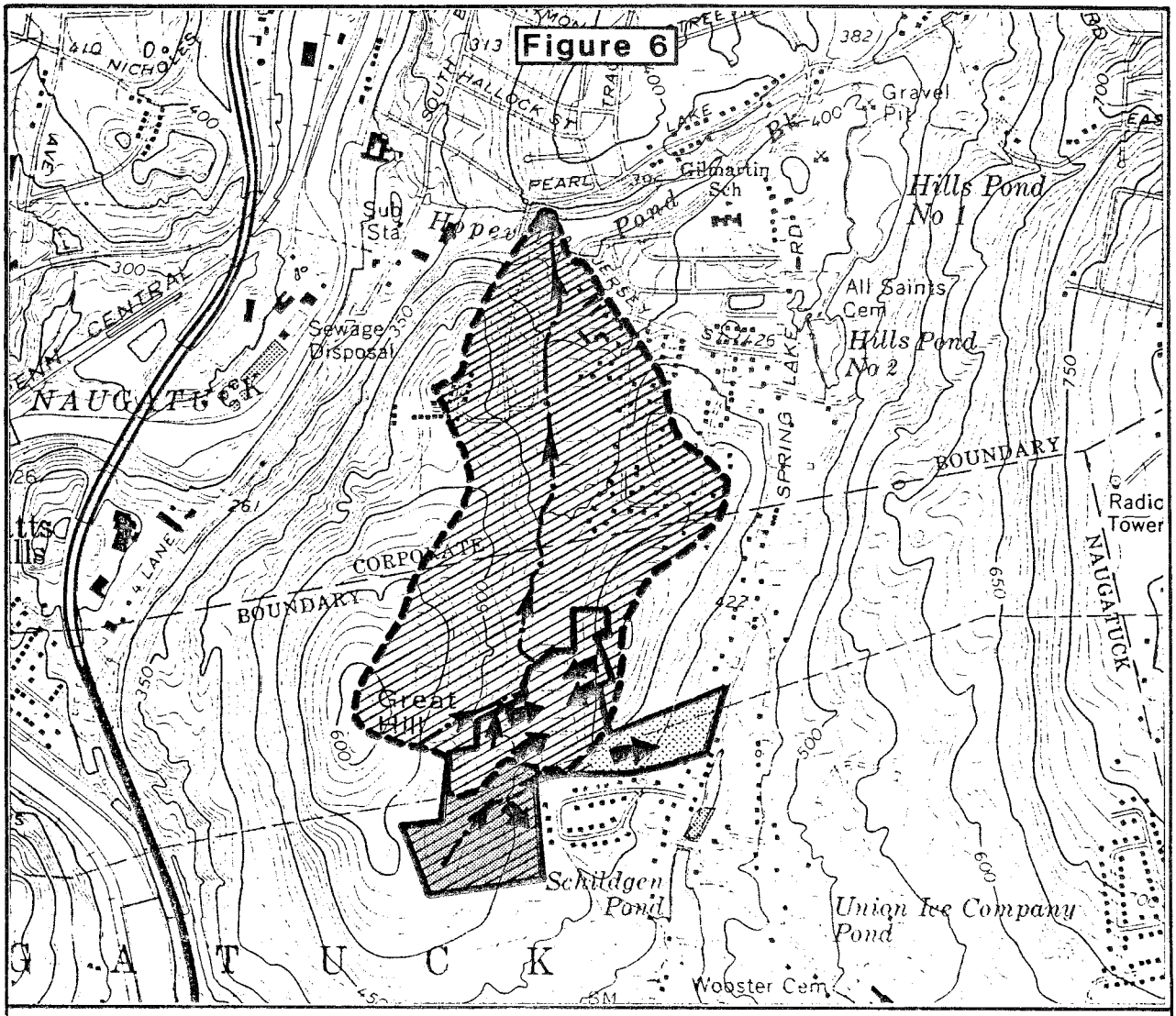
Although undesireable, wetland road crossings are feasible provided the road is properly engineered. When constructing roads or driveways over wetland soils, provisions should be made to mitigate adverse environmental impacts. The most obvious technique available

to mitigate the impact on the wetland is to avoid the wetland altogether and develop in adjacent areas that will have minimal impact. Both of these measures may, however require that the site plan be modified. Another valuable technique is to properly size and locate culverts so as to allow the natural flow of water to continue. This will minimize the alteration of the water levels in the wetland. Finally, road construction through wetlands should preferably be done during dry climatic conditions. To illustrate this, unstable soil material beneath the proposed road should be removed. The road bed should then be backfilled with a road base fill material and the installation of culverts may be necessary. The road should be at least 1.5 feet or preferably two feet above the surface elevation of the wetland. This will allow for better drainage of the roads and it will also decrease frost heaving potential of the road. Effective erosion and sedimentation control measures should also be implemented.

Finally, the surface hydrology of the wetland area will need to be further assessed, particularly along the pipe draining surface water to David Street, south of the gas transmission line bisecting the south-central part of the study site.

Hydrology

Surface drainage within the site may be divided into three areas (Figure 6). Surface runoff emanating from the northern half of the parcel drains via seasonal drainage channels and sheet flow into "Cat Swamp." The gas transmission line and dirt road bisecting the site east to west acts as a drainage divide for this part of the



Approximate property boundary

Watershed boundary* and design point for the unnamed stream which drains "Cat Swamp"

Area analyzed to determine pre and post development runoff depths shown in Table I

Section of property which will be piped into the "Cat Swamp" watershed

Watercourses showing direction of flow

Direction of surface flow

Portion of property* which drains eastward towards Fulling Mill Brook (pre and post development runoff depths not calculated for this part of the site)

*The watershed boundary shown may not account for possible drainage re-routing through man made structures

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WATERSHED BOUNDARY

King's Mark Environmental Review Team

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property. However, based on a cursory inspection of the area, it appears that during periods of heavy precipitation stormwater may spill over the dirt road and drain southward to David Street. The unnamed outlet stream for "Cat Swamp" drains northward toward Jersey Street in Waterbury. It is tributary to Hopeville Pond which ultimately drains into the Naugatuck River.

Surface runoff from the southern and southwest corner of the study area presently drains via seasonal drainage channels, sheet flow and the storm water system for the subdivision south of the property to an unnamed tributary to Fulling Mill Brook. Fulling Mill Brook ultimately empties into the Naugatuck River. According to the proposed plan, stormwater runoff from this section of the study area would be piped into the "Cat Swamp" watershed.

Surface runoff originating from the protruding eastern section of the property will flow downslope toward Union City Road. It is then routed under Union City Road and ultimately discharges into Fulling Mill Brook. Groundwater movement parallels surface runoff to a great extent within the site. It is controlled mainly by the underlying bedrock.

Development of the site will lead to at least some increases in runoff. The amount of the increase will depend upon the extent of development, the amount of impervious surfaces crested, and the amount of vegetation removed. The added runoff could cause increased overland and stream channel erosion, especially in concentrated areas, and it may increase the peak flood flows of streams on the site. These problems can be ameliorated by formulating a stormwater management plan for the subdivision.

Although the site plan was not by itself sufficient to allow the determination of the effects from storm sewering, it is possible to estimate the magnitude of runoff changes due to land-use modification for pre-and post development.

Runoff depths for certain storm events (e.g., the 10, 25, or 100 year storm) may be estimated by using a simplification of a method described in Technical Release No. 55 (TR-55) of the USDA-Soil Conservation Service. In order to calculate runoff changes, TR-55 requires the estimation of curve numbers, which relate amounts of precipitation to amounts of runoff. A higher curve number indicates that a greater volume of runoff would occur following a given amount of precipitation.

For purposes of this discussion, changes in runoff were analyzed only for the southwestern and northern sections of the proposed subdivision. This area accounts for approximately 88 percent of the total development. Generally speaking, the area analyzed includes all of the land area draining into "Cat Swamp." As mentioned earlier, stormwater runoff generated in the southwest corner will be piped into the "Cat Swamp" watershed, and therefore, was included in the post-development runoff estimates. The remaining portions of the subdivision, including lots 1-10 in the eastern part of the study area were not addressed in the calculations. This part of the subdivision drains to Union City Road.

Table 1 indicates the runoff depths estimated for that portion of the subdivision draining into "Cat Swamp." These estimates should prove useful as "ball park" guides to anticipated runoff changes for the land area analyzed. Estimates are provided for 24-hour rainfall

amounts that would be expected to occur, over a very long period of time, once every ten years, once every 25 years, and once every 100 years. In any given year, these rainfall amounts have respectively, a ten percent, four percent and one percent probability of occuring.

TABLE 1

ESTIMATION OF RUNOFF

AVERAGE STORM FREQUENCY	10 Years	25 Years	100 Years
Runoff before development (inches/1 acre)	1.96	2.40	3.60
Curve Number (69)			
Runoff after development (inches/1 acre)	2.04	2.49	3.70
Curve Number (70)			
Percent Increases	4%	4%	3%

As the above table indicates, the overall increases in runoff from the area analyzed are four percent or less. Because the density of the proposed subdivision is quite high, the increases in runoff from a storm drainage system on the site could have potential for erosion. The potential for erosion due to concentrated runoff from the site may be further increased by the presence of moderate to steep slopes on the site. In order to avoid this potential problem, a comprehensive erosion and sediment control plan will need to be developed for each phase of the proposed development. Strict control and engineering measures will also be needed to overcome potential erosion problems. In addition, it is suggested that the applicant submit detailed hydrologic information on pre-and post-development runoff volumes and peak flows from the site. This should

include all phases of the development. Estimates should be provided for the 10, 25, and 100 year storms. Detailed design specifications for all the stormwater control facilities (i.e., detention ponds, energy dissipators, or catch basins) should also be submitted for town review.

Water Supply

Although the Borough of Naugatuck has a public water supply system, the subdivision site plan calls for on-site wells to serve each lot. It should be pointed out that a public water sypply storage tank owned by the Connecticut Water Company is located on Great Hill, just west of the site. However, extension of the water supply line to serve this proposed subdivision would entail obtaining a right-of-way through adjoining properties. Therefore, it seems likely that each lot in the subdivision would need to derive it's water supply from drilled wells, cased with steel pipe, into the underlying metamorphic bedrock.

The exact yield of a bedrock-based well is a function of many geologic factors such as the number and size of fractures present in the bedrock. Since fractures in bedrock are irregular, there is no practical way of predicting the yield of a bedrock well drilled in a specific location. Even with geophysical exploration, it is extremely difficult to predict such yields. Nevertheless, wells drilled in bedrock are generally capable of supplying small but reliable water yields.

An assessment of existing bedrock-based wells has been conducted for the Lower Housatonic River Basin which includes the study

site (Source: Connecticut Water Resources Bulletin No. 19). All of the 294 wells surveyed in this study tapped crystalline bedrock, which is the same type of bedrock underlying the study site. This assessment allows one to predict the chances for any new well to achieve certain minimum yields. According to the well study, 85 percent of the wells tapping the type of bedrock underlying the site yielded about two or more gallons per minute (GPM); 70 percent yielded about four or more GPM; 50 percent yielded six or more GPM; and only 28 percent yielded nine or more GPM.

Another study surveyed 24 wells. According to this report, existing bedrock-based wells serving homes along Crestwood Drive and Autumn Ridge Road east of the site indicated yields ranging between 2 GPM to 6 GPM at depths from 125 feet to 410 feet. The average yield and depth for the 24 wells surveyed is 4.5 GPM and 256 feet, respectively.

A water-related question needing further evaluation is whether or not the proposed drilled wells will interface with each other or nearby wells during peak pumping periods. This could cause the water yield of a particular well or wells to be seriously depleted.

When any type of well or group of wells are pumped, it can generally be expected to result in some lowering of the water table. Instead of moving toward discharge zones, such as a stream, spring or seep, the groundwater moves towards the pumping well in every direction. The pumping well creates an artificial discharge area by lowering the water table around the well and withdrawing water from saturated fracture zones in the bedrock. This results in a cone of depression or an area of drawdown. The area of drawdown will depend

largely upon the duration and rate of pumping wells, the aquifer's physical characteristics, the natural slope of the water table, and the availability of recharge to the aquifer. Even with the use of geophysical equipment, it is very difficult to determine the area of drawdown for a particular bedrock well.

A relatively large number of wells (i.e., 86) are proposed to be installed in a small area (i.e., 54 acres). Though the proposed subdivision will be served by public sewers, only surrounding on-site septic systems would be expected to recharge the bedrock aquifer with renovated domestic wastewater to some degree. Thus, there may be a chance for mutual interference among drinking wells. It should be pointed out that moderate to high density residential housing south and east of the proposed subdivision are also served by on-site wells. In view of the potential problem, every effort should be made to investigate the possibilities of serving the proposed subdivision by public water to avoid the chance of mutually interfacing wells.

It should be noted that the lack of public water will not necessarily preclude development of this site. The development is feasible with on-site wells. However, the proposed density of the development may create some water problems such as interfering drinking wells. By reducing density through larger lots, thereby reducing the overall number of wells, the developability of the site may be enhanced. It seems likely that the average recharge rates to the wells would exceed the water demands for larger sized lots. For example, by increasing in the lots to 1.5 to 2 acres, approximately 25 to 27 lots can be developed. This density can adequately sustain on-site wells and on-site septic systems if necessary. Also, with

individual pumping wells in the middle of the lot, wells would be approximately 300 to 400 feet apart. This is an adequate distance to avoid mutually interfering wells. A competent consulting geologist should be able to address this water related concern in more detail.

Finally, the natural quality of groundwater in this area should be satisfactory. However, due to the mineralogy of the rock types underlying the site, there may be a chance that elevated iron and manganese levels could affect well water quality. As a result, it may be necessary to install an appropriate water treatment filtration system.

SOIL RESOURCES AND CHARACTERISTICES

Introduction

The attached soil survey map and narrative is a revision of the data contained in the Soil Survey of New Haven County, Connecticut. The letter symbols on the map identify map units. Each map unit symbol has a unique composition of soils. Areas with the same symbol have the same composition.

Inland Wetland Soils

The inland wetland soils on this site are poorly or very poorly drained. These soils play vital roles in detaining storm water runoff. This in turn, regulates the flow of flood water to downstream areas. In addition, these wetlands provide important wildlife habitat.

The soil map identifies the approximate location of the inland wetland areas (map units AA and Lc). The exact boundary of these wetlands should be located on the ground and then surveyed onto the site plan. Other small inland wetland areas and water courses should also be located on the site plan.

Map Unit AA

This map unit is composed of Adrian and Palms soils on slopes of less than 1 percent. The Adrian and Palms soils are very deep and very poorly drained. They have a high water table within 12 inches of the soil surface. Water ponds on these soils following storm events. Both soils have organic surface layers 16 to 51 inches thick overlying

mineral soil material (Figure 7).

Development potential is limited on these soils because of their high water table. If drained, the organic surface layer will subside. This area should be left in its natural condition in order to continue to control storm water runoff.

Map Unit Lc

This map unit is composed of Leicester soils on 0 to 3 percent slopes. These soils are very deep and poorly drained. Typically, they have fine sandy loam textures to a depth of 60 inches or more. Some stones and boulders also occur throughout the soil's depth. Leicester soils have a high water table within 1.5 feet of the soil surface. Their surface is covered with 15 percent or more stones and boulders.

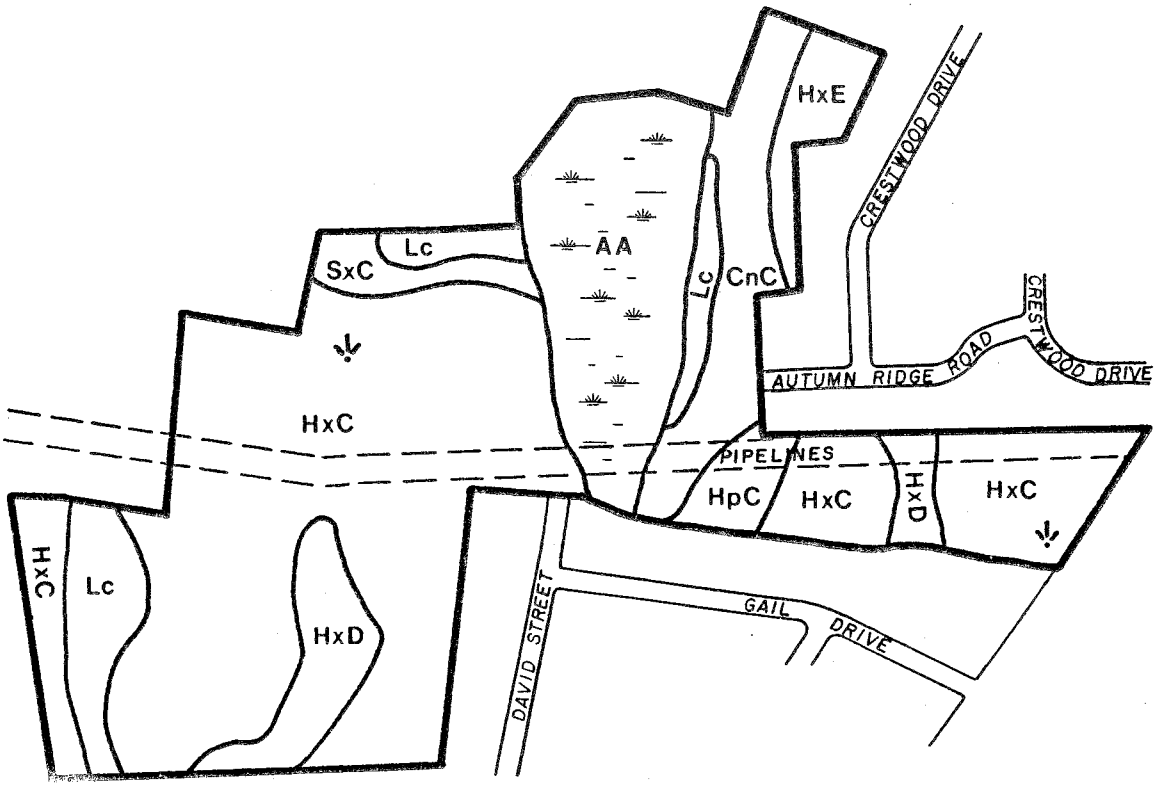
Development on Leicester soils is limited by their high water table. Use of curtain drains is not an option since they would not have a drainage outlet. Frost heaving is a problem on these soils. Landscaping on these soils requires water tolerant plantings. These soils will be soft and muddy with prolonged foot traffic.

Special Symbols

Some wet areas on the landscape were too small to delineate on the map. These areas have characteristics that are significantly different from the soils mapped adjacent to them.

The symbol () identifies small areas of poorly and very poorly drained soils. These soils have a high water table within 20 inches of the soil surface.

Figure 7



CORSINO SUBDIVISION PROPERTY

NAUGATUCK, CONNECTICUT

DISTRIBUTION OF SOILS

King's Mark Environmental Review Team

0 400'

N

Non-Inland Wetland Soils

Map Unit CnC

This map unit is composed of Charlton soils on 3 to 15 percent slopes. The Charlton soils are very deep and well drained. Typically, they have fine sandy loam textures to a depth of 60 inches or more. In this area, the Charlton soils contain a small amount of stones, usually 1 to 4 feet in diameter, occurring throughout their depth. In addition, these Charlton soils have a high water table at about a 30 inch depth. These soils have up to 25 percent stones and boulders on their surface.

Construction of roads and buildings on these soils should be relatively easy. Excavations will not cut into bedrock; however, some large boulders may be encountered which may require blasting. Curtain drains may need to be installed to keep water from seeping into basements. Properly seeded and fertilized lawns should be easy to establish on these soils.

Map Unit HpC

This map unit is composed of two soils that are so intermingled on the ground that they could not be separated on the map. One soil is named Hollis. Hollis soils are shallow and well drained. These soils have fine sandy loam textures overlying consolidated bedrock at a depth of 10 to 20 inches.

The other soil component is named Charlton. Charlton soils are very deep and well drained. These soils have fine sandy loam textures to a depth of 60 inches or more. Small amounts of stones 1 to 4 feet

in diameter occur throughout their depth. The Charlton soils comprise about 25 percent of this map unit.

A few small outcrops of consolidated bedrock also occur within the HpC map unit.

The Charlton and Hollis soils have greater than 15 percent of their surface covered by stones and boulders.

Roads, buildings and underground utilities will be extremely difficult to construct on the Hollis soils. Any excavations into the Hollis soils will require special construction equipment or blasting. At least six inches of topsoil will be needed to cover exposed bedrock in order to establish lawns.

Map Unit HxC, HxD and HxE

These map units are composed primarily of two soils that are so intermingled on the ground that they could not be separated on the map. One soil is named Hollis Variant. Hollis Variant soils are shallow and well drained. These soils have fine sandy loam textures overlying very large boulders 5 to 15 feet in diameter. Depth to the boulders generally is 10 to 20 inches.

The other soil is named Charlton. These soils are very deep and well drained. Charlton soils have fine sandy loam textures to a depth of 60 inches or more. A small amount of stones 1 to 4 feet in diameter occur throughout their depth.

The HxC map unit has slopes of 3 to 15 percent and contain about 35 percent of the very deep Charlton soils. The HxD map unit has slopes of 15 to 25 percent and contains about 20 percent Charlton soils. The HxE map unit has slopes of 25 to 45 percent and also

contains about 20 percent Charlton soils. The Charlton and Hollis Variant soils in each of the map units have greater than 15 percent of their surface covered by stones and boulders.

Roads, buildings and underground utilities will be extremely difficult to construct on these soils. Moving the many large boulders in the Hollis Variant soils will require special construction equipment or blasting. Construction costs will be very high on all slopes greater than 15 percent.

Opportunities exist for creative landscaping. Stones and boulders should be planned into the final landscaping design or removed from the site. The texture of the soil material with the rocks removed will support the establishment of lawns and gardens.

Map Unit SxC

This map unit is composed of Sutton soils on 3 to 15 percent slopes. These soils are very deep and moderately well drained. Typically, they have fine sandy loam textures to a depth of 60 inches or more. Depth to the water table ranges from 1.5 to 2.5 feet. The surface of these soils is covered with greater than 15 percent stones and boulders.

The high water table in the Sutton soils and their surface make them difficult soils to use in a residential development. Curtain drains may be required in order to keep water out of basements. Care must be taken in designing and constructing the foundation footing since the soils are subject to frost heaving.

Finally, the high water tables will also make lawns difficult to establish in these soils.

Erosion and Sediment Control

All soil erosion and sediment control planning should follow the planning principles detailed in the Guidelines for Erosion and Sediment Control Handbook (1985).

As with any large subdivision, the sequence of major construction activities should be carefully planned and scheduled. This site lends itself very readily to the phasing of development on a section by section basis. This would minimize the amount of land at any one time being in an disturbed and unprotected condition.

The phasing and construction sequence for this project should be timed to coincide with vegetative seeding periods to allow maximum soil erosion control. It will be critically important to permanently seed down all disturbed areas immediately after final grades are reached. All distrubed areas that will not receive final grading for longer than 60 days, or after September 1, should be seeded using temporary vegetative measures or mulched at a rate of 90 pounds per 1,000 square feet.

The preliminary subdivision plan shows a very dense lot layout especially in steeply sloping areas with slopes of 25 percent and greater. Lots 5-7, 51-55 and 78-84 will require extremely intensive and complex erosion and sediment control measures to protect adjoining properties from serious off site sedimentation problems.

Lots 13-18 also present serious soil erosion and sedimentation potentials due to the very steep slopes at the backs of these lots. In places, the existing houses along Crestwood Drive are situated at the very top of slopes approaching 2:1 (2 feet horizontal to 1 foot

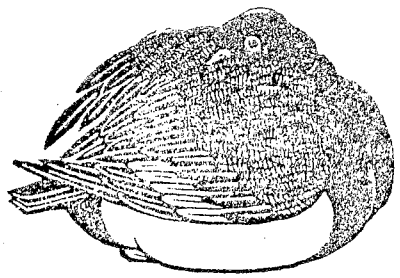
vertical.) These slopes are somewhat stabilized by large boulders at their bases.

Vegetative stabilization of 2:1 slopes is very difficult, if not impractical due to the low fertility of the soil and the low available moisture. Examples of this situation abound in the Naugatuck Valley and are characterized by bare soil slopes in backyards which continue to erode with each rain storm.

Erosion and sediment control planning should pay particular attention to the designated open space in the central portion of this site. Soils mapped as Adrian Palms Muck in this area can be seriously damaged and even completely destroyed by sedimentation from construction activities if not adequately protected.

Assistance on all phases of soil erosion and sediment control planning, installation, application and maintenance is available from the Soil Conservation Service office in Wallingford.

BIOLOGICAL RESOURCES



BIOLOGICAL CHARACTERISTICS OF CORSINO SUBDIVISION

Forest and Vegetation Characteristics

Stand Descriptions

Oak/Mixed Hardwood (Large Poles)

This 12-acre variably-stocked stand is composed of fair to medium quality, large pole to small sawtimber-sized red oak, white oak, hickory and black birch. These trees are growing at a fair rate on a medium to good site and are 40-60 years in age.

Understory species encountered include saplings of the above species, plus some maple-leaved viburnum and scattered highbush blueberry (Figure 8).

Oak

This 23-acre understocked stand primarily contains poor quality, large pole to sawtimber-sized red and white oaks. Scattered throughout are similarly-sized red maple, hickory and black birch. These trees are badly fire-scarred, growing at a fair to poor rate on a medium to fair site. They are 50-70 years old.

The understory consists of multi-stemmed saplings to pole-sized sprout growth of red maple, with some maple-leaved viburnum, winterberry and highbush blueberry. Scattered red oak saplings can be found as well (see Figure 8).

Oak/Mixed Hardwoods

This fully-stocked stand contains extremely dense sapling-sized sprout growth of red oak, red maple and diseased American chestnut. Additionally, saplings of gray birch can be found. The growth rate is vigorous on a fair to poor site. It is approximately four acres in size (see Figure 8).

It is believed this growth represents regeneration from a severe forest fire or multiple fires some 15 years ago.

Wooded Wetlands

These areas, totalling three acres, are fully-stocked. They are characterized by a high water table, with a shrub understory consisting primarily of spicebush, although some highbush blueberry may be found in the drier margins (see Figure 8).

Two areas exist:

(1) The northernmost area is small, being approximately 0.1 acre in size. This is basically a depression filled with water, seemingly year-round. The resulting pond is surrounded by a ring of sawtimber-sized, fair to poor quality red maple and red oak.

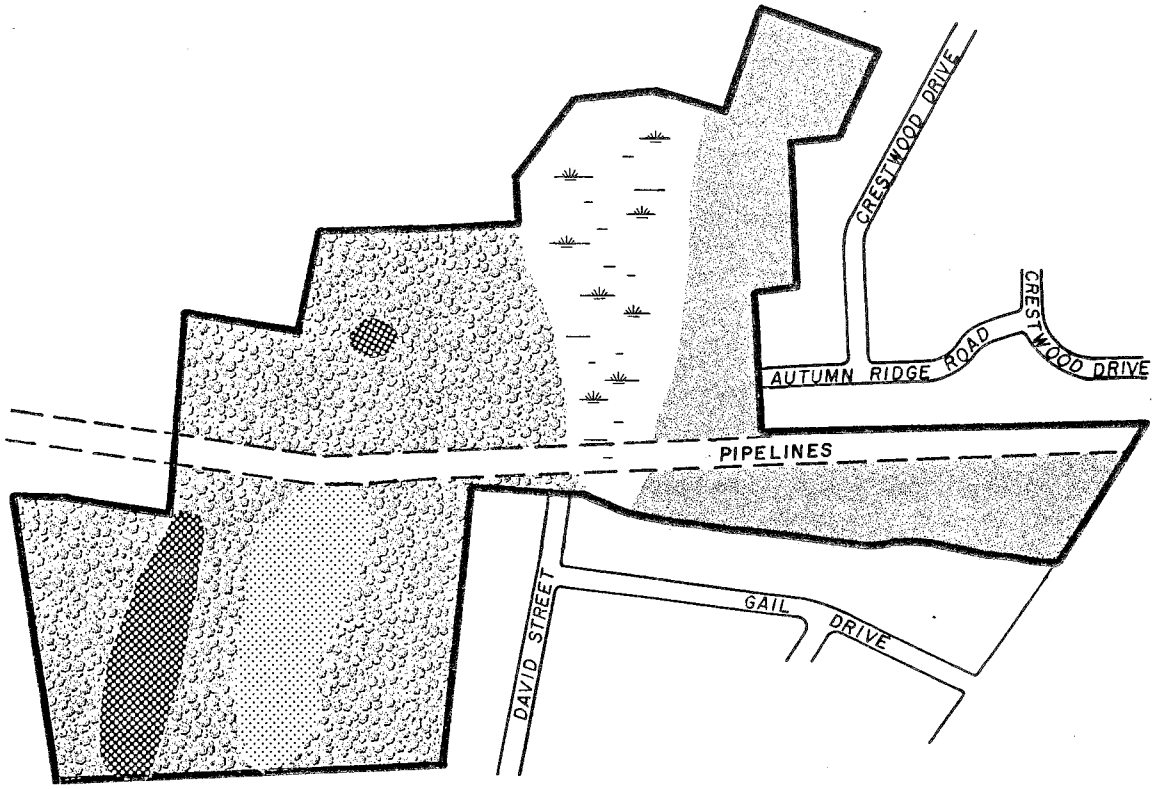
(2) The southwestern area is a hardwood swamp, consisting of pole-sized, fair quality, red maple. Some black birch and ash may be found on the drier margins.

Discussion

Throughout the property, evidence can be found of heavy usage by inhabitants of the surrounding developments. Rough log structures, litter and trails abound.

Historically, this area has been a problem spot, with a high incidence of forest fires. The oak/mixed hardwood area (large

Figure 8



OAK/MIXED HARDWOOD - large poles/small saw timber

OAK - large poles/saw timber

OAK/MIXED HARDWOOD - saplings

WOODED WETLANDS - poles

GASLINE AND OPEN WETLANDS

CORSINO SUBDIVISION PROPERTY

NAUGATUCK, CONNECTICUT

FOREST TYPES

King's Mark Environmental Review Team

0 400'

N

poles), being closest to residential areas and, therefore the area most visible, has been spared in recent years. However, the western half of the property has been burned repeatedly over the years.

Throughout this area, trees that are badly fire-damaged will deteriorate in the coming years to a point at which they will represent a threat to safety. If development is imminent, it might be best to remove all of the poor quality trees now and allow the new homeowners to plant new trees - trees which will be disease-free, strong and healthy. Even though this may well mean the removal of all of the dominant trees on the property, it is a prudent course of action to investigate. Certainly, it would be best to employ the services of a private forester to examine trees that may be left after development in order to determine their overall state of health and projected suitability for a residential development.

Wildlife Resources

The study area may be divided into three wildlife habitat types. They are: (1) mixed hardwoods; (2) wetlands; and (3) openland.

Wildlife Habitat Types

Mixed Hardwoods

This wildlife habitat type consists of oak and oak/mixed hardwood stands. Species composition is dominated by red and white oaks, along with hickory, black birch and red maple. Understory vegetation consists of seedling/sapling hardwoods along with maple-leaved viburnum, highbush blueberry, winterberry, blackberry, dewberry, greenbriar, grasses and various herbaceous species.

Wildlife utilizing such habitat include white-tailed deer, turkey, gray and flying squirrel, rabbits, red fox, raccoon, raptors (or birds of prey such as hawks), passerines (i.e., songbirds) and a great variety of other non-game species.

Wetlands

The wildlife habitat consists of a seasonally, flooded mixed hardwood community with open water. The seasonally flooded mixed hardwoods are dominated by red maple. Black birch and ash are found along the drier edges. Understory vegetation includes spicebush, club moss, highbush blueberry, grasses, ferns and herbaceous species.

Wildlife species frequenting such areas include white-tailed deer, American woodcock, raccoon, striped skunk, mink, wood duck,

woodpeckers and numerous non-game species.

The open water wetland type is dominated by tussock sedge. Overstory composition consists of red maple, with scattered ash, buttonbush and dogwood. Aquatic vegetation includes duckweed, pondweed, smartweed, buttercup, watershield and pickerelweed.

Wildlife utilizing such areas include beaver, river otter, mink, muskrat, waterfowl, raccoon, herons, kingfishers, kingbirds, swallows, flycatchers and numerous non-game species.

Openland

This habitat type consists of a shrub/grass composition along a gas transmission line right-of-way. Vegetation includes goldenrod, ragweed, sweet fern, greenbriar, blackberry, dewberry, grasses and hardwood saplings. Habitat diversity created by right-of-ways often benefit a variety of animals.

Wildlife species frequenting such sites include white-tailed deer, turkey, raccoon, rabbits, sparrows, meadowlarks, raptors and numerous non-game species.

Discussion

Since Connecticut is a densely populated and growing state, available wildlife habitat continues to decline. It is therefore prudent to consider maintaining and enhancing existing habitat areas to protect indigenous wildlife species. The following practices will help to improve conditions within the various habitat types.

Woodland Guidelines

* Create a diversity of habitat by making small, irregularly shaped (1/4 to 1 acre) openings in an east to west direction in order to maximize sunlight. This will encourage fruit producing shrubs needed to many types of wildlife.

* Pile brush along edges of openings for small mammals and birds.

* If timber harvesting is planned, these practices will enhance wildlife habitat:

    * Encourage mast producing trees (oak, hickory, beech);
    * Leave 5 to 7 snag trees per acre;
    * Exceptionally tall trees (utilized by raptors for perching and nesting) should be encouraged;
    * Trees with vines (i.e., berry producers) should be encouraged;
    * Create small irregularly shaped openings with feathered edges;
    * Construct brush piles along edges of openings.

Wetland Guidelines

* Leave a natural buffer strip of vegetation along wetland areas to help filter and trap sediments.

* Develop potholes (18-24 inches deep) within the seasonally flooded mixed hardwood communities to insure year-round water for wildlife.

* Place three wood duck boxes on the open water area.

* Culverts should have screens to lessen potential damage from beavers.

* Encourage natural landscaping; limiting chemical lawn applications will lessen habitat damage and open water weed problem potential.

* Retention ponds should be strategically designed and located to benefit wildlife, particularly waterfowl.

Openland Guidelines

* Expand right-of-way openland area to average width of 100 feet by use of cordwood cutters.

* Develop access measures to control impact of off-road vehicles.

* Place bluebird boxes along edges of openland to encourage eastern bluebirds to nest in the study area.

* Shrubs should be controlled every 3 to 5 years to provide optimum wildlife habitat conditions.

As this area is developed, there will be immediate and long-termed negative impacts on wildlife. The primary potential impact is direct loss of habitat due to roads, houses, driveways and sidewalks. Another potential impact is the change in habitat where forests are cleared for lawns and landscaping. A third potential impact is the increased human presence, vehicular activity and free roaming dogs and cats. This will drive less tolerant species away from the site, even though there has not been any change in existing wildlife habitat.

A number of the previously discussed management guildelines could be implemented in order to minimize negative impacts from development. Due to the abundance of industrial and residential development presently within the vicinity of the study area, and the compact nature of the development proposal, habitat management practices on a large scale are not feasible. The best approach in this situation would be to encourage individual homeowners to practice backyard wildlife habitat management improvement projects. Such activities include providing food, water, cover and nesting areas (see Appendix C).

Wetland Characteristics

The site contains only one area of regulated inland wetlands. This area is of major ecological significance due to its size, character and location on the property. The site is nearly bisected by a 12-acre wetland area. This wetland consists primarily of very poorly drained organic (i.e., peat and muck) soils. The wetland is essentially in an undisturbed condition except for the gas transmission line crossing its southerly tip. This low profile gravel fill roadway will also partially serve as the location for the proposed subdivision roadway crossing.

The wetland, referred to as "Cat Swamp" is classified by the U.S. Fish & Wildlife Service-National Wetlands Inventory as a semi-permanently scrub-shrub swamp with deciduous broad leaved vegetation. The southerly end of the wetland exhibits open water and shallow water emergent vegetation (e.g., weeds, reeds and sedges). Moving in a northerly direction through the main axis of the wetland, the vegetation changes through four transition zones. Immediately north of the small open water zone, dense emergent sedges and reeds are encountered. This area is in transition to a scrub/shrub community dominated by highbush blueberry, spicebush and mosses. Isolated red maple deadwood saplings can also be found in this zone. Immediately north of this zone is a scrub/shrub swamp with some live red maple saplings and more woody vegetation. The northern portion of the wetland exhibits a wooded swamp overstory underlain by organic soils. The understory exhibits less dense shrubbery. The perimeter of this major wetland, features diverse hardwood tree growth

over poorly drained soils. These vary from 15 to 50 feet from the line defined as "edge of wet area" according to the proposed subdivision plan (Figure 9).

The water regime of this wetland may have been altered by construction of the gas transmission line at it's southern end. The low profile, gravel roadway at this location inhibits outflow of water to the south. This results in a six inch to one foot increase in water elevation and accounts somewhat for the presence of open water at this end of the wetland. However, it is worth noting that drainage into a culvert under David Street is also impeded due to culvert elevation and clogging effects. The wetland also drains to the north. Due to the presence of the gas transmission line, this northern outlet serves as the major outflow for the wetland system. This is appropriate since as the stream corridor at the northern boundary of the wetland is better able to receive this flow than is southern outlet.

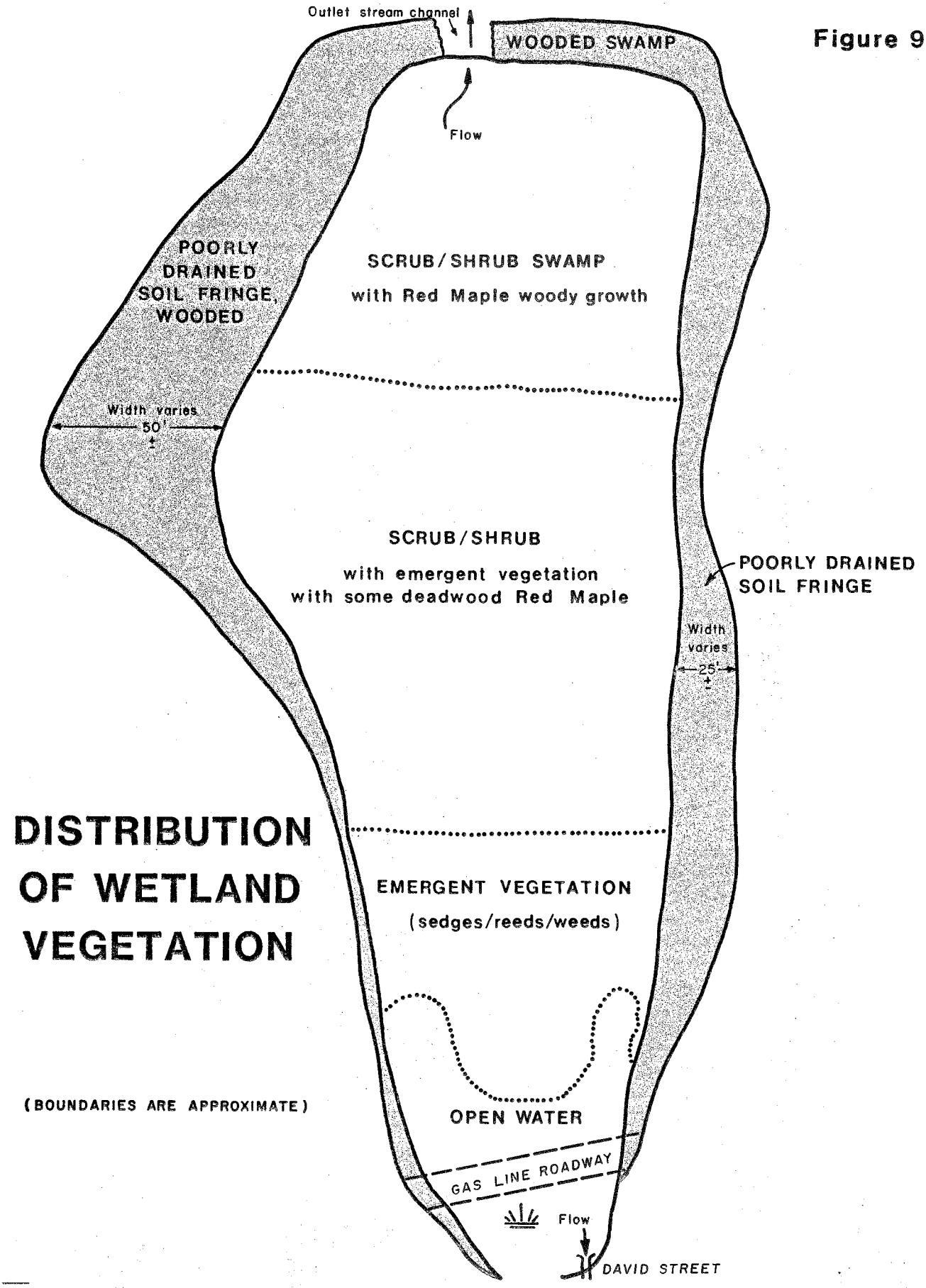
Wetland Values

The inland wetland on the site exhibit the following values: (1) provides wildlife habitat; (2) provides hydrologic functions; (3) maintains water quality; and (4) provides many recreational and educational opportunities.

Wildlife Habitat

Due to the size and vegetative diversity of this wetland, it appears to support significant populations of birdlife, amphibians, muskrats, and other terrestrial mammals such as white-tailed deer, red

Figure 9



DISTRIBUTION OF WETLAND VEGETATION

(BOUNDARIES ARE APPROXIMATE)

fox and raccoon. The presence of open water will attract waterfowl while the presence of dead standing trees and fruiting shrubs will attract a wide variety of woodpeckers and songbirds, respectively.

Hydrology

The central position of this wetland increases its importance from a stormwater management standpoint. A substantial portion of the site presently drains overland into the wetland. The post-development storm drainage system may well direct even more of the site runoff into this wetland. The wetland presently receives runoff from the site and releases it slowly to the outlet stream, thereby buffering the effects of large storms. The ability of this wetland to absorb water from adjacent lands and "meter" flows also sustains stream flow during dry weather conditions. Finally, this wetland probably performs in the recharge of the bedrock acquifer in the vicinity.

Water Quality

The aquatic vegetation and organic soil substrate of this wetland maintains and improves the quality of water leaving the property. This is accomplished by the nutrient uptake of plants and by the biological activity performed by small organisms in the soil-water environment of the wetland. This function will be increasingly important when post development runoff conditions are considered. This wetland has the capacity, if not overtaxed, to remove pollutants from roadway runoff and fertilizers,

Aesthetic, Recreational, Educational Values

Based upon its location, size and healthy environmental condition, this wetland is ecologically unique and important to the area. It provides scenic value as an aesthetic feature of the local landscape. It provides an excellent opportunity for passive recreation, birdwatching and nature study.

Potential Adverse Environmental Impacts

The proposed development will potentially impact the wetland area in the following ways.

Short Term

* The wetland will receive sediments as a result of soil erosion from the upland areas during the development of roadways and building lots. The amount of erosion and degree of impact will depend upon sediment and erosion control measures implemented during construction.

Long Term

* The wetland will receive increased post development runoff volumes and velocities after lawns, driveways, rooftops, roadways, and storm drains are installed. The impact of runoff increases can only be accurately assessed when a drainage plan is completed and computations of runoff are available.

* Post development runoff will contain pollutants that do not presently reach the wetland from forested uplands. Management techniques are available to mitigate these impacts.

* Wildlife habitat will be impacted when the adjacent uplands are

developed. Tree cutting, human and motor vehicle interaction will result in a decline in the desireability of the wetland (and the site as a whole) for wildlife. Certain efforts can, however, reduce these impacts.

Management Guidelines

Because of the proposed development density and the proximity of building lots to the wetland, it is essential that these wetland soils be clearly and accurately delineated. Field identification of wetlands by a soil scientist and transferring the wetland boundaries by survey methods will show the limit of wetlands. This will allow for evaluation of the proximity of potential homesites.

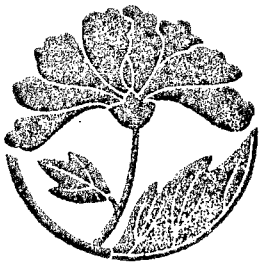
A comprehensive site plan showing limits of wetland areas, fill, grading structures, storm drainage, and erosion and sediment controls should be developed.

Storm drainage computations should be provided to allow the assessment of drainage impacts on the wetland and off-site properties. To minimize stormwater runoff effects, plunge pools at pipe outlets are suggested. Several separate locations will diffuse runoff to the wetland. This is preferable to one single concentrated storm drainage outlet. The drainage outlet to David Street could be improved to prevent further clogging.

Maintaining an undisturbed buffer strip would improve the aesthetic and environmental value of the post-development wetland. This strip could contain a walking path around the wetland and thereby provide increased value for passive recreation. While this wetland has exceptional value in its natural state, minor excavation at the

southern tip along the existing gas transmission line could enhance the open water aspects for feeding waterfowl or ice skating. Such work could be conducted by a hydraulic backhoe or dragline no further than 50 feet from the existing roadway and should not exceed six feet in depth. The highly organic substrate of this wetland makes creation of a large pond or lake here undesirable. One or two boardwalk piers into the swamp could enhance access for birdwatching or environmental studies.

LAND USE
AND
PLANNING CONSIDERATIONS



LAND USE AND PLANNING CONSIDERATIONS

Existing Land Use

The 54 acre site is situated abutting a fully developed single-family residential (124 estimated units) development to the east and the Naugatuck Industrial Park to the west and south. The most northern part of the property is approximately 500 feet from the Naugatuck/Waterbury town line. The Algonquin Gas Transmission Company underground gas line bisects the property east to west in a 60-foot easement. Great Hill Road, the industrial park's principal access is 250 feet west of the proposed subdivision development. Abutting park parcels Number 8 and Number 7 it is understood, are under option. Other than 108 acres of vacant land zoned for industry in Waterbury north of Naugatuck's Industrial Park, the remaining area is mostly residential development. There are 94 residential units in two federal low-income projects in Waterbury on Spring Brook Road which is the extension of Union City Road in Naugatuck.

Naugatuck's Plan of Development

The Plan of Development for the Borough was prepared in 1973 by Bryan & Panico Consultants. The study site is designated SR (Suburban Residential) and proposes residential densities at, "...two to five families per acre..." in areas, "...adjacent to existing urban development or in newer single-family residential areas with public facilities generally available." The circulation segment of the plan designates Union City Road (which will carry the generated traffic to and from the proposed development) as a

"Secondary Thoroughfare." Their description of this function is, "...to collect and distribute traffic from major thoroughfares and to connect secondary traffic generators." Municipal sewage disposal and public water supply connections are recommended for all residential development exceeding a density of one family per acre.

State/Regional/Water Adopted Plans

State

The Locational Guide Map of the 1982-1985 State Plan of Conservation and Development defines the area under consideration as "Urban Growth Area." The applicable definition is, "Moderately developed area with available vacant, developable lands, existing or planned water or sewer services, and potential for future mixed use and intensive development of areawide significance." The related State policy for the Urban Growth Area is "Concentrate New Growth."

Regional

The Plan of Regional Development amended and adopted in 1977 recognizes the Borough of Naugatuck and City of Waterbury as constituting the "Urban Core" of the thirteen municipality region. The proposed subdivision property is defined as "Urban Development-Low," recommending 2 to 4 dwelling units per acre net.

Waterbury

Given the study site's proximity to the City of Waterbury, their 1971 Comprehensive Plan was also reviewed. Spring Lake Road (the

extension of Union City Road into Waterbury) is defined as a collector street serving traffic between arterials and local streets. Their land use plan defines the adjacent area as "Residential-Low Density." That classification recommends restriction to one or two family homes with a caveat on multi-family group dwellings on a special permit basis at a density not to exceed 12 units per acre.

Existing Zoning and Subdivision Regulations

Present zoning is designated R-15 which permits a single-family detached dwelling for one family and not more than one such dwelling per lot (Figure 10). Each lot must be at least 15,000 square feet with a minimum street frontage of 85 feet. In addition, each lot must be so configured that an 85-foot square will fit on the lot. Interior lots are permitted provided that each lot is 1.5 times the minimum lot area and has an accessway of 30 feet. Present zoning does not specifically require public water and sewer availability for the 15,000 square foot lots. The Zoning Commission is presently considering substantial revisions to these regulations. These revisions, which have been publicly heard include a specific requirement of public water/sewer service connections for 15,000 square foot lots. The developer has stated that without these utilities present, R-15 development would be impossible.

The subdivision regulations require that lots not served by public water supply and/or sanitary sewers shall have sufficient area and suitable space to accommodate a private water supply system and/or to accommodate the proper layout, installation and future

extension of a private sewage disposal system.

Maximum length of permanent cul-de-sacs are stipulated at 1,000 feet, although temporary dead-ends may exceed that length. Maximum grade for local residential streets is 10 percent.

Developed land to the east of the property is also zoned R-15. Land to the west and south is zoned PD-2 which is a Planned Industrial District, in this case owned by the Borough (see Figure 10). Recently, land to the north was added to PD-2 abutting the City of Waterbury. City of Waterbury land use plan and zoning ordinance were amended in 1980 to provide industrial park development on 108 acres abutting Naugatuck. While this parcel was initially intended for dog track racing purposes, it has the physical capability of tieing into Naugatuck's PD-2.

Traffic and Access

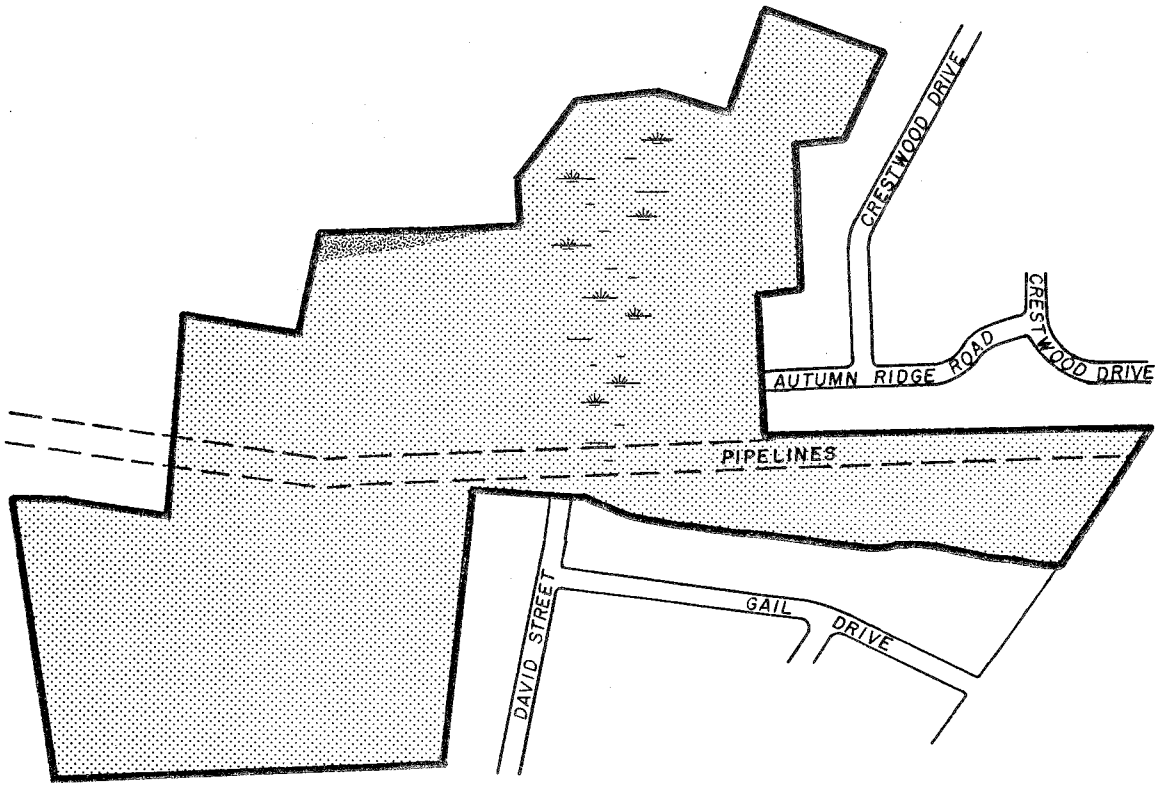
Traffic Analysis

This section consists of an estimate of the traffic volumes generated by the proposed subdivision and an analysis of the impact of the project on the nearby Route 68/Union City Road intersection.

Trip Generation

Based on a total of 86 new dwelling units, it is estimated that the subdivision will generate a maximum of 1,400 trips per weekday. The maximum was derived from the trip generation rates presented in the 1985 ITE Trip Generation report. The maximum for the subdivision was assumed to be halfway between the average and maximum rates given in the report. During the peak commuting hour, it is estimated that

Figure 10



R-15 (Single Family detached-25,000 square feet)

PD # 2 (Planned Industrial District)

CORSINO SUBDIVISION PROPERTY

NAUGATUCK, CONNECTICUT

ZONING

King's Mark Environmental Review Team

0 400'

N

each unit will generate a maximum of 1.2 vehicles approaching each house and 0.8 leaving. For purposes of the Route 68/Union City Road intersection analysis, it is assumed that 70 percent of this traffic will be traveling on the section of Union City Road between the subdivision and Route 68. It is also assumed that most of this traffic will be traveling on Route 68 to or from the west.

Intersection Capacity Analysis

The T-intersection capacity analysis procedures for unsignalized intersections (from the 1985 T.R.B. Highway Capacity Manual) were used to estimate the subdivision's traffic impact on the Union City Road/Route 68 intersection. To do the analysis, peak hour turning movements had to be estimated. The 1983 average daily traffic (ADT) counts are available from the Connecticut Department of Transportation for Route 68 and Union City Road. These were converted to 1985 ADT's assuming a two percent annual growth in traffic. The 1985 ADT's were converted to peak hour volumes (PHV's) using the assumption that PHV's are 10 percent of the ADT's (Table 2).

TABLE 2

AVERAGE DAILY TRAFFIC COUNTS

	Route 68 West of Union City Road	Route 68 East of Union City Road	Union City Road North of Route 68
1983 ADT	7,200	7,100	3,100
1985 ADT est.	7,500	7,400	3,200
1985 PHV est.	750	740	320

The peak hour volumes were converted to directional volumes using assumptions on the directional splits. The intersection turning movements were estimated using the T-intersection procedures in NCHRP Report 255, Highway Traffic Data for Urbanized Area Project Planning and Design.

The intersection capacity analysis worksheet without the subdivision and with the subdivision is in Appendix B. In both instances the intersection will operate at a satisfactory level of service based on the estimated turning movements. With the addition of the subdivision, however, it is estimated that the intersection will be operating at the high end of C (Table 3).

TABLE 3

LEVEL OF SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS

Reserve Capacity (PCPH)	Level of Service	Expected Delay to Minor Street Traffic
> - 400	A	Little or no delay
300 - 399	B	Short traffic delays
200 - 299	C	Average traffic delays
100 - 199	D	Long traffic delays
0 - 99	E	Very long traffic delays
*	F	*

*When demand volume exceeds the capacity of the lane, extreme delays will be encountered with queuing which may cause severe cogestion affecting other traffic movements in the intersection. This condition usually warrants improvement to the intersection. (Source: TRB, Highway Capacity Manual, 1985)

Infrastructure

Water Supply

Water supply provision is an acknowledged problem by the developer. It appears that the best source of service would be through a connection from the Borough Industrial Park. This provision would not only serve the proposed development but could ultimately be extended into the residential areas to the east now utilizing on-site wells. The immediate problem with such a water line extension appears to be the fact that industrial park Lot Number 18, through which a water line easement would be sought, is under option without the easement. Economic Development Commission officials are not prepared to disturb those negotiations at this time by interjecting an easement possibility.

While the Great Hill Road connection would be most advantageous to the developer, another point of extension could be made from the existing 16 inch main at the intersection of Union City Road with the industrial park access roads. According to officials of the Connecticut Water Company, residents on Union City Road and in the development adjacent to the proposed subdivision had inquired about such as extension. The possible cost of such an extension was prohibitive in the view of the residents and therefore has not been prusued further.

Sewage Disposal

Sewage disposal to the municipal system is also a problem which can only be resolved by Borough officials and the developer. Given the small 15,000 square foot lots, density of the development,

extreme "boniness" of the soils and the overriding subdivision requirment regarding connection into the municipal system, on-site disposal would be limited. It is understood that there is a trunk line capacity problem on Prospect Street. Studies have indicated that approximately 1,100 feet would have to be replaced with alarger diameter pipe to accommodate the proposed development and still reserve capacity for the Borough's two industrial parks.

Storm Drainage

Storm drainage layout potential is such that surface and road drainage can be principally piped and directed to the existing scrub/shrub wetland in the center of the property. The gas transmission line, in effect, created a dam forcing all the present wetland water to flow to a north outlet directly into Hopeville Pond Brook in the City of Waterbury. The developer has stated an intent to raise the gas line "dam" three or four feet above the present elevation plus some encroachment by the proposed extension of Autumn Ridge Road. Both actions, potentially having an effect on the scrub/shrub wetland should be carefully examined. The downstream impact (to the north in Waterbury) should also be evaluated. Run-off calculations should be prepared by qualified engineers to assure that the increased rate of storm runoff will not create flooding problems in Waterbury.

A small amount of runoff to the south will be directed into David Street and Gail Drive storm drainage systems. Provided the loop road drainage in the west portion of the development can be directed to the wetland, it does not appear that storm flow rates would be

increased to any downstream detriment at the southern exit. In fact, with the loop road as proposed, some surface water naturally draining east to properties on David Street will be redirected to the scrub/shrub wetland.

Conclusions

* The proposed residential use of the subject property is compatible with existing adjacent uses. While industrial development adjacent to single-family residential may not initially appear compatible, Naugatuck's conscious siting and development controls in their industrial park will provide compatibility. The gas transmission line and building constraint over it provide a limiting design factor which can be accommodated.

* While the adopted town plan was developed over 12 years ago, it appears at this time that the applicable recommendations have been followed in developments adjacent to the subject property and that the proposed subdivision development would be in accord with that plan.

* The proposed residential development is in general accord with State, regional and municipal plans of the Borough and City of Waterbury.

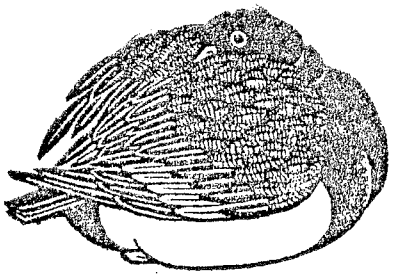
* The proposed subdivision can meet all the zoning and subdivision requirements provided public water and sewer connections are made possible. The 85-foot squares and interior lot layouts also meet the regulations. Maintaining the 10 percent maximum grade may be difficult to achieve in the western loop portion and still create buildable lots without excessive cutting and filling. Rather than

looping the road as now proposed, a series of three or four relatively short cul-de-sacs off the extension of Autumn Ridge Road might alleviate the siting problems.

* Crestwood/Autumn Ridge Road and Gail/David Street access to Union City Road are capable of handling the increased capacity generated by the proposed developemnt. The intersection of Union City Road with Route 68 may need some relatively minor improvements to accommodate an acceptable level of service.

* Definite public water supply and sewage disposal problems inhibit the development of this property. Without such tie-ins to municipal systems, significantly larger lots will have to be created. The solution to these problems rests with Borough officials and the developer. Storm drainage solutions appear obtainable subject to qualified engineering data.

APPENDICES



APPENDIX A

SOILS LIMITATION CHART

SOILS LIMITAT I CHART

Soil Symbol	Soil Name	Septic system	Shallow Excavations	Dwellings W/O Basement	Dwellings W/ Basement	Local Roads and Streets	Lawns and Landscaping
AA	Adrian Part	Severe: Wetness, floods	Severe: Wetness cutbanks, cave, excess humus	Severe: Wetness frost action, excess humus	Severe: Wetness excess humus	Severe: Wetness frost action, low strength excess humus	Severe: excess humus, wetness
AA	Palms Part	Same as above	Same as above	Same as above	Same as above	Same as above	Same as above
CnC	Charlton	Severe: Large Stones	Severe: Large Stones	Severe: Large Stones	Severe: Large Stones	Moderate: Large Stones	Severe: Large Stones
CrC	Charlton Part	Same as above	Same as above	Same as above	Same as above	Same as above	Same as above
CrC	Hollis Part	Severe: Depth to rock, Lg Stones	Severe: Depth to rock, Large Stones	Severe: Depth to rock, Large Stones	Severe: Depth to rock, Large Stones	Severe: Depth to rock, Large Stones	Severe: Depth to rock, Large Stones
HkB	Hinckley	Slight	Severe: Small stones, cutbank, cave	Slight	Slight	Slight	Severe: Small stones, droughty
HpE	Hollis Part	Severe: Slope, Depth to rock, Lg. stones	Severe: Slope, depth to rock, large stones	Severe: Slope, depth to rock, large stones	Severe: Slope, depth to rock, large stones	Severe: Slope, depth to rock	Severe: Slope, depth to rock, large stones
HpE	Charlton Part	Severe: Lg. stones, Slope	Severe: Slope, Large stones	Severe: Slope, Large stones	Severe: Slope, Large stones	Severe: Slope,	Severe: Slope, Large stones
Rn	Ridgebury Part	Severe: percs slowly, wetness Lg. stones	Severe: Wetness, Large stones	Severe: Wetness, Frost action, Large stones	Severe: Wetness. Large stones	Severe: Wetness, Frost action	Severe: Wetness, Large stones

SOILS LIMITAT CHART

Soil Symbol	Soil Name	Septic system	Shallow Excavations	Dwellings W/O Basement	Dwellings W/ Basement	Local Roads and Streets	Lawns and Landscaping
Rn	Leicester Part	Severe: Lg. stones, Wetness	Severe: Large Stones, Wetness	Severe: Wetness, Frost action, Large Stones	Severe: Large Stones, Wetness	Severe: Large Stones, Wetness, Frost action	Severe: Wetness, Large Stones
Rn	Whitman Part	Severe: Wetness, Percs slow, Lg. stones	Severe: Large Stones, Wetness	Severe: Wetness, Frost action, Large stones	Severe: Wetness, Large stones	Severe: Wetness, Frost action	Severe: Wetness, Large stones
SxC	Sutton	Severe: Wetness, Lg. stones	Severe: Wetness, Large stones	Severe: Large stones	Severe: Large stones, Wetness	Moderate: Slope, Frost action	Severe: Large Stones

EXPLANATION OF RATING SYSTEM:

1. SLIGHT LIMITATION: Indicates that any property of the soil effecting use of the soil is relatively unimportant and can be overcome at little expense.
2. MODERATE LIMITATION: Indicates that any property of the soil effecting use can be overcome at a somewhat higher expense.
3. SEVERE LIMITATION: Indicates that the use of the soil is seriously limited by hazards or restrictions that require extensive and costly measures to overcome.

Note: Soil limitations based upon USDA Soil Conservation Service criteria.

APPENDIX B

WORKSHEETS FOR ANALYSIS OF T-INTERSECTIONS

WORKSHEET FOR ANALYSIS OF T-INTERSECTIONS

LOCATION: Nak, Rte 68 @ Union City Rd NAME: RH

HOURLY VOLUMES plus subdivision

Major Street: Rte 68 N

N = 1

Grade 3%

220 V_2

80 V_3

V_5 340

V_4 130

N = 1

V_7 V_9

50 160

☐ STOP ☐ YIELD

N = 1 Minor Street:

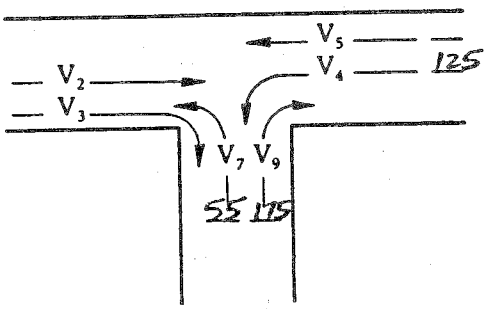
Date of Counts: 1985 estimates

Time Period: PM Peak

Average Running Speed: 40

PHF: 0.85 Grade 0 % Union City Rd

VOLUMES IN PCPH



VOLUME ADJUSTMENTS

Movement No.	2	3	4	5	7	9
Volume (vph)	220	80	130	340	50	160
Vol. (pcph), see Table 10-1			0.95 / 125		1.1 / 55	1.1 / 175

STEP 1: RT from Minor Street ↷ V_9

Conflicting Flow, V_c: $1/2\ V_3 + V_2 = 40 + 220 = 260$ vph (V_{c9})

Critical Gap, T_c, and Potential Capacity, c_p: $T_c = 6.0$ sec (Table 10-2) $c_{p9} = 730$ pcph (Fig. 10-3)

Actual Capacity, c_m: $c_{m9} = c_{p9} = 730$ pcph

STEP 2: LT From Major Street ↰ V_4

Conflicting Flow, V_c: $V_3 + V_2 = 80 + 220 = 300$ vph (V_{c4})

Critical Gap, T_c, and Potential Capacity, c_p: $T_c = 5.2$ sec (Table 10-2) $c_{p4} = 830$ pcph (Fig. 10-3)

Percent of c_p Utilized and Impedance Factor (Fig. 10-5): $(v_4/c_{p4}) \times 100 = 15\%$ $P_4 = 0.9$

Actual Capacity, c_m: $c_{m4} = c_{p4} = 830$ pcph

STEP 3: LT From Minor Street ↶ V_7

Conflicting Flow, V_c: $1/2\ V_3 + V_2 + V_5 + V_4 = 40 + 220 + 340 + 130 = 730$ vph (V_{c7})

Critical Gap, T_c, and Potential Capacity, c_p: $T_c = 7.0$ sec (Table 10-2) $c_{p7} = 290$ pcph (Fig. 10-3)

Actual Capacity, c_m: $c_{m7} = c_{p7} \times P_4 = 290 \times 0.9 = 260$ pcph

SHARED-LANE CAPACITY

$$SH = \frac{v_7 + v_9}{(v_7/c_{m7}) + (v_9/c_{m9})} \text{ if lane is shared}$$

Movement No.	v(pcph)	c_m (pcph)	c_{SH} (pcph)	c_R	LOS
7	55 } 230	260	510	~~280~~ 205	C C
9	175)	730		555	A
4	125	830	- - -	705	A

12/18/85

WORKSHEET FOR ANALYSIS OF T-INTERSECTIONS

LOCATION: Naugatuck, Rte 68 @ Union City Rd NAME: RAD

HOURLY VOLUMES

Major Street: Rte 68 N

N = 1 Grade 3%

220 V_2 → 70 V_3 →

← V_5 340 ← V_4 70

N = 1

1983 ADT converted to 1985 PHV

Date of Counts:

Time Period: PM Peak

Average Running Speed: 40

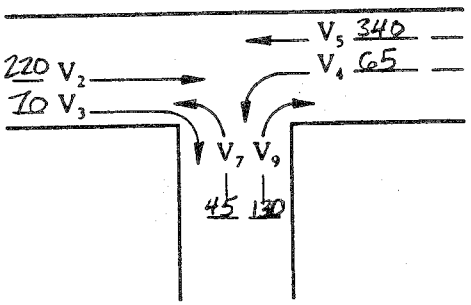
V_7 40 V_9 120

☑ STOP ☐ YIELD

N = 1 Minor Street: Union City Rd

PHF: 0.85 Grade 0 %

VOLUMES IN PCPH



VOLUME ADJUSTMENTS

Movement No.	2	3	4	5	7	9
Volume (vph)	220	70	70	340	40	120
Vol. (pcph), see Table 10-1			0.95 / 65		1.1 / 45	1.1 / 130

STEP 1: RT from Minor Street ← V_9

Conflicting Flow, V_c: $1/2\ V_3 + V_2 = 35 + 220 = 255$ vph (V_{c9})

Critical Gap, T_c, and Potential Capacity, c_p: $T_c = 6$ sec (Table 10-2) $c_{p9} = 750$ pcph (Fig. 10-3)

Actual Capacity, c_m: $c_{m9} = c_{p9} = 750$ pcph

STEP 2: LT From Major Street ↰ V_4

Conflicting Flow, V_c: $V_3 + V_2 = 70 + 220 = 290$ vph (V_{c4})

Critical Gap, T_c, and Potential Capacity, c_p: $T_c = 5.2$ sec (Table 10-2) $c_{p4} = 850$ pcph (Fig. 10-3)

Percent of c_p Utilized and Impedance Factor (Fig. 10-5): $(v_4/c_{p4}) \times 100 = 8\%$ $P_4 = 0.95$

Actual Capacity, c_m: $c_{m4} = c_{p4} = 850$ pcph

STEP 3: LT From Minor Street ↱ V_7

Conflicting Flow, V_c: $1/2\ V_3 + V_2 + V_5 + V_4 = 35 + 220 + 340 + 70 = 665$ vph (V_{c7})

Critical Gap, T_c, and Potential Capacity, c_p: $T_c = 7$ sec (Table 10-2) $c_{p7} = 340$ pcph (Fig. 10-3)

Actual Capacity, c_m: $c_{m7} = c_{p7} \times P_4 = 350 \times 0.95 = 330$ pcph

SHARED-LANE CAPACITY

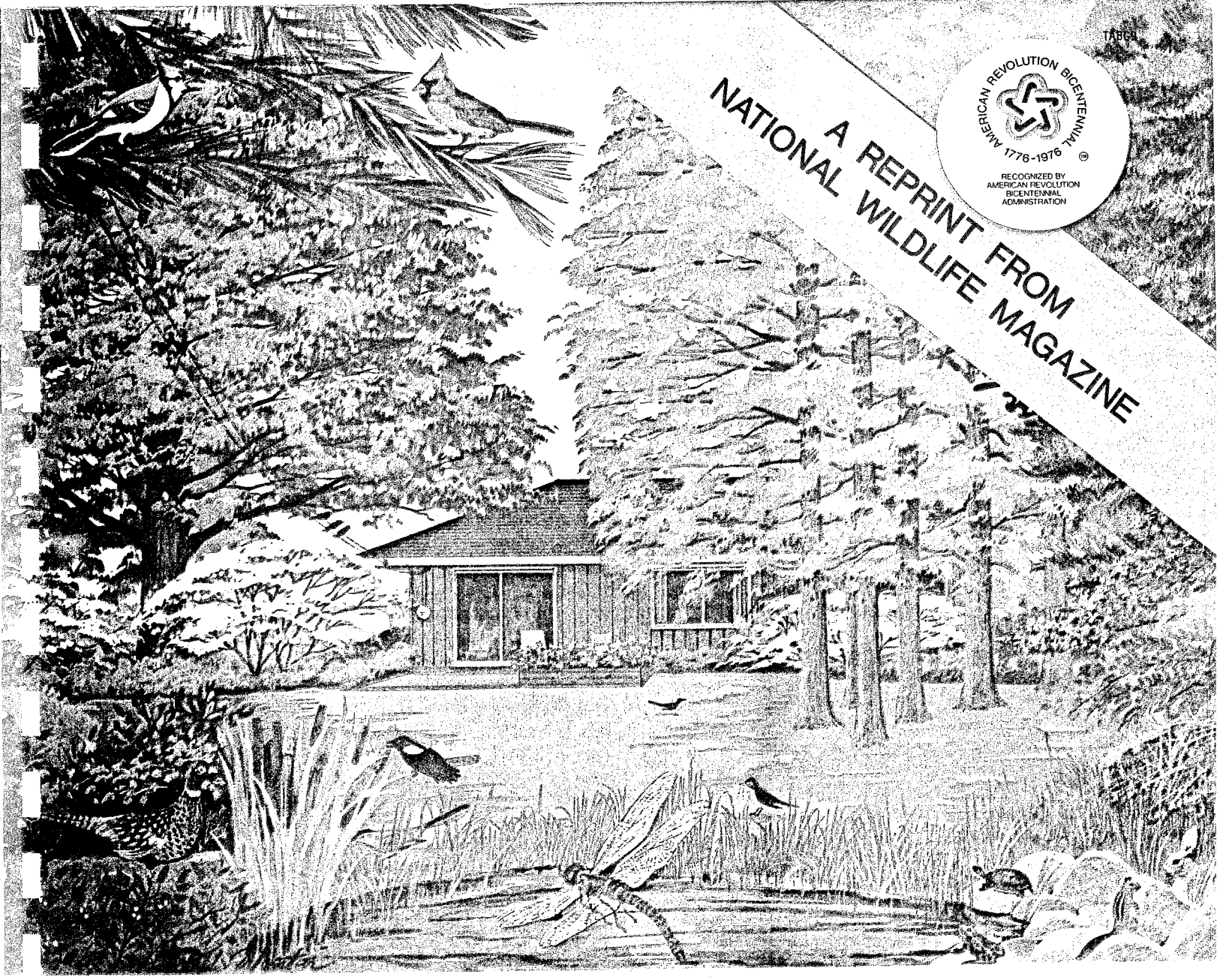
$$SH = \frac{v_7 + v_9}{(v_7/c_{m7}) + (v_9/c_{m9})} \text{ if lane is shared}$$

Movement No.	v(pcph)	c_m (pcph)	c_{SH} (pcph)	c_R	LOS
7	45 ~~175~~	330	~~566~~ 330	~~391~~ 285	B C
9	130	750	750	620	A
4	65	850	---	785	A

12/18/85

APPENDIX C

BACKYARD WILDLIFE MANAGEMENT GUIDE



A REPRINT FROM NATIONAL WILDLIFE MAGAZINE

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

RECOGNIZED BY AMERICAN REVOLUTION BICENTENNIAL ADMINISTRATION

TABCO

THE NATIONAL WILDLIFE FEDERATION says:

Invite wildlife to your backyard

BY JACK WARD THOMAS, ROBERT O. BRUSH AND RICHARD M. DeGRAAF

GO OUT IN YOUR BACKYARD and look around. Watch the fish weaving among the water lilies, the dragonflies moving in glittering arcs above the little pool. Don't move — the robins are busy feeding their youngsters in that nest above your head; squirrels are edging down the beech trunks behind you and darting into the shrubbery. The wisteria on your stone wall is almost irresistible to the hummingbird that just appeared, and song sparrows are adding their notes to a tangle of birdsong sifting down from the oaks and maples. If you're really patient, that timid cottontail might bring her brood onto the grass for one last taste of the dew-silvered grass.

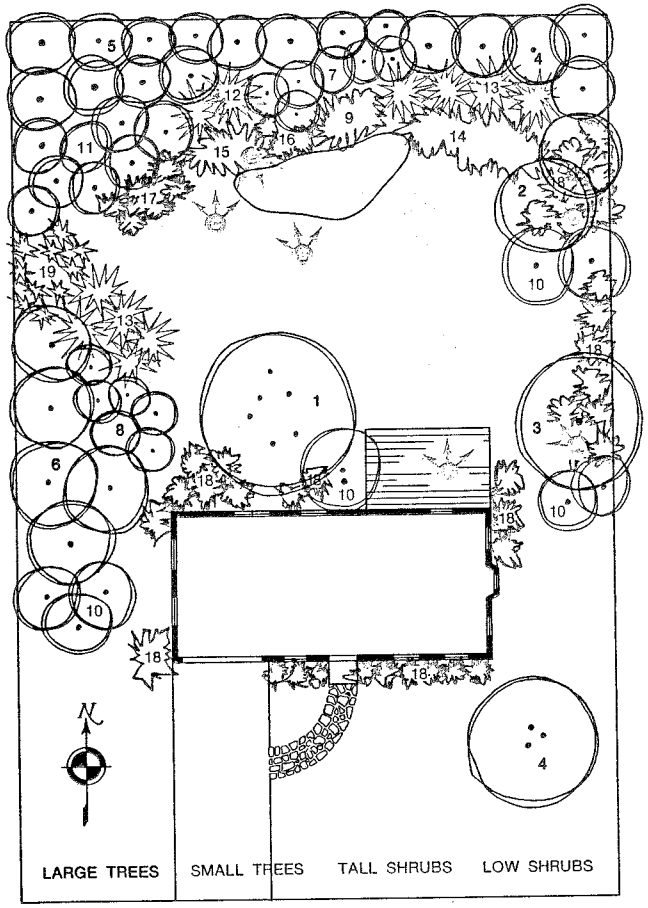
This isn't your yard, you say? It could be. If you have even a quarter-acre of crabgrass right now, you can turn it into a wildlife habitat as beautiful and gratifying as the one above. A few square yards — yes, even a window box

Your backyard can look like this — for as little as $200 and a plan like ours. This lot, viewed from the rear, has the mature plantings that attract a maximum variety of wildlife. On page 7, you can see this idealized wildlife habitat as viewed from the house patio.

Reprinted from April-May 1973 National Wildlife Magazine, a membership publication of the National Wildlife Federation, 1412 16th St. N.W., Washington, D.C. 20036

The logo in the upper right corner of this page symbolizes recognition of the National Wildlife Federation's Backyard Wildlife Habitat Program as an official Bicentennial activity. Participants enhance the quality of life in America's third century.

After the initial planting of trees, shrubs, flowers and herbs the first year, robins and other birds will feed on the lawn, and ground-feeding sparrows and finches will forage among the shrubs and flowers. Bird nesting will be limited, but many species will be attracted by the feeders and water.



The overhead view of this ideal backyard plan keys plantings to table on pages 4-5, and gives artist's viewing position in illustrations for food (A), water (B), cover (C), and reproductive area (D) on pages 8 -11. Page 1 view is from backyard (E); Stages I, II, and III are viewed from terrace (F). Backyard area is 100 by 120 feet (about one-quarter acre).

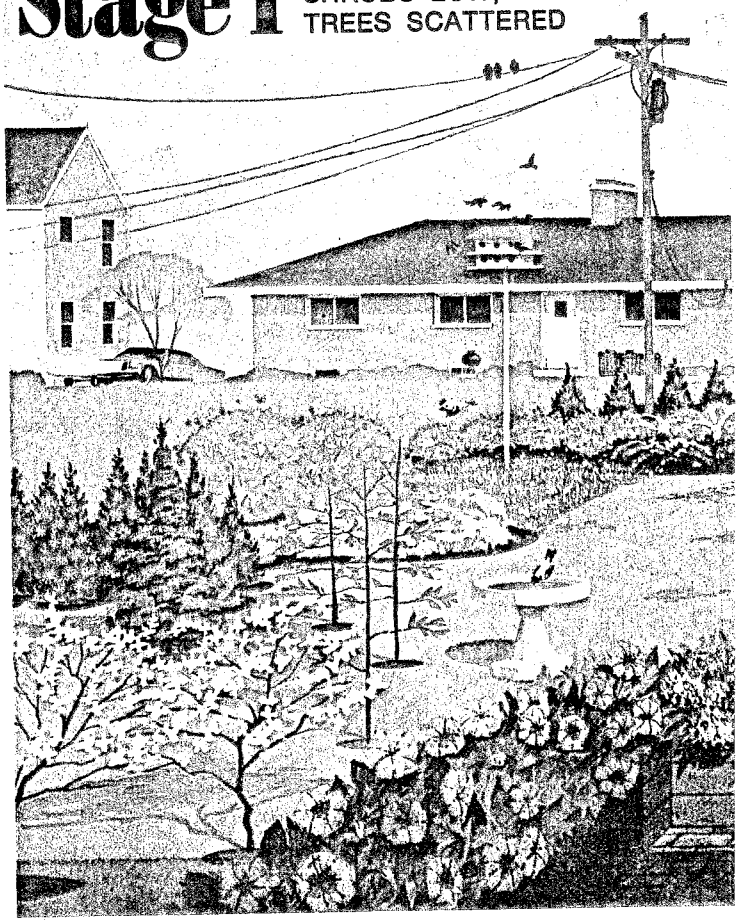
– can become a wildlife refuge-in-miniature. You start with a dream – but then you need a plan. Want to have your own wildlife haven? Well, here is the plan . . .

Where do you start? This backyard habitat plan is divided into three model stages. No matter what your backyard looks like now, it will fit into one of them, give or take a few years' growth. But, before you do anything, put your plan on paper, no matter how crudely. Because the planning you do at the outset will determine the whole course of your backyard wildlife program.

No matter how large or small your backyard is, you use the same basic principles to attract wildlife

Stage I

FIRST YEAR PLANTING;
SHRUBS LOW;
TREES SCATTERED



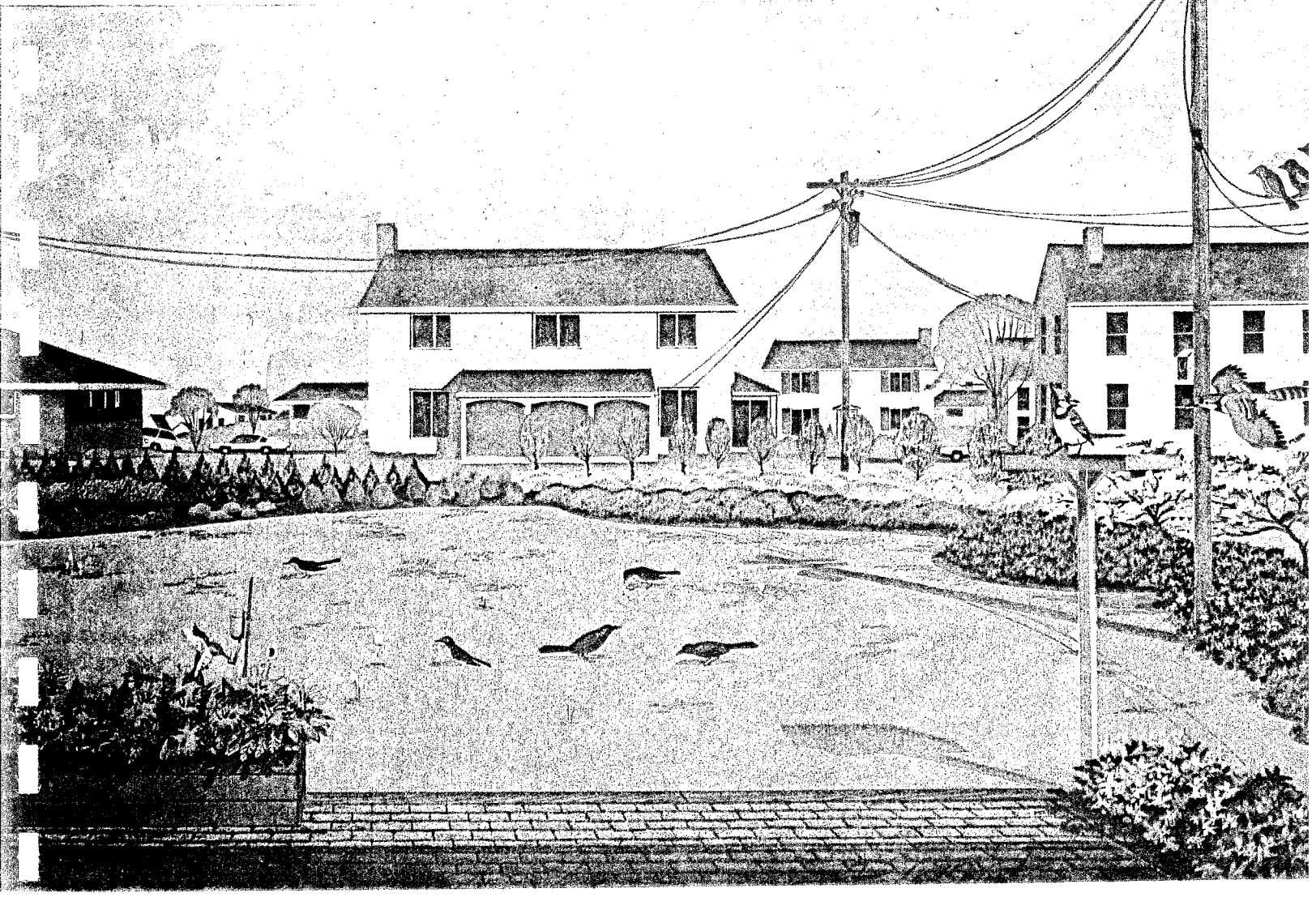
Stage I. If you start with only a sodded yard, and plant the trees, shrubs and herbs suggested on pages 4-5, your yard will be in Stage I. At this point you will already have some sparse, but usable wildlife habitat. In the early years, you really need to augment food and water resources with artificial feeders and birdbaths. Bird nesting will be limited, but here you can help with nesting boxes. Robins will feed on the lawn and ground-feeding sparrows and finches may forage among the shrubs and flowers. Cottontails may also come occasionally.

If you already have trees and shrubs in your yard but the kind, numbers and placement don't fit the total backyard habitat program outlined here, work out your own version of this plan. Use what you have to best advantage. Take out undesirable plants and relocate others.

Leave enough open space so you can observe wildlife without disturbing it. Consider the eventual heights of your plantings so the taller ones will be in the rear. Vary the heights of masses for a visually pleasing growth.

Stage II. It takes a yard about 5 to 10 years to progress from the initial plantings of Stage I to the fairly mature shrub condition of Stage II. The trees will be about 25 feet tall. If your yard is in this stage now, but is a dense wooded area of young trees and shrubs, make a plan to thin vegetation to achieve a balanced habitat.

In Stage II there will be enough flowers and fruits to



attract a variety of birds and insects, which will in turn attract reptiles and amphibians. A small pond will replace the birdbath. Robins will raise broods in the trees. Catbirds, cardinals and song sparrows will nest in the denser shrubbery. Dusk will bring rabbits to browse in the security of your yard. Mornings will find chipmunks emerging from holes in your stone wall to scurrry up trees.

Stage III. Starting from scratch, you can expect Stage III 30 to 40 years after initial planting. This means a yard with varied mature trees, with hardwoods in full fruit production, plus mature shrubs and sufficient open areas.

If, however, your yard has little shrubbery, but already has a reasonable number of these trees producing fruits and nuts, you can plant shrubbery and low vegetation to achieve Stage III in 5 to 10 years.

NATIONAL WILDLIFE *worked over a period of months with Ralph Winter, noted architectural artist, and a research team to develop this backyard wildlife feature. The authors are U.S. Forest Service specialists researching urban habitat needs for wildlife at the Environmental Forestry Research Unit, Amherst, Mass. Jack Ward Thomas, Unit Leader, and Richard M. DeGraaf are wildlife biologists; Robert O. Brush is a landscape architect experienced in wildlife management.*

This stage attracts the maximum number of wildlife species. Orioles and tanagers will nest in the higher branches; foliage-gleaning warblers will feed in the treetops. Rabbits will feed on the lawn and low shrubs and may even raise their young in well-hidden nests. Squirrels will live in tree hollows or nest boxes, if available. Chipmunks, field mice, garter snakes, toads, butterflies and other insects may make your backyard home.

As darkness falls, bats and nighthawks may swing through the sky on feeding flights. Deeper into the night, whip-poor-wills and owls will mingle their calls with croaks of frogs and the chirps and trills of katydids.

Four wildlife needs. All wildlife, indeed all life, requires four basic elements to survive: food; water; cover as protection from natural enemies and the elements; and areas where they can reproduce and bear their young in safety. Combinations of these four elements are unique for each species, but you can plan a habitat that offers enough combinations to attract the greatest number and variety of wildlife your area will support.

Working with the natural resources at your disposal, your aim should be to plan the vegetation, supply water and natural, as well as artificial food, so that you provide the maximum number of homes for wild creatures.

Be sure to select your plants carefully to provide the maximum overlap of flowering and fruiting times. Food

Shrubs are almost full-grown and trees are about 25 feet high with 5-10 years' growth. Enough flowers and fruits are present to attract birds and insects, which will in turn attract reptiles and amphibians. Rabbits and chipmunks should appear at this stage. Many birds can nest in the shrubbery.

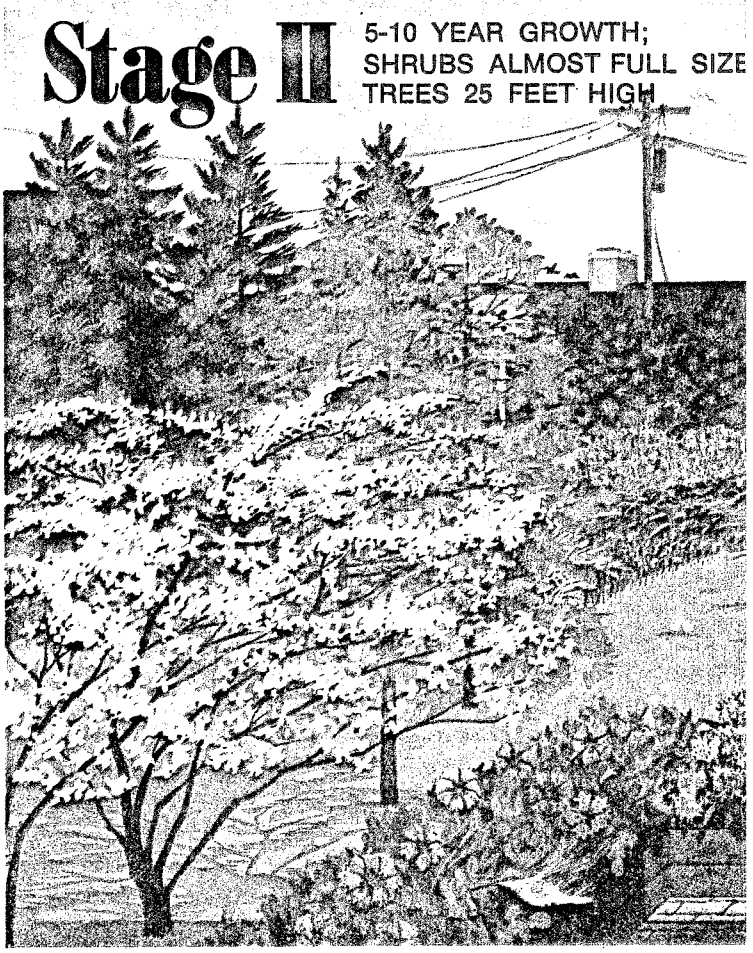
should be available as needed. For birds, this means a year-round supply. If you have bird feeders, continue to fill them through the spring until new growth takes over.

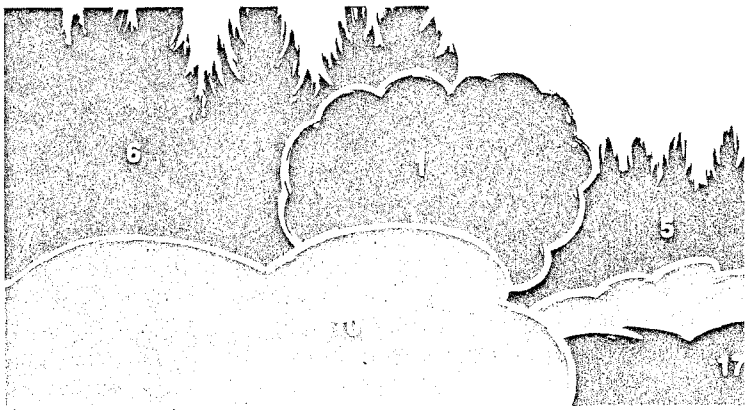
Trees. Trees are the key element in progressing to Stage III because they take the longest to reach maturity. They're essential to most backyard wildlife, providing food, cover, and nesting sites for many songbirds as well as squirrels and raccoons.

Get advice locally on species best suited to your lot, considering soil, moisture, nutrients and sunlight. It is possible to overcome some natural limitations through watering, landscaping and fertilizing.

Shrubs. They are really more important than trees in your wildlife program. Shrubs are less fussy, grow faster and provide food, cover and reproduction areas for a great variety of wildlife which lives on or near the ground. Don't prune the lower branches.

Blend your plantings. How you arrange your trees and shrubs is important. This suggested plan uses all of the basic principles of wildlife management to best advantage. For example, wildlife researchers have found





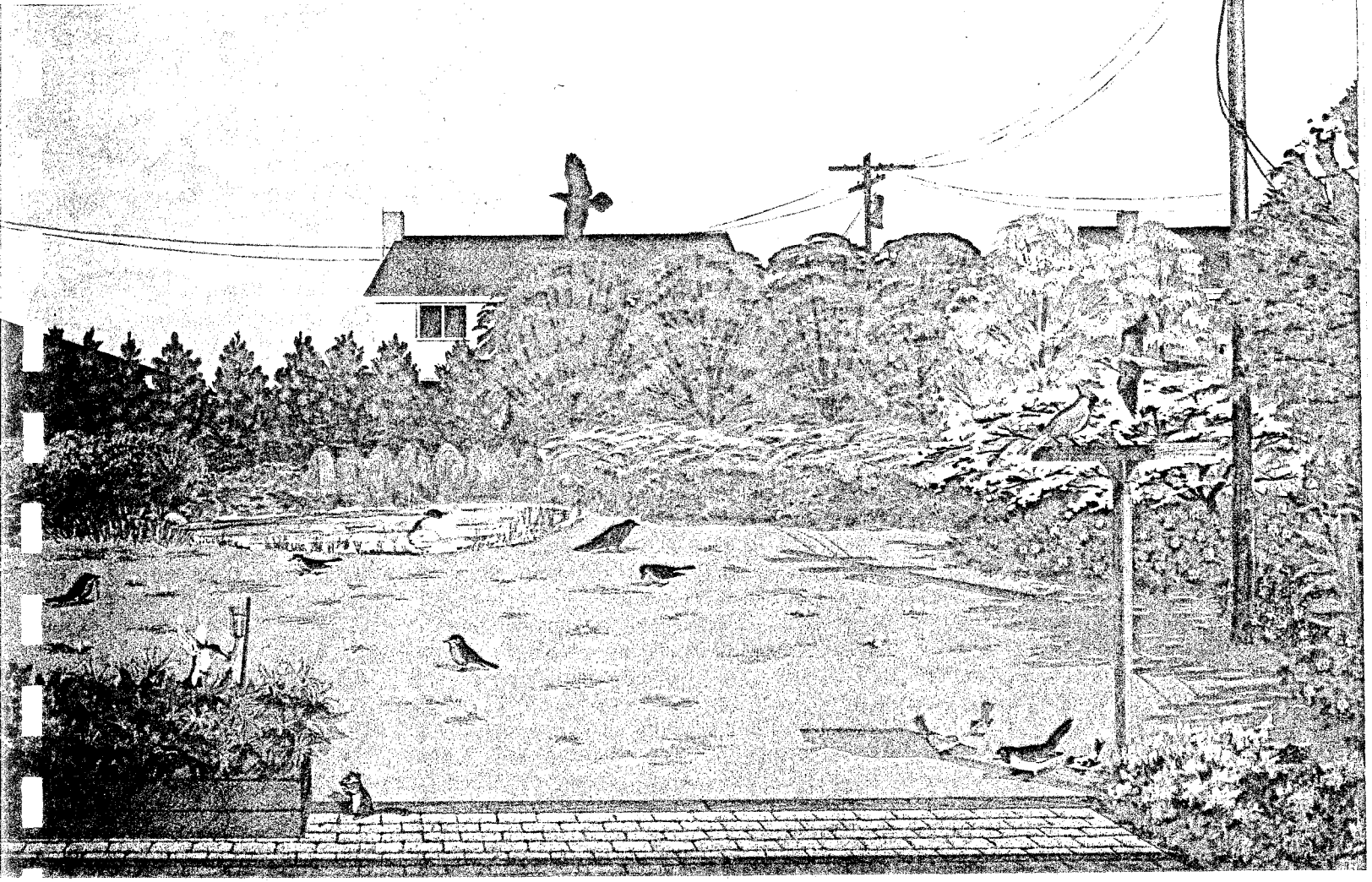
Key to Backyard Plantings

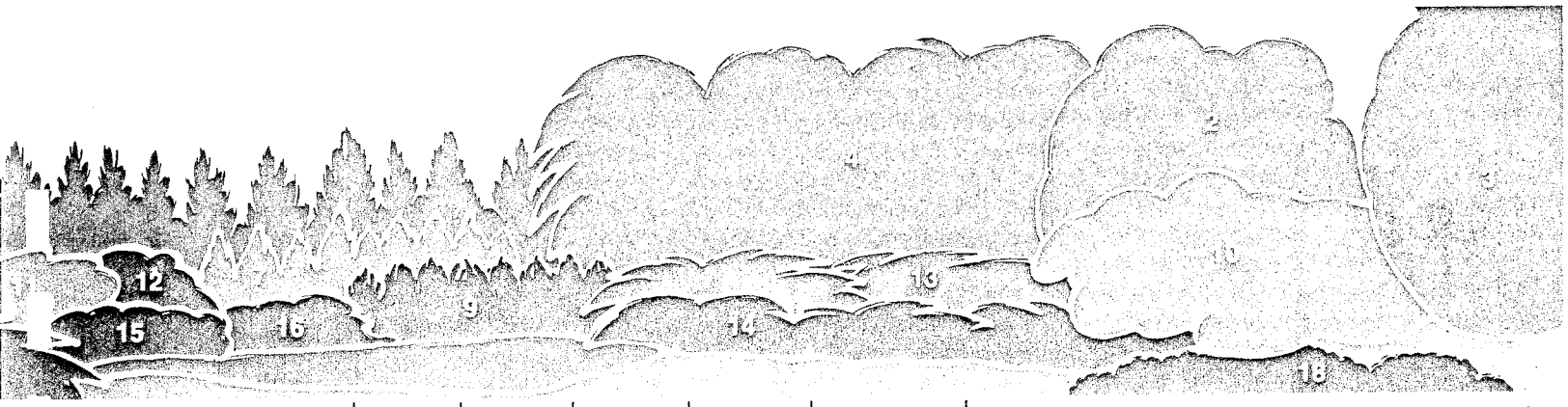
This list contains the plant materials suggested in our backyard wildlife plan for the Northeast. You may substitute others (see list on pages 6 - 7), but remember to select a variety of species that produce a year-round supply of food. Also, be sure that moisture and light requirements match your yard's conditions.

All the plants are available at commercial nurseries; many can also be transplanted from the wild.

An excellent guide to wildlife food habits is *American Wildlife and Plants* by Alexander C. Martin, Herbert S. Zim and Arnold L. Nelson (McGraw-Hill).

SPECIES	MATURE HEIGHT	FLOWERS	FRUITS	SUN/ SHADE	WET/DRY	WILDLIFE SERVED
Trees						
1. Beech	50-100′		Sept-Oct	Lt shd/sun	Moist	Nuts, seeds, acorns: fall and winter food for squirrels, large songbirds. Spring, summer foliage: cover and reproductive areas for songbirds, tree-dwelling mammals, insects. Leafless branches: winter roosting for birds.
2. Red oak	50-100′		Sept-Oct	Lt shd/sun	Moist	
3. White oak	40-100′		Sept-Nov	Lt shd/sun	Moist/dry	
4. Red maple	40-100′			Shd/sun	Moist/ well-drained	
5. White pine	40-100′		Aug-Sept	Sun	Dry	Cones: fall, winter food for pine squirrels, songbirds. Boughs: year-round cover, reproductive areas for songbirds, tree-dwelling mammals, insects.
6. White spruce	40-100′		Aug-Sept	Sun	Dry	
7. Hemlock	50-80′			Shd/sun	Moist	
8. Red cedar	30-80′		Sept-May	Sun	Moist/dry	
Small Trees						
9. Winterberry	10′	May	Oct	Lt shd	Wet/moist	Flowers: food for butterflies, other insects. Berries, fruit: fall, winter food for songbirds. Spring, summer foliage: cover, reproductive areas for songbirds. Leafless branches: winter cover, roosting for songbirds.
10. Flowering dogwood	10-40′	Mar-June	Aug-Nov	Sun	Well-drained/ dry	
Shrubs						
11. Hawthorne	10-20′	June	Oct-Mar	Sun	Dry	
12. Crabapple	15-30′	Mar-May	Sept-Nov	Sun	Moist/dry	
13. Autumn olive	10′	May-July	Sept-Feb	Sun/lt shd	Moist/dry	
14. Silky dogwood	6-8′	May-July	Aug-Sept	Sun/lt shd	Wet to dry	
15. Red osier dogwood	to 10′	May-Aug	July-Oct	Sun	Moist/wet	





SPECIES	MATURE HEIGHT	FLOWERS	FRUITS	SUN/ SHADE	WET/DRY	WILDLIFE SERVED
16. Elderberry	3-13′	June-July	Aug-Sept	Sun	Moist/wet	Spring, early summer flowers: food for butterflies, other insects. Berries: food for songbirds. Foliage: cover, reproductive areas for songbirds, mammals, reptiles, amphibians, insects. Dead branches: winter cover for ground-dwelling mammals and birds.
17. Blackberry	to 10′	May-July	July-Sept	Sun	Moist	
18. Rhododendron	10-15′	May-July	Aug-Dec	Shd	Moist	Spring flowers: food for butterflies, other insects, hummingbirds. Foliage: dense cover, reproductive areas for songbirds, mammals. Rhododendron foliage: winter cover for songbirds, mammals.
19. Honeysuckle	to 10′	June-July	July-Sept	Sun/shd	Well-drained/ dry	
Annual Flowers						
20. Sunflowers	to 5′	Aug-Oct	Sept-Nov	Sun	Moist/dry	Flowers: food for butterflies, other insects. Seeds: late-summer, fall, winter food for many seed-eating birds, especially sparrows.
21. Asters	to 4′	Aug-Oct	Sept-Nov	Sun	Moist	
22. Daisies	to 2′	June-Aug	July-Sept	Sun	Dry	
23. Marigolds	to 2′	Aug-Oct	Sept-Nov	Sun	Moist/dry	
24. Black-eyed Susans	to 2′	June-Sept	July-Sept	Sun	Dry	

Mature trees, more than 50 feet tall, characterize a yard in Stage III, 30-40 years after initial planting. Hardwoods in full fruit production will provide food for squirrels and jays. Orioles and tanagers might rear young in higher branches. This stage will attract the maximum number of wildlife species.

that different plant growth forms – grasses, shrubs, trees – planted around open areas create the "edge effect." These edges attract the greatest variety and numbers of wildlife to the smallest piece of land.

When do you start? Today. Of course, the best time to plant trees and shrubs is spring or early fall. But you can make your all-important plan, clear out unproductive growth, and prepare your soil almost any time. Maybe you'll build a bird feeder the first rainy weekend.

What's the cost? The answer to that is how much do you want to spend? You can make your own plans, provide your own muscle power and, if you don't mind waiting a little while for concrete results, you can start with quite small plant materials.

Retail nursery and garden centers are equipped to give you advice and supply the needed plants. Mail order nursery catalogs carry a wealth of information.

If cost is not a concern, you can hire a landscape architect to design your own backyard and a landscape firm to do the installation. This way you will see the fastest results in the shortest time.

You will have additional cost for periodic maintenance. But expenditures for fertilizer, water and labor are no more for this kind of wildlife backyard than for a lawn.

How big a backyard? The backyard brought to life on these pages is about 100 feet by 120 feet (about one-fourth acre). If your yard is smaller, it may be difficult to provide food, water, cover and breeding areas for many species. But it *is* possible to provide one or more of them and attract *some* wildlife.

If you have no yard at all, you can still provide food and water in window box planters (see page 12). These can bring a little piece of nature into the lives of even apartment dwellers – provided, of course, that some bird life is already present, your apartment is not too high above the ground, and you can open your windows. Your window box can support the same basic processes as any natural area – soil, water, sunlight and plants combining to produce life in a microcosm. With a little luck, birds will make your window box a part of their lives.

If your yard is larger than our model, you're lucky. You can use the same basic principles to create a wildlife habitat which is vastly more effective because it can be more complete, diverse and stable (see page 12). It takes an acre or more to attract animals higher in the food chain – those that live on other animal life. These would include hawks and owls, as well as raccoons, skunks and foxes, which eat both plants and small animals.

Cooperation with neighbors to provide a larger area of suitable habitat will multiply the effects of your efforts

Regional Equivalents for Plantings

The plant materials listed on pages 4-5 and illustrated on these pages grow best in the Northeast. Use this list to select those best suited to other areas.

HERBACEOUS GROWTH

Northeast
Panicgrass
Timothy
Sunflower

Southeast
Lespedeya spp.
Panicgrass
Sunflower

Northwest
Turkeymullein
Timothy
Sunflower
Filaree
Lupine
Fiddlenecks
Tarweed

Southwest
Turkeymullein
Sunflower
Filaree
Lupine
Fiddlenecks

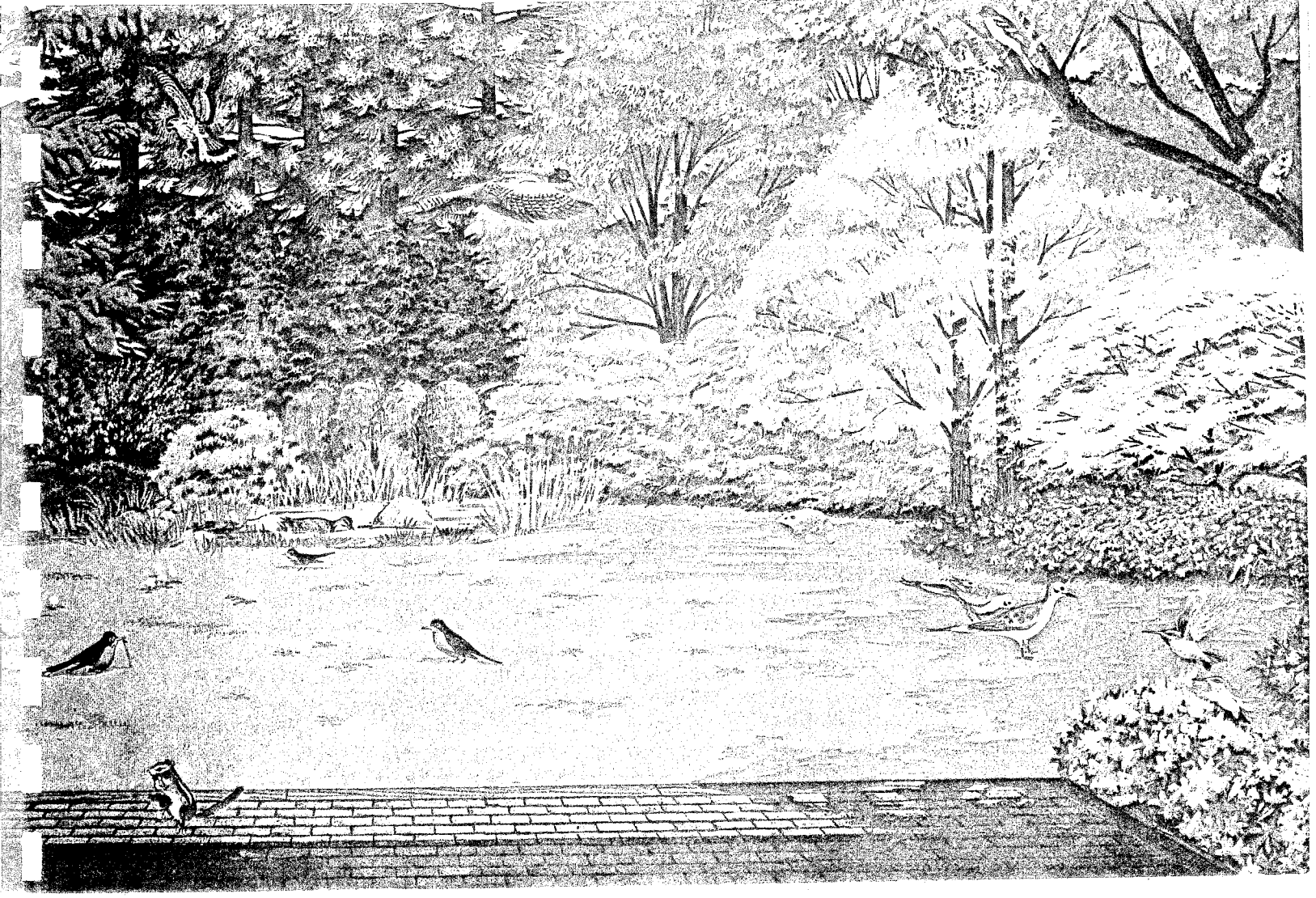
LOW SHRUBS

Northeast
Blackberry
Blueberry
Huckleberry
Snowberry

Southeast
Blackberry
Blueberry
Bayberry
Spicebush
Huckleberry

Northwest
Blackberry
Blueberry
Snowberry
Oregon grape

Southwest
Utah juniper
Blackberry
Spicebush
Prickly pear
Algerita



TALL SHRUBS

Northeast
Sumac
Dogwood
Elderberry
Winterberry
Autumn olive
Wisteria

Southeast
Sumac
Dogwood
Elderberry

Northwest
Sumac
Bitterbrush
Russian olive
Elderberry
Buckthorn
Madrone

Southwest
Mulberry
Lote bush
Sumac
Manzanita
Madrone

SMALL TREES

Northeast
Flowering dogwood
Crabapple
Hawthorn
Cherry
Serviceberry
Red cedar

Southeast
Holly
Dogwood
Serviceberry
Cherry
Persimmon
Red cedar
Palmetto
Hawthorn
Crabapple

Northwest
Serviceberry
Dogwood
Hawthorn

Southwest
Serviceberry
Dogwood
Mesquite
Crabapple

TALL TREES

Northeast
Coniferous
White pine
Hemlock
Colorado spruce
Deciduous
Sugar maple
White oak
Red oak
Beech
Birch

Southeast
Coniferous
Longleaf pine
Loblolly pine
Shortleaf pine
Deciduous
Ash
Beech
Walnut
Live oak
Southern red oak
Black gum
Pecan
Hackberry

Northwest
Coniferous
Douglas fir
Ponderosa pine
Western white pine
Lodgepole pine
Colorado spruce
Deciduous
Oregon white oak
California black oak
Bigleaf maple

Southwest
Coniferous
Arizona cypress
Pinon pine
Deciduous
Live oak
Pine oak
Bitter cherry

Wildlife has the same needs in your yard as in National Forests... food, water, cover and suitable sites for reproduction

It works anywhere. While this backyard plan is designed for the Northeast, you can apply these same principles wherever you live. In Miami, fill your yard with night-blooming jasmine and lemon trees and listen to the mockingbirds. In Tucson, plant flowering cactus and enjoy the white-winged doves. In Seattle, grow lupine and attract western bluebirds. In a window box or a national forest, the same principles apply. So, no matter where your yard is, or how big it is, you can refer to the substitution chart on pages 6-7 for suitable plant materials.

Where to get help. Your county agricultural agent or state university landscape specialist has free advice on a wide variety of problems you may encounter. So does your local nurseryman. If you live in a Soil Conservation District, you can get help on water and soil problems from that office. Some state game departments have staff biologists that can help you. Your local zoo, natural history museum or nature center can tell you the specific needs of wildlife in your area. And some commercial nursery catalogs are gold mines of information.

Don't expect too much. The illustrations on these pages show the variety of wildlife that might visit your backyard over a 24-hour period. However, it will be impossible for you to attract every kind of animal you would like to see in your backyard. The combinations and amounts of food, water, shelter and breeding sites for each species are too complex and varied.

Only a limited number of animals can use a single yard as home, particularly during the breeding season when a bird may require a larger territory and will defend it against others. Once the breeding season ends, however, territorial defense stops and additional individuals and species may use your backyard.

Include your neighbors. Your small island of good habitat will be a happy haven for some wildlife. But you'll be more successful if you can persuade your neighbors to cooperate in a backyard habitat program. And as the trend toward urbanization continues, green space for people and plantings for wildlife will become increasingly important. By cooperating with your neighbors, you can create "wildlife neighborhoods" that will aid wildlife and make life more fun for you and your family.

Informally, you can share plant materials and ideas. Formally, you can plan together. For example, if your yard is in Stage I, with only grass and shrubs, and is next to a neighbor's yard with 25-foot trees, the combined habitat would be close to Stage II in completeness. If you are lucky enough to have a neighbor with a stream or pond, or with a fairly wild woodlot or field, your total

Food

Food for wildlife is easy to furnish. You can supplement natural growth with a variety of products, especially for seed-eating birds. In fact, many people who don't have enough land to provide water, cover and reproductive areas can enjoy some wildlife through feeding alone.

The ideal wildlife management plan, however, supplies as much food as possible through vegetation, and variety — from berries to nuts — is necessary to meet the year-round needs of many species.

But don't make the mistake of considering food provision the beginning and end of wildlife management. Food must be accompanied by the other three habitat elements to enable wildlife to live in your yard.

Mallard ducks turn "bottoms up" in search of aquatic plants.

Male towhee scratches in dead leaves for an insect meal.

Water

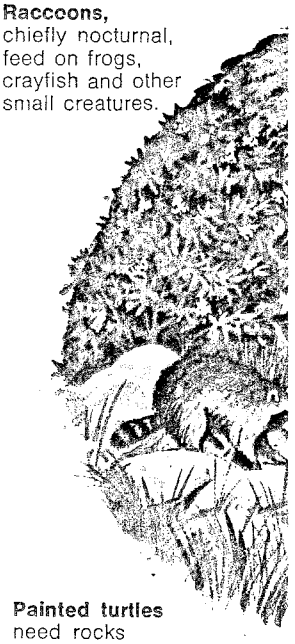
You can fulfill wildlife's critical water needs — drinking and bathing — with a simple bird bath or ground watering device. Most desirable, however, is a small pool with an area large enough to support plants that grow in water, as well as around the edge. It will become the scene for a broad range of wildlife activity.

During the night, raccoons might make feeding forays while bats sweep the air above the pool for insects. In very early morning and late evening, rabbits will feed on the succulent growths around the edge, to the accompaniment of a nighthawk's plaintive "peent" as it, too, hunts insects overhead. Activity will drop during the day, but birds will still use the area for watering and bathing, turtles and frogs for sunning.

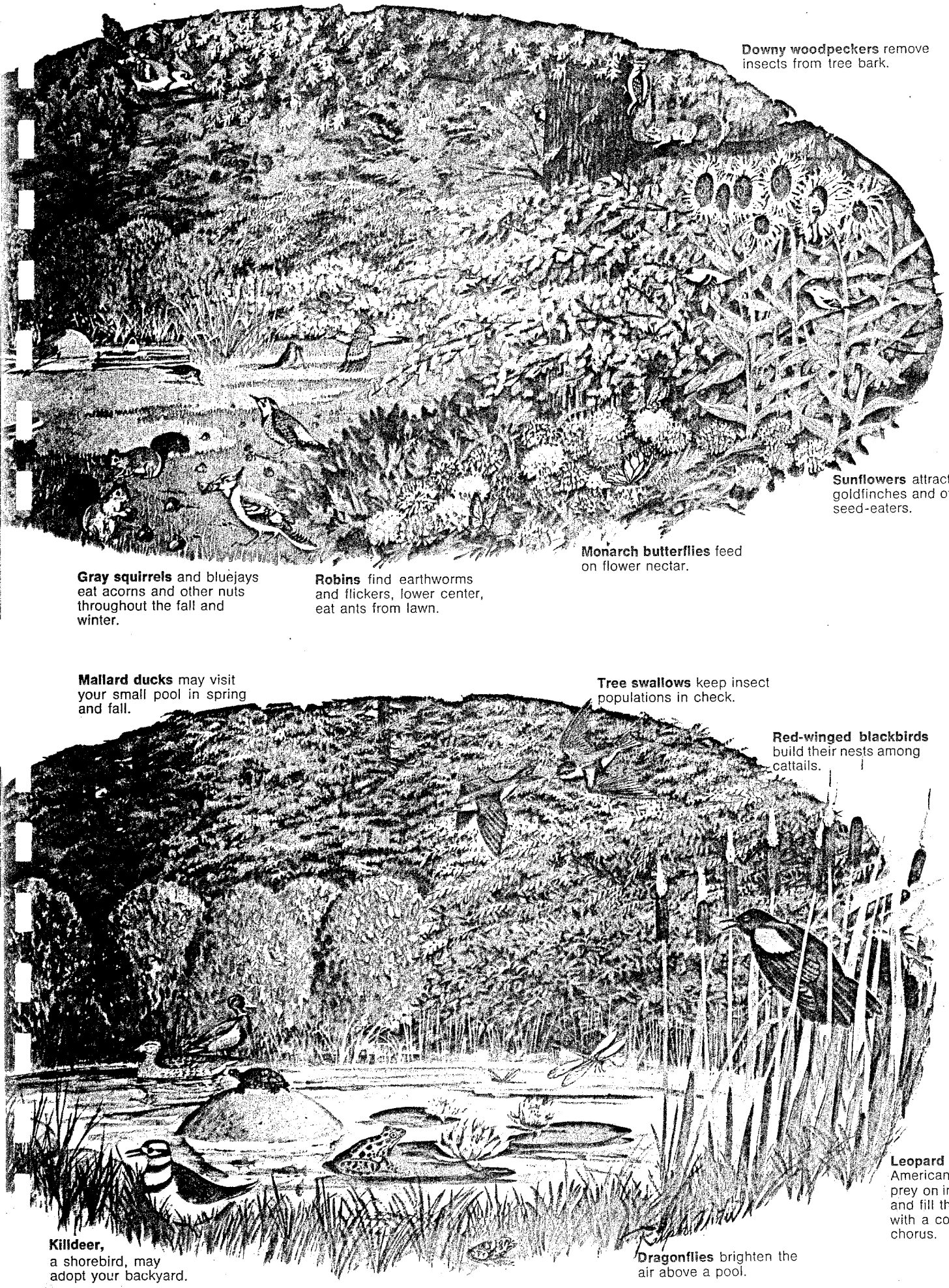
You can encourage winter activity by keeping a section of the pool ice-free; use a livestock trough warmer.

In addition to its wildlife value, the water area will provide a key focal point in the landscape design. Locate it to provide maximum visibility from the terrace or windows of the house.

Raccoons, chiefly nocturnal, feed on frogs, crayfish and other small creatures.



Painted turtles need rocks and logs for sunning.



Downy woodpeckers remove insects from tree bark.

Sunflowers attract goldfinches and other seed-eaters.

Monarch butterflies feed on flower nectar.

Gray squirrels and bluejays eat acorns and other nuts throughout the fall and winter.

Robins find earthworms and flickers, lower center, eat ants from lawn.

Mallard ducks may visit your small pool in spring and fall.

Tree swallows keep insect populations in check.

Red-winged blackbirds build their nests among cattails.

Killdeer, a shorebird, may adopt your backyard.

Dragonflies brighten the air above a pool.

Leopard frogs, American toad, prey on insects and fill the night with a country chorus.

Avoid uniformity; the greatest variety of wildlife species is found where one habitat type blends into another

habitat will attract wildlife much more successfully than your yard could alone. And if your neighbor likes wildlife too, he's not as likely to complain if rabbits wander into his cabbage patch.

Unwelcome wildlife. Let's face it, some wildlife tenants are unwelcome. Rabbits may girdle shrubs. Squirrels may rob bird feeders or get into attics. Snakes repel some people, and bees and wasps may sting if disturbed. You have two choices when faced with undesirable species. You can accept the situation, or you can control it.

If you decide on control, you can either alter the habitat to eliminate the life requirements of the unwanted animals, or directly remove the offending individuals. You can discourage squirrels by using bird feeders that are squirrel-proof, taking down winter nest boxes, sealing the attic and covering tree holes with tin. Or you may want to live-trap the squirrels and transplant them.

While the actions of dogs and cats, whether pets or strays, are natural and part of the drama of nature, you can do this: increase the cover, move the bird feeder out of reach of cats, or move it closer to protective cover. Or, chain the dog, bell the cat, build a fence.

What's the pay-off? As your habitat develops and grows, it will become an increasingly exciting and intimate part of your family's life. Your backyard can become a stage where wild animals are the stars and people the audience. Inviting wildlife to your backyard is probably the best way for children to learn a simple tenet of the complex science of ecology: life operates in one large system and everything in that system is interconnected; any change in one part affects the rest of the system.

The case presented here is simple. Man's habitat can be wildlife habitat, too. If we are to maintain any contact between urban and suburban man and nature, we must share our living space. Also, studies show that property values rise from three to ten percent with the addition of vegetation and good tree cover.

What's really important. Anthropologist Rhoda Metraux has said that only when man has incorporated into the urban setting all that he once gained through living in nature will he be "fully and faithfully . . . urbanized."

Our society has been alerted to the deterioration of our environment, and we have heard the call to great crusades, both public and private. Yet there is a question in many minds: what can one person do?

You can improve your own environment with plans like these-and, in doing so, exhibit a concern for, and a faith in, the solution of environmental problems. And you can do it where it means most to you – in your own backyard.

Cover

Cover is any place that protects animals from predators and the weather. Different species have different cover requirements: rock piles or stone walls for chipmunks and lizards . . . brush piles or dense shrubs for cottontails and towhees . . . evergreens for chickadees and pine squirrels . . . water for frogs and turtles.

Cover also serves as a home base — the farther an animal must venture from cover, the more vulnerable it is to predators. So try to provide cover close to food and water. Many cover plants can also be food plants.

You can also arrange cover to please the eye. Define your yard's open spaces with trees, shrubs and stone walls, grading their heights so tall trees and shrubs won't block open areas and low growth from view.

Hooded warbler uses dense cover to escape from sparrow hawk.

Reproductive areas

All wildlife needs a specific kind of cover where it can produce young, and, in most cases, raise them. Each reproductive area must offer protection from the elements and be relatively safe — either inaccessible to predators or well hidden.

The diversity of cover you need for a complete habitat requires mature trees. These provide den sites for squirrels and nesting places for both high- and low-nesting birds.

Until your habitat is complete, you can compensate for a lack of big trees with nest boxes for squirrels and some birds — English sparrows, house wrens and tree swallows will probably use them.

Unmowed lawn edges and low shrubs are perfect sites for song sparrows and cottontails; the moistness will attract katydids, crickets and grasshoppers.

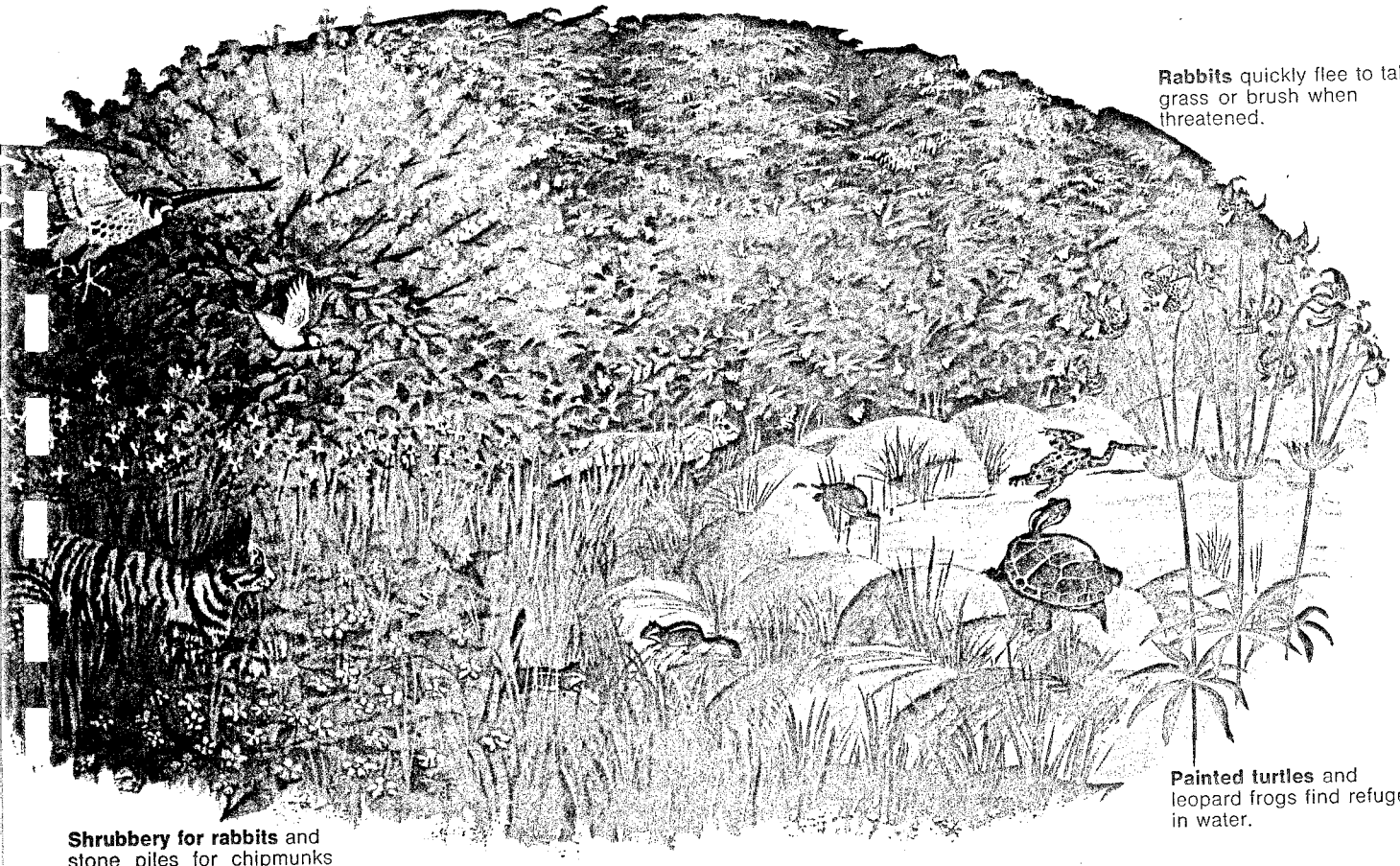
Frogs, toads, salamanders and fish may deposit their egg masses in the pool and its vegetation, and water insects such as dragonflies, waterstriders and back-swimmers will breed there.

Cardinals, center, need dense shrubbery for nesting.

Painted turtles live in water, but lay eggs on land near pool.

Mallards need high grass near water to nest and raise broods.

Rabbits make their hair-blanketed nests in tall grass.



Rabbits quickly flee to tall grass or brush when threatened.

Painted turtles and leopard frogs find refuge in water.

Shrubbery for rabbits and stone piles for chipmunks provide cover from cats and dogs.

Scarlet tanager's stick nest is flat and usually placed on high branch.

Robins nest in forks of low trees and shrubs.

Nest boxes for gray squirrels should be at least 20 feet above the ground.

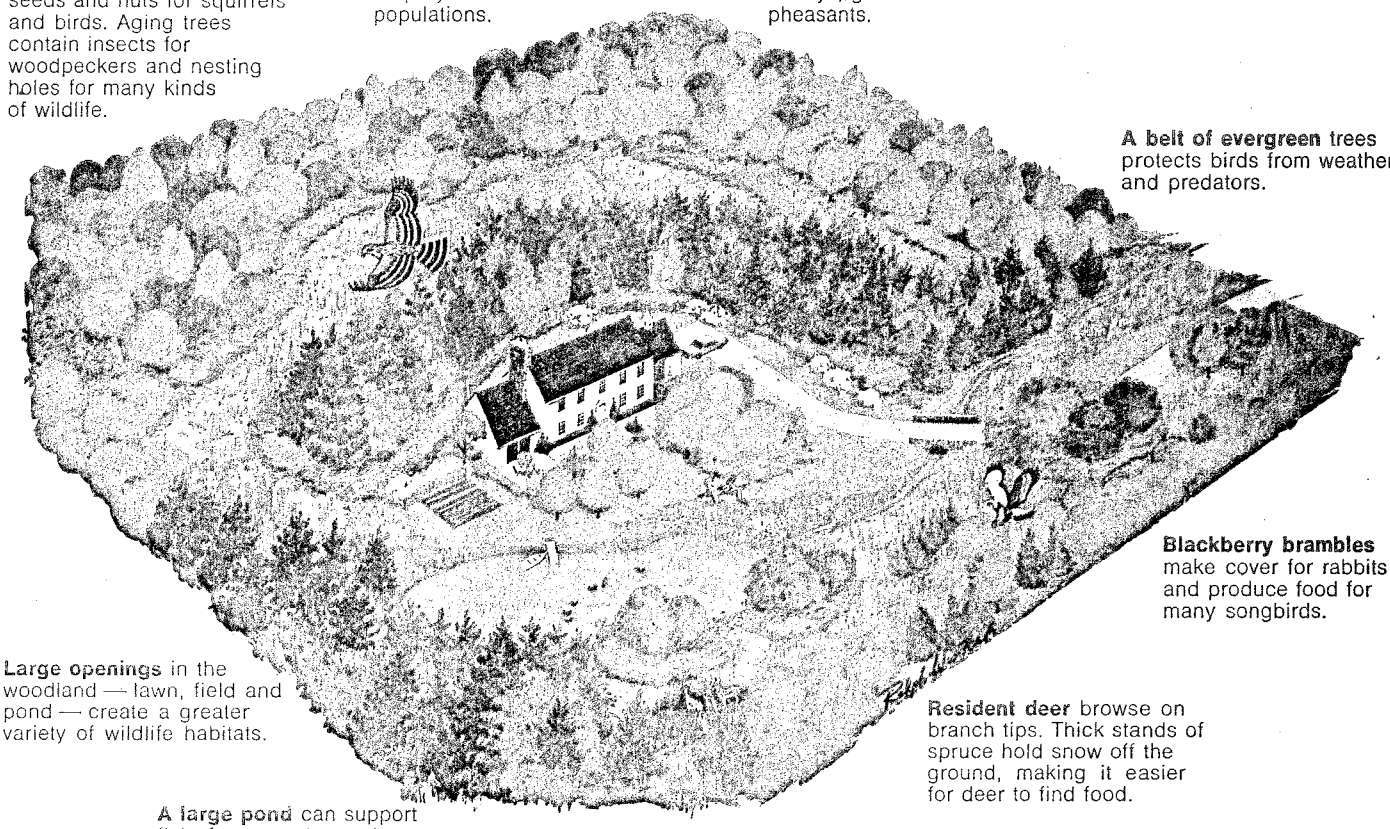
Baltimore orioles suspend basket-nests from high branches of mature trees.

Tall grass conceals a ring-necked pheasant's nest and brood.

Mature hardwoods produce seeds and nuts for squirrels and birds. Aging trees contain insects for woodpeckers and nesting holes for many kinds of wildlife.

Soaring red-shouldered hawk and other birds of prey control rodent populations.

A field of tall weeds and wild flowers attracts quail, turkeys, grouse and pheasants.



A belt of evergreen trees protects birds from weather and predators.

Blackberry brambles make cover for rabbits and produce food for many songbirds.

Large openings in the woodland — lawn, field and pond — create a greater variety of wildlife habitats.

Resident deer browse on branch tips. Thick stands of spruce hold snow off the ground, making it easier for deer to find food.

A large pond can support fish, frogs, turtles and a variety of water birds and mammals.

...Three acre lot

Increased size allows you to expand all the requirements of wildlife to support more species, including bigger animals and those higher on the food chain.

...Window box

If you don't have a yard, you can use a window box planter to provide three basic elements — food, water and cover — to support a microcosm of life.

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MAKE YOUR BACKYARD OFFICIAL:

Realizing the tremendous value of wildlife which is so rare in urban and suburban communities, the National Wildlife Federation has launched a program to establish a nationwide network of mini-refuges in the backyards of Federation members.

"We're proud of the way many of our members are already providing for wildlife," says Thomas L. Kimball, Executive Vice President of the Federation, "and we want to applaud them. If thousands of others would follow their example, vast amounts of land in residential neighborhoods could be turned into a tremendous asset to wildlife—and people."

Everyone who has a backyard is eligible to participate in this Backyard Wildlife Program. Anyone whose application shows evidence of good wildlife habitat may receive a Backyard Wildlife Registration Certificate.

For details on the Backyard Wildlife Program, or reprints of this article at 25 cents each, write to: Backyard Wildlife Program, National Wildlife Federation, 1412 Sixteenth Street, N.W., Washington, D.C. 20036.

ABOUT THE NATIONAL WILDLIFE FEDERATION

The National Wildlife Federation is a private, nonprofit conservation education organization, publicly but not governmentally supported. It aims to inform our citizens concerning the wise management of our natural resources and the importance of a clean environment for man and the other inhabitants of Earth.

One way to do this is by circulating, free in single copies, the many conservation education publications which we produce. People often respond by asking, "What can I do to help?"

One of the best things you can do is to keep an eye on local, state, and federal government actions that might affect the environment. Learn the facts and make your views known in every forum available. You will be doing the environment—*your* environment—a favor.

Something else you can do: join an organization such as the National Wildlife Federation. As a conservation education organization, the Federation is working for a better environment for man and wildlife. If you would like information on becoming a member, please write to us.