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The Land Book

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JAMES B. LONGLEY
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ALLEN G. PEASE
STATE PLANNING DIRECTOR

Dear Reader:

We are pleased to have the opportunity to distribute The Land Book to communities in Maine to assist in their planning activities.

While The Land Book was prepared for use by local governments in New Hampshire by the New Hampshire Office of Comprehensive Planning, the conditions there are similar enough to Maine to make The Land Book useful here as well. We feel fortunate that New Hampshire has produced such a fine publication and that it has been made available to us for use in Maine.

We hope that you will find The Land Book a thorough and practical guide for the preparation of community comprehensive plans.

Sincerely,

Allen Pease

ALLEN PEASE
Director

ap.j
Encl.

This publication was printed for distribution in Maine by the Resource Planning Program of the Maine State Planning Office. Funds for this project were provided through a Comprehensive Planning Assistance Grant from the Department of Housing and Community Development.

Maine State Planning Office

THE LAND BOOK

The Challenge of Making Wise Community Development Decisions

A Practical Guide for the Layman

Published by

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State of New Hampshire

In conjunction with

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A

TOWARD A LAND USE PLAN

1. BACKGROUND
2. THE LAND PLANNING PROCESS

Chapter 1

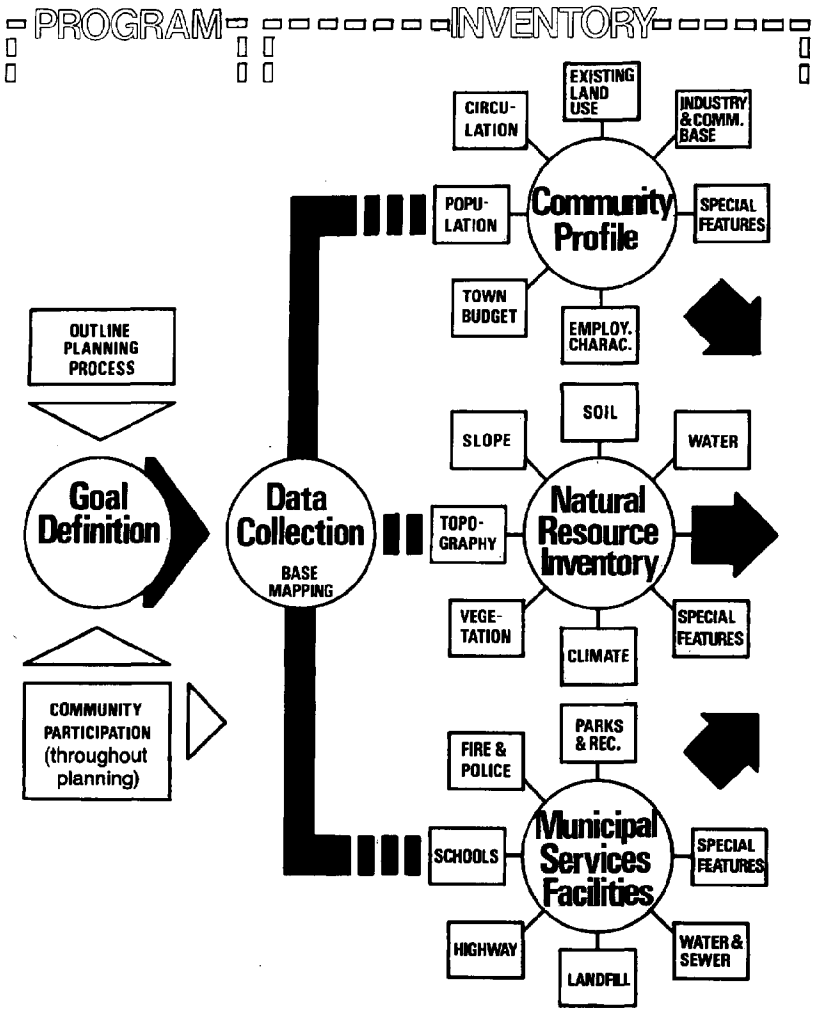
BACKGROUND

This book is about land planning. Its purpose is to acquaint local officials in New Hampshire with the benefits, principles, and techniques of community land use planning. The Land Book is designed for use as a practical guide by citizen planners; methods are described in detail so that community leaders will have the tools to initiate land planning themselves and to recognize when they need to ask for professional help.

Land is a community's basic resource. Its use determines in large part the character and quality of community life. The rate, location and type of growth--and the extent of protection of unique features--directly affect not only the physical appearance of the community, but also its need for public services and facilities, and their costs. A community that plans wisely for land use will be far better equipped to anticipate and deal with a variety of demands and problems. The Land Book provides one way of meeting the challenge of making sound community development decisions. Its publication underlines the continuing commitment of the Office of Comprehensive Planning to strengthen planning and decision-making capabilities at the local level.

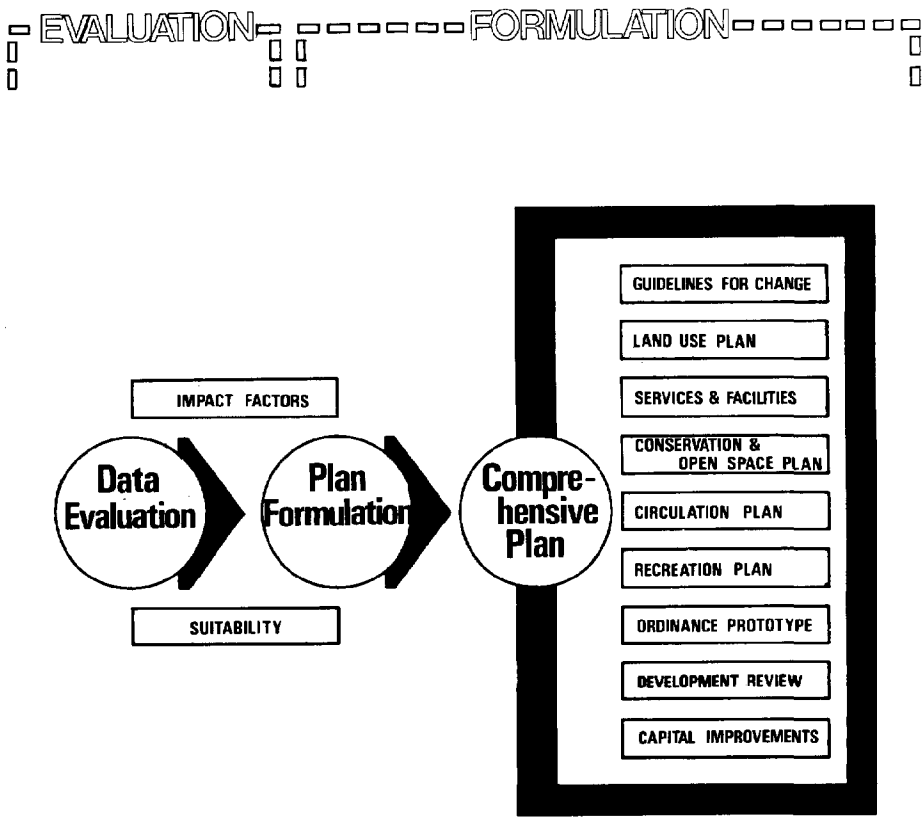
Comprehensive Community Planning

Land planning, the subject of this book, is only one part of the overall community planning process; to put land planning in its proper context, it is necessary to describe the overall process. Comprehensive community planning is concerned with all aspects of community growth and development, including such things as education, public services and land use. A comprehensive plan (sometimes referred to as a master plan) is a reference document that offers guidelines for community decision makers. By presenting coordinated



policies for development, transportation, environmental protection, community facilities, and fiscal management, a comprehensive plan helps a community meet change responsibly and guide growth in an orderly, constructive manner.

Preparation of a comprehensive community plan is a major responsibility of the planning board. It may elect to undertake the job itself or engage professional assistance in completing some or all of the necessary planning activities. As illustrated in the Critical Path diagram, the planning process is an organized method of conducting planning activities. It begins, logically, with goal definition. When a planning board decides to prepare a plan, it must establish the direction in which it wishes to proceed: what are the most commonly held community values? does the community desire economic growth? does the



Critical Path for Comprehensive Community Planning

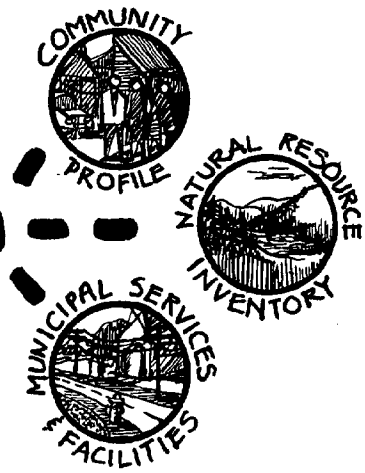
community desire to conserve open space? These and many other questions can be answered through the use of a

Goal Definition »»

community opinion poll or survey. Community opinions need not be solicited only in the initial stages of the planning process, however, and adequate channels for citizen input and public participation should be provided throughout the process. Appendix C more thoroughly discusses the importance of planning as a participatory process. Appendix E suggests methods of handling a community survey questionnaire.

Concurrent with community goal definition, the second major step in the planning process, data collection or inventory, begins. This is the job of assembling all the pertinent facts about existing conditions. In comprehensive planning, data collection is organized in three major subject areas: community profile, natural resource inventory, and community services and facilities.

»» Data Collection



The community profile data describe the citizens, their ages, employment, income, and life styles. This is the human resource base on which a community depends. The natural resource inventory is essentially the land

base on which the community builds; The Land Book covers this aspect in detail. A community's facilities and services are its capital assets and public service programs. Data collection in these three broad areas should be aimed at providing an objective, detailed picture of the community.

When the facts have been assembled, the planning process moves into an evaluation phase--what do the facts

Evaluation

mean? Evaluation of a natural resource base might show that the land most suited to development is also the best farmland. Evaluation of community facilities and services data might show that the municipal water supply system will reach capacity use in five years if present growth continues. Facts and trends should then be compared with the community's goals and objectives: is the community moving in the desired direction? If it is, how can positive trends be reinforced? If it isn't, how can the trends be altered?

At this point in the comprehensive planning process, planners must devise the policies that resolve these questions. Experience, judgment and community understanding are needed in the formulation of strategies and policies. When conflicts arise, community goals should be utilized to help resolve them.

Formulation

COMPREHENSIVE COMMUNITY PLAN

The comprehensive plan is a document that contains a written and graphic presentation of the inventory data, evaluation criteria and policies developed during the planning process. The function of such a plan is to present coordinated policies and guidelines relating to several areas of community concern. General policies and specific guidelines can be used as a reference by local decision-makers in the ongoing administration of community affairs. A plan is not legally enforceable in itself and affects the community only when its policies and guidelines are translated into action by local officials.

The Community Land Use Plan

While all elements of a comprehensive community plan are useful and valuable, the most important single element for many New Hampshire communities is the land use plan. Land planning is founded on the belief that the use of land should respect the inherent physical capability of the land, the pattern of existing uses, and the level of municipal services and facilities, as well as economic realities, private property rights, and community needs. The purpose of land use planning--to encourage rational, economically and environmentally efficient use of land--has been deemed to be in the public interest; promoting it has been deemed a public responsibility.

In practical terms, land planning benefits the community in several ways. A land use plan suggests a desirable pattern of land use within the community for the future. When the plan is grounded on thorough knowledge of land capabilities and builds on existing services and facilities, municipal costs savings can be achieved. Orderly community growth permits more economical public investments in roads, water and sewer installations, schools and other necessary public facilities; it simplifies public service and maintenance operations. Planning that conserves important community resources reduces public costs resulting from pollution and environmental damage. Land use planning also gives communities an objective and legally recognized foundation on which to base land use ordinances and regulations.

Who Prepares a Land Use Plan

A planning board is charged with performing two major functions which directly influence land use: one is to prepare a community comprehensive plan, including the land use plan, and the other is to regulate land subdivision. These complementary functions, when coordinated, enable a planning board to guide growth and strengthen the fabric of land use in the community.

The planning board is responsible for initiating and administering the community's land planning activities, though the members may not do all the work themselves. There are three basic organizational approaches that a planning board can use in developing a land use plan: (1) the do-it-yourself approach; (2) the professional approach; or (3) a combination of the two. Each approach has certain advantages and disadvantages, and a community must decide for itself which one best satisfies its needs.

The do-it-yourself approach appeals to many communities, especially when the planning budget is limited. A planning board may elect to do the work itself or may enlist "in-house" aid from a conservation commission, citizen groups and interested individuals. In some

instances a land use sub-committee of the planning board is organized to carry out land planning activities. The conservation commission is a logical partner in the do-it-yourself approach, because it is directly concerned with land and resource use and may have already accumulated information and materials that will be useful in

the planning process. A planning board-conservation commission team can also mobilize and direct the efforts of other volunteers, such as garden groups, clubs, scouts, and school, church and civic organizations.

The do-it-yourself approach keeps planning costs to a minimum, facilitates citizen participation, and increases community self awareness. A plan developed in this way is truly a community plan, and those involved in its preparation are also likely to work for its implementation. The principal shortcoming of this approach is that the judgment, perspective and knowledge of planning professionals are missing. Some communities may have resident experts in some aspects of planning, but many do not, and the results of trial and error planning are unpredictable. Professional help can cut down on time and errors without sacrificing community participation.

An alternative to the do-it-yourself approach is to hire professional planners to prepare the land use plan. This may be done by retaining a "town planner" on the community payroll, by utilizing the services of a regional planning commission, or by hiring a planning consultant. Professionals experienced in land use planning customarily work with a planning board to define the community's needs and goals, and then tailor a program to fit its budget requirements. A community using this approach benefits from the professionals' technical knowledge, experience and objective overview, so a plan may be prepared with a minimum of time and effort by the planning board.

Limited funds may be a factor hindering the professional approach, and community participation is usually not as great as in the do-it-yourself method. In some communities there is a skepticism about "outside experts"

that can undercut the credibility and effectiveness of professionals. For many communities the answer to "who prepares the land use plan?" lies somewhere in between. Citizen involvement in the planning process is productive and desirable, but most communities will need some professional assistance. When and how much professional help is necessary will depend on community circumstances. A planning board should assess local capabilities and outside requirements before starting on a planning program; in this way it can budget time and money to meet its needs, and planning can proceed without interruptions.

Professional assistance can come from several sources. The New Hampshire regional planning commissions provide communities with local planning services. Trained staff can assist local planning officials in conducting a planning program, assuring public participation, and in implementing the policies and plans developed. Substantial technical information concerning soil and water resources is available from Federal agencies, mainly the Soil Conservation Service, the Corps of Engineers, and the U.S. Geological Survey. A listing of public sources of planning assistance, both general and technical, is found in the Yellow Pages at the end of The Land Book. In the private sector a number of firms offer planning services to New Hampshire communities, ranging from those specializing in technical engineering studies to firms capable of undertaking and coordinating the entire comprehensive planning function.

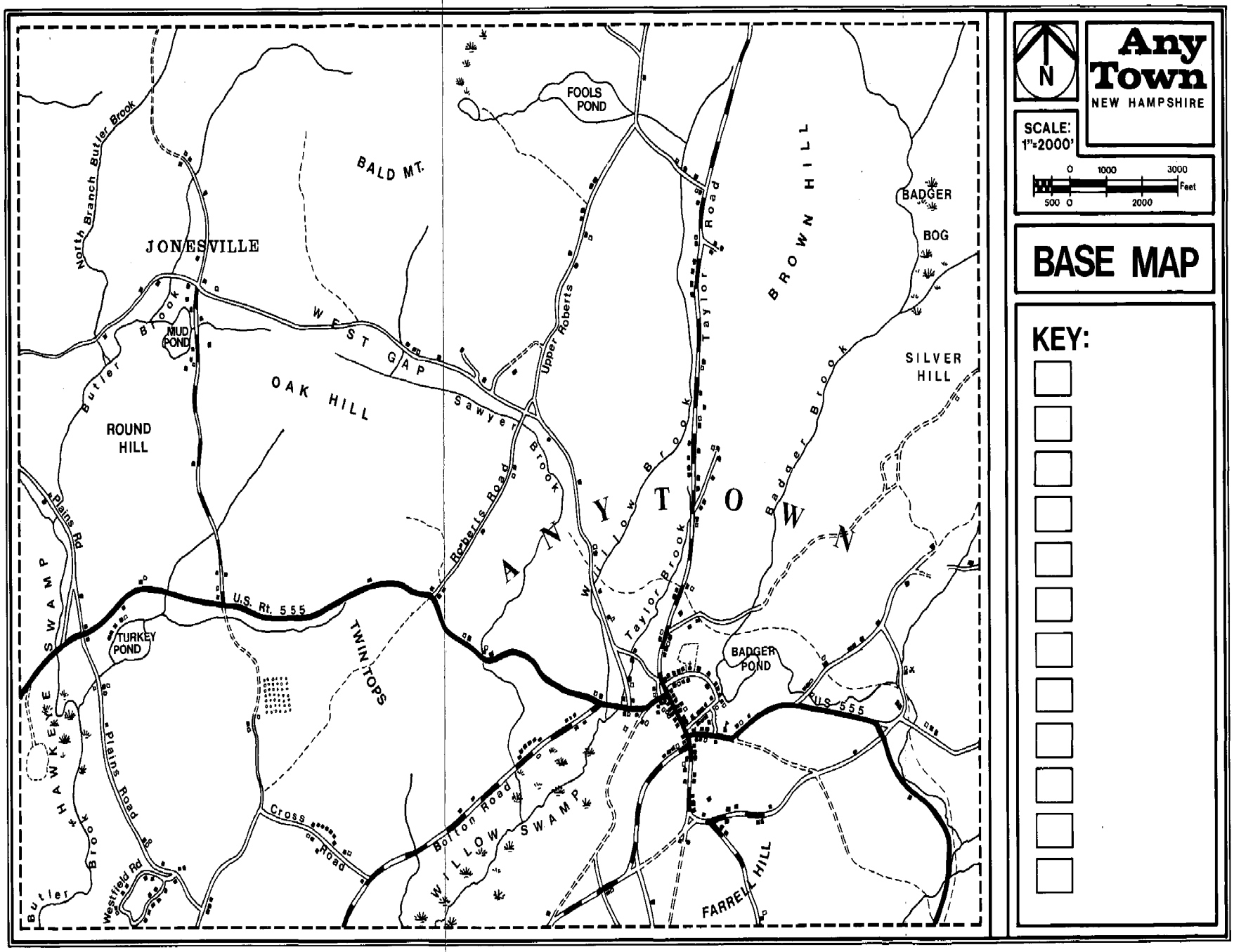
Maps for Land Planning

Land areas, land use patterns and natural characteristics are subjects that cannot be described adequately with words. For this reason, planners utilize maps to describe, evaluate, relate and plan land areas. Because maps are so essential to the planning process, planners must be able to read and use them proficiently. Appendix A of The Land Book contains fundamental instructions in how to read planimetric and topographic maps. It explains map preparation and includes information about sources of available maps.

When a planning board has resolved to proceed with land use planning, it should immediately take steps to obtain a base map of the community at a scale of 1"=1,000' or 1"=1,500' suitable for planning purposes. The map should indicate the community's political boundaries, streets and roads, water bodies, important natural features, and man-made features (such as dwellings and commercial, industrial, and public buildings). It should contain the name of the community, the title and scale of the map, a north arrow, and the sources from which the map was derived.

The next important map which must be acquired by the planning team is a topographic map, which is discussed in Chapter 3. Both the base map and the topographic map are used to record and display other data the community will acquire. Since many copies of these maps will be used during the planning process, master copies should be prepared on a stable, transparent material such as mylar, which can be used in a print machine to produce as many copies as desired.

BASE MAP →


Any Town
NEW HAMPSHIRE
N
SCALE:
1"=2000'
0 1000 3000 Feet
500 0 2000
BASE MAP
KEY:
FOOLS POND
BALD MT.
JONESVILLE
North Branch Butler Brook
Butler Brook
MUD POND
WEST GAP
OAK HILL
ROUND HILL
Upper Roberts
Sawyer Brook
Roberts Road
Taylor Road
BROWN HILL
BADGER BOG
SILVER HILL
Badger Brook
Willow Brook
Taylor Brook
ANYTOWN
Plains Rd
SWAMP
U.S. Rt. 555
TURKEY POND
TWIN TOPS
BADGER POND
U.S. 555
HAWKEYE
Plains Road
Cross Road
Bolton Road
WILLOW SWAMP
Butler Brook
Westfield Rd
FARRELL HILL

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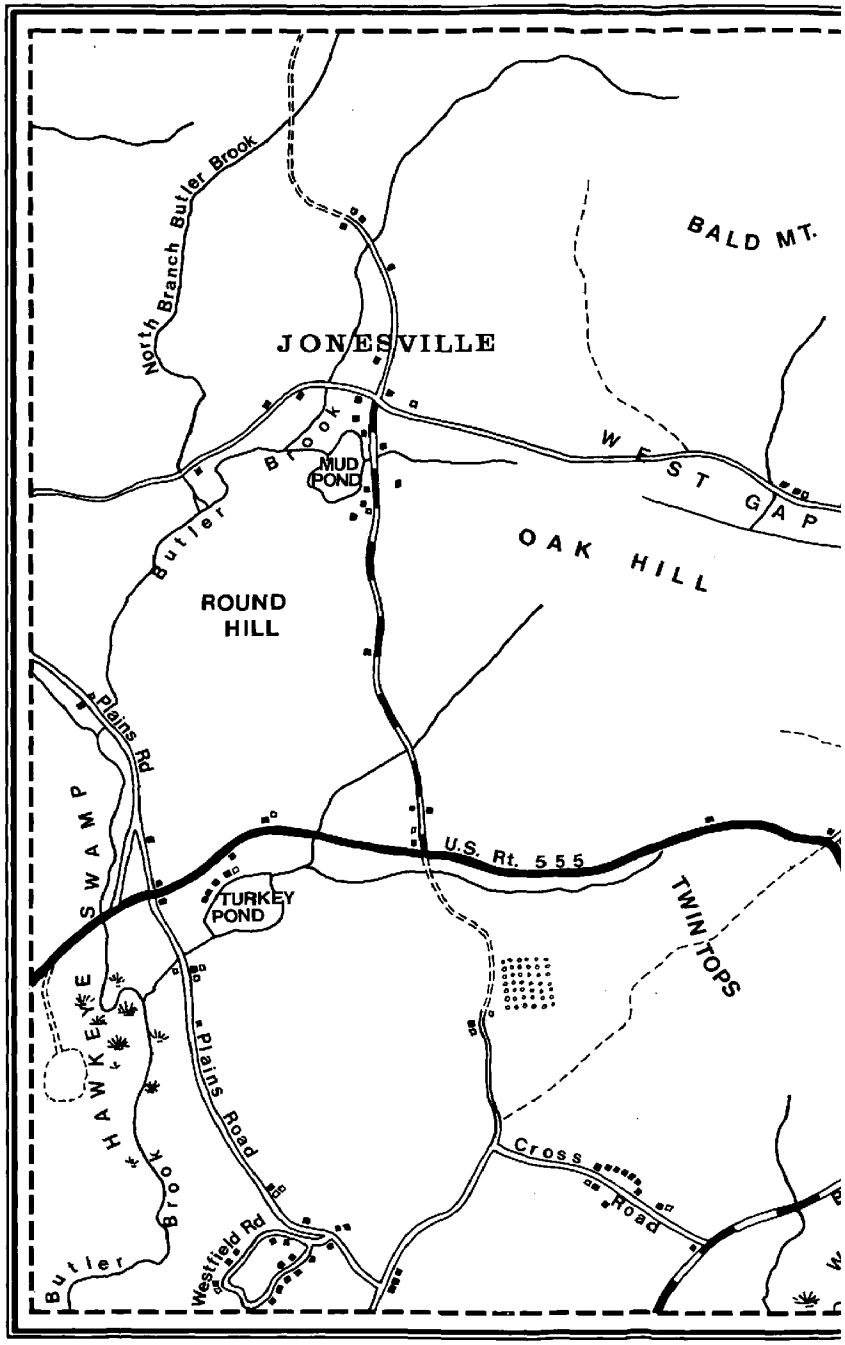
North Branch Butler Brook
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ROUND HILL
Plains Rd
SWAMP
U.S. Rt. 555
TURKEY POND
TWIN TOPS
HAWKEYE
Plains Road
Butler Brook
Cross Road
Westfield Rd

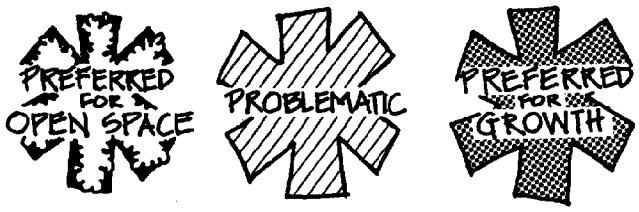
Chapter 2

THE LAND PLANNING PROCESS

The Essence

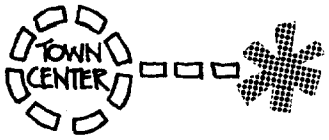
The land planning process can be divided into two major parts: preparing a plan, and implementing a plan. The emphasis of The Land Book is on the first part.

Simply stated, there are four steps in the preparation of a land use plan. In the first step, environmentally critical land areas are identified and designated as "preferred for open space." All remaining land is then considered as potentially developable. In the second step, areas where the physical suitability for development will need further investigation are designated "problematic." Then, areas of developable land most suited physically and most favorably located in relation to the existing pattern of land use are designated as "preferred for growth." Placing areas into these three categories establishes the basic framework of a community land use map. Formulating guidelines for use, development and protection of these areas is the fourth step in preparation of the plan.



Areas preferred for open space include those environmentally critical areas that ought to be managed so that they continue to perform important natural functions or maintain a vital natural balance. These areas may merit protection for their own sakes, because of their influence on adjacent areas, or because they have an important existing or potential function for the community. If these areas are used improperly, detrimental economic or environmental impacts are likely to result. A top priority in land use planning is to identify areas preferred for open space, indicate their location on a community map, and formulate management policies to guide their use. If a community can accomplish these basic tasks, it has established a natural framework within which growth can be safely accommodated.

Areas preferred for growth are developable areas that are also desirably located in relation to existing development, roads and services. In many communities, areas preferred for growth will be located in or adjacent to existing town centers. A community may also consider the option of encouraging the development of new, self-supporting village centers. When such satellite villages, which provide many of their own services, are developed under a single plan, they are known as planned unit developments (PUDs).



By designating areas as preferred for growth and establishing policies that encourage new development to occur there, a community can obtain more efficient use of the land and minimize the costs of municipal services.*

Problematic areas, while potentially developable, should not be preferred for growth until they are analyzed further. Some of these areas may be sources of community water supply which may or may not need protection from development. Some may be areas having slope or soil conditions with inherent limitations for building. Communities need to develop guidelines for use of these areas before development can be considered. However a community

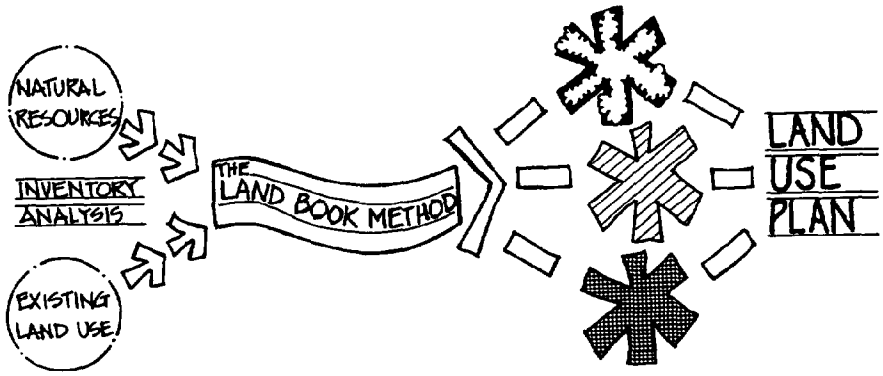
*The advantages of concentrated development are detailed and documented in a study entitled "The Costs of Sprawl." (See Yellow Pages.)

should maintain an open, flexible attitude about planning for land use in problematic areas and look at each development proposal for such areas carefully.

When a map showing areas preferred for open space and for growth and problematic areas has been prepared, policies to guide land use in these areas should be formulated. Then, the community land use plan is essentially complete. A community can next turn its attention to the implementation of the plan and the ongoing administration of land use measures.

The Land Book Method

The process of locating areas preferred for open space and areas preferred for growth involves an examination of two factors: (1) the natural land characteristics of the community; and (2) the existing pattern of land use in the community. To analyze the first factor, natural characteristics are inventoried and evaluated to determine which areas, because of their inherent qualities, are preferred for open space, problematic or readily developable. Next, the existing pattern of land use is inventoried and evaluated to determine which areas, because of their relationship to the pattern of existing uses, services and facilities may be preferred for growth.



A land use plan that delineates these three basic areas is probably adequate for many small New Hampshire communities. More populated or rapidly growing communities may wish and need to identify specific areas for residential, commercial, industrial or municipal use within this general framework. This next level of refinement can help ensure compatibility among land uses and lead to identifying specific locations especially suited to a particular use.

These two studies can then be compiled and compared, leading to identification of the basic physical pattern for preferred land use. Communities that require or desire a further definition of areas preferred for specific types of use may continue to refine plans within this basic framework using goal-related criteria and more advanced community planning techniques.

Information compiled during the inventory phase becomes the basis for plans and for land use decisions. Knowledge of facts helps take the guesswork out of planning and strengthens the objective and legal foundation of community land use policies. The evaluation phase of planning is less objective, and while everyone may agree on the facts, conclusions and interpretations may vary widely. Differences of interpretation may be settled through professional, legal, political or scientific consensus.

In the final analysis, there are no absolute rules of land use; there is no single "best" plan. Houses can be built on mountaintops; wetlands can be dredged and filled; and strip development can occur. Whether these uses are desirable or necessary is a question that a community seeks to answer through defining its goals and planning for their accomplishment.

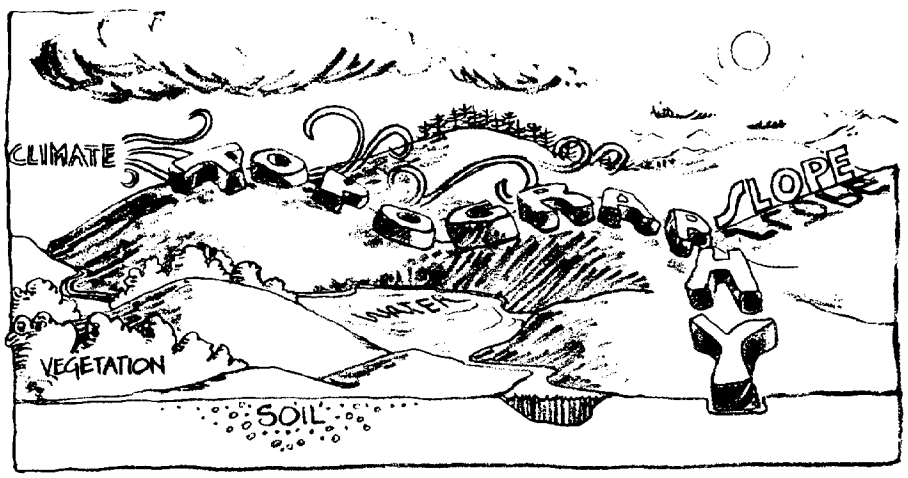
B

INVENTORY & ANALYSIS

3. TOPOGRAPHY
4. SLOPE
5. SOIL
6. WATER RESOURCES
7. THE SUMMARY ANALYSIS MAP
8. EXISTING LAND USE

Inventory and Analysis

A well known planner once said, "let the land do the planning." He meant that the basic characteristics of the land itself influence its use. The relationship of hills and valleys shapes the pattern of settlement. Soil conditions inhibit development in some areas and encourage it in others. Slope conditions affect road access and erosion potential. The abundance or absence of water resources influences the nature and rate of growth. So, it follows that the first step in land planning is to examine thoroughly the physical characteristics of the community's land base.



For planning purposes the most important physical characteristics of land are topography, soil, slope and water resources. The interaction of these characteristics creates opportunities for and limitations to various land uses. A fundamental analysis of land involves examination of each of these four characteristics and their interrelationships. The following four chapters of The Land Book describe these characteristics, how they can be inventoried, and how they affect land use. When the influence of each characteristic is understood by itself, their combined influence can be more easily perceived. Chapter 7 presents a method for combining the four physical characteristics on one map. The general principles described in each chapter are applied to a fictitious New Hampshire town called Anytown to show how they might work in practice.

Anytown, New Hampshire:

Anytown is representative of many of New Hampshire's smaller communities. It has a land area of about 19 square miles (12,397 acres) and a population of some 700. The community is growing slowly, but local leaders feel that--in the face of continuing demands for land, particularly for residential use--planning should be undertaken as a means of encouraging sensible growth.

To carry out a land planning program for the community, the planning board has set up a special subcommittee made up of its own members, members of the conservation commission, and several citizens who are interested and knowledgeable about land in the town. This "planning team" follows The Land Book method, and the description of their efforts shows how the process works in their particular situation.

Any Town
NEW HAMPSHIRE

SCALE: 1"=2000'

0 1000 3000 Feet
500 0 2000

TOPOGRAPHY

KEY:

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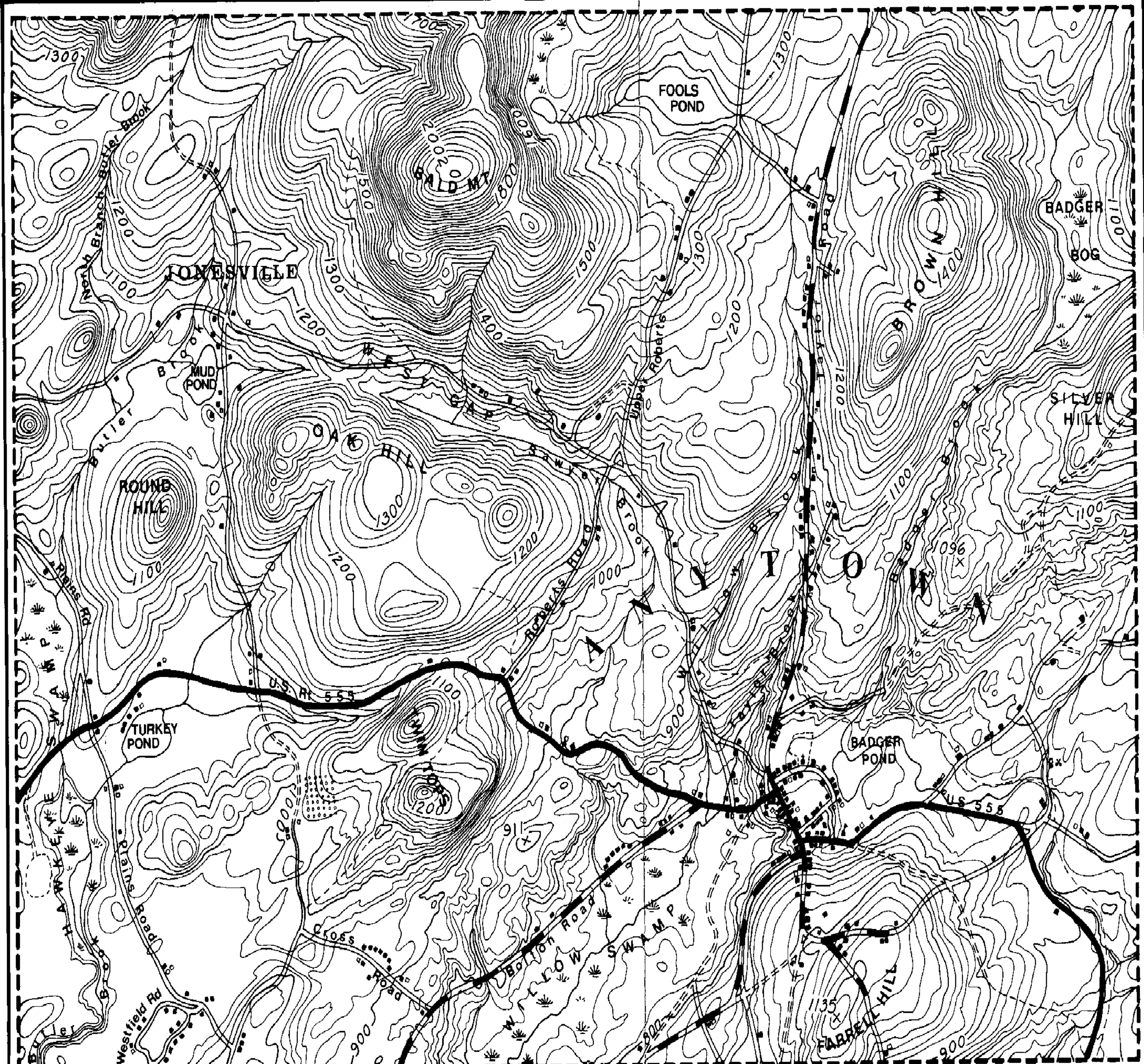


Notes

TOPOGRAPHY MAP →

Notes

TOPOGRAPHY MAP

Chapter 3

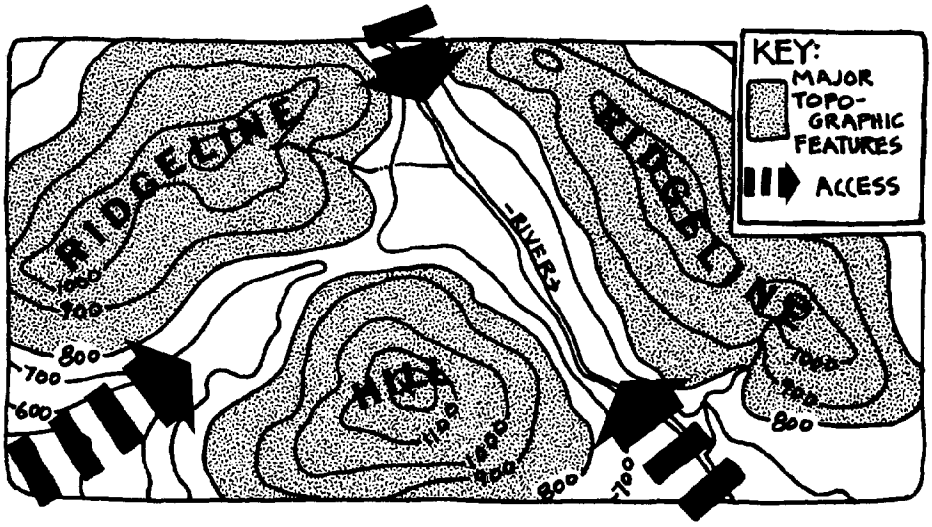
TOPOGRAPHY

Topography is the shape of the land: its ups and downs, hills, valleys, ridges and plains. In a community planning context, these features impose a natural order on the land that, in turn, influences the pattern of land use. An awareness of topography in a community may show why the existing pattern of land use developed as it did, and may also suggest ways in which future patterns could evolve. A study of topography is relatively easy, and it is recommended that a planning team begin its physical analysis with this study. (See Appendix A.)

Topographic maps utilize the community base map, superimposing contour lines which show differences in land elevation. Topography analysis is aided by coloring a topographic map of the community to emphasize changes in elevation and highlight the principal physical features of the landscape. By studying a colored topographic map, a planning team can better understand how land shapes the pattern of land use. Topography influences land use in very elemental ways: hills are like walls, and valleys are like corridors. These simple conditions affect travel, commerce, vision and even social relationships.

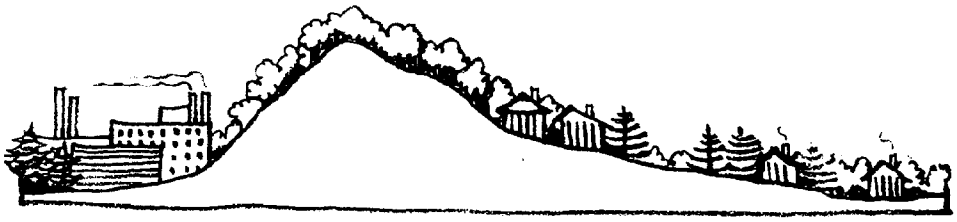
The most significant influence of topography on the pattern of land use relates to access; mountains, hills and ridges all constitute barriers to movement. In the

early days of land settlement, the lowlands, and particularly the river valleys, were settled first because they were most accessible. As roads were built, they



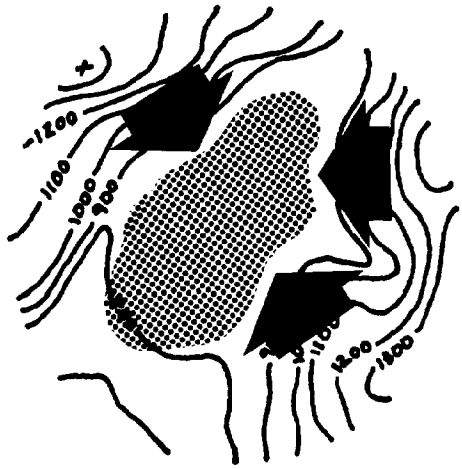
followed the paths of least resistance, going around instead of over mountains; topography continues to exert the same influence on access today. In an even more basic way, hills, mountains and ridges act as dividers that naturally define and separate land areas; sometimes topographic features create natural divisions between land uses. For example, valleys may be settled and

farmed, while mountains are timbered and wild. One side of a hill may be residential, while the other side is industrial. A planning team should consider topography as a basic element influencing land use.

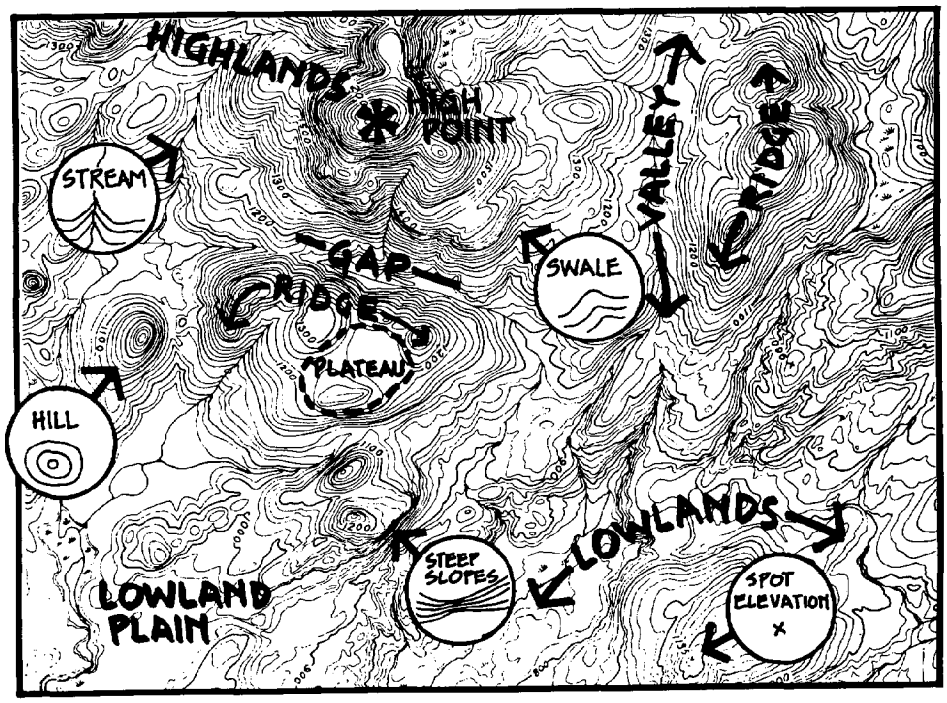


Planning that respects the influences of topography can yield practical economic benefits: sewers can be

laid out to take advantage of gravity flow, and roads can be built more economically and efficiently. Thus, a planning team should use topography to help locate areas for future growth; the shape of the land is the structural framework of the plan.



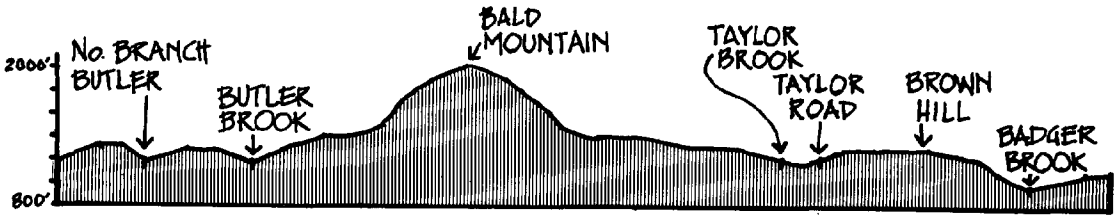
The logic of topography becomes self evident in the course of preparing and studying a topographic map. Once a planning team is able to visualize the overall shape of the land in its community, common sense will suggest how topography influences land use and how it can be used to evaluate future land use patterns.



Anytown, New Hampshire:

Highlighting the major land features of the community, the Topographic Map of Anytown, New Hampshire, defines several separate but contiguous land areas. A closer inspection of the map reveals that the lowlands are the most settled areas, and the highlands and mountains are more sparsely populated. Topographic constraints that shaped the existing pattern of land use begin to suggest a logic for future land use in Anytown.

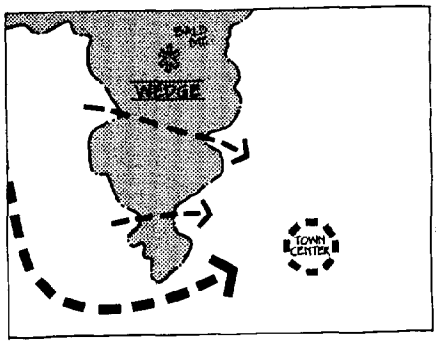
The most striking and influential topographic feature of the community is Bald Mountain; located in the north central part of the town, it visually and physically dominates a large area surrounding it. The mountain separates the eastern and western lowlands and



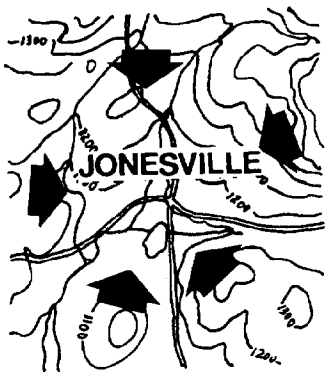
WEST-EAST PROFILE VIEW THROUGH SUMMIT BALD MT.

presents a barrier to traffic flow; roads go around the mountain but not over it, and consequently the upland area is undeveloped. Oak Hill, just south of Bald Mountain, is characterized by a steep ridgeline running east-west and a plateau area on the southeast side. Topographically, Oak Hill is an extension of Bald Mountain and further blocks movement from east to west, except for West Gap Road which runs through a steep, narrow pass on the north side of the hill. To the south of Oak Hill are the Twin Tops, two hills that rise sharply from the surrounding land. The principal east-west highway (U.S. 555) in Anytown passes between Oak Hill and Twin Tops.

Together, these three topographic features form a large wedge that divides the community into eastern and western sections. This division has important planning implications: access is forced around the wedge, or confined to the two gaps through it; and development



occurring west of the wedge is physically separated from the present town center. Although U.S. 555 provides a good link between the sections, other road connections are weak; Jonesville and the Westfield Road area are both more difficult to serve than areas east of the wedge. The isolation of Jonesville is emphasized topographically by the presence of Round Hill.



The southwest corner of Anytown is a broad, gently sloping area with few internal circulation barriers. From a topographic perspective, it can accommodate a variety of land uses, including agriculture and residential development. Jonesville, on the other hand, is essentially an enclosed valley, hemmed in on all sides by hills and mountains. It is oriented inwardly and does not relate strongly to the rest of the community.

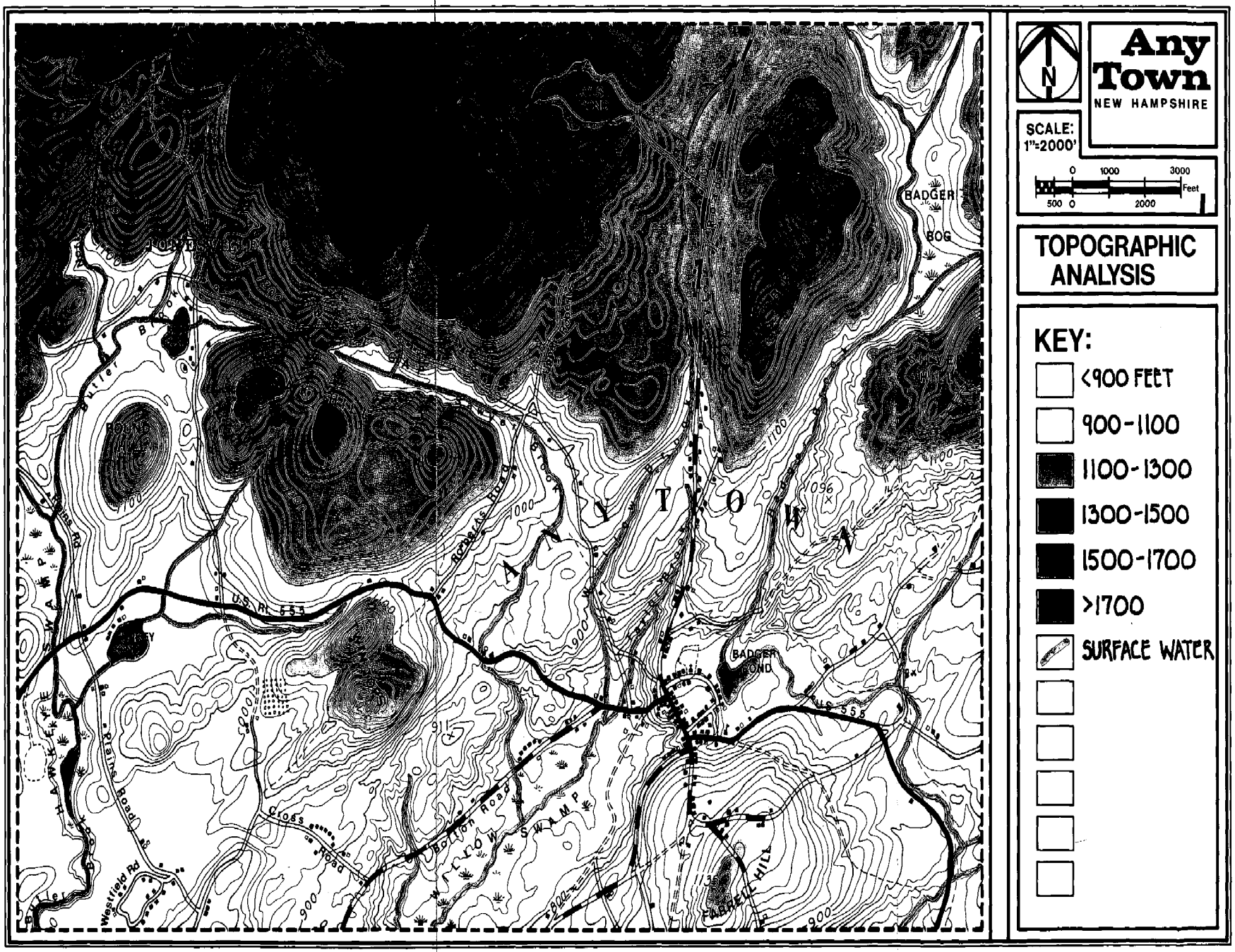
East of the wedge, the land forms a broad lowland valley extending south into the neighboring town, but narrowing to a linear valley in the north. Access throughout the lowland area is relatively unrestricted, and it is suitable topographically for many types of use. Most of the community's existing development has taken place in this area.

In the northeast corner of the town is an isolated, uninhabited valley called Badger Bog. Although there is presently no road to the area, there is potential access through the gap between Brown Hill and Silver Hill. Badger Bog covers a portion of the valley floor, and a study of the topography indicates that a relatively small dam could turn Badger Bog into a large lake.

The major topographic features of Anytown have important implications in terms of future land use. Since the concentration of existing development is located east of the wedge, that is a logical area in which to encourage growth in the immediate future. If development is to occur west of the wedge, a new village center might be fostered to provide services to residents of that area.

By coloring the Topographic Map to distinguish among various ranges of elevations, the significant topographic features of Anytown become evident. Such a Topographic Analysis Map provides an easily understood graphic representation of the community's land forms.

TOPOGRAPHIC ANALYSIS MAP →


Any Town
NEW HAMPSHIRE
N
SCALE:
1"=2000'
0 1000 3000
Feet
500 0 2000
TOPOGRAPHIC ANALYSIS
KEY:
<900 FEET
900-1100
1100-1300
1300-1500
1500-1700
>1700
SURFACE WATER
BADGER BOG
BADGER POND
U.S. Rt. 555
Butler Brook
Plains Road
Westfield Rd
Cross Road
Bolton Road
WILLOW SWAMP
FARRELL HILL
1096
911
1000
900
1100

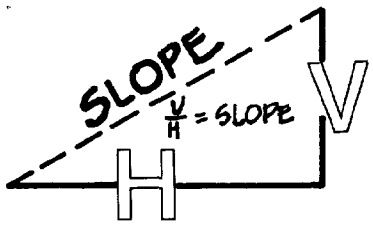
Notes

Chapter 4

SLOPE

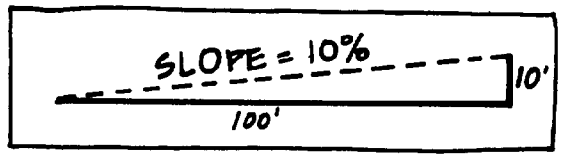
Slope refers to the gradient or steepness of the land. The slope of land influences the economic and physical feasibility of various land uses; it is harder to farm steep land than flat land, and it is harder to build on a steep slope than a gentle one. The slope of land generally is a very localized condition; in New Hampshire, where much of the land is hilly to mountainous, slope can change significantly within short distances. A study of slope conditions in a community is an important part of the land planning process.

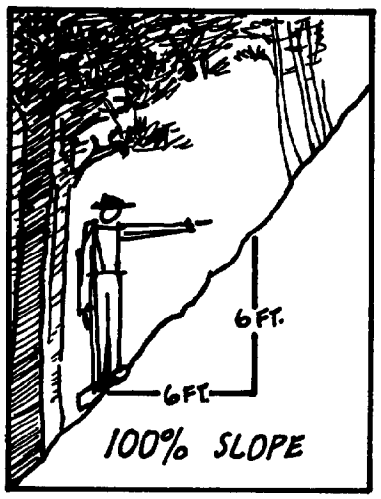
The slope of land is defined as the change in elevation (vertical distance) over horizontal distance:

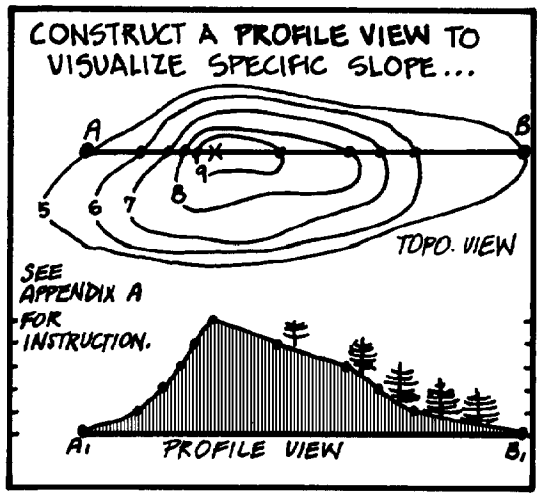


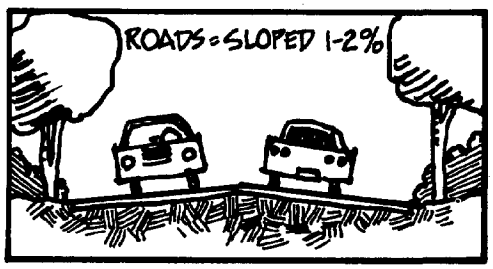
$$\frac{\text{VERTICAL DISTANCE}}{\text{HORIZONTAL DISTANCE}} = \frac{V}{H} = \text{SLOPE (\%)}$$

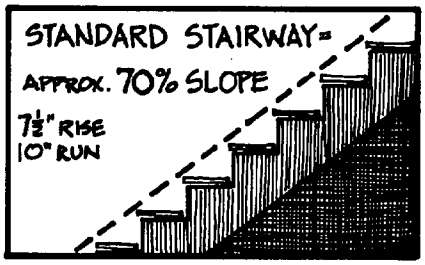
the more abrupt the change in elevation, the steeper the slope. Slope is measured and expressed as a percentage that represents this relationship between elevation and horizontal distance; for example, if the land rises 10 feet in elevation over a horizontal distance of 100 feet, the slope of the land is 10/100, or 10 percent.





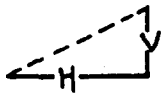






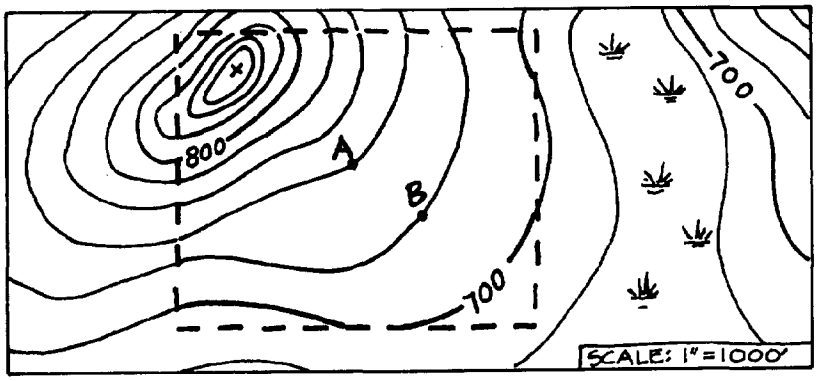
Knowing the percentage of slope between two points is useful when one is concerned with a specific alignment across the terrain (see Appendix A). For general planning purposes, however, it is more helpful to know the slope conditions for broader areas of land. It is useful to know, for example, the location of areas characterized by steeper slopes and those characterized by more gradual slopes; this information can be derived from the community slope map.

* CALCULATION OF SLOPE PERCENTAGE

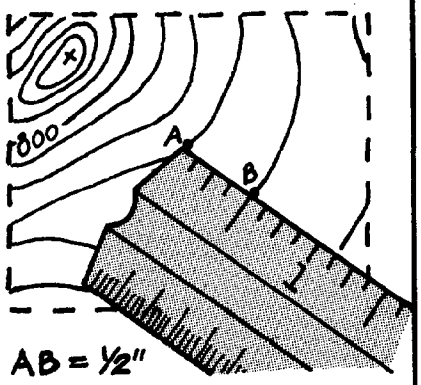


$$= \frac{\text{VERTICAL DISTANCE}}{\text{HORIZONTAL DISTANCE}} = \frac{V}{H} = \text{SLOPE (\%)}$$

PROBLEM ▶ TO FIND SLOPE OF AB



1 STEP 1: ESTABLISH HORIZONTAL DISTANCE



AB = ½"

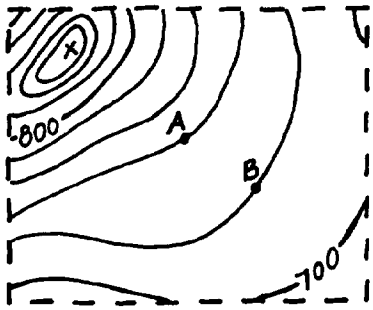
SINCE SCALE IS 1" = 1000', THEN:

½ × 1000 = 500

AB = 500'

H = 500'

2 STEP 2: ESTABLISH VERTICAL DISTANCE



SINCE VERTICAL DISTANCE EQUALS THE DIFFERENCE BETWEEN CONTOURS, AND SINCE CONTOUR INTERVAL ON THIS MAP IS 20 FEET, THEN:

A - B = 740' - 720' = 20'

V = 20'

3 $$\frac{V}{H} = \frac{20'}{500'} = .04$$

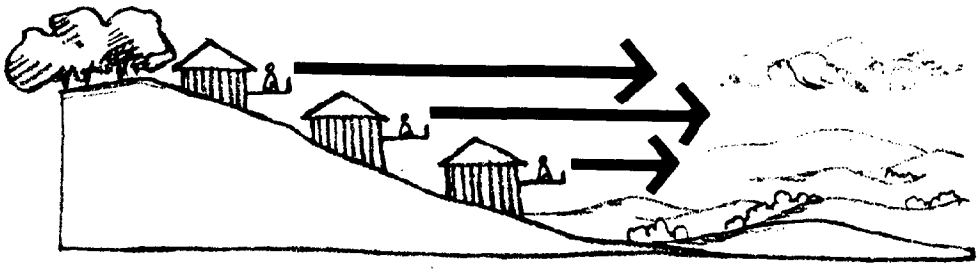
SOLUTION ▶ SLOPE AB = 4%

Slope analysis is relatively straightforward, and the results can be shown graphically by coloring a topographic map to differentiate categories of slope conditions. The planning team can use this slope map to identify critical slope areas, to help identify areas preferred for growth, to evaluate proposed road alignments, and to review specific land use proposals.

The Influence of Slope on Land Use

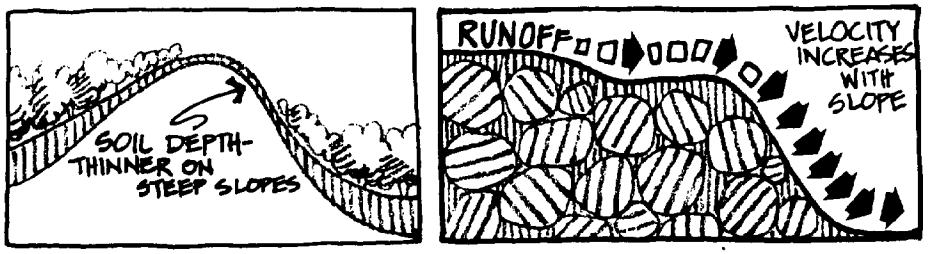
The influence of slope on land use depends on its steepness and on its relationship to soil, water and vegetation conditions.

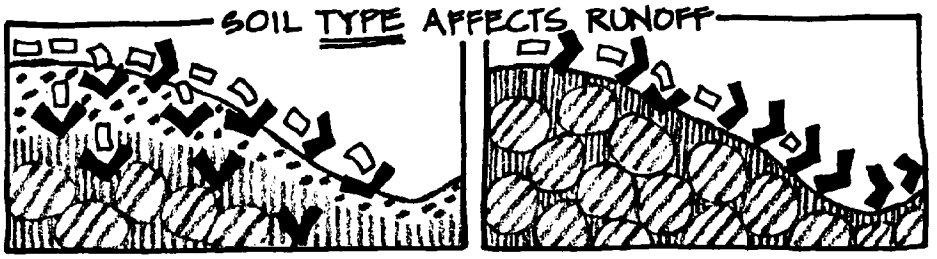
Variations in steepness affect such things as the amount of cutting and filling necessary to build roads or to prepare building sites, road maintenance and snow removal, and utility construction and service. Whereas moderate slope conditions present few inherent limitations to most uses, the cost and difficulty of many development activities are likely to increase in steeper areas. Opportunities that steeper areas present for unique recreational or residential use, however, may override basic cost considerations.



Soil drainage characteristics are important under any slope condition. In steep areas, however, soils usually are shallower, the volume and velocity of surface water runoff is higher, and the absorption capacity

of soil is often very limited. Though erosion potential tends to increase with steepness, soil type also has a direct influence on the erodibility of sloped areas and can lessen or magnify erosion potential.





Because of complicating factors on steep slopes, active land uses should be planned and undertaken with caution in such areas. In areas of greater than 25 percent slope, the erosion potential is severe, and adequate and safe septic effluent disposal is extremely difficult and costly; active use of these areas often poses problems to the developer, to the purchaser, to landowners down the slope, and ultimately to the community; the same problems are likely to be encountered in areas of 15-25 percent slope. For these reasons The Land Book recommends that areas of greater than 25 percent slope be designated as preferred for open space and that areas of 15-25 percent slope be designated problematic.

Slope may become a factor at the other extreme as well--in flat areas where there are poorly drained

soils, water may pool at or near the surface. Special engineering and construction techniques may be needed to prevent structural or septic tank problems in these areas. Well-drained, flat to gently sloping areas are suitable for almost any land use.

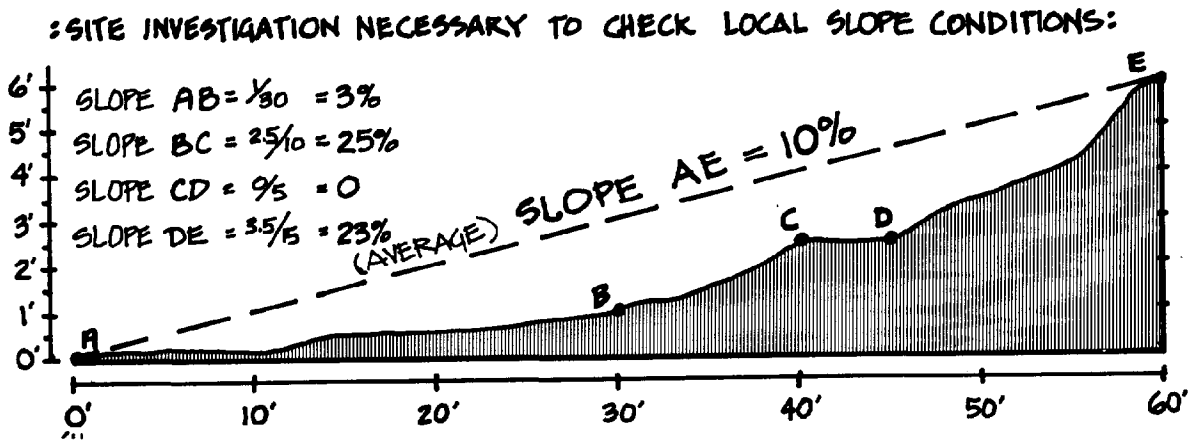
The percentage of slope above which environmental problems arise or the percentage of slope below which drainage becomes a problem cannot be definitely set. Problem situations result from a combination of slope, soil, vegetative, and water runoff conditions. To establish slope limitations in a community, the planning team should consult a soil scientist.

Using a Slope Map

In devising a community land use plan, the planning team can use the slope map to delineate areas of greater than 25 percent slope for designation as preferred for open space. The map can also be used to identify gently (3-8 percent) to moderately (8-15 percent) sloping areas that ususally are well suited for development; flat areas (0-3 percent slopes) and areas of 15-25 percent slopes should be evaluated more carefully in terms of ponding or erosion potentials. The slope map can also be very useful in laying out new roads or adjusting the alignments of old ones; by avoiding the steeper areas, cuts and fills can be reduced, resulting in lower construction and maintenance costs. The map can be used in reviewing site plans as an initial check for potential drainage or erosion problems.

The accuracy of the community slope map is limited at the site level, however, and on-site investigation of conditions should be made before reaching final decisions regarding specific land use proposals.

Land that appears steep on a map may nevertheless be usable when properly planned and engineered. Conversely, land that appears gently sloping may nevertheless have a potential erosion problem because of the underlying soil conditions. There is no substitute for on-site investigation of all factors.

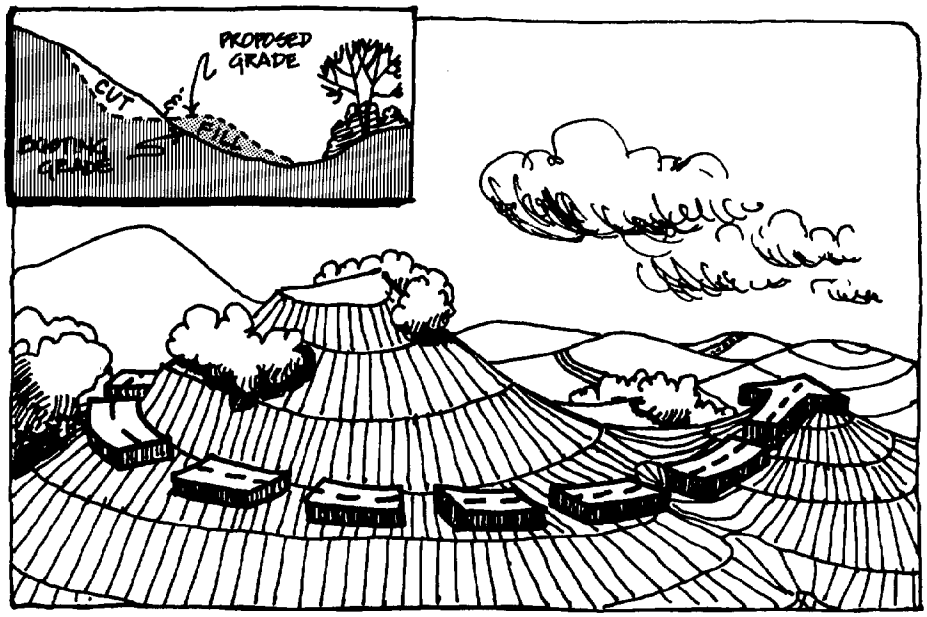


Anytown, New Hampshire:

The Slope Map of Anytown divides land into five categories of steepness, with each category represented by a different color and the darker colors indicating steeper slopes. Slope characteristics were determined by measuring the distance between 100' contour lines (every 5th line on a 20' contour interval map); the resulting map clearly illustrates areas of varying steepness throughout the community.

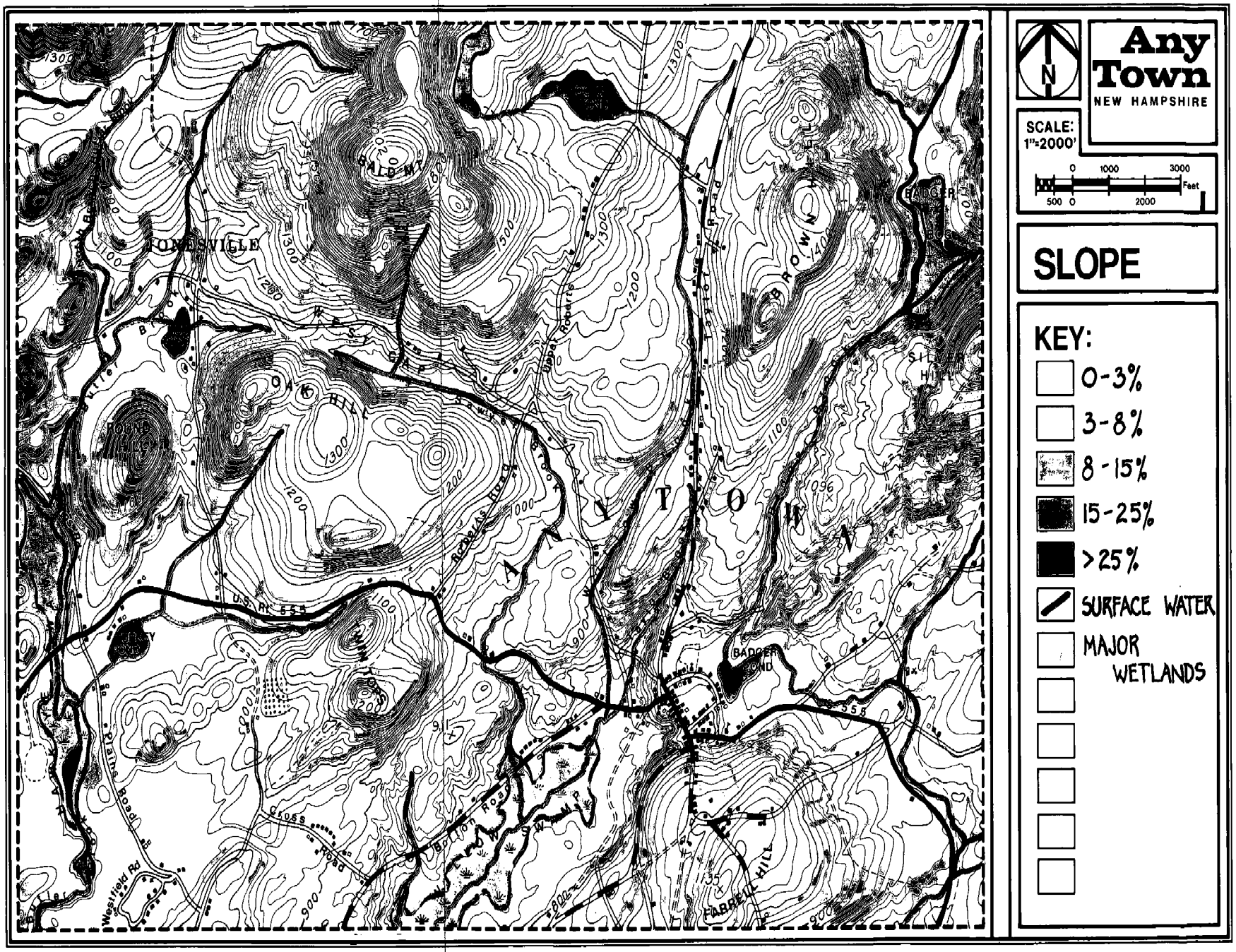
It is not surprising that the greatest area of steep land is found on Bald Mountain and that much of the flattest land is found in the flood plains and wetlands. In between, steepness varies according to local topographic features. A pattern emerges that is similar, though not identical, to the one shown by the Topographic Analysis Map--in Anytown, areas of higher elevation tend to be characterized by steeper slopes. The wedge, Round Hill, and Brown Hill areas are relatively steep compared to other parts of town. As the pattern of roads was shaped by topographic features, it was also shaped by slope conditions. Roads do not circumvent all hills; they circumvent only the steepest ones. They cross areas of greater

than 25 percent slope only in places where the cost of "going around" is significantly greater than the cost of "going over." With careful engineering, and at greater expense, roads can be built up or across steep slopes without causing major erosion problems.



In the course of the planning process, the planning team will use the Slope Map of Anytown to decide which roads ought to receive priority for improvement and which areas of the community are more suitable for future growth in terms of ease of access and service. For example, slope conditions in the vicinity of Farrell Hill and Silver Hill are suitable for future development, but slope conditions along the West Gap Road give that area a lower priority both for road improvements and for growth. The Slope Map of Anytown will be helpful in making preliminary assessments of proposed land uses; by examining the slope, the planning board will be alerted to extreme conditions where erosion or drainage problems may exist.

In preparing the land use plan for Anytown, the Slope Map has been used to identify areas where slope alone has a significant effect on land use. Areas of greater than 25 percent slopes are highlighted on the Summary Analysis Map and designated as preferred for open space; areas of 15-25 percent are designated as problematic.


Any Town
NEW HAMPSHIRE
N
SCALE:
1"=2000'
0 1000 3000 Feet
500 0 2000
SLOPE
KEY:
0-3%
3-8%
8-15%
15-25%
>25%
SURFACE WATER
MAJOR WETLANDS
JONESVILLE
BALD MT
OAK HILL
ROUND HILL
BROWN HILL
BADGER
SILVER HILL
BADGER POND
FARRELL HILL
U.S. Rt 555
Roberts Road
Upper Roberts
Cross Road
Bolton Road
Plains Road
Westfield Rd
Butler Brook
Sawyer Brook
Taylor Road
A N Y T O W N

SLOPE MAP

Notes

Chapter 5

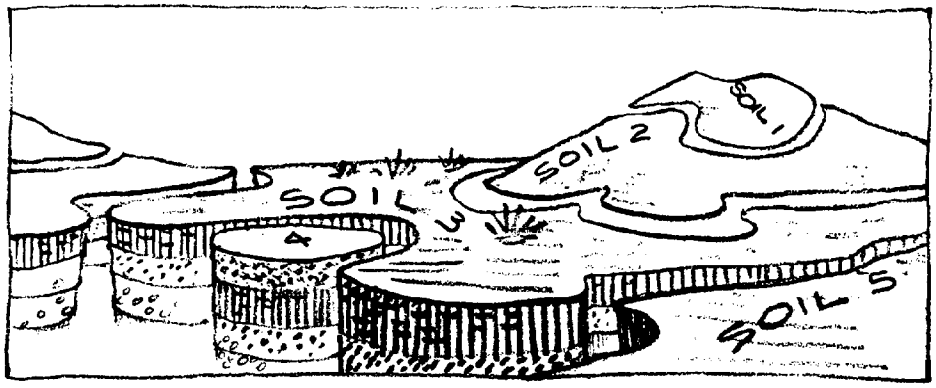
SOIL

Soil is the ingredient of the land itself--the ground on which land use happens. Because it is the foundation for all uses, the condition of the soil is an important factor in all land use decisions. To conduct a community soil study, however, the planning team will have to engage professional assistance.

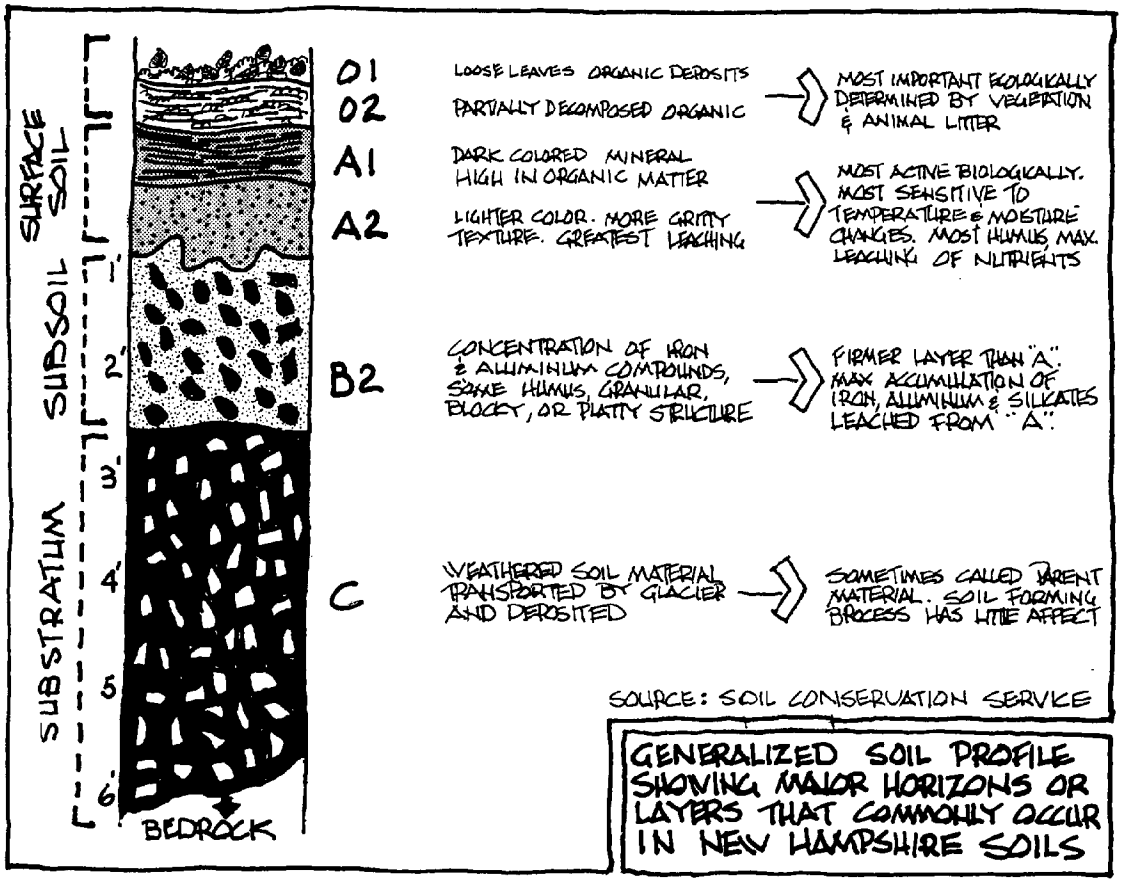
The Meaning of Soil

The soil has different meanings to different people: the potential homeowner often thinks of soil merely as a place to build a house and grow a lawn; engineers commonly consider soil as all the unconsolidated material overlying bedrock; soil scientists consider soil as a natural body that has both depth and surface area. For planning purposes, the soil scientist's definition is used, because the greatest source of soil information available to communities is scientists working for the Soil Conservation Service (SCS) of the U.S. Department of Agriculture.

A soil scientist is concerned primarily with the condition of the soil within four feet of the surface. According to SCS soil scientists, "soil is a dynamic three dimensional body. Its upper surface is the surface of the land; its lower boundary is parent



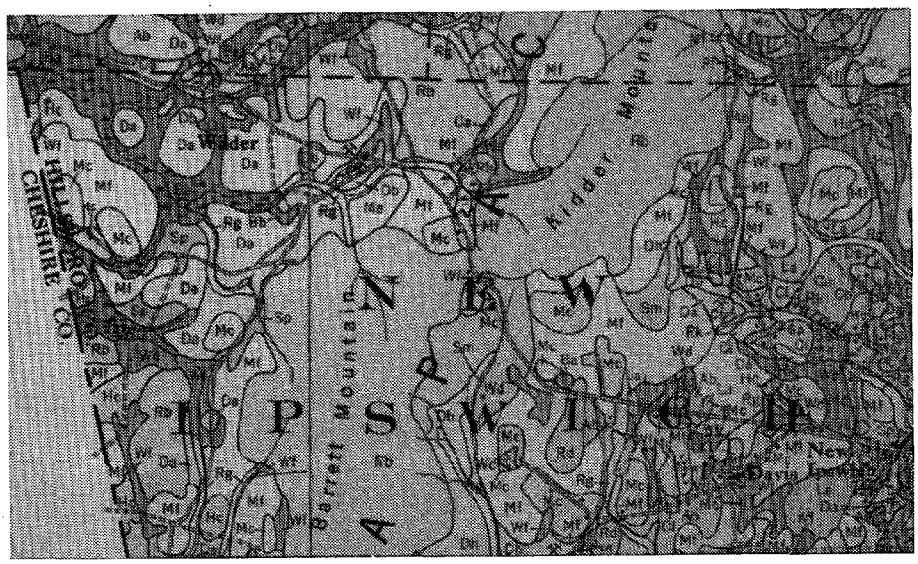
material or bedrock; and it is bounded on its sides by other soils. The properties of a soil represent the integrated effect of climate and living matter on the parent material, as conditioned by relief and time."



GENERALIZED SOIL PROFILE SHOWING MAJOR HORIZONS OR LAYERS THAT COMMONLY OCCUR IN NEW HAMPSHIRE SOILS

SCS Soil Surveys

"Soil survey" is a general term for the systematic examination of soils in the field and in laboratories--the description, classification and mapping of soil types, and the interpretation of their adaptability for different uses. For more than 40 years, SCS soil scientists have been engaged in surveying New Hampshire



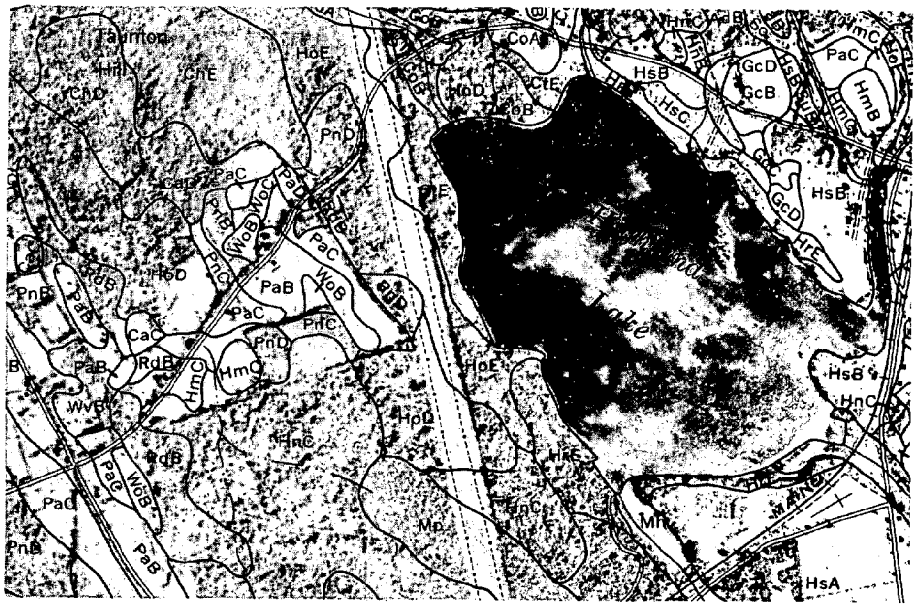
soils. During that period they have identified over 100 different kinds of soil, each one having distinctive properties. Soil surveys were completed for all New Hampshire counties except Carroll County prior to 1959. These county survey maps (produced at a scale of 1:62,500) did not provide soil boundary information in enough detail, however, to be used by communities for land use planning. Since 1959 the SCS has been re-surveying New Hampshire soils in greater detail, with the aid of advanced techniques. These recent "modern" soil survey maps are being produced at a scale of 1:15,840 and 1:20,000.

The pre-1959 soil surveys of New Hampshire counties have been published and are available from SCS county offices. "Modern" surveys have been completed for many communities and some counties, and may be obtained from SCS county offices (see Yellow Pages for listing). A planning board or planning team should give priority

to obtaining a modern soil survey if one has not been completed for the community. Assistance can be requested from the Soil Conservation Service, or a private consultant can be engaged to conduct a soil survey under SCS supervision.

Using Soil Survey Information

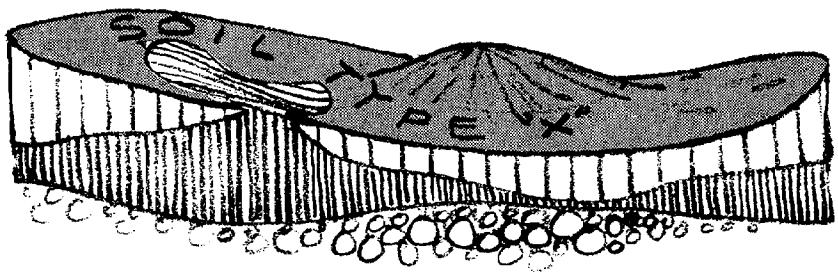
When the planning team has obtained a soil survey map of the community, at the same scale as the base map, it should transfer the soil boundary lines onto a community base map; this will greatly facilitate cross-referencing between the soil map and other maps. It may be possible to have SCS prepare a photo-mosaic from the soil survey map. These are separate aerial photos pasted together, with the soil boundaries inked on them. Photo-mosaic soil maps have proved very useful to several New Hampshire communities.



Essentially, a soil survey map shows the location of different soil types in the community. The lines

on the map indicate the boundaries between one soil type and another, and the symbols, which are keyed to written soil surveys, identify the type of soil and the general slope condition within the soil boundary. Actually, soil boundaries are approximations and, in most places, one soil type "phases" into another over a distance of 50-200 feet.

The designation of soil types and slope conditions represents the dominant characteristics. The soil type name shown for a particular area is the predominant soil type; very probably there are deposits or pockets of other soil types within the boundaries, but they are either too small or too irregular to be shown on the map. Similarly,



the slope code simply indicates the predominant condition of the area, and actual slopes may be greater or less than the indicated range.

Over the years, soil scientists have analyzed and observed the characteristics and behavior of many different soil types. Knowing the distinctive properties of the different soils allows soil scientists to make predictions about the suitability of a soil for different uses. For example, soil scientists know that an Acton soil is accompanied by a shallow water table; therefore, they can predict that wherever Acton soils are found, shallow water tables are also likely to be found. A planning team can use this accumulated knowledge of characteristics and behavior to identify potential problems, such as high water table and shallow depth to bedrock, to locate favorable soil conditions such as well drained loams, or to find deposits of sand and gravel. The key to what properties, behavior and limitations characterize each soil type is found in the soil survey interpretations sheets.

Soil Survey Interpretations Sheets

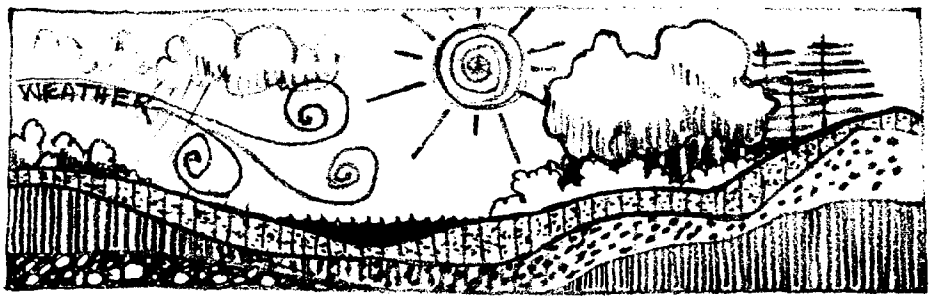
A soil survey map is accompanied by corresponding soil survey interpretations sheets, one for each soil type shown on the map (see page 57). The sheets describe the physical properties of each soil, such as its content of clay, silt, sand and gravel, and any particular associated conditions, such as the presence of hardpan or seasonal high water table. The sheets also provide interpretations (predictions) of the suitability of each soil for a variety of uses. Suitability is expressed in terms of the limitations that the soil poses for different uses. The degree of limitation is rated as slight, moderate or severe.

According to the Soil Conservation Service, a "slight" rating is given to soils that have properties favorable to the intended use. The degree of limitation is minor and can be easily overcome. These soils are considered to have the best potential for the intended use. A "moderate" rating is given to soils that have properties moderately favorable for the intended use. Limitations can be overcome or modified by special planning, design, construction or maintenance. These soils are considered to have intermediate potential for the intended use. A "severe" rating is given to soils that have one or more properties unfavorable to the intended use. Use of these soils generally requires major soil reclamation, special design and construction, or intensive maintenance. These soils are considered to have the poorest potential for the intended use.

The meaning of soil limitations deserves further explanation. A rating of severe does not mean that the intended use cannot occur on that soil; it does mean, however, that severe limitations may exist and corrective treatment may be necessary to overcome them. When a soil has been rated severe for a particular use, both the planning board and the developer should be aware of the specific conditions involved, the treatment necessary to overcome them, and the probable additional expense.

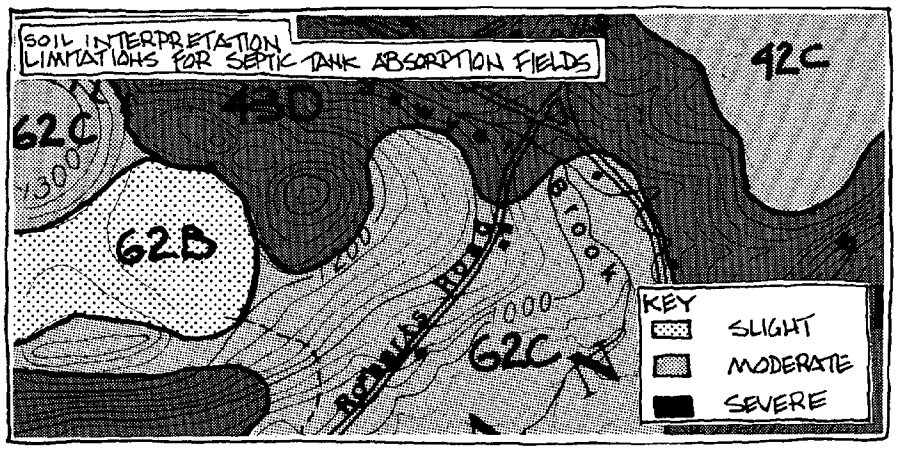
Soil survey map interpretation does not eliminate the need for on-site sampling, testing and study of other relevant conditions. As noted before, pockets of different soils, possibly having completely different qualities, may be present. For example, a soil may be rated severe because of its generalized slope condition, but on-site inspection may reveal localized slope conditions that are favorable to the intended use.

Soil properties do not function independently of each other; the behavior of a soil depends upon all properties and natural features present. The criteria for soil survey



interpretations sheet predictions are based upon present knowledge and may change in the future with more experience, data or better techniques.

When a planning team has acquired a soil survey map and interpretations sheets for the community, it has the tools to do a basic soil analysis. The maps permit the team to locate and identify areas of high water table, wetland soils, gravelly soils, or loamy soils. Using the interpretations sheets, the planning team can rank the community's soils according to their limitations for agriculture, local roads, recreation or septic effluent



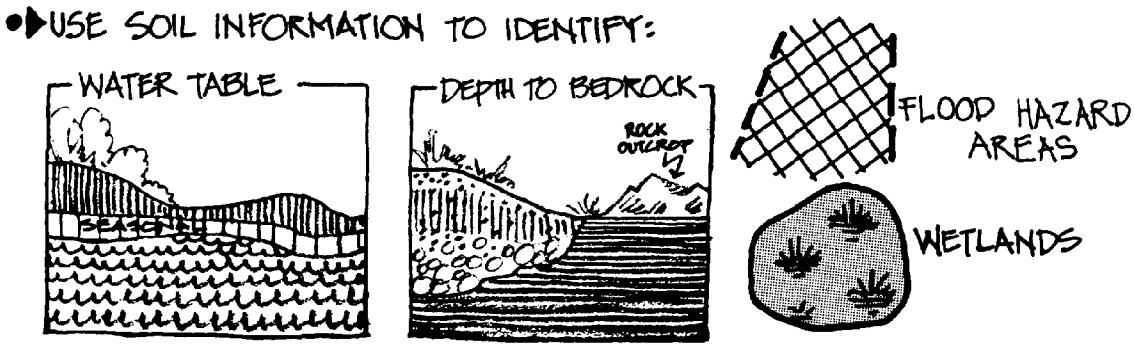
disposal. For specific locations, the planning team can make preliminary judgments about the suitability of soils for a particular use. As always, the map information should be supported by a site inspection.

SCS Interpretive Maps

Although a planning team is capable of performing its own soil interpretation studies with the aid of a soil survey map and soil survey interpretations sheets, it may desire further assistance; in this case, the local office of the Soil Conservation Service should be contacted. SCS soil scientists can prepare interpretive maps for such uses as agriculture, recreation, forestry, resource recovery, and development-related functions. The interpretive maps most often requested for community planning purposes include maps showing degrees of limitation for septic tank absorption fields, sewage lagoons, dwellings with basements, and local streets and roads.

Use of Soil Information in the Preparation of a Land Use Plan

Soil survey information can play a significant part in the preparation of a community's land use plan. An important use of soil information in this regard is the identification of flood hazard areas and major wetlands.



A planning team should locate and delineate these areas on a map and include them in the preferred for open space category. A planning team can also use soil information to identify problematic conditions, such as high water table or shallow depth to bedrock, that present on-site development problems, but may not affect the community at large.

Delineation of Wetlands

"Wetlands" refers to the group of soils and miscellaneous land types that are commonly found in a waterlogged condition. Wetland soils include muck and peat, marsh, and mineral soils that are poorly or very poorly drained, as defined by the SCS. In a wetland the water table is typically at or near the ground surface for seven to nine months of the year or more; some of these soils are ponded or have standing water on them most of the year. Although wetland conditions can be overcome, making them suitable for development, they ususally should be classified as preferred for open space.

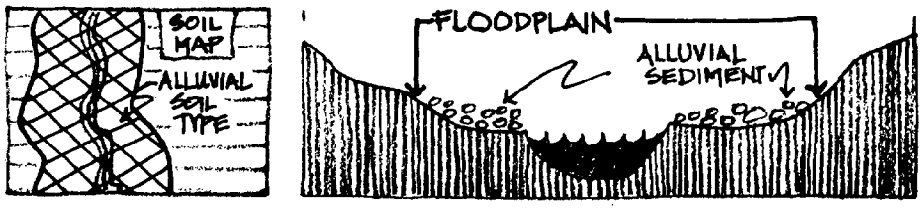
Arguments can sometimes be offered that wetlands should be classified as problematic rather than preferred for open space, because they may not perform critical environmental functions and may even permit significant water loss by evaporation. On the other hand, wetlands almost always provide habitats for wildlife, and often serve as aquifer recharge areas. Their economic value to a community is typically greater when they are kept as open space; therefore, major wetlands are recommended for

open space designation. In areas where the demand for land for development is intense, further analysis of the best use for specific wetland sites may be required.

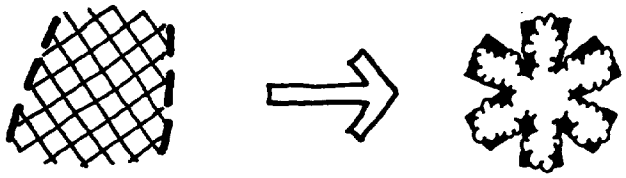
If soil information is to be used for developing and administering a wetlands ordinance, a modern detailed soil survey covering the area is essential. Small areas of better drained soils are generally included within the overall wetlands delineation; where small land areas are important, on-site examination to supplement the soil survey is essential. Any proposal to permit corrective treatment and development of wetlands should be carefully and fully considered by the planning board.

Delineation of Flood Hazard Areas

The modern detailed soil survey can be a useful tool in the preliminary delineation of flood hazard areas, since it identifies alluvial soils that are or have been subject to prior flooding. In a preliminary analysis, areas where these soils are located can be considered flood hazard areas and designated as preferred for open



space. The soil interpretation method of flood hazard area delineation, however, does not indicate the frequency of floods or the depth of flooding experienced. It is not intended to be--and should not be used where competition for land and land values demand that specific flood hazard areas be located with a high degree of accuracy.



The soil interpretation method does delineate an area as being "susceptible to the hazard of flooding." And, in the absence of other information, it can be used as a legal basis for the development and administration of land use regulations, codes and ordinances. It warns both present and prospective property owners of the potential hazard of flooding. In rural communities, such information can be relied on until more complete engineering surveys can be made.

Other Uses of Soil Survey Information

In addition to locating areas preferred for open space and areas having problematic soil conditions, a planning board can use the soil survey map in the ongoing administration of land use regulations in the community. In many towns the irregular configuration of soil boundaries makes it impractical to develop a

land use plan based solely on soil suitability; however, a planning board can use the soil survey to help evaluate soil suitability whenever a specific land use proposal is being considered. For example, if a residential subdivision is proposed in the community, the planning board can refer to the soil survey map and the soil interpretations sheets to make a preliminary assessment of soil suitability. Whenever soils are rated "severe" for the proposed use, the planning board is alterted to a potential problem and should then consult the soil interpretations sheets to determine why the severe limitation rating has been given. If the rating is based on shallow to bedrock conditions, for instance, the planning board should ask the developer how he proposes to overcome the condition.

The soil survey map may also be used to assist in locating areas for sanitary landfill operations, community recreation areas, school sites, and public roads. The soil survey should be referred to frequently throughout development of the land use plan, but it may have even greater usefulness in the ongoing process of implementation and administration.

Anytown, New Hampshire:

The Soil Map of Anytown, prepared using information supplied by the Soil Conservation Service, reflects common soil groupings in New Hampshire. The SCS information, showing the boundaries of the different soil types, was transferred onto a community base map, and each soil type was color coded. The various slope phases of the same soil type were not differentiated by color, because a separate slope map has been prepared. Thus, a Paxton soil gently sloping phase is shown in the same color as a Paxton soil moderately steep phase. When interpreting soils, however, the slope phase should always be considered.

Soil types are identified by number, as shown in the accompanying list; the letters following the numbers reflect slope conditions. Many older soil maps have only letter symbols which abbreviate the soil names, but the more recent SCS mapping utilizes both numbers and letters.

The Soil Map of Anytown shows a variety of soil types distributed throughout the community in irregular shapes. Soil survey interpretations sheets can be used in conjunction with this map to make general predictions about soil behavior. In Anytown, the first use of the soil survey information was to identify the flood hazard areas and the major wetlands in the community;

the boundaries of these areas were later transferred to the Summary Analysis Map and the areas designated as preferred for open space.

As shown on the Soil Map, there are two general flood hazard areas in Anytown: Hawkeye Swamp and Willow Swamp. Alluvial soils (Rumney and Ondawa) bordering the lower reaches of Butler and Willow Brooks indicate a history of past flooding and warn prospective users that these areas may be inundated again in the future. In addition to the flood hazard areas, major wetlands and soils with high water tables can be identified from the soil survey, with interpretations sheets. In the Jonesville vicinity, poorly drained soils cover a large flat area at the bottom of the "bowl." Badger Bog is characterized by poorly drained soils and is wet for most of the year. The only identified area of muck and peat is just upstream from Fools Pond, at the base of Bald Mountain.

Although there are many different soil types in Anytown, several specific soils are dominant. Among them is Charlton very stony loam (or very stony fine sandy loam) for which the indicated symbol is 63. The sample Soil Survey Interpretations sheet shows that Charlton very stony loam generally has four to six feet or more depth to bedrock, with similar depth to seasonal high water table. Given the New Hampshire Water Supply and Pollution Control Commission requirement of four feet of soil above seasonal high water table and eight feet above bedrock for septic tank leach field construction, septic tank use may be possible, although some care may have to be exercised in construction. A further indication of caution is found in the bottom section of the first page of the interpretations sheet. In that section, the Soil Conservation Service has indicated the degree of limitation for certain types of development on the soil under study. On moderate slopes, there is only a moderate limitation for septic tank use; on steeper slopes, there is a severe limitation.

Other sections of the Soil Survey Interpretations sheet indicate the suitability of the soil as a resource material (for topsoil, sand and gravel mining, or landfill purposes) and for various engineering uses. The second side of the sheet indicates the soil limitations for recreational, farm, woodland and wildlife use. The best use for Charlton very stony loam appears to be woodland production and management. This does not mean, however, that the soil cannot support other uses, if its limitations are recognized, respected, treated and overcome.

SOIL SURVEY INTERPRETATIONS

SOIL: Charlton very stony loam or very stony fine sandy loam
MAP SYMBOL(S): 63
BRIEF SOIL DESCRIPTION:

STATE: New Hampshire
DATE: 7-73
MLRA(S): 144

These are well-drained soils that formed in glacial till. Typically these soils have a dark brown very stony fine sandy loam surface layer 8 inches thick. The subsoil from 8 to 26 inches is yellowish-brown and light olive brown fine sandy loam. These soils occupy hilly uplands. Below this to 42 inches is grayish-brown gravelly fine sandy loam. Slopes range from 3 to 35 percent.

ESTIMATED PHYSICAL AND CHEMICAL PROPERTIES FOR ENGINEERING

Depth From Surface (Inches)	Classification			Percentage Less Than 3 Inches Passing Sieve No.			Permeability (in/hr)	Available Water Capacity (in/in)	Soil Reaction (pH)	Shrink-Swell Potential
	USDA Texture	Unified	AASHO	4	10	200				
0- 8	stv-fsl, stv-l	SM, ML	A-4	85-95	80-90	35-60	0.6-2.0	.11-.23	4.5-6.0	Low
8-26	fsl, l	SM	A-2 A-4	80-90	75-85	30-50	0.6-2.0	.09-.19	4.5-6.0	Low
26-42	gfsl, gsl, fsl, sl	SM	A-2 A-4	70-85	65-80	20-40	0.6-2.0	.06-.16	4.5-6.0	Low

Depth to Bedrock (Ft): 4-6+
Depth to Fragipan (Ft): —
Depth to Seasonal High Water Table (Ft): 4-6+
Flood Hazard: None
Potential Frost Action: Moderate
Hydrologic Group: B

SUITABILITY AND MAJOR FEATURES AFFECTING SOIL AS A RESOURCE MATERIAL

Topsoil	Poor: stoniness
Sand	Unsuited: excess fines
Gravel	Poor: excess fines
Roadfill	Fair: moderate potential frost action
Daily Cover For Landfill	Fair: stoniness

MAJOR SOIL FEATURES AFFECTING SPECIFIED ENGINEERING USES

Highway Location	Moderate potential frost action, stoniness
Pond Reservoir Areas	Moderate permeability, stoniness
Pond Embankments	Moderately slow permeability, stoniness
Sprinkler Irrigation	High available water capacity, stoniness
Drainage	Well-drained, stoniness
Diversions and Waterways	Moderate permeability, high available water capacity, stoniness

DEGREE OF SOIL LIMITATION AND MAJOR SOIL FEATURES AFFECTING TOWN AND COUNTRY PLANNING

Use	Slope	Degree of Limitation	Major Soil Feature(s) Affecting Use
Septic Tank Absorption Field	B & C D & E	Moderate Severe	Stoniness Slope
Sewage Lagoon	B C, D & E	Moderate Severe	Moderate permeability Slope
Dwellings (With Basements)	B & C D & E	Moderate Severe	Stoniness Slope
Dwellings (Without Basements)	B & C D & E	Moderate Severe	Moderate potential frost action, stoniness Slope
Lawns and Landscaping	B & C D & E	Moderate Severe	Stoniness Slope
Local Roads, Streets and Parking Lots	B C,D & E	Moderate Severe	Moderate potential frost action, slope Slope
Shallow Excavations (6 feet or less)	B & C D & E	Moderate Severe	Stoniness Slope

Charlton very stony loam or very stony fine sandy loam

DEGREE OF SOIL LIMITATION AND MAJOR SOIL FEATURES AFFECTING RECREATION DEVELOPMENT

Use	Slope	Degree of Limitation	Major Soil Feature(s) Affecting Use
Camp Areas (Tent and Camp Trailers)	B & C D & E	Moderate Severe	Stoniness Slope
Picnic Areas (Park-Type)	B C D & E	Slight Moderate Severe	 Slope Slope
Playgrounds (Athletic Fields)	B C, D & E	Moderate Severe	Stoniness Slope
Paths and Trails (Hiking and Bridle)	B, C & D E	Moderate Severe	Stoniness Slope

SUITABILITY AND MAJOR SOIL FEATURES AFFECTING FARM USE

Use	Slope	Suitablity	Major Soil Feature(s) Affecting Use
Truck Crops	All	Unsuited	Stoniness
Field Crops	All	Unsuited	Stoniness
Hay and Pasture Crops	B, C & D E	Poor Unsuited	Stoniness Slope
Apple Orchards	B, C & D E	Poor Unsuited	Stoniness Slope

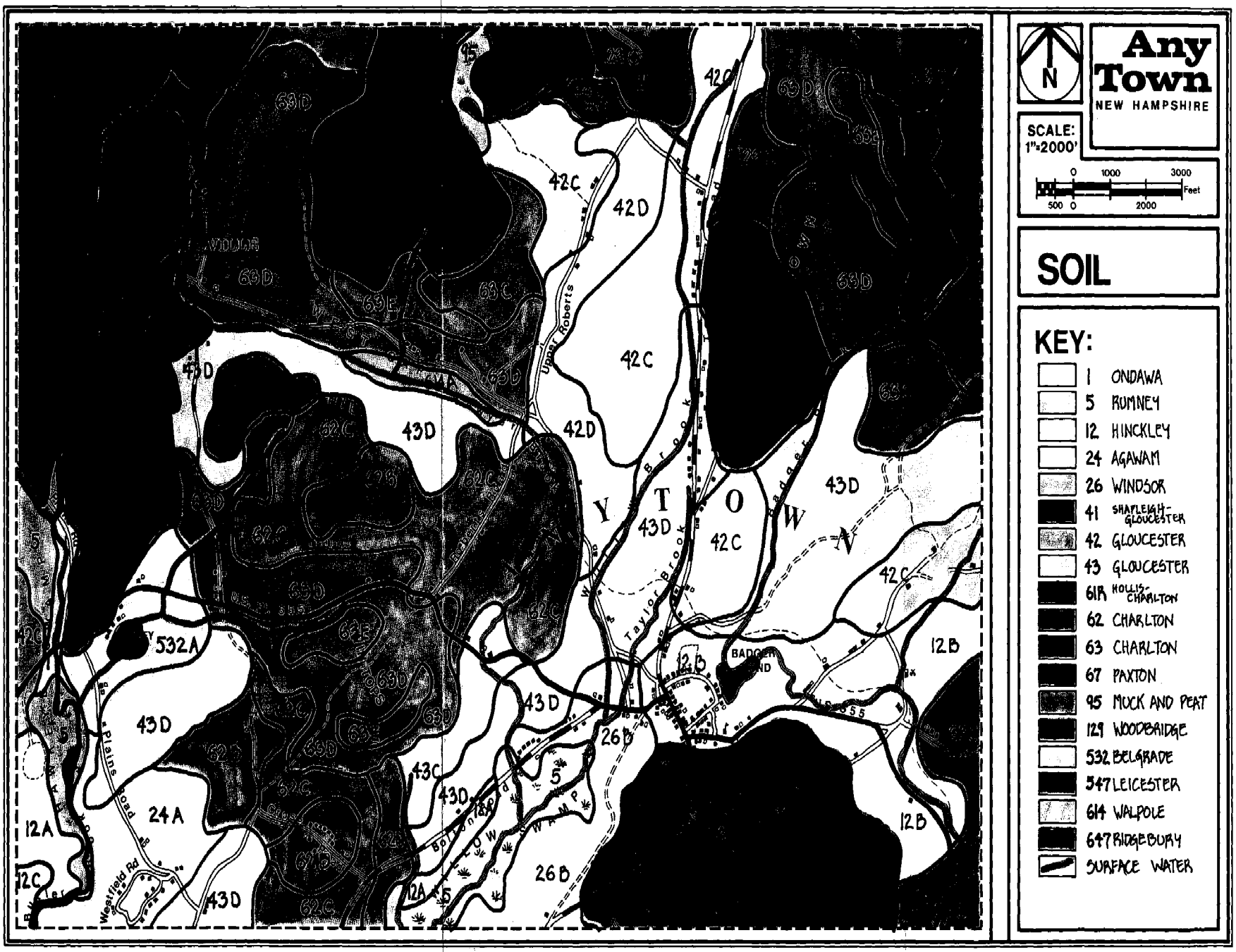
SUITABILITY FOR WOODLAND PRODUCTION AND LIMITATIONS FOR MANAGEMENT

Slope	Degree of Limitation Related to - - -						Productivity			Species to Favor - -	
	Seedling Mortality	Plant Competition		Windthrow Hazard	Erosion Hazard	Equipment Restrictions	Suitability Group	Major Species	Site Index Range	Existing Stands	For Planting
		Hardwood	Conifer								
B & C	Slight	Slight	Moderate	Slight	Slight	Slight	4o2	White Pine* Red Oak Red Pine Northern Hardwoods	60-70 55-65 60-70 52-59	W.P. R.O. S.M. Y.B. Hem.	W.P. R.P. W.S.
D & E	Slight	Slight	Moderate	Slight	Slight	Moderate	4r1				

SUITABILITY AND MAJOR SOIL FEATURES AFFECTING USE FOR WILDLIFE

Kinds of Wildlife	Slope	Suitability	Major Soil Feature(s) Affecting Use
Openland	All	Poor	Stoniness
Woodland	All	Good	
Wetland	All	Very Poor	Deep to water table, slope

* Indicator Species



Any Town
NEW HAMPSHIRE
N
SCALE: 1"=2000'
0 1000 3000 Feet
500 0 2000
SOIL
KEY:
1 ONDAWA
5 RUMNEY
12 HINCKLEY
24 AGAWAM
26 WINDSOR
41 SHAPLEIGH-GLOUCESTER
42 GLOUCESTER
43 GLOUCESTER
61R HOLLIS-CHARLTON
62 CHARLTON
63 CHARLTON
67 PAXTON
95 MUCK AND PEAT
129 WOODBRIDGE
532 BELGRADE
547 LEICESTER
614 WALPOLE
647 RIDGEBURY
SURFACE WATER
Y T O W N
Upper Roberts
Taylor Brook
Plains Road
Westfield Rd
BADGER POND
42C
42D
43D
43C
26B
12A
12B
532A
24A
5

SOIL MAP

Notes

Soil Survey Legend

1	Ondawa fine sandy loam
5	Rumney fine sandy loam
12A	Hinckley loamy sand, 0-3% slopes
12B	Hinckley loamy sand, 3-8% slopes
12C	Hinckley loamy sand, 8-15% slopes
24A	Agawam very fine sandy loam, 0-3% slopes
26B	Windsor loamy sand, 3-8% slopes
41C	Shapleigh-Gloucester very rocky sandy loams, 8-15% slopes
41D	Shapleigh-Gloucester very rocky sandy loams, 15-25% slopes
41E	Shapleigh-Gloucester very rocky sandy loams, 25-35% slopes
42C	Gloucester sandy loam, 8-15% slopes
42D	Gloucester sandy loam, 15-25% slopes
43C	Gloucester very stony sandy loam, 8-15% slopes
43D	Gloucester very stony sandy loam, 15-25% slopes
61RD	Hollis-Charlton fine sandy loams, 15-25% slopes
61RE	Hollis-Charlton fine sandy loams, 25-35% slopes
62B	Charlton loam, 3-8% slopes
62C	Charlton loam, 8-15% slopes
62D	Charlton loam, 15-25% slopes
63C	Charlton very stony loam, 8-15% slopes
63D	Charlton very stony loam, 15-25% slopes
63E	Charlton very stony loam, 25-35% slopes
67D	Paxton very stony loam, 25-35% slopes
67E	Paxton very stony loam, 25-35% slopes
95	Muck and Peat
129C	Woodbridge very stony loam, 8-15% slopes
532A	Belgrade silt loam, 0-3% slopes
547A	Leicester very stony loam or very stony fine sandy loam 0-3% slopes
614A	Walpole loamy sand, 0-3% slopes
647B	Ridgebury very stony loam, 3-8% slopes

Chapter 6

WATER RESOURCES

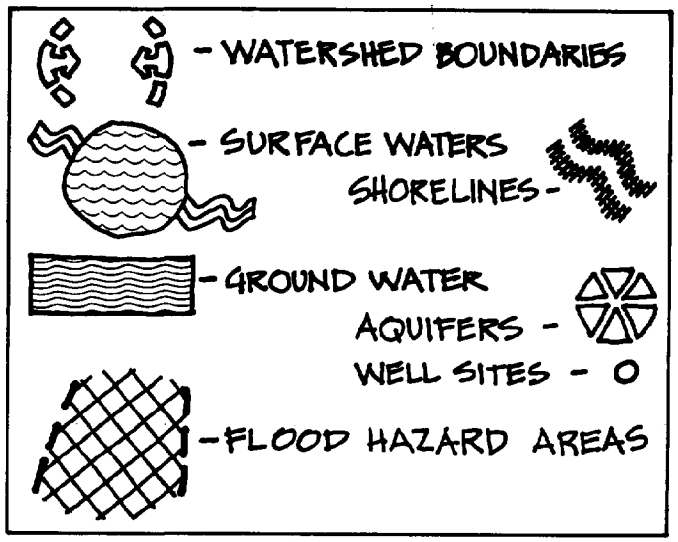
Water is one of New Hampshire's most abundant and useful natural resources; with proper management, plentiful clean water will always be available for domestic and commercial consumption and for recreational and scenic enjoyment. A study of community water resources is an integral part of the land planning process.

Land is an inseparable part of water resource management, since the way in which land is used affects the availability and quality of surface and ground water supplies. The purpose of a community water resource study is to locate useful supplies, determine their relationship to land use, and develop policies to ensure their continued availability and quality. Additionally, a water resources study should include a further examination of flood hazard areas and flooding in the community. Knowledge of all water movements will assist in planning land uses to protect supplies and avoid flood damage.

With limited professional assistance, a planning team can conduct its own water resources study. By using a topographic map to inventory surface waters and wetlands, define watershed boundaries, and consolidate available

information on known ground water aquifers, a planning team can learn how land areas and land use relate to the community's water resources. It also can identify

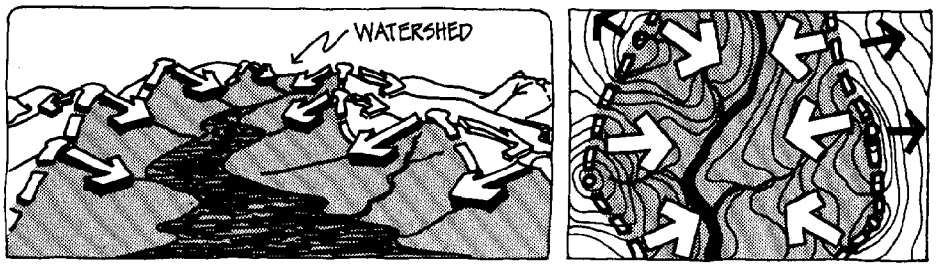
WATER RESOURCE INVENTORY →



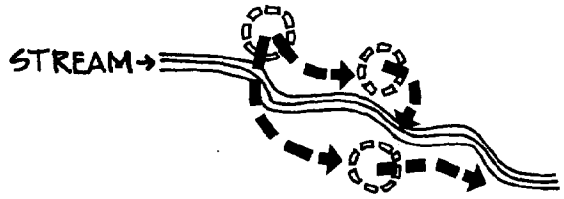
any areas of critical significance, and it can delineate areas of development opportunity. The planning team can then use this information in formulating the framework of the community land use plan and in developing a community water resource management program.

Surface Water

Both standing and flowing surface waters offer recreational, aesthetic and economic benefits to the communities in which they are located. The planning team should inventory all surface waters in the community as a means of assessing the extent and distribution of these resources. Indicating watershed boundaries on the topographic map will help clarify and emphasize the pattern and direction of flows.

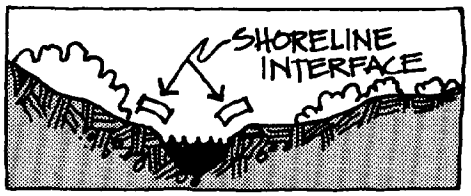


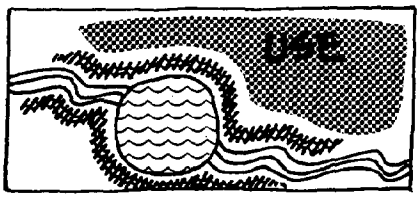
Water, by its nature, connects land areas, so shoreline land use--when it affects the water--can have an impact downstream or on the opposite shore. In studying



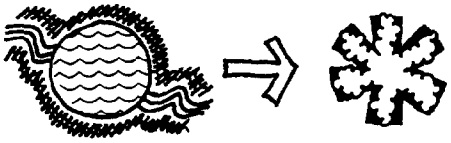
the drainage pattern of surface waters, a planning team should look at entire watershed areas. Special attention should be paid to places where watersheds cross political boundaries. The way in which one community manages its land and water can have a significant effect on other communities in the watershed.

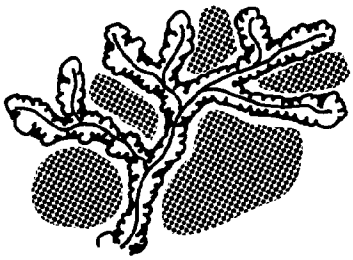
There is a direct relationship between land use and surface water quality because of the manner in which precipitation flows from the land surface into the drainage network. It is most critical at the actual interface between land and surface waters. Thus, if development can be set back from shorelines, water quality will be



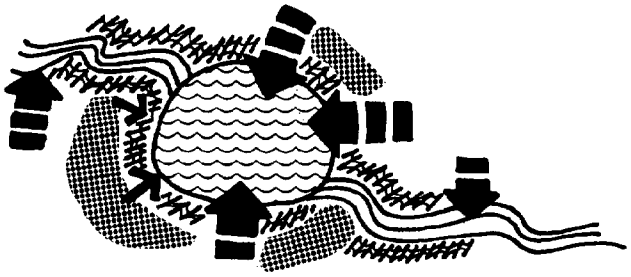


easier to maintain. As an initial step toward proper management of water and related land resources, The Land Book recommends that shorelines be designated as preferred for open space. In addition to protecting the critical land-water interface, this designation creates an open space network that reaches into every corner of the community, forming a natural framework within which development can occur.





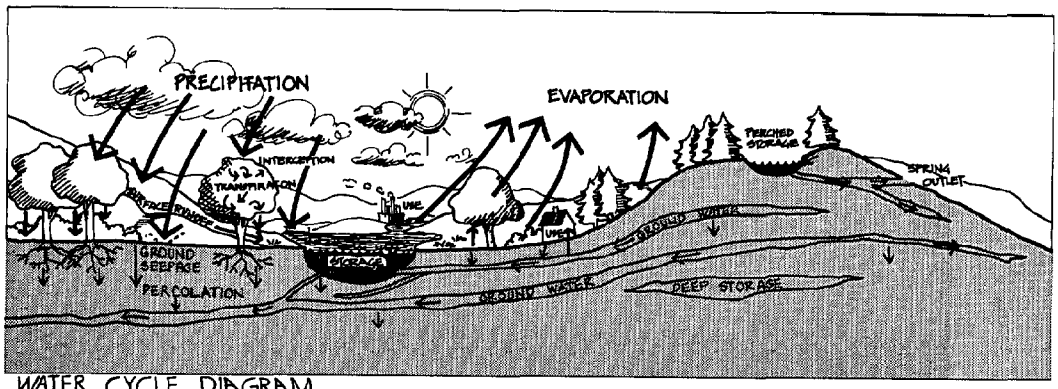
Designating shorelines as preferred for open space should not preclude all developed use of these areas. Some commercial and many recreational uses depend on direct access to or contact with surface waters. Waterfront development can be achieved in an environmentally



sound manner, if such activities are governed by criteria which ensure water quality. In the course of inventorying the community's surface waters, a planning team may find it useful to identify both existing and potential shoreline uses.

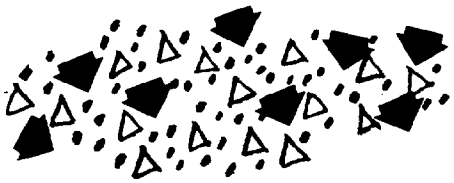
Ground Water and Aquifers

A second major source of New Hampshire's water is in the ground. Precipitation that does not run off as surface water infiltrates the soil. Some may remain near the surface as soil moisture, where it is drawn up by the roots of plants, but much of it continues to percolate downward, becoming ground water. Depending on underground conditions, recoverable ground water supplies may be plentiful or scarce in any given location.

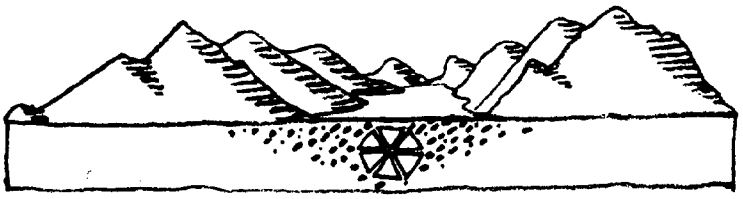


WATER CYCLE DIAGRAM

An aquifer is a soil deposit--or sometimes a porous rock formation--that contains a recoverable volume of ground water. Ease of recoverability is one of the most important aspects of an aquifer as it relates to development potential. Much of New Hampshire is covered by glacial till (hardpan)--an unsorted mixture of clay, silt, sand, gravel, and boulders. These till deposits store a signficant amount of water, but it moves very slowly through the tiny pore spaces and is not easily recoverable. Accordingly, till is a poor aquifer and normally does not yield enough water to meet municipal, industrial or commercial needs; it may, however, yield enough water for individual, scattered residences. On the other hand, in stratified deposits of sand and gravel there are



abundant large pore spaces between grains to store and transmit water. Ground water exploration in New Hampshire has been most successful where thick, water-saturated sand and gravel deposits occur--chiefly in valleys.



Because sand and gravel aquifers are porous and transmit water rapidly, they are also susceptible to pollution. Once a pollutant enters an aquifer, its movement is governed by the ground water flow, and it may remain in the aquifer for an indeterminate period of time. The impact of a pollutant on an aquifer depends on the size and characteristics of the aquifer and on the nature and amount of pollution that is introduced. Sources of aquifer pollution are often located on the ground surface directly above or contiguous to the aquifer; septic tank effluent, land fill refuse, leakage from sewer lines or ruptured fuel tanks, and even agricultural fertilizers and pesticides are possible sources of aquifer pollution.

The likelihood of aquifer pollution from these and other sources depends largely on the depth to the aquifer water table (the level of permanent saturation). The deeper it is, the more likely it is that pollutants will be absorbed in the soil or will become diluted before they reach the water table.

The productivity of an aquifer can be limited by covering the ground surface above it with impervious material; extensive paving and building coverage can prevent water from quickly entering the ground and replenishing the ground water supply. Removal of overlying sands and gravels may expose the water table to direct pollution and may result in increased evaporation.

Since aquifers often occur in valleys, and are often flat, well drained, easily excavated, and easily developed, these areas are in demand for many uses. A planning team should carefully assess the existence of aquifers in the community in terms of present and future demands for water; the potential lasting values of aquifers should not be jeopardized by excessive exploitation of their other values. Aquifers should be designated as problematic areas; a cautious approach should be taken to planning for surface uses of these areas until their importance has been more fully explored.

Locating aquifers is more difficult in New Hampshire--because of its glacial geology--than it is in other parts of the country where the geology is more uniform. To gain an understanding of local ground water conditions, a planning team should compile all locally available information about possible ground water sources; local well drillers and citizens familiar with the ground water situation in their areas can be very helpful in this regard. Additional data can be obtained from records of the depth, type,

and flow of water wells where such records have been kept and are available. By locating known wells on a topographic map and drawing on local wisdom, a planning team can piece together a beginning inventory of ground water sources. Once this has been done, a planning team may wish to seek professional assistance to further the exploration process. If a community has a pressing need to locate ground water supplies, it should engage an engineering consultant experienced in this field. From experience and a study of local surficial geology, ground water experts can predict where recoverable sources may be found and can conduct test borings to find out whether their predictions were correct. An important source of professional assistance to communities is the Water Resources Division of the United States Geological Survey.

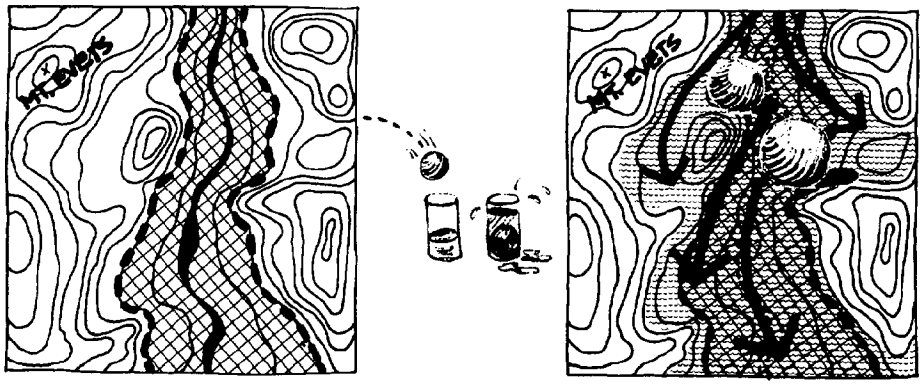
USGS
United States Geological Survey

The U.S. Geological Survey in cooperation with the New Hampshire Water Resources Board is in the process of surveying and mapping potential ground water resources throughout the state; this work will be completed in 1976. The purpose of the investigation is to identify areas where recoverable ground water is likely to be found in large quantitities.

Essentially, these maps provide a preliminary assessment of ground water availability, based on estimates of the capability of aquifers to store and transmit water. The aquifers are rated as having high, medium or low potential to yield ground water. Such a map serves as a guide for ground water exploration and alerts a community to land areas that deserve special consideration. A planning team should obtain a copy of the USGS ground water availability map and transfer the pertinent information onto the water resources map. USGS ground water experts can assist a planning team in interpreting this information and can suggest ways in which it might be used.

Flood Hazard Areas

Floods are a natural and normal phenomenon; they become a problem to man only when he competes with streams and rivers for the use of floodplains. During normal stream flow, water is carried in the channel; but in times of high runoff, water rises over the banks and flows onto the floodplain, frequently damaging structures located there.



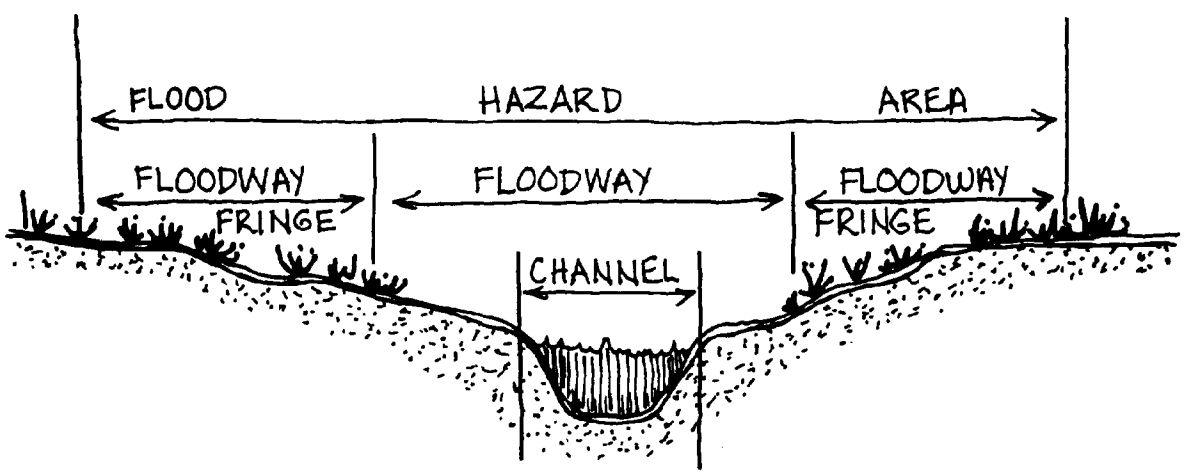
There are two broad solutions to the flood problem: the protective solution, which utilizes structural features such as dams, levees and other construction techniques to minimize flood damage; and the preventive solution, which relies on regulation of land uses to keep flood-damageable property out of flood hazard areas. For many years, the protective solution has been relied on to avert flood damage; this alone has not done the job, and the emphasis is now on the preventive approach. The new strategy is being implemented through the National Flood Insurance Program, in which the Federal government requires that a community regulate construction in flood hazard areas in order to qualify for the sale of flood

insurance. Failure of a community to participate in the program renders all property owners in that community ineligible for Federally-subsidized flood insurance. The National Flood Insurance Program has made land management in flood hazard areas a virtual necessity for many New Hampshire communities.

The first step in managing the use of flood hazard areas is to identify and map them. The soil interpretation approach has already been discussed, and it serves as a useful, necessary beginning. That method, however, has certain limitations: for example, soils define an area that at one time or another has been inundated with water; they do not show how deep the water was, how frequently the area has been flooded, or how recent changes in land use or construction of flood control structures may have altered floodplain and flooding characteristics. Engineering studies and analysis of historic flood information are needed to determine depth and frequency, and to identify accurately the extent of flood hazard areas.

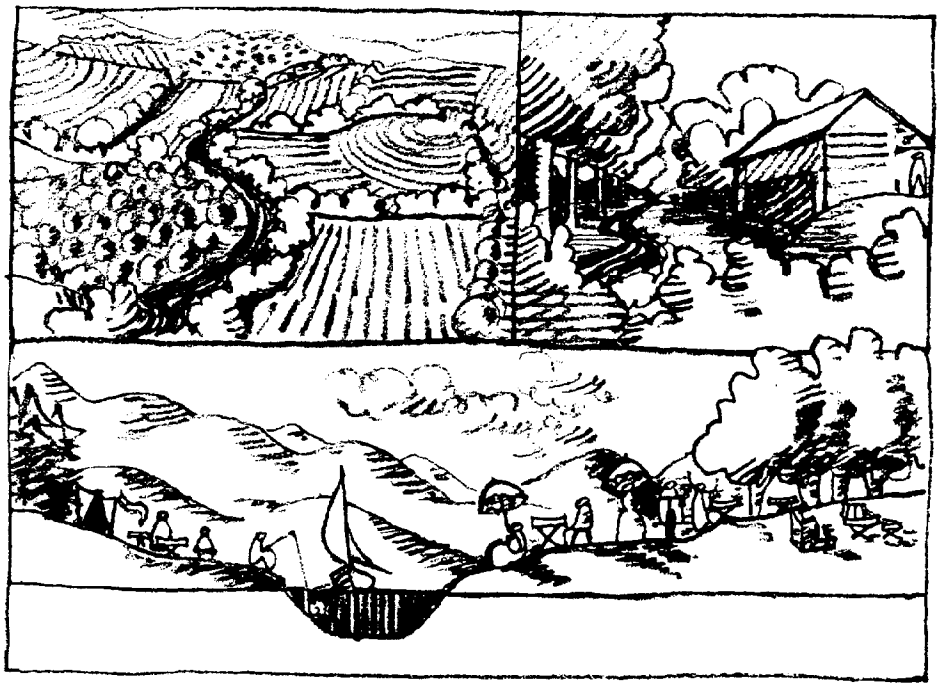
Several Federal agencies are presently engaged in researching and mapping flood hazard areas; much of the information they are gathering is being made available to communities as part of the Flood Insurance Program. A planning team should obtain whatever information it can from the various sources concerned with flood hazard area mapping and plot this information on the water resources map.

Floodplains, or flood hazard areas, actually have two parts: the floodway and the floodway fringe. The floodway includes the channel and an additional area that often carries excess flow. The floodway fringe is a broader area over which floodwater sometimes spreads, but where

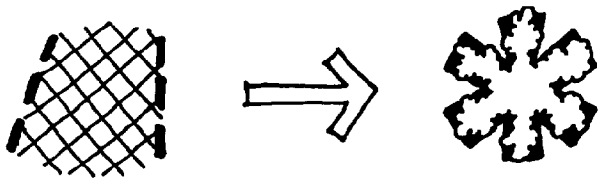


UNDEVELOPED FLOODPLAIN SECTION

the flow velocity is slower. This distinction has land use implications, for some uses can occur safely in the floodway fringe, but not in the floodway. If a community's flood hazard area information does not distinguish the floodway from the floodway fringe, a planning team should consider designating the entire flood hazard area preferred for open space until further studies are completed. Where a distinction has been made between floodway and floodway fringe, the floodway should be designated as preferred for open space, and criteria established for land use in the floodway fringe. As a general rule, land in flood hazard areas is more suitable to non-structural uses, such as agriculture, recreation, roads and parking; however, the floodway fringe can be used for limited development when structures are sufficiently elevated and flood-proofed.



The subject of flood hazard area delineation and regulation is important. In a community that has several rivers and streams, a planning team may want to establish a sub-committee to deal exclusively with these matters.



Any Town
NEW HAMPSHIRE

SCALE: 1"=2000'

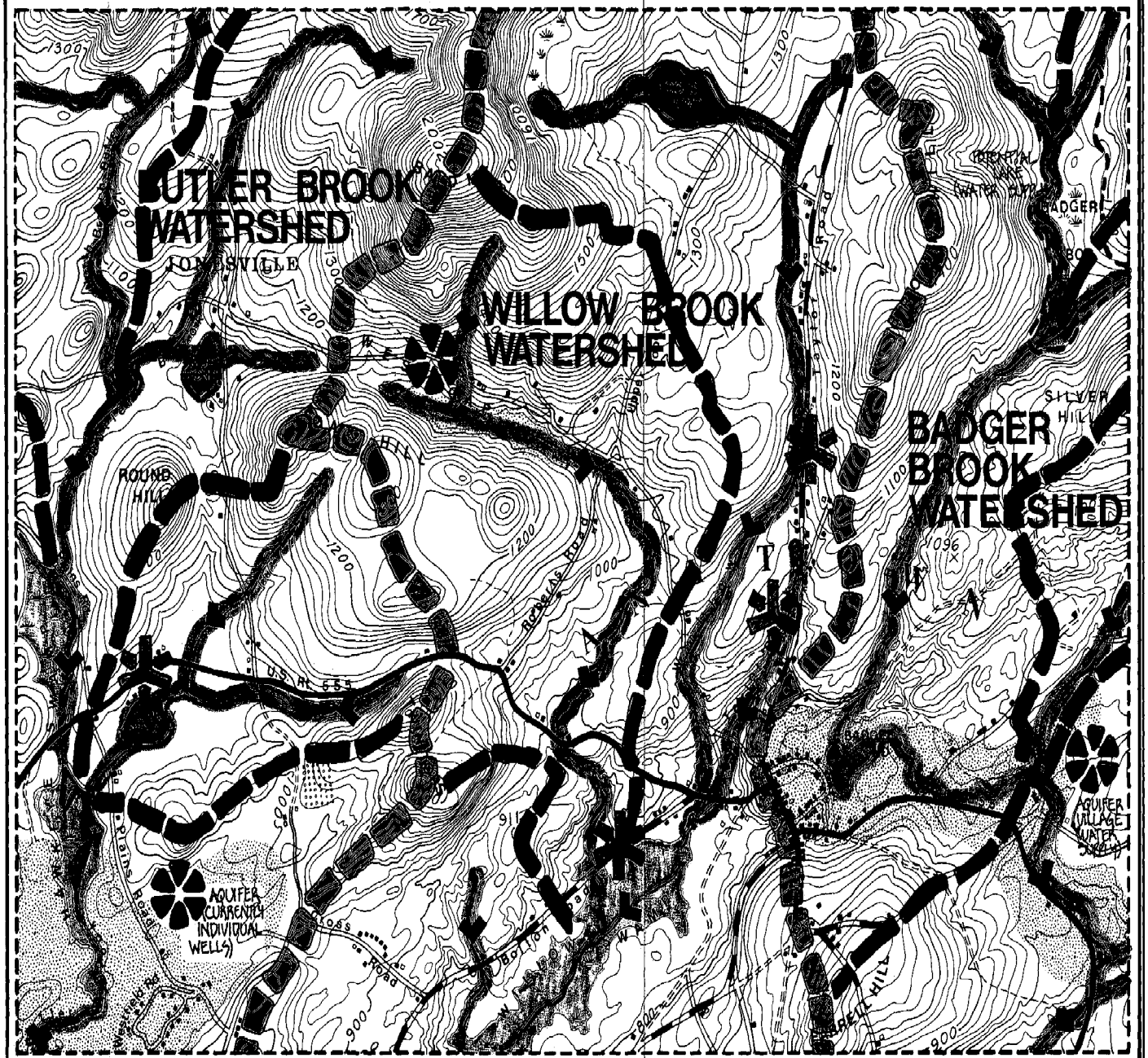
0 1000 3000 Feet

500 0 2000

WATER RESOURCES

KEY:

- SURFACE WATER
- FLOOD HAZARD AREAS
- STREAM BORDERS
- PRIMARY WATERSHED BOUNDARY
- SECONDARY WATERSHED BOUNDARY
- CAUTION AREAS • WATER QUALITY
- POSSIBLE AQUIFER
- DIRECTION OF STREAM FLOW



Notes

WATER RESOURCES MAP

Notes

WATER RESOURCES MAP

Anytown, New Hampshire:

The Water Resources Map of Anytown shows that the community has an abundance of surface water, as well as large potential ground water supplies. Water resources are well distributed throughout the community, and with one exception they are presently of high quality. The Water Resources Map also shows flood hazard areas as they were delineated by the soil interpretation method.

A study of the surface water drainage network in Anytown illustrates how it connects diverse land areas. One of the first observations that can be made from this pattern is that the direction of most surface water drainage is southerly from the highlands to the lowlands. Watershed boundaries show that there are three principal watersheds within the community, two of which have headwaters extending into neighboring towns. As a consequence, land use in these neighboring towns, beyond the control of Anytown, partially determines the quality of water in Anytown. On the downstream side, the neighboring communities are in turn affected by Anytown's water and related land resource management policies.

The western portion of Anytown falls within the Butler Brook watershed. Although most of the headwaters of Butler Brook are contained in the large "bowl" area around Jonesville, the watershed boundaries do extend into neighboring towns. In the lower reaches, tributary flows from Turkey Pond and from the west enter Butler Brook before it flows through a large wetland area known as Hawkeye Swamp (identified through topographic and soil interpretation as a flood hazard area). There are two small ponds in the watershed, and although neither is large enough to accommodate intensive recreational use, summer camps have been built along the shores of Turkey Pond. Turkey Pond is being polluted by effluent from malfunctioning septic systems serving the camps and by agricultural wastes being washed into it from the adjoining dairy farm.

The Willow Brook watershed has its headwaters in Anytown. The main brook begins high on Bald Mountain and flows eastward into Fools Pond, an attractive mountain water body with recreational potential. From there, flowing southward along Taylor Road, the main stream is joined near the village by a small tributary before flowing into Willow Swamp where it is joined by Sawyers Brook. Willow Swamp also is a flood hazard area according to the soil survey.

Maintenance of the existing high water quality of Willow Brook depends largely on the stream bank management policies adopted by Anytown. The water resources map reveals two areas within the watershed where the possibility of pollution from septic tank leach fields appears high. In the West Gap area several residences are grouped along a small tributary which, due to its low volume of flow, could be easily polluted. Similarly, along Taylor Road several residences utilizing septic tanks abut Taylor Brook. In both places roads run parallel to the brooks, raising the possibility that winter road salting could cause water contamination.

The future of Fools Pond should be carefully considered by the planning team to help ensure that its recreational potential can be realized without sacrificing its scenic qualities. Shoreline setbacks are advisable, as are regulations governing the speed and horsepower of motor boats. Acquisition and development of a public access area might also be considered.

Badger Brook begins in the neighboring town, flows southward into Badger Pond near the village and thence eastward into the next town. A community park and recreation area is located at the pond adjacent to the village, and the pond is used for swimming and non-power boating. Although the quality of water in Badger Brook is high at present, residential growth in the village area could create problems, and the situation should be closely monitored. As a safeguard, the shoreline of both the brook and the pond should be designated as preferred for open space. The potential for developing a major lake in the

Badger Bog area should also be kept in mind for future reference; this could eventually be utilized as a surface water supply for the community.

Flood hazard areas in the community fortunately have not been developed, although the temptation appears to exist in several places. Before development expands into the flood hazard area (a growing mobile home park is situated at its edge), a building code governing construction in these areas should be formulated.

Flood hazard area identification in Anytown was based on soils information, and an effort should be made to refine these data in the future. When a clearer definition of the floodway and floodway fringe has been established, regulations can be modified to reflect the new boundaries.

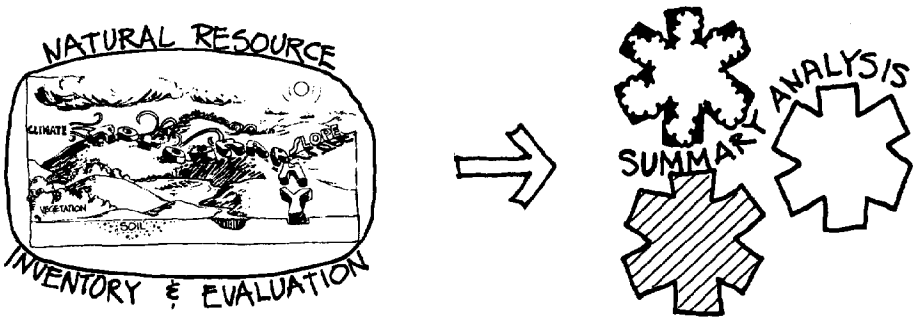
Potential ground water sources have been indicated in each of the watersheds, based on information obtained from the USGS. A large gravel deposit in the lower Butler Brook area is already being tapped by individual wells; the aquifer under the town center is the source of the community water supply, and a small deposit in West Gap is being used by residences there. Development is occurring over all three aquifers, and septic tanks are being used. Although no detrimental effects are evident yet, the situation deserves closer inspection; excessive development utilizing septic tanks in these areas could cause contamination of ground water sources. Drilling records for the town well should be reviewed in an effort to determine the depth of the water table in the aquifer area. Because the community water system relies on the aquifer under the town center, future development in the area should be served by a sewage collection and treatment system. Until such time as one is built, the planning team might consider proposing limitations on the density of development on the aquifer.

Notes

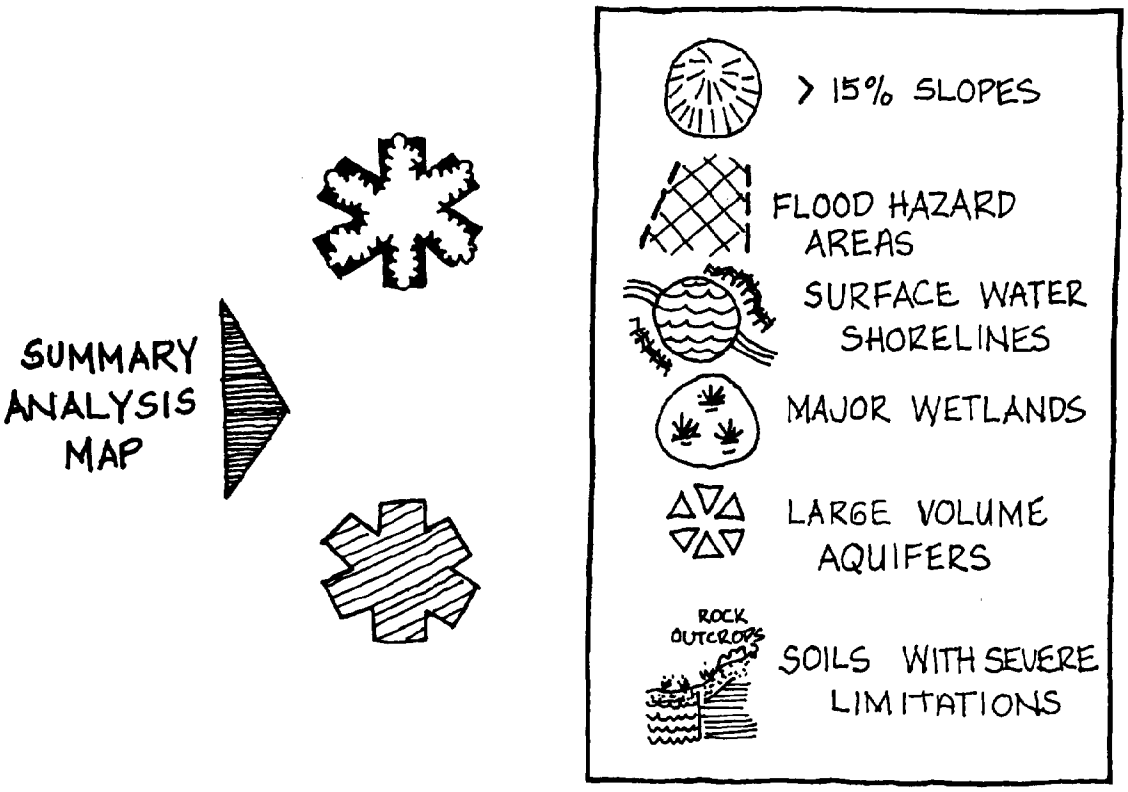
Chapter 7

THE SUMMARY ANALYSIS MAP

A summary analysis map graphically summarizes those physical features, characteristics and conditions that have the greatest influence on land use in the community. It capsulizes the most significant aspects of the topography, slope, soil and water resources studies and shows all areas preferred for open space and major problematic areas. The summary analysis map illustrates the interrelationships among the most critical natural systems in the community.



As indicated in prior sections, the areas that definitely should be considered for designation as preferred for open space are: slopes greater than 25 percent, flood hazard areas, major wetlands, and surface water shorelines. Problematic areas should also be noted on the map, even though their final significance may not have been determined. These include soils with certain "severe" limitations, slopes of 15-25 percent, known large-volume aquifers, and similar conditions which may present complex development problems; these are areas which warrant further investigation, or for which available information is insufficient.

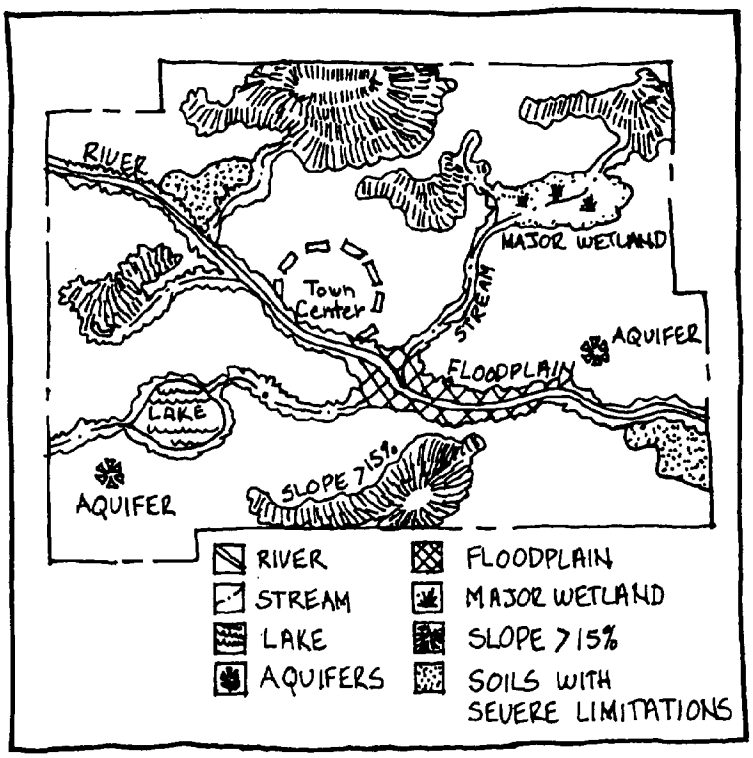


Preparation of a summary analysis map is an important step in the land use planning process. In the plan formulation phase the summary analysis map will be combined with the existing land use map and a map of community special features; the resulting land use review map will be used to designate areas preferred for growth. Some communities may find, however, that the summary analysis map is sufficient for this purpose.

Using the Summary Analysis Map for Land Use Decisions

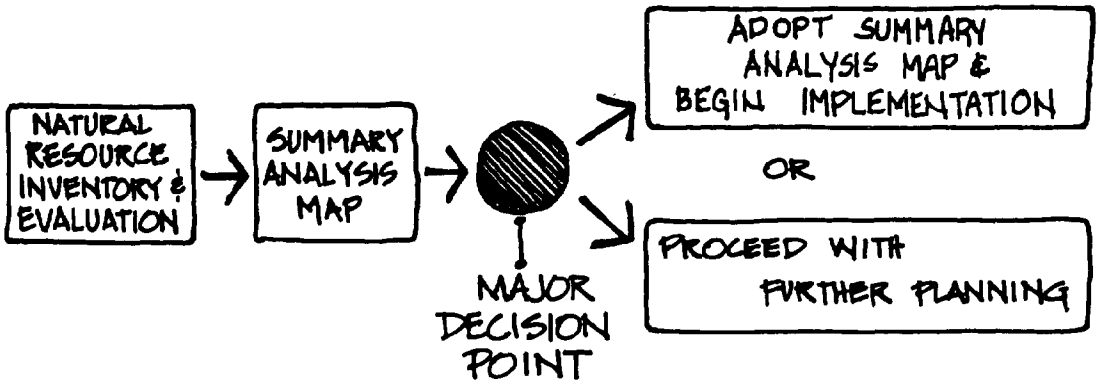
The critical areas designated as preferred for open space constitute a framework within which areas suitable for future growth can be identified. This framework can become an open space system for the community and, at the same time, ensure the continued functioning of essential natural processes. The problematic areas signal caution in the development process, both for potential developers and for community officials. If the preferred for open space and problematic areas shown on the summary analysis

FRAMEWORK FOR DEVELOPMENT



map are properly protected, managed and regulated, a basic objective of land use planning--to promote environmentally efficient land use--will have been achieved.

For some of the smaller communities in New Hampshire, a summary analysis map may be sufficient as a policy and legal foundation on which to base land use decisions and formulate regulations to implement them. If a community decides that a summary analysis map fulfills its land use planning needs, it can begin implementation at this point. Appropriate guidelines, criteria and regulations governing the use of areas preferred for open space and problematic areas can be formulated and adopted.



Although a small community may be adequately served by an analysis that identifies only areas preferred for open space and problematic areas, many will benefit from a more refined process that goes further and identifies specific areas preferred for growth and their potential uses.

When this is the case, the next step for the planning team is to inventory and evaluate the existing pattern of land use in the community.

Anytown, New Hampshire:

The Summary Analysis Map of Anytown consolidates the most significant findings of the four physical studies; it indicates areas of greater than 25 percent slope, shorelines, flood hazard areas, and major wetlands. Because of their critical function or balance, all of these are preferred for open space. The map also delineates problematic areas that should be approached with caution until their implications for land use can be more clearly defined: slopes of 15-25 percent, aquifers, and high water table soils. Topographic "wedges" are also shown because of their influence on land use in the community. The Summary Analysis Map will eventually be used in the plan formulation process, although it could stand alone as a land use map for Anytown.

Slopes greater than 25 percent cover a significant portion of Anytown. The largest contiguous areas of 25 percent plus slopes are located on the Bald Mountain wedge, Oak Hill ridge, and Twin Tops; slopes exceed 25 percent on a significant area of Brown Hill; and there are numerous localized steep areas throughout the rest of the community. Shorelines of all surface waters in Anytown have been placed in the preferred for open space category to emphasize the importance of careful land management in these areas.

The surface waters themselves are highlighted to underline their significance to the community. Badger Bog, Willow Swamp, and Hawkeye Swamp, along with a smaller bog above Fools Pond, are the major wetlands in Anytown and are preferred for open space. Flood hazard areas, which in some cases coincide with the major wetlands, are prominent critical areas in the southern part of the town.

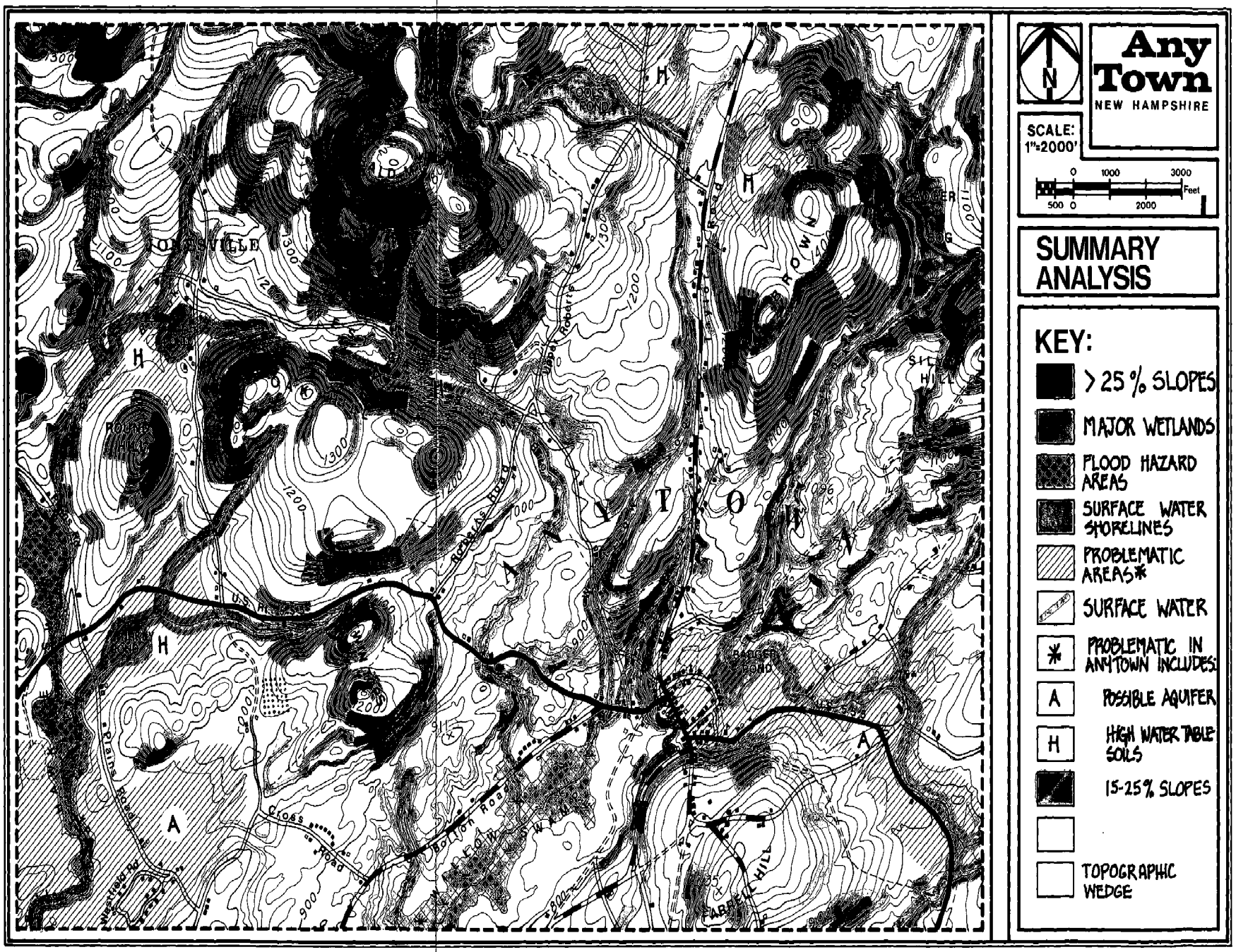
Problematic areas in Anytown merit further study when developed use is being contemplated; site conditions may limit development or natural systems may be vulnerable in these areas. Problematic slopes of 15 to 25 percent are widely scattered throughout Anytown. Although they serve as a warning signal for proposed development, soils and vegetative conditions at the specific sites should be considered whenever development is considered. Guidelines for use should be established.

The aquifers, also problematic, present a significant problem in Anytown, since they are in otherwise highly developable areas. However, with projected increased residential development, Anytown should protect its ground

water supplies at this time. Areas of high water table soils also signal caution for development, and careful on-site analysis will be required; guidelines for use should be established.

The Summary Analysis Map reveals simultaneously an environmentally logical open space framework for the community and intervening areas of developable land. The network of critical areas is a fundamental structure within which the community can begin to guide land use. Although the Existing Land Use Map and the Future Land Use Map remain to be completed, the planning team can begin to make decisions based on the Summary Analysis Map.

SUMMARY ANALYSIS MAP →


Any Town
NEW HAMPSHIRE
N
SCALE: 1"=2000'
0 1000 3000 Feet
500 0 2000
SUMMARY ANALYSIS
KEY:
> 25 % SLOPES
MAJOR WETLANDS
FLOOD HAZARD AREAS
SURFACE WATER SHORELINES
PROBLEMATIC AREAS*
SURFACE WATER
* PROBLEMATIC IN ANYTOWN INCLUDES:
A POSSIBLE AQUIFER
H HIGH WATER TABLE SOILS
15-25% SLOPES
TOPOGRAPHIC WEDGE
JONESVILLE
ANYTOWN
Roberts Road
Upper Roberts
Cross Road
Bolton Road
Plains Road
Westfield Rd
U.S. Rt. 1
FOOLS POND
BADGER POND
FARRELL HILL
SILVER HILL
ROUND HILL
1300
1200
1100
1000
900
800

Notes

Chapter 8

EXISTING LAND USE

The existing pattern of land use in a community has a direct effect on decisions about its future development. The location and extent of farms, residences, businesses and industries--and their relation to each other--are important community features; the road network determines ease or difficulty of access; the location of fire stations, health facilities, community centers, schools, town wells, and sewage treatment plants all affect the ease with which public services can be provided to different areas of the community.

Land Use Survey

An existing land use study begins with the identification, location and mapping of land uses in a community. There are many different, specific land uses, but it isn't necessary for planning purposes to record and evaluate all of them individually. The planning team should develop a land use classification system which groups individual uses having similar characteristics into several basic categories. For most small New

Hampshire communities the following categories should be sufficient:

1)	Residential	6)	Institutional
2)	Agricultural	7)	Recreation
3)	Commercial	8)	Forest
4)	Industrial	9)	Open Land
5)	Governmental	10)	Surface Water

If necessary, such a classification system can be expanded and refined easily. The residential use category, for example, can be subdivided into single family residential at various densities (dwellings per acre or acres per dwelling), duplexes (two-family residences), multiple family dwellings (apartments, rooming houses, condominiums, or by density--dwelling units per acre--if desired), mobile homes, seasonal homes or camps. Agricultural uses can be broken down into field crops, pasture, orchard or vineyard. Commercial shopping centers can be distinguished from strip commercial development, individual businesses and home occupations. Light and heavy industry, warehousing or wholesaling uses can be identified separately. The level of detail needed depends in part on the size of the community and types of development, and in part on what the planning team decides will be most useful to it and the community for planning purposes.

In addition to the general land use classifications, land use surveys should include notation of special points of interest within the community, such as those included in Appendix B, Special Features. These may be shown on the existing land use map or mapped separately.

Land use information should be collected in the field--out in the community. Two-person teams are effective in field work: one person can drive while the other records information on a work map. This is called a "windshield survey" and often is the easiest and quickest way of obtaining the needed land use information. By making this kind of survey, the planning team will be able to identify and locate accurately most of the land uses in the community.

Preparation is needed before the windshield survey can be started. Travel routes should be plotted; if more than one survey team will be involved, decisions need to be made about which areas are to be surveyed by each team. Some basic fundamentals about making the survey and recording the information properly should be learned. Team members should become familiar with the land use classification system being used. Necessary supplies and materials

have to be obtained, and arrangements for transportation and mutually convenient times for doing the survey have to be made.

Paper prints of the community's base map, topogaphic map or tax map normally are used in the field. As land uses are identified, they are recorded on the work map in color code, by symbol or in some other suitable manner. These field notes should be transferred to a clean map--a second work map--as soon as possible after the survey teams return from the field. Notes made in the field often are sketchy and abbreviated and should be recorded in more complete form while still fresh in the minds of those who made them.

Aerial photographs of the community are also helpful at this point; they can be used to check the field work, verify the extent of areas used for various purposes, and identify uses in back areas which cannot be reached or seen easily from a road.

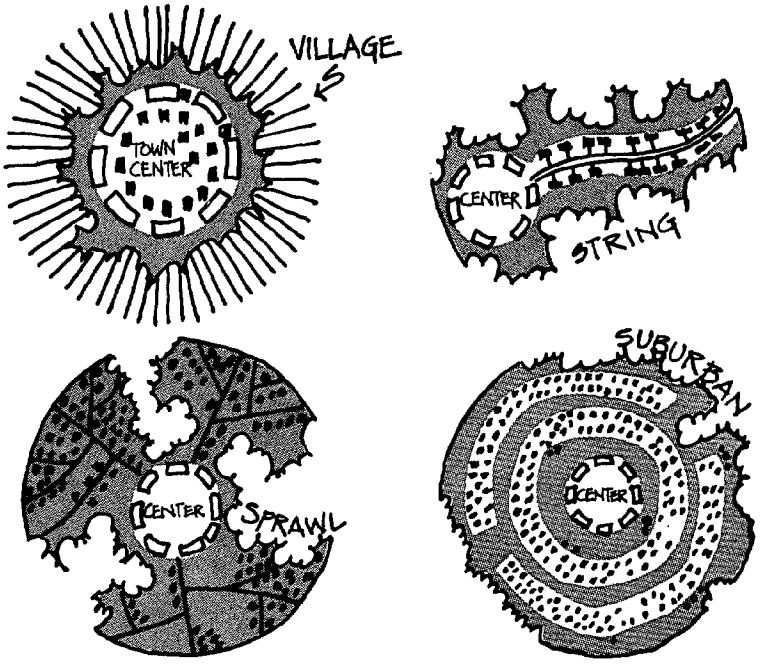
The existing land use map can be prepared in final form after the second work map has been checked for completeness and accuracy. Symbols or distinctive shadings can be used to show the various categories of land use. Usually, a paper print of this map is colored, using markers or pencils, to make the existing land use map more readable and easily understandable.

A suggested method for conducting a land use survey and preparing the existing land use map is contained in Appendix D. A good source of help in preparing for and making a land use survey is the regional planning commission; its professional staff will be thoroughly familiar with land use survey techniques and can provide valuable guidance.

Land Use Patterns

When the land use map has been completed, it will reveal graphically the pattern of existing uses. In many New Hampshire communities the pattern is characterized by a town center surrounded by a sparsely populated rural area. This "village pattern" evolved in an era when most

families required land for their subsistence and livelihood. The advent of the automobile and the supermarket resulted in departures from the traditional village pattern. Emerging patterns were characterized by residential development away from the central town and took several forms: "string" or "strip" development, which occurs in a linear fashion

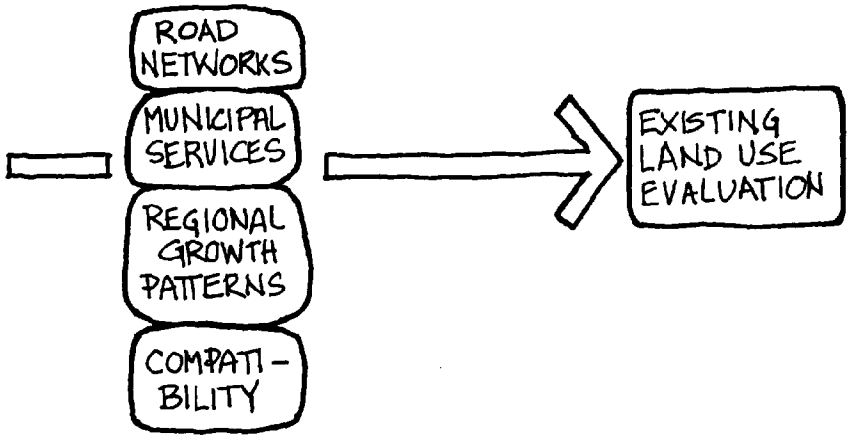


along existing roads; "sprawl," or random development in outlying areas; and "suburban" development, referring to rings of development around a village. An examination of the land use map may reveal one or more of these patterns in the community.

Land Use Analysis

An evaluation of existing land use should go beyond an observation of the present pattern to address the question of how future growth can best be accommodated.

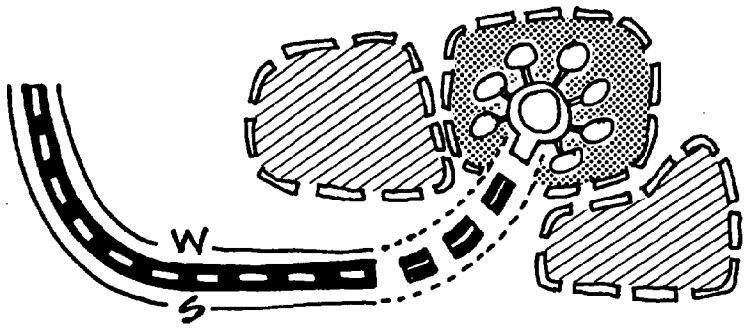
The most important factors in this analysis are: road networks, municipal services, regional growth patterns, and compatibility of land uses.



In many communities, road maintenance expenses are a major budget item; the location of future development can have a significant impact on highway construction and maintenance expenses. When development occurs in the sprawl pattern, the community is faced with upgrading and maintaining many miles of rural road, but when development is concentrated, these expenses are minimized. A planning team should examine and classify the community's roads according to their present condition and function (see Appendix D). The existing road network may suggest that certain areas of the community are preferred for growth because they are already served by a good road. On the other hand, a community can sometimes direct growth into an area by upgrading the road access.

Other factors that should be considered are the layout of municipal water and sewer lines, the location of fire stations, and the like. These services can be extended to new development more efficiently and economically if development occurs near existing systems and facilities. Location or extension of public services can be used to reinforce the existing land use pattern or to change the pattern; a common method of encouraging a desired pattern of growth is to allow a greater density

of development in areas served by municipal water or sewer. If there are no services at present, or if the existing services are being used at capacity, a community may wish to provide new services in areas where it wishes to encourage growth.

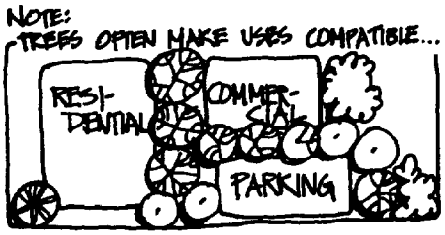


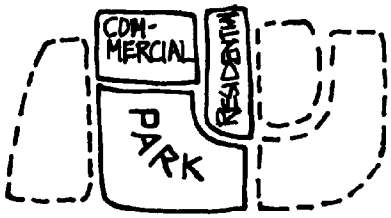
Part of this evaluation should be an inventory and review of publicly-owned land. Often a community owns more land than is generally recognized; identifying and locating public land on a map may stimulate suggestions for new uses for this community resource. For example, if a community is in need of a new town well, it may discover that it already owns land on top of an aquifer; there may be publicly-owned waterfront land that has recreational development potential; or possibly there

is state forest land that could be used as a park. If a community finds that it owns land for which it has no immediate or foreseeable use, it might consider selling the land and using the proceeds to acquire a more usable parcel. When examined in the context of existing or future uses, publicly-owned land may turn out to be an extremely valuable asset.

Regional land use affects the pattern of community land use; development in one town often has a direct effect on neighboring towns, and the planning team should be aware of and consider these regional trends in conjunction with the regional planning commission. For example, if growth in a town is moving toward a common boundary, it may encourage growth in the neighboring community as well.

Compatability of uses is an important factor to be considered in the existing land use study. While it is generally believed that residential, commercial and other land use should be segregated into different land areas, it is also recognized that, with proper design, a certain amount of integration of land uses is possible and even desirable. The success of mixing land uses depends on many design and compatability factors and informed, experienced decision makers; for example, a convenience store might fit nicely into a residential neighborhood, whereas a shopping center might best be located in another area. A study of the pattern and mix of existing uses can suggest which areas might be preferred in the future for various land uses.

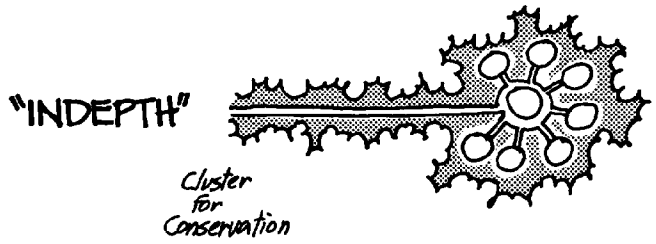




A planning team should observe and evaluate the factors influencing the pattern and mix of land use and then consider whether it is desirable to reinforce or attempt to change current trends. From a planner's point of view, the village pattern is often the most desirable. If residents prefer low density development throughout the community, however, that pattern must be considered as an alternative. A good way to assess citizen preferences is to include questions about land use, accompanied by illustrations, in a public opinion survey. (See Appendix E.) Once a preferred pattern and mix have been identified, the process of delineating areas preferred for growth may be undertaken.

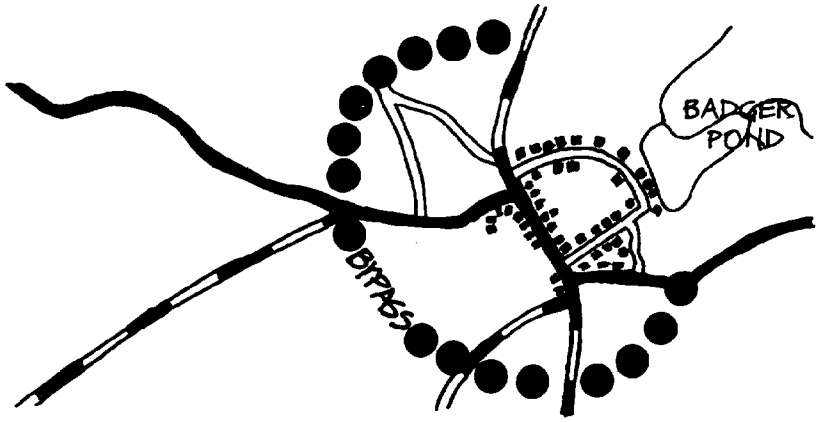
Anytown, New Hampshire:

The existing land use map of Anytown shows a pattern and mix of land uses typical of many smaller New Hampshire communities. As might be expected, the two predominating land uses are residential and forestry, although there are a few small commercial and industrial enterprises, municipal buildings and farms. The pattern shows a town center in the southeast part of the community surrounded by less densely populated rural areas. The pure "village" pattern is being altered by residential "string" development along many of the roads radiating from the town center, especially along Taylor Road. As is often the case in rural towns, new residences are being established along existing roads instead of being developed "in-depth," with new roads extended into interior land.



One result of residential "string" development along Taylor Road is that the road's arterial function is being impaired by local turning traffic; Taylor Road conducts regional traffic to the Interstate Highway to the north. If development continues along this road, the conflict between different types of road users will intensify and

improvements may be necessary. "String" development along roads directly south of the town center presents the same kind of problems. Rural residences along West Gap Road do not create conflicting road uses at present, but if growth continues in this area, it will eventually necessitate road upgrading. Finally, there is a potential for traffic congestion in the town center; local shoppers and regional through traffic are funneled into a confined area where mini-traffic jams occur during peak traffic flow hours. While there is no need to consider a bypass of the town center in the near future, long range planning should consider this possibility.



Mobile home residential development has occurred in two relatively compact locations: one of them along Bolton Road, and the other just off Cross Road. There is a mobile home sales operation associated with the Bolton Road Park. In the Cross Road location a farmer has subdivided a section out of one of his fields and is operating a mobile home park. Like all residences in the community, the mobile homes utilize individual septic tanks for waste disposal, but in each park a central well supplies water to all homes.

The Westfield Road subdivision in the southwest corner of town is the only example of in-depth residential development in the community. The development is built on an aquifer and each house has its own well. Westfield Road demonstrates how in-depth development makes more efficient use of space, creates a neighborhood effect, and requires less road maintenance per residence.

There is a very loose clustering of residences in the Jonesville area of town. At one time Jonesville was an established village with a mill, church and general store, but now it is only a small hamlet of older houses removed from the flow of traffic.

Although Anytown is not a vacation center, a number of seasonal or vacation homes are located along the Upper Roberts Road near Fools Pond, and just off U.S. 555 overlooking Turkey Pond. The houses adjacent to Turkey Pond are poorly constructed, and malfunctioning septic systems are polluting the water.

Municipal land use in Anytown is concentrated primarily in the town center area; a town hall, library, post office, and elementary school are all grouped within walking distance of each other. The elementary school land is adjacent to a community waterfront park, and the library is conveniently just across the street. (High school students attend a regional school in the neighboring community to the north.) The only municipal facilities not in the town center are the fire station and sanitary landfill, both of which are located along U.S. 555 away from the center.

Commercial land use is also concentrated in or near the town center area; there are two stores and a service station in the center itself, and the mobile home sales operation is just outside it. Residents must travel to the neighboring town to the south for most of their shopping, banking and other services.

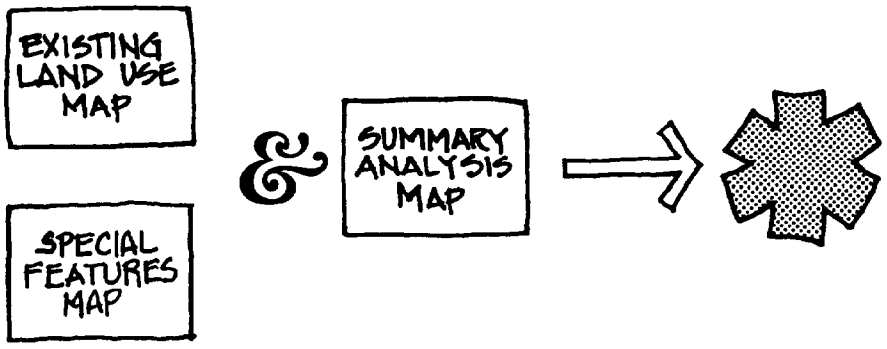
Industrial land use is also very limited; the sawmill and the gravel excavation pit are both family operations. The Old Ironworks is now being used as a combination handicraft factory and sales room employing about five people. The printing plant is somewhat larger and employs 12 persons.

Agriculture in the community continues to dwindle and there are now only four operating farms. The sheep farm on Taylor Road is run by a retired executive as a hobby. The vegetable farm on Cross Road is still run as a business, but the farmer found it necessary to supplement his income by opening a mobile home park. The orchard west of Twin Tops is a hobby farm run by a retired couple. The dairy farm is the only full-time agricultural endeavor in the community, but the farmer is getting older, and it is doubtful that anyone will continue to farm this land when he retires. To supplement his income, the farmer has already subdivided some of his land fronting Turkey Pond; when he stops farming, he will probably support himself through continued subdivision of his farm property.

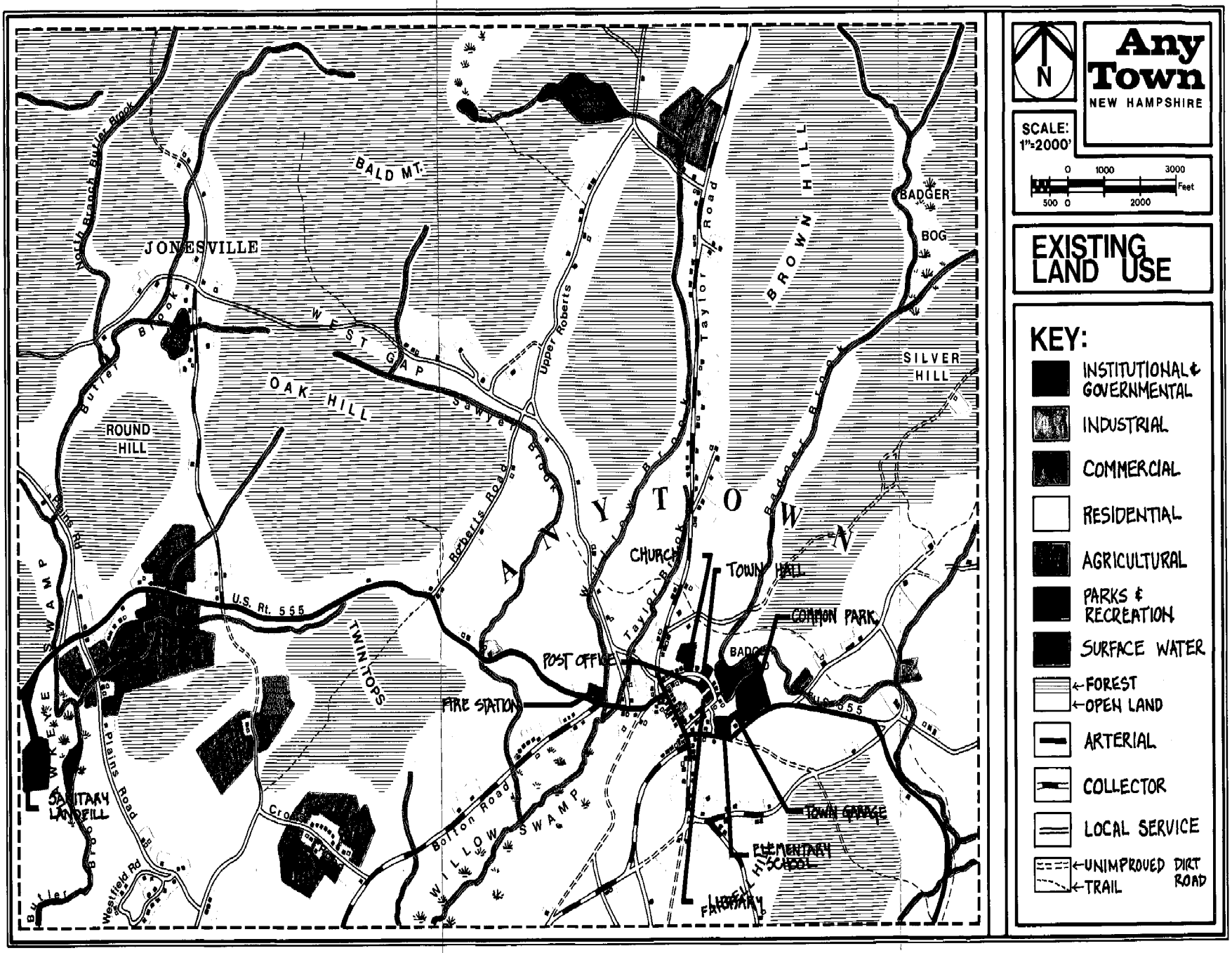
(Special features in Anytown are described in Appendix B, which also includes a Special Features Map.)

The present mix and pattern of land uses in Anytown, New Hampshire, is on the whole desirable and attractive. Commercial and municipal facilities are centrally located with respect to the greatest number of people, and access to the town center from outlying areas is adequate at the moment. A few situations do present potential problems, however, and deserve continued monitoring. Extensive string development along Taylor Road and in the West Gap area may necessitate road improvements. Further developments along collector and arterial roads should be carefully evaluated in terms of the traffic problems they may create. Development is occuring west of the wedge away from the existing service center; continuation of this trend may require upgrading road and service links with the town center. Another alternative that should be considered is the possibility of encouraging a satellite center west of the wedge. Anytown's sanitary landfill operation presents a potential hazard to surface and ground water resources in the western part of the town. Although it is conveniently located, it is in a flood hazard area and abuts an aquifer. Professional advice and assistance should be obtained to help find an environmentally safer site or method of disposal.

The town center may warrant a more thorough examination if it begins to develop "urban" problems, particularly traffic congestion. The areas immediately surrounding the center, however, deserve close attention now. Since



the village pattern has been declared desirable, but the center is fully developed, the question is: where should future growth occur? Answers can be found by examining the Existing Land Use Map in combination with the Summary Analysis Map and the Special Features Map.



Any Town
NEW HAMPSHIRE
N
SCALE: 1"=2000'
0 1000 3000 Feet
500 0 2000
EXISTING LAND USE
KEY:
INSTITUTIONAL & GOVERNMENTAL
INDUSTRIAL
COMMERCIAL
RESIDENTIAL
AGRICULTURAL
PARKS & RECREATION
SURFACE WATER
FOREST
OPEN LAND
ARTERIAL
COLLECTOR
LOCAL SERVICE
UNIMPROVED DIRT ROAD
TRAIL
BALD MT.
JONESVILLE
North Branch Butler Brook
Butler Brook
WEST GAP
OAK HILL
ROUND HILL
Sawyer Brook
Upper Roberts
Roberts Road
Taylor Road
BROWN HILL
BADGER BOG
SILVER HILL
Badger Brook
ANYTOWN
CHURCH
TOWN HALL
COMMON PARK
POST OFFICE
FIRE STATION
U.S. Rt. 555
TWIN TOPS
Plains Rd
Plains Road
WAKEYE SWAMP
SANITARY LANDFILL
Westfield Rd
Bolton Road
WILLOW SWAMP
TOWN GARAGE
ELEMENTARY SCHOOL
LIBRARY

Notes

Any Town

NEW HAMPSHIRE

N

SCALE: 1"=2000'

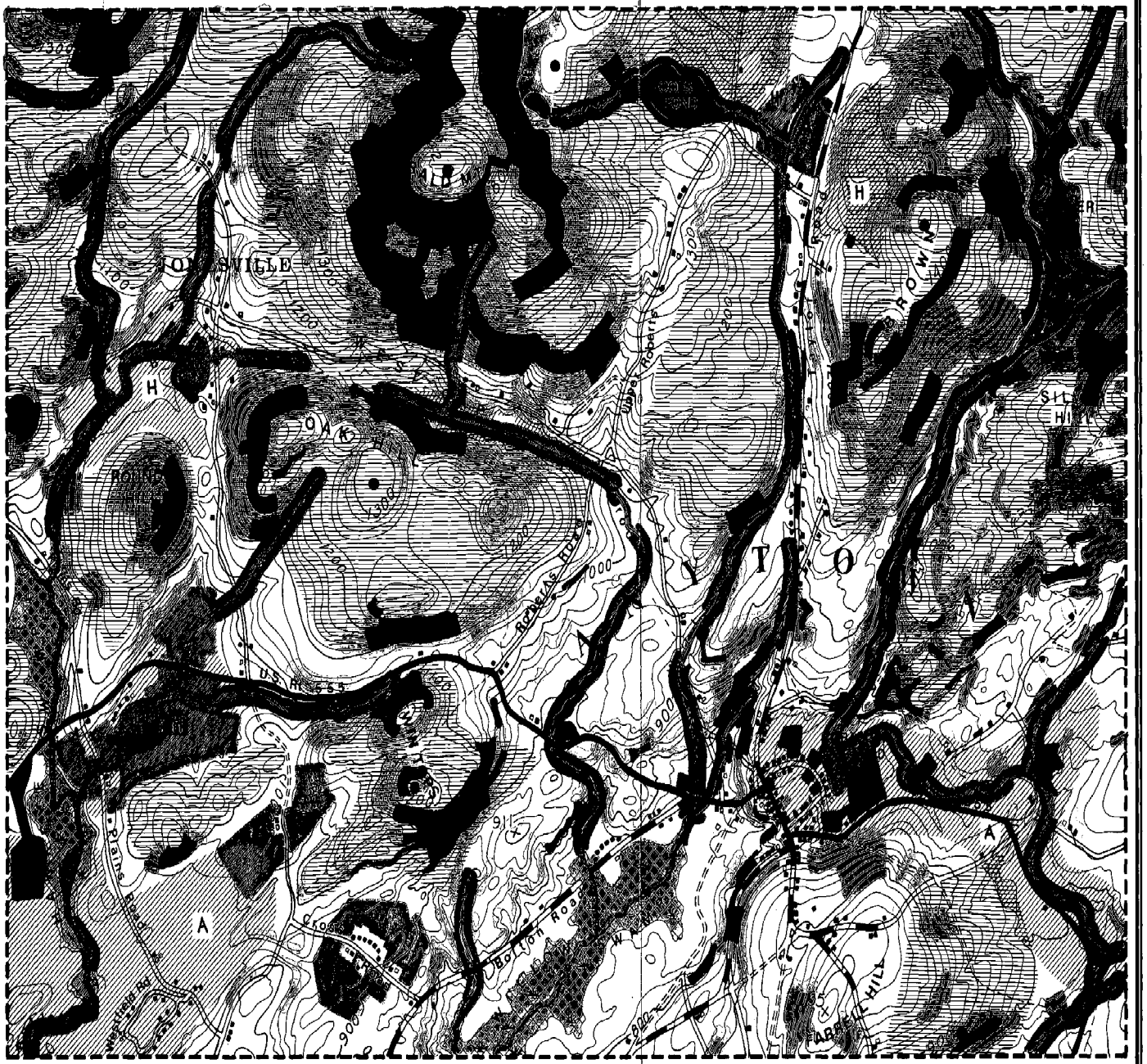
0 1000 3000 Feet

500 0 2000

LAND USE REVIEW

KEY:

- INSTITUTIONAL & GOVERNMENTAL
- INDUSTRIAL
- COMMERCIAL
- RESIDENTIAL
- AGRICULTURAL
- PARKS & RECREATION
- SURFACE WATER
- MAJOR WETLANDS
- SURFACE WATER SHORELINES
- 15-25% SLOPES
- >25% SLOPES
- FLOOD HAZARD AREAS
- A POSSIBLE AQUIFERS
- H HIGH WATER TABLE SOILS
- ● SPECIAL FEATURES



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LAND USE REVIEW MAP

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FORMULATION & IMPLEMENTATION

9. FORMULATING THE LAND USE PLAN

10. IMPLEMENTATION

Notes

Chapter 9

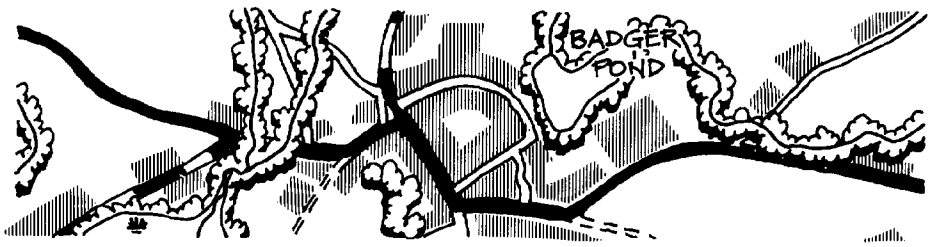
FORMULATING THE LAND USE PLAN

When a planning team has completed the summary analysis map and the existing land use study, it is ready to begin formulating the plan. The framework of open space, the pattern of existing land uses, the location of community facilities and services, and the amount and type of growth anticipated or desired suggest the basic options open to the community. Within these opportunities and limitations, alternative patterns and policies for future growth can be considered.

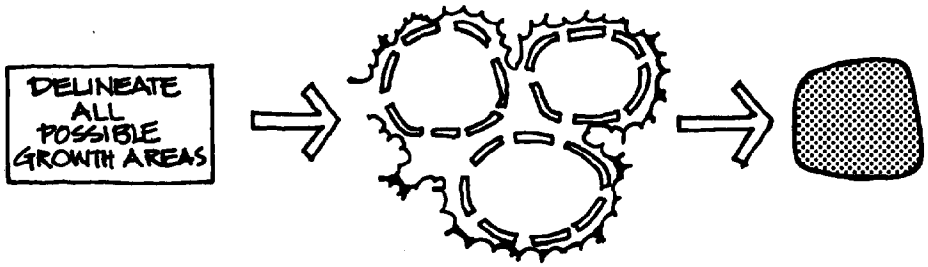
Future Land Use Map

Possible growth patterns can be examined by combining the summary analysis map, the existing land use map, and the special features map. This can be done by transferring all of the information onto one map or by using the overlay

method. The result is a visual statement of the options, a land use review map: essentially, the colored-in areas are preferred for open space, problematic or already developed; the blank, or "white," areas indicate where future growth can be more easily accommodated.

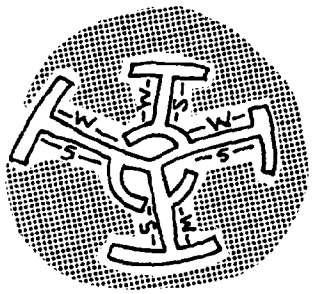


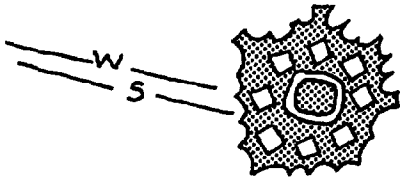
The process of deciding which developable areas are "preferred for growth" is the essence of the planner's art. There will probably be several areas that relate closely to the existing building and road pattern, and there will probably be several potential growth centers in rural parts of the community. A planning team should compare the advantages and disadvantages of each possible growth area. During this comparison process, frequent reference should be made to the various community maps.



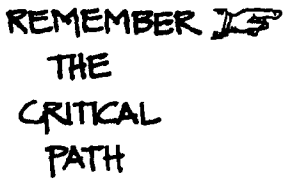
The evaluation process should take into account all pertinent factors including topography, soil, slope, water resources, access to the area, existing land uses, and special features. In addition, the realistic land use needs of the community and citizen preferences should be considered.

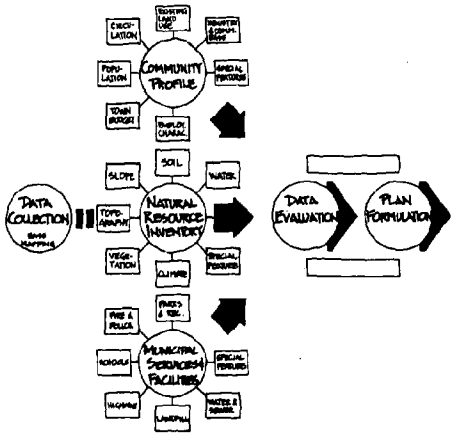
In general, growth is preferred in those developable areas that most logically and conveniently relate to existing developed areas and community facilities and services; if possible, growth should be a direct and compatible extension of existing development. Conversely, growth in inaccessible areas is not preferred unless it can be served independently and economically.





A planning team must develop its own methods of making decisions and struggle with alternatives and conflicting opinions and priorities. The areas a plan-

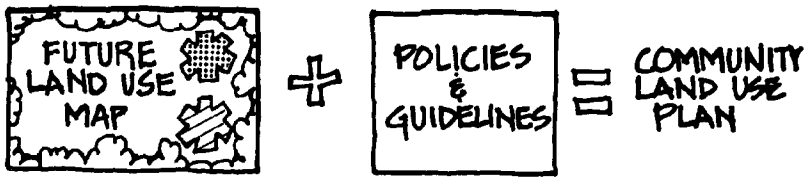




ning team eventually designates as preferred for growth will represent its judgment of what constitutes a desirable development pattern for the future. This pattern forms the outline of the future land use map.

This outline may be filled in by designating areas preferred for various residential, commercial, industrial, community and other uses. Designation of areas for particular uses should take into account existing characteristics and use, compatibility among existing and potential future uses, and possible alternatives to the preferred pattern.

When a planning team has selected areas for future growth and designated their preferred uses, it has completed the mapping phase of the plan preparation. It should then begin to develop the policies and criteria needed to govern the use of areas designated preferred for open space, preferred for growth, and problematic. The map and accompanying policies, or guidelines, together constitute the land use plan.



Land Use Policies

As it begins to discuss and formulate land use policies, a planning team should hold at least one public informational meeting to display and present the inventory and preferred-area maps. Arrangements should be made to have a professional planner and a soils expert attend the meeting to help explain the inventory data, analyses and technical aspects of land use planning. When this step has been taken, the planning team can proceed with writing land use policies, some of which may later be translated into implementing regulations and ordinances.

Land use policies should be based on the physical conditions identified during the mapping process and on community goals and objectives. These policies should encourage development in areas designated preferred for growth; they should discourage it in areas designated preferred for open space; and they should recognize that problematic areas involve questionable conditions which require further consideration or special treatment.

The policies should include statements concerning the extent and types of land use to be encouraged, where these uses can best be developed in terms of physical conditions and compatibility, the services and facilities

needed to serve them, the timing or rate of development considered desirable, and similar factors. Land use policies should also state the reasons for discouraging development in areas designated preferred for open space and outline restrictions under which development--if it were to take place--might be permitted in such areas. Finally, they should contain use criteria for areas designated problematic. Professional assistance is needed in formulating the restrictions for preferred for open space areas and the use criteria for problematic areas.

These written policies and the future land use map provide the community with its land use plan. The next step is official adoption of the plan by the planning board--to be used as a guide for development--followed by specific implementation proposals.

Anytown, New Hampshire:

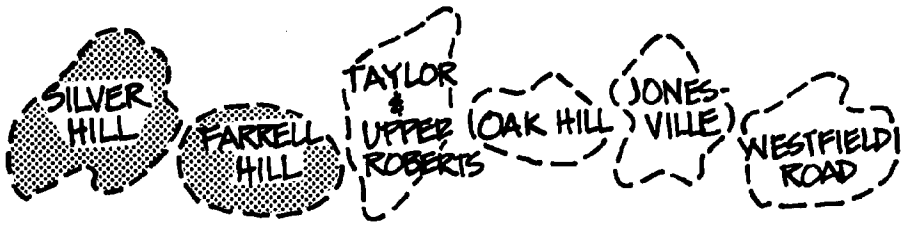
When the Summary Analysis Map, Existing Land Use Map, and Special Features Map of Anytown are combined, the basis for future land use decisions is revealed in the Land Use Review Map. The white areas show where growth can occur most easily, but the question of which areas should be preferred is more complicated. In principle, it is desirable to encourage further development as a logical extension of the existing pattern; therefore, developable areas near the town center should be considered for preferred designation.

There are several possible growth areas in the vicinity of the town center, each one having advantages and disadvantages. After comparison and evaluation, the Farrell Hill area and the Silver Hill area have been designated as preferred for growth; both these areas have good road connections with the town center and with U.S. 555, and are served internally by existing town roads that could be upgraded. They are characterized by relatively moderate slope conditions, and the town water supply system could be conveniently expanded to serve either area. In terms of land area, Silver Hill and Farrell Hill are large enough to accommodate the growth that is likely to occur in Anytown in the foreseeable future.

The principal drawback to both Farrell Hill and Silver Hill is that, according to soil interpretation sheets, the soils in both areas may pose a severe limitation to septic tank leach fields. This could be a major constraint to intense development because the community does not have a public sewerage system; however, existing residences in

these neighborhoods are utilizing onsite septic disposal with no apparent difficulty. Although the soil and slope maps indicate a large flat area adjacent to the town center that is capable of handling septic disposal, there are drawbacks to expanding in this area. USGS information shows that this may be a significant aquifer that is probably the source of the community's municipal water supply.

This conflict may ultimately be resolved by the installation of a community sewer system and treatment plant. In the meantime, however, it would appear best to encourage growth with appropriate precautions on Farrell Hill and Silver Hill, rather than on the possible aquifer. In addition to designating these areas as preferred for growth, the planning team should develop criteria to ensure that septic systems are carefully located and designed to overcome possible soil limitations.



Another large developable area east of the wedge is located between Taylor Road and Upper Roberts Road. According to SCS soil interpretation sheets, most of the soil in this area poses only moderate limitations for septic tank leach fields. The slope conditions of the area are quite favorable for development; access to the area is fair, but could be greatly improved by minor straightening and widening of Upper Roberts Road. Some growth can be accommodated in this area, but it is not recommended as preferred for growth at the present time, because of its relative distance from existing services.

There are several other smaller developable areas east of the wedge, some more desirable than others in terms of access and physical characteristics. Development can probably occur in these areas without causing any serious problems. Within the wedge itself there is a large plateau on the south side of Oak Hill that is suitable for development; the plateau is physically separated by its elevation from lands both to the east and to the west, soils in the area pose only slight to

moderate limitations to septic tank leach fields, and slopes are generally quite gentle. While there are no roads into this area at present, access is possible from U.S. 555. The self-contained character of this area might make it a desirable location for a satellite community which could include residential, commercial and even industrial land uses.

West of the wedge, separate from the existing town center, are two distinct developable areas, one in the Jonesville area and the other in the vicinity of Westfield Road. The Jonesville location is less preferable because of its relative inaccessibility, soil limitations and confining slope conditions; nevertheless, well planned or low density development could safely occur in this vicinity. The Westfield Road area has the advantage of greater accessibility to the town center, to the regional center, and to U.S. 555. Topographically, the area is gently rolling, and slope conditions do not present any problems. Soils throughout the area are quite variable, however, and those presenting the least limitation to septic tank leach fields, according to SCS, again happen to correspond with a probable aquifer. The Westfield Road area shows signs of becoming a separate growth center, especially when viewed in a regional context; adjacent land to the south is in great demand for residential use. Although this is not a high priority growth area, road improvements should be considered--if it continues to grow spontaneously.

At present, commercial development in the community and in the nearby regional center is adequate to meet local needs; however, with a growing population there will be increasing demands for more local businesses. Space for new commercial building in the town center is limited, if authentic historic qualities are to be preserved. (An Historic District should be considered, as discussed in Appendix B.) Some of the town center homes could be converted to small retail shops or offices, but any appreciable commercial expansion should probably take place outside the center. Several potential commercial locations along U.S. 555 are accessible from most parts of the community; these sites are not shown on the Future Land Use Map, but criteria for the location of future commercial development should be contained in the land use policies.

The developable areas in the vicinity of Twin Tops have possibilities for industrial development in terms of physical site characteristics and potential access from U.S. 555. There is no apparent demand, however, for industrial land at the present time. Therefore, the planning team decided not to show industrial areas on the

Future Land Use Map but to include development criteria in the land use policies.

The Anytown, New Hampshire, planning team is now ready to present the inventory maps, Future Land Use Map, and tentative conclusions at a public informational meeting. At the meeting, the planning team describes and illustrates the process followed to arrive at its proposals; a professional planner from the regional planning commission and a soil scientist from SCS are there to help explain and answer questions about technical points. Comments, criticism and suggestions--and interaction among those present at the meeting--provide further guidance in defining areas where growth should and should not take place, the character of community desired in the future, and the kinds of policies and criteria which the planning team should formulate.

Following the public informational meeting, the planning team prepares written policies and criteria to guide future development in Anytown; they address primarily the larger preferred locations for and density of residential development, historic preservation, water supply and sewerage needs, and protection of critical areas. Since the first meeting produced many ideas--and some conflicts--the planning team is careful to give all viewpoints adequate consideration; a second meeting is held to present the policies and criteria and to explain why suggestions made at the first meeting were accepted, modified or rejected.

Completion of land use plan revisions after the second meeting satisfies the planning team that it has formulated a plan which recognizes both the physical features of the community and most of the desires of the townspeople about the community's future character. It is a plan that also provides a sound legal basis for implementation.

The planning board is now ready to adopt the plan officially, consider alternative implementation methods, draft regulations and ordinances, have them reviewed by legal counsel, present them at further public informational meetings, and--as appropriate--adopt them or prepare warrant articles for adoption at town meeting.

ANYTOWN'S FUTURE LAND USE MAP →

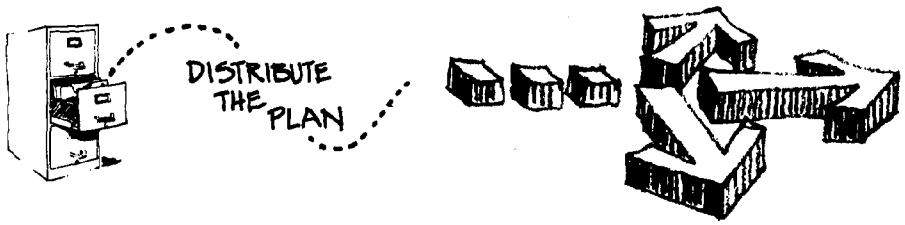
Any Town
NEW HAMPSHIRE
N
SCALE: 1"=2000'
0 1000 3000 Feet
500 0 2000
ANYTOWN'S FUTURE LAND USE
KEY:
STREAM BORDER > 25% SLOPES MAJOR WETLANDS FLOODPLAINS
SURFACE WATER
POTENTIAL GROWTH CENTERS - REFER TO TEXT
PREFERRED FOR GROWTH
PROBLEMATIC AREAS
A POSSIBLE AQUIFER
H HIGH WATER TABLE SOILS
15-25% SLOPES
JONESVILLE
ROUND HILL
U.S. RT. 655
Cross Road
Bolton Road
Plain Road
Westfield Rd
1300
1200
1100
900
800

Notes

Chapter 10

IMPLEMENTATION

Implementation means putting the plan to work. A land use plan is made to be used--to be consulted by the selectmen and the planning board and other community leaders, as well as by landowners and developers, in the process of making land use decisions. Public awareness and understanding of the goals, facts and guidelines contained in a plan will greatly facilitate the implementation process. Therefore, a land use plan should receive as wide a distribution as possible, and the inventory maps should be available for public information and review.



If the plan materials are being used in the decision-making process, and if the guidelines are being followed, the plan is being implemented.

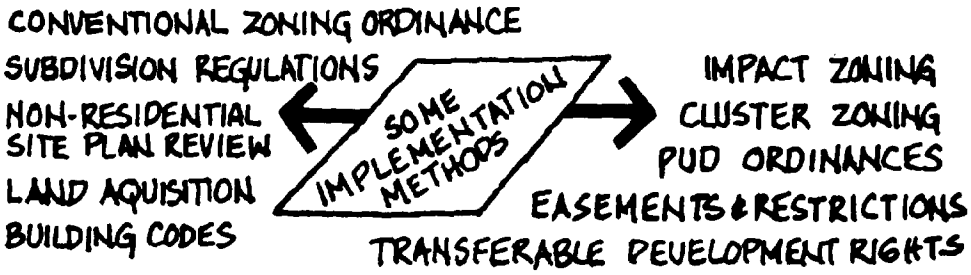
Governing Land Use

An in-depth discussion of the many techniques available for governing land use is beyond the scope of The Land Book; however, it should be mentioned that there are many approaches that can be used to achieve a desirable pattern of land use. A planning board should consider implementation alternatives rather than rushing to convert a plan into detailed restrictive ordinances. Instead of adopting ironclad regulations that try to anticipate every eventuality, a planning board should approach implementation with a flexibility that allows for innovative land use. Restrictive ordinances often prevent detrimental development; they also can prevent, or at least discourage, creative development that may not conform to traditional standards but is, nevertheless, highly desirable.

The assistance of an experienced professional planner is particularly helpful in devising flexible methods of implementation that are most suited to the community. A professional is familiar not only with alternative approaches, but also with the implications and complications associated with them. He can work with the planning board to put together an individualized community program of implementation measures.

CREATE A FLEXIBLE IMPLEMENTATION PROCESS

Some Implementation Methods



There are many techniques and methods that can be used to implement a plan, and each one has advantages and disadvantages depending on its application and on community conditions. The most commonly known methods of implementation are conventional zoning ordinances,

subdivision regulations, land acquisition, building codes, and non-residential site plan review. Along with variations and combinations of these methods, many communities are considering new approaches and techniques such as impact zoning and cluster zoning, Planned Unit Development ordinances, easements and restrictions, and transferable development rights. These creative new methods of governing land use employ flexible incentives and guidelines to encourage sound, sensible growth. Implementation methods are presented and discussed in detail in other handbooks published by and available from the Office of Comprehensive Planning.

Conclusion

Actually, there is no conclusion to the planning process; planning is the ongoing process of meeting change, and even before a plan is finished, new circumstances can require revisions and adjustments. In land use terms, New Hampshire has gone from forests to farms and back again to forests. Now new trends are in progress; new responses and new directions must be explored. By creating a sound framework within which many land uses can occur, a community retains the flexibility to accommodate the unexpected.

The Land Book

Notes

GLOSSARY

Additional Sources:

N.H. Soils and their interpretations for various uses Research Report #3, October 1968 (USDA-SCS, Durham)

Glossary of Geology - American Geological Institute

alluvial	Pertaining to material that is transported and deposited by running water.
aquifer	A geologic formation or structure capable of yielding water in considerable quantity to wells or springs. Aquifers are usually saturated sand, gravel, bedrock fractures and cavernous rock.
bedrock	The solid rock that underlies soils or is exposed at the surface. It is often referred to locally as ledge if it is exposed at the surface.
contour	1) An imaginary line on the surface of the earth connecting points of the same elevation. 2) A line drawn on a map connecting points of the same elevation.
drainage basin	The area drained by a river and its tributaries.
flood hazard area or floodplain	Nearly level land that borders a stream, lake or watercourse and is subject to flooding unless protected artificially. The flood hazard area, or floodplain, consists of: 1) the stream or river channel, or the water body; 2) the floodway (which includes the channel); and 3) the floodway fringe.

floodway	The land area immediately adjacent to a stream, river or lake, which is subject to a flood of a given magnitude.
floodway fringe	An area which may be inundated during periods of extreme flooding, but where flood waters are not generally characterized by a destructive, fast-moving flow.
glacial till	Material picked up, mixed, broken down, transported and deposited through the action of glacial ice with little or no transportation by water. Till consists of varying amounts of different sized fragments ranging in size from clay to boulders.
ground water	Water that fills all the pores of subsurface soil material below the water table.
hardpan	A compact soil layer high in silt and very fine sand and generally low in clay. It is quite dense and has very little pore space. The hardpan retards the downward penetration of water and roots. Permeability is slow.
infiltration	The process whereby water enters a soil through the surface.
interpretations sheets	(soil survey) See p. 48 of text.
leaching	The removal of materials in solution by percolation through the soil.
parent material (soils)	The unconsolidated, chemically weathered mineral or organic matter from which the upper part of a soil profile has developed.
percolation	The flow of water, usually downward, through soil by the force of gravity or under pressure, through small openings of porous material. Also used as a synonym of "infiltration." (Glossary of Geology)

permeability	That quality of a soil that enables it to transmit water or air. Permeability ranges from "very slow" (less than 0.2 inches per hour) to "very rapid" (over 6.3 inches per hour).
planimetric	Relating to the mapping and measurement of surface, or plane, areas.
pore space (soil)	The total space not occupied by soil particles in a bulk volume of soil, commonly expressed as a percentage.
porosity (soil)	The degree to which the total volume of a soil, sediment or rock is permeated with pores or cavities, generally expressed as a percentage of the whole volume unoccupied by solid particles.
runoff	That portion of the precipitation on a drainage area that is discharged from the area. Types include surface runoff, groundwater runoff, and seepage.
slope	See p. 33 of text.
soil limitations	See p. 48 of text.
soil map	A map showing the distribution of soil types or other soil mapping units.
soil profile	A vertical section of the soil from the surface through all its horizons or layers.
soil survey	A general term for the systematic examination of soils in the field and in laboratories; their description and classification; the mapping of kinds of soil; the interpretation of soils according to their adaptability for various uses; and their behavior and productivity under different treatment and management for plant production or other purposes.

soil treatment	Erosion and sediment control practices which minimize the damage to the soil surface from natural weathering caused by rainfall or flooding. Treatment measures include: vegetative measures such as seeding, mulching and retaining natural vegetation; and structural measures such as proper grading, slope protection through riprap and stone work, surface and subsurface drainage, diversion ditches, and sedimentation ponds (basins).
stratification (sediments)	The formation, accumulation or deposition of materials in layers, or strata. (Glossary of Geology)
surficial geology	The study of surficial rock-related deposits: soils, as well as unconsolidated and residual, alluvial, or glacial deposits (generally unstratified) lying on bedrock. The term is sometimes applied to the study of bedrock at or near the Earth's surface.
till	See glacial till.
topography	See p. 25 of text.
water resources	The supply of ground water and surface water in a given area.
water table	The upper surface of ground water, or the upper limit of the part of the soil or underlying material wholly saturated with water.
watershed area	All land and water within the confines of a drainage basin.
wetland	See p. 51 of text.

APPENDICES

A. MAPS

B. SPECIAL FEATURES

C. PARTICIPATORY PLANNING

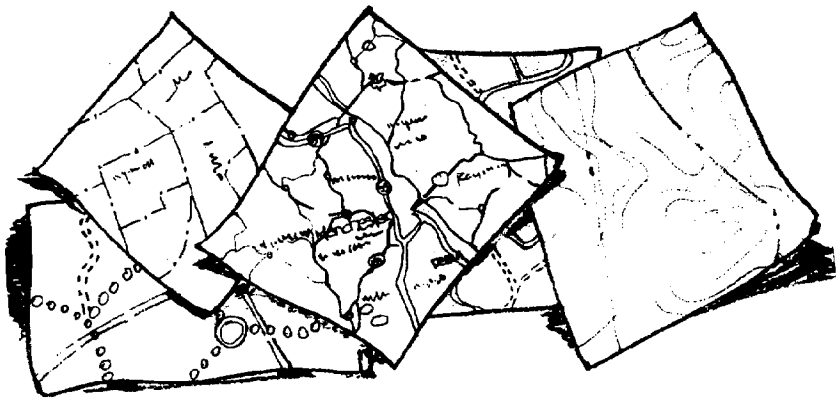
D. PREPARING AN EXISTING LAND USE MAP

E. THE LOCAL PUBLIC OPINION SURVEY

APPENDIX A: MAPS

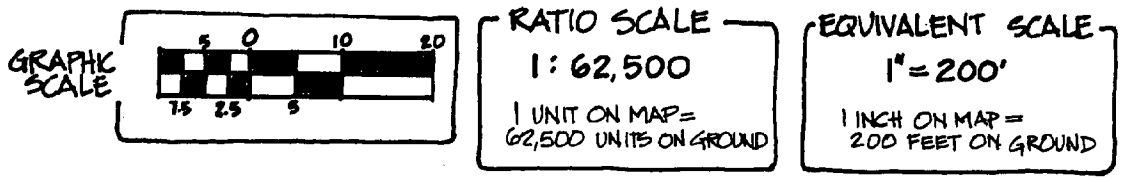
Land areas and their inherent characteristics cannot be described adequately in words, but when they are graphically represented on maps, they can be more easily studied and understood; by definition, a map is a "representation of an area of the earth's surface." Because maps are an indispensable tool in land planning, the ability to read and utilize them is essential.

There are many kinds of maps, such as road maps, tax maps, globes and property maps; each tells something different about the land area it represents. To understand the information being shown on a map, one

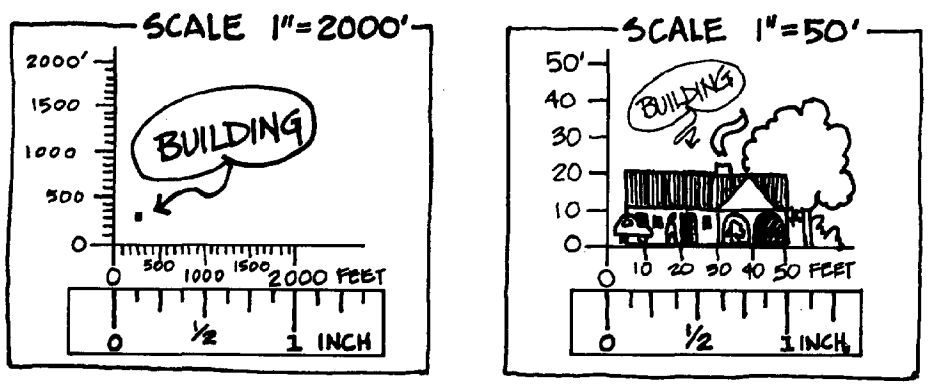


must first look at the map title block and map key. They contain such information as the name of the area being shown, the map title or subject, the orientation relative to north, the scale, the date, and the author of the map. One of the most important facts contained in the key is the scale of the map. The scale is the relationship between distance on the map (usually measured in inches) and distance on the ground (usually measured in feet or miles). Scale may be expressed as a graphic measure, as a ratio, or as an equivalent. A graphic scale is usually a bar with distances marked off on it. A ratio scale expresses the numerical relationship between map distance and ground distance; for

example, in the ratio 1:62,500, one unit of measurement (such as a foot) on the map equals 62,500 of the same unit on the ground. An equivalent scale equates different units of measurement; for example, 1"=200' means that a distance of one inch on the map equals a distance of two hundred feet on the ground.

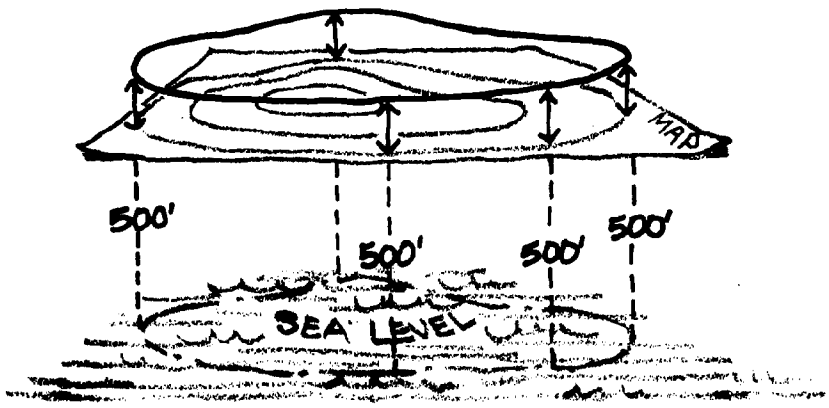


Knowing the scale of a map is critical to all measurements of distance or area; the same size pieces of paper can represent vastly different land areas, depending on the map scale. Scale also determines the amount of detail that can be shown; the larger the scale (fewer ground-feet per map-inch), the greater the detail of information that can be included. For example, on a map where 1"=2,000', a house might be represented by a small dot, but at a larger scale (1"=50'), a house would be roughly the size of a postage stamp. When the scale of a map

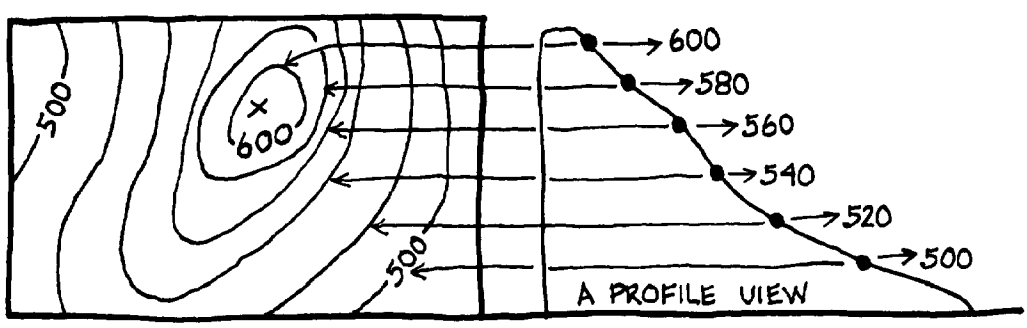


is known, two-dimensional ground areas can be calculated; it is possible to figure out how many square feet, acres or square miles are represented by a map or by any portion of a map. Finding the ground area of regularly shaped tracts requires the use of simple geometry; a special instrument known as a planimeter can be used, with little instruction required, to measure irregularly shaped sites.

Maps that show only two dimensions (area) are known as "planimetric" maps. "Topographic" maps represent all three dimensions of land--elevation as well as area--through the use of "contour lines." On topographic maps, contour lines connect points of equal elevation above sea level; every point on a 500' contour line is 500' above sea level. Contour lines are drawn to represent

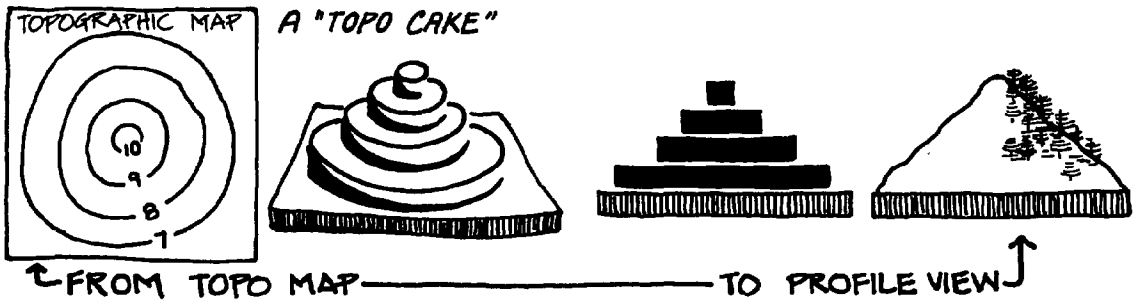


different elevations of the land and the vertical distance between two adjacent contour lines is known as the "contour interval." For example, if one contour line represents an elevation of 520' above sea level and the next line represents an elevation of 540' above sea level, the contour interval is 20'. The contour interval may differ from one map to another, but on any particular map it remains constant.



It takes practice to read a topographic map and to visualize the shape of the land it depicts. It is helpful to remember that the perspective of a topographic

map is always vertical--as if the viewer were looking straight down on the land from an airplane. Most people picture the shape of land as if they were viewing it from ground level, but if one can imagine what a hill or valley looks like from a position directly above it, then it is easier to see how contour lines represent the shape of the land.

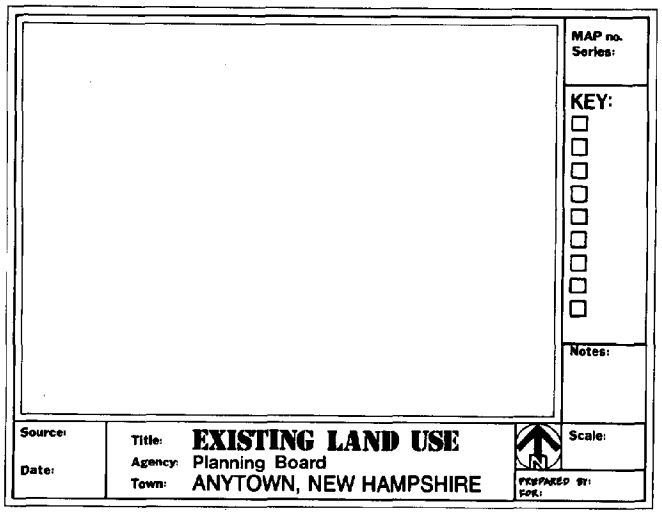


Maps for Community Planning

For community land planning purposes, a planning team should obtain reproducible base and topographic maps of the community at a scale of 1"=1,000' or 1"=1,500'. The

SAMPLE FORMAT

COMMUNITY PLANNING MAP



base map should indicate political boundaries, streets and roads, water bodies, and major man-made features. The topography map should add contour lines to the detail on the base map. Each map should contain the name of the community, the map scale, a north arrow, and sources from which the map was derived. Space should be left in the key to identify information to be shown on the map.

Base and topographic maps for community planning may be obtained through the New Hampshire Office of Comprehensive Planning, or from regional planning commission offices. If a topographic map of the community is not available from one of these sources, an enlargement of existing U.S. Geological Survey maps may be used.

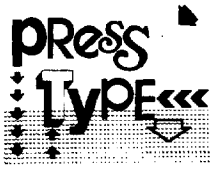
USGS Maps

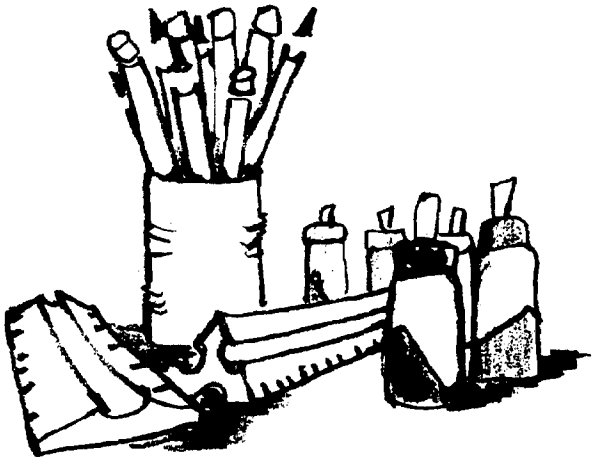
The U.S. Geological Survey, Department of the Interior, is engaged in a nationwide program of topographic mapping. USGS maps of New Hampshire have been completed at a scale of 1:62,500 (1"=5,208'), using a 20' contour interval. The original maps were produced a number of years ago using ground survey techniques; "cultural" information (roads, dams, buildings) is periodically updated; and the date of the most recent revision is noted on the map.

The USGS is now engaged in re-mapping portions of New Hampshire at a scale of 1:24,000 (1"=2,000') with 10' to 40' contour intervals, using aerial photography techniques. These maps are of superior quality and accuracy.

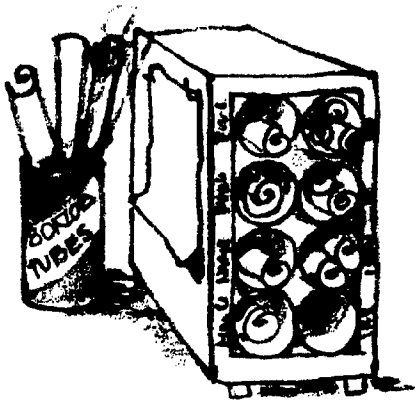
USGS topographic maps are available for sale through many retail outlets or from U.S. Geological Survey headquarters in Reston, Virginia. At relatively minor expense, these topographic maps can be photographically enlarged to provide a suitable map for community planning purposes; a number of blue print companies have the equipment to do this. It should be remembered, however, that errors contained in small-scale maps will be magnified when the map is enlarged.

Mapping Tools





In addition to having good maps for community planning purposes, there are several other tools that will be helpful for land planning. A workroom and work table are essential; large maps can be cumbersome to handle and it is desirable for a planning team to set aside space for storing, displaying, and working with maps. Walls or bulletin boards on which maps can be tacked, a large smooth working surface, and a rack, cabinet, or cardboard tube file for storage are helpful.



In the actual map preparation, an "engineers scale" simplifies map measurements by converting map distances directly into ground distances. Broad-tipped felt markers will come in handy for map marking and are generally more satisfactory than either crayons or colored pencils; colors should be carefully selected to ensure readability and compatibility. A roll of yellow tracing paper can also be very helpful when working with maps. A wheel scale is an inexpensive tool that can be used to measure curved as well as straight line distances; a piece of butcher string can also be used to measure curves.

APPENDIX B: SPECIAL FEATURES

Within every community there are special features that ought to be considered in the planning process but are not easily categorized. The "special features" classification refers to unusual places or characteristics that may influence planning decisions. There is no set list of what should be included, but some possible items are: historic buildings and landmarks, unique natural features, significant wildlife habitats, power lines, railroad crossings, and abandoned quarries.

Special features deserve careful consideration; in the process of inventorying them, a planning team should consider how they can be included in the plan. For example, a grouping of old buildings might be incorporated into an historic district, or a network of "old town roads" might be used as part of a community trail system. The act of recognizing the unique characteristics of a special feature often suggests an appropriate planning treatment.

Historic Districts

The New Hampshire General Court has declared that the preservation of structures and places of historic and architectual value is a public purpose. To achieve historic preservation, the legislature has given communities the power to establish historic districts. If a community contains old buildings or groups of buildings that are well preserved, or have the potential to be restored, a planning team should consider delineating an historic district to include the significant sites.

Identifying and Mapping Special Features

The process of identifying special features presents an opportunity for a planning team to enlist citizen participation and seek public opinion. A special features subcommittee of the planning team might be formed to conduct the inventory, using field surveys, interviews and general research; the windshield survey for collecting land use information, discussed in Chapter 8, can include identification of special features. It may be helpful to document special features with a short written description and photographs that can be keyed to a map. The written description should tell why a feature is unique and should record such facts as: the nature of the feature or area, its size, distinguishing characteristics, ownership, access, and land use considerations.

When special features are known and included in the planning process, the pattern of land use is individualized; each community develops a plan around its own particular characteristics. A plan that recognizes the special qualities of the town gives continuity to planning decisions and strengthens the fabric of the community.

Anytown, New Hampshire:

The Special Features Map of Anytown, New Hampshire, shows a number of historic buildings and places, and several wildlife areas, views and trails. These features are worthy of special consideration in planning land use at the town and at the individual site level. In terms of the overall community land use plan, the most significant feature is probably the concentration of historic buildings in the town center.

The town center, with many colonial houses, the old church, coach tavern, and town meeting house, remains very well preserved. The authentic appearance of this colonial village deserves to be maintained through the creation of an historic district. The purpose of the historic district is not to prohibit change and progress, but to ensure that changes are visually compatible and consistent with the historic qualities of the community.

The Special Features Map also indicates several wildlife areas, places characterized by an abundance and variety of animal and bird life due to habitat characteristics. As it happens, most of these areas have been designated as preferred for open space because of other conditions. If they were not, a planning team might encourage the owners to plan and manage these areas carefully, the community might consider acquiring the sites for conservation use, or it might designate them as preferred for open space.

The Special Features Map notes several significant scenic areas. Bald Peak is a visual focus from many places in the community, and the planning team might consider the use of a scenic easement or outright purchase to prevent a clutter of antennas or buildings on the summit. In addition, there are several places in the community where scenic panoramas are visible from the roadside; scenic turnouts or picnic areas might be considered for these locations in conjunction with road improvements.

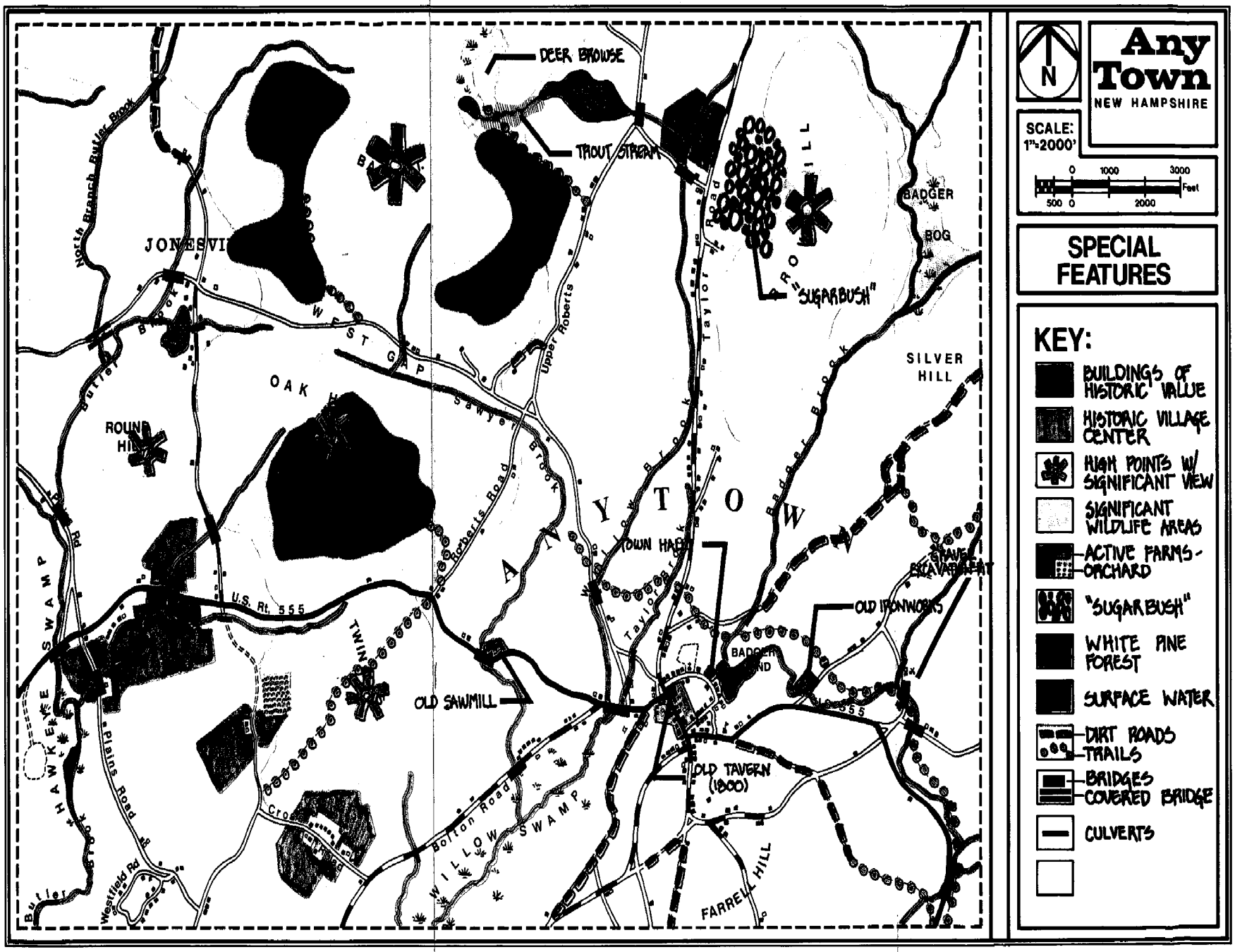
The map indicates several dirt roads and trails that might serve as a basic framework for a recreational trail system in the community. Potential connections between existing trails should be investigated and owners of property over which new trails might pass should be contacted about possible trail easements. A hiking trail to the summit of Bald Peak would be a top priority in this regard.

Another potential recreation source is in the Fools Pond area; although it is a public waterbody, all the frontage is privately owned. The community should consider acquiring public access to Fools Pond following the method established by New Hampshire statutes.*

Other special features, such as the mature sugarbush, deserve recognition although special planning treatment is not necessary. Accurate recognition of special features may be the first significant step in preserving the community's identity.

*The method for acquiring public access to a public waterbody is established in RSA 235, as amended. This requires a petition to the Governor and Council who appoint a commission to determine after a hearing whether there should be such public access and where it should be. If approved, the State will provide funds for construction of an access road.

SPECIAL FEATURES MAP



Any Town
NEW HAMPSHIRE
N
SCALE: 1"=2000'
0 1000 3000 Feet
500 0 2000
SPECIAL FEATURES
KEY:
BUILDINGS OF HISTORIC VALUE
HISTORIC VILLAGE CENTER
HIGH POINTS W/ SIGNIFICANT VIEW
SIGNIFICANT WILDLIFE AREAS
ACTIVE FARMS - ORCHARD
"SUGARBUSH"
WHITE PINE FOREST
SURFACE WATER
DIRT ROADS
TRAILS
BRIDGES
COVERED BRIDGE
CULVERTS
DEER BROWSE
TROUT STREAM
"SUGARBUSH"
BADGER BOG
SILVER HILL
JONESVI
ROUND HI
OAK H
WEST GAP
ANYTOWN
TOWN HALL
OLD IRONWORKS
OLD SAWMILL
OLD TAVERN (1800)
FARRELL HILL
WILLOW SWAMP
HAWKEYE SWAMP
U.S. Rt. 555
Upper Roberts
Roberts Road
Sawyer Brook
Taylor Road
Taylor Brook
Badger Brook
Bolton Road
Plains Road
Westfield Rd
North Branch Butler Brook
Butler Brook

Notes

APPENDIX C: PARTICIPATORY PLANNING

When community comprehensive planning is undertaken, it is important to consider the citizen consensus about the directions in which the town should grow. There are a number of different ways in which citizen participation can be sought, including a questionnaire*, a series of organized workshop and discussion sessions, and citizen committees formed to participate in and/or oversee part or all of the planning process.

In Amherst, New Hampshire, the Planning Board chose to establish a citizen group called the Sounding Board. Although the Amherst project related to community master planning, the approach taken in that community can readily be utilized or adapted by other New Hampshire communities for the purposes of land use planning, zoning ordinance enactment or revision,or other similar projects with community-wide impact.

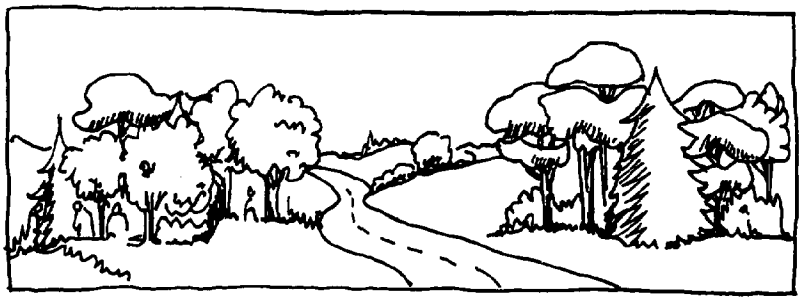
Amherst is a community of about 7,500 people, which has grown from a 1960 population of 2,500. The existing Amherst zoning mandated one-family dwellings on two-acre lots in almost all of the community, limited commercial and industrial development, and permitted no multiple-dwelling construction. The original two-acre residential limitation had been aimed at restricting growth; it did indeed control the type of growth, but did not seem to inhibit the rate of increase. It also caused an extremely expensive kind of scattered development, which entailed maintenance of many miles of town roads, longer school bus routes and other related problems.

Amherst's location (six miles from Nashua and 12 miles from Manchester), its extremely attractive physical appearance, and its two-acre zoning appealed to people who could afford to pay the ever-increasing price of land in that community. The new population was

*Questionnaires are discussed in Appendix E.

relatively homogeneous: management and professional personnel from Manchester and Nashua, mostly with out-of-state origins, mostly mobile in nature, mostly ranging in age from 30 through 50. As growth continued, it became evident that the eventual result would be an Amherst dotted with 22,000 two-acre lots, each with a very expensive house on it. This would mean that the attractive open fields and woodland in Amherst would disappear, and the town would become a high-priced housing development.

This was an end result which very few people in Amherst wished to see; the growing realization of that eventuality brought with it some agreement among Planning Board members to examine other land use control measures for the community. The members' motivations and proposed solutions were mixed: some were interested in preservation of the Amherst appeal and historic integrity; some were worried about saving the community's open space; some saw a change to ten-acre zoning as the only solution to existing problems.



In 1974, the town of Amherst voted the sum of $10,000 to be used by the Planning Board to undertake town master planning. To assist in the project the Planning Board hired as consultants the Nashua Regional Planning Commission and a landscape architectural firm.

To encourage community participation, the Planning Board created the Sounding Board. This was a 60-member group, a representative sample of new and old residents, young and elderly, wealthy and less affluent. The Planning Board chose members from all parts of the community, to ensure the inclusion of a diversity of viewpoints. Each member's only commitment was a promise to attend one meeting per month for the duration of the project, perhaps as much as two years.

At meetings of the Sounding Board, the consultants briefed its members and the Planning Board on the vital physical, demographic, and socio-economic circumstances relating to Amherst. Then, with the help of the professionals, the members of both boards debated possible

approaches to new methods of land use control for Amherst. The joint group effort was based on the assumptions that the primary objective of planning is implementation, since the best ideas, if not adopted by the town, are of little value; that outside planners cannot and should not tell the town what to do, but should recommend alternative approaches and point out their implications; and that the voters must be kept fully informed and helped to understand the process in order to gain their support.

The 21-month work program was designed to permit in-depth exploration of the proposals, and an extensive public information effort preceding Town Meeting in 1976. In June, 1974, the work began with the first convening of the Sounding Board. By August, the Sounding Board was involved in analysis of the development suitability of land in Amherst and an examination of the community economic base, with attention to the economic implications of different types of development patterns.

In the analysis process, the Sounding Board and the Planning Board gained a new perspective on their community. It became evident to them that the existing zoning restrictions were so demanding that teachers and policemen who worked in Amherst were prohibited from living within the community by the cost of land and construction. So a new motivation entered the planning process for some members: to permit a broader cross-section of citizens to live in the town.

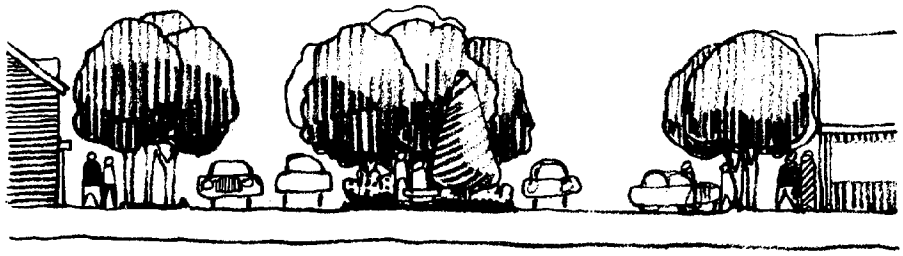
In September, the Sounding Board was provided with an inventory of existing land use control techniques, and a review of alternative land use patterns, including an examination of the implications of each kind of pattern on the quality of Amherst life. In October, the Sounding Board analyzed the growth-no growth dilemma, and attempted to establish community goals. In November, there was a discussion of possible alternative land use patterns for Amherst, with the implications of each and the requirements for implementation of each. From December, 1974, through April, 1975, there was public review and discussion of the proposed community goals and alternative land use patterns, and an in-depth review and analysis of the land use alternatives, culminating in the selection of a preferred alternative as a base for future planning.

From May to October, the Sounding Board developed a plan for implementing the preferred land use alternative, and prepared related items such as recreation, open space, transportation, utilities, and public facility plans. Once again they presented the products of these sessions to the public for review.

In June and July, the public information program was continued; work was begun on the implementation package; and the plan was revised, based on community reaction. In August, the Land Use Plan was finalized and adopted by the Planning Board; more work was done on the implementation program. By this time, it became clear that the work would have to continue at a faster pace in order to be ready for Town Meeting in March, 1976. Many members of the Sounding Board volunteered to spend additional time and effort on the project, meeting in subcommittees to work on formulation of zoning change proposals to appear on the ballot, and on public information programs.

From September to November, the work on the zoning changes was continued, preparatory to holding an initial public hearing in December. The Sounding Board and Planning Board members began the public information effort to inform the Amherst citizens about the proposed changes. They visited every group which would permit them to address its members, and they initiated a series of informational articles in the weekly newspaper which serves the community.

After some 18 months, the group was ready to formulate final warrant article proposals. To describe the complex proposed changes, nine articles were required. They included provisions to add a new "Town Center Commercial District," to create and modify other commercial and industrial districts in more outlying areas, to enact new "Open Space Development" regulations which made provision for single family "attached housing" and transfer of development rights, to re-



quire scenic setbacks on certain listed roads, to enact a "Watershed Protection Area" along certain brooks, to define a new rural district in which only limited development would be permitted, to restrict sign sizes, types, and locations, and to require placing utility lines underground.

A synopsis of the Amherst Plan, developed by the Sounding Board, follows this section.

In January, 1976, a "first" public hearing was held, as required by law, to provide an opportunity for the Amherst citizens to comment on the zoning proposals. In February, the second required public hearing was held. In March, when the Zoning Ordinance revisions, based on the Sounding Board plan, were presented to the Amherst Town Meeting, eight of the nine warrant articles passed easily, this despite the fact that the result would be a significant change from existing zoning, permitting multi-family dwellings for the first time, and enacting regulations which would preserve the rural character of some parts of town.

The Sounding Board had provided a means through which the Planning Board broadened its perspective on community goals and objectives. The efforts of both boards served as a forum through which townspeople had an opportunity to express their views, a direct means by which citizen input was included in the planning process.

Such citizen input is a crucial part of the land planning process outlined in The Land Book.

Citizen voices are most effective when they speak in unison. Frequently, citizens sharing common concerns, and desirous of promoting common objectives, will organize to express their concerns and achieve their objectives.

Special committees may be formed to deal with important aspects of any organized citizens' group effort. These individual committees, or sub-committees, generally deal with the following:

1. Fact-finding--gathering of information on which suggested community decisions may be based.

2. Policy--development of a clear statement of the group's objectives, and determination of what the ultimate aim of the group is or should be.

3. Communications--raising community awareness of the issues involved and publicizing informational meetings, work sessions, and key opportunities to influence decisions.

4. Strategy--analysis of ways to influence local decisions and implement recommended action of the group.

The citizens' group should include broad representation from the community, like the Amherst Sounding Board. The greater the numbers and interests that are represented, the greater the credibility of the group within the community.

In some communities, small, informal neighborhood meetings can be held to encourage people to talk about land use planning. These meetings may well precede the establishment of special subcommittees to carry out the project, since such meetings should generate the necessary understanding and community support. Or, as in Amherst, they may follow the planning effort, and serve as a means of informing people prior to town meeting.

Crisis and the threat of perceived intolerable changes are too often the primary stimulus behind the organization of citizens' groups. Yet, just as community planning has become a necessary and valuable continuing activity in even the smallest New Hampshire towns, so should continuing public participation be a part of any planning process. A community's citizens may find that there is less need for them to react on a crisis basis if more people are involved in the planning process, if decision-making techniques have been devised, and if information about the community is readily available.

Communities should recognize that the work of a planning team is never completed. Rather, the involved citizens should strive to reflect the changing opinions, feelings, attitudes and hopes of the townspeople.

Change, then, need not be viewed only as a threat to all that is valued in New Hampshire: the landscape, the natural beauty, the way of life. Change also poses challenges: the challenge of environmentally sound development and the challenge of participatory planning. If these challenges are met capably and fully, change can reflect the benefits of sound planning and the virtues of a dynamic community, fully aware of its role in determining its own future.

A MASTER PLAN SYNOPSIS
For
Amherst, New Hampshire

I INTRODUCTION

Amherst is located in one of the fastest growing areas in the United States. Southern New Hampshire represents a most desirable combination of living close to well-paying employment while allowing residents to "get back to the land," a desire felt more and more strongly as urban and suburban living loses its appeal. The pressure to grow is intense. The population of Amherst doubled in the decade of the 'sixties, and has almost doubled again in the five years since 1970. This growth cannot be stopped. However, it can be controlled by good planning.

Amherst is unique. In formulating a Master Plan, this uniqueness must be recognized and preserved. Of all the towns in this region, Amherst has evolved over two centuries into a very special place, unlike any other community in several important ways. In its hey-day, before the Industrial Revolution, Amherst was the social and political center of a primarily agricultural and hand crafted society. In those early days the pace of life was slower. The sense of community was greater. As the town evolved, its character and traditions were formed under conditions very different from those in which the mill towns, the railroad towns, the manufacturing towns in the vicinity later evolved during the Industrial Revolution. One needs only to walk through the historic village center at any season of the year to sense the unique character of this town. One needs only to stand at the top of any of the seven hills of Amherst on a clear day to sense the open rural beauty of the town as a whole.

It is these unique characteristics which attract people to Amherst. Ironically, unplanned growth threatens to destroy the very things which attracted so many people to Amherst in the first place. A further important consideration in the planning process is the financial one. How can we preserve the town's uniqueness while providing all the services our citizens expect, and still afford to live here?

The Master Plan for Amherst must be based on:

(a) the physical and natural characteristics of the terrain,

(b) the historical evolution of the town to date,

(c) the expressed desires of the townspeople, and

(d) the fiscal realities of increasing costs and higher taxes in the face of continued rapid growth.

II PURPOSES

This Master Plan is created to provide a blueprint for action. Unless translated into action, the plan will fail. The plan presupposes action, both public and private, which will preserve those characteristics of the town which should be maintained, while minimizing those effects of rapid growth which the townspeople agree are undesirable. The Master Plan is designed to channel further development into those areas of town whose topography, soil types, drainage, slope, water supply and other features of terrain can best support development.

It is the purpose of the Plan to preserve and protect open space, waterways, and scenic areas for the enjoyment and wellbeing of all citizens.

It is the purpose of the Plan to preserve and protect the Historic Village District and its approaches so that a gem of colonial American architecture will be available for the edification of future generations.

It is the purpose of the Plan to ensure the health and vitality of the community by encouraging a diversity of people, a variety of age groups of different interest and backgrounds.

It is the purpose of the Plan to enhance the unity of community spirit and to encourage citizen participation in the affairs of the town.

It is the purpose of the Plan to encourage development which protects the environment and which also provides a tax base which is both affordable and sufficient to meet the financial needs of the town.

In short, the purpose of the Master Plan is to undertake actions necessary to achieve those major goals for the town which are agreed to be desirable by a majority of its citizens.

III GOALS

There are six major planning goals which are achievable and which, if achieved, will begin to fulfill the purposes enumerated above. These are:

1. Preserve and enhance the small town character of Amherst and its unique colonial village center.
2. Preserve and protect the open, rural character of the land, as well as its natural and scenic resources.
3. Encourage a vital community composed of a variety of types of people who feel a strong sense of community spirit.
4. Encourage a diversity of housing opportunities and housing types.
5. Minimize unsightly strip development along the town's major roads.
6. Encourage the development of clean, non-polluting industries and small, attractive commercial activity in those zones where such activities are permitted.

IV IMPLEMENTATION

To achieve the six major goals, the Master Plan calls for changes in the Amherst Zoning Ordinance and the formation of a non-profit private Land Trust, as described below. The Master Plan also requires continued scrutiny and, if necessary, revision to assure that the desired purposes are served and that the desired goals are being achieved. The tools for the implementation of the Master Plan include the Amherst Zoning Ordinance, the Subdivision Regulations, the Non-residential Site Plan Regulations, the town tax maps, the town road maps, the Wetlands and Floodplain District Maps, the soils map, the hydrology, slopes, elevation and development suitability maps, and the Open Space Development Plan. Indeed this Master Plan is embodied in all of those documents and changes thereto. While the overall purposes and goals of the Master Plan will remain constant, it is envisioned that the tools of implementation will continue to be refined as more work and study are performed, and will be changed from time to time to accommodate to changing times. It is emphasized that this Master Plan is not a single inflexible document, but is embodied in all of the noted instruments and their interpretation by the various town officials, boards, and commissions. The steps currently required to implement the Master Plan are seven in number. They are:

1. Incorporate zoning changes concerning commercial and industrial regulations, to limit the types of commercial activities and regulate setbacks, signs and frontage requirements to minimize traffic problems and unsightly strip development in the areas currently zoned and contemplated for commercial or industrial uses.

2. Provide for Open Space Development to encourage better planning for permanent open space in the design and layout of new developments, which in turn will provide for the establishment of additional recreational areas and a network of public trails throughout the town.

3. Establish scenic setbacks on major routes through town to preserve the rural and open character of Amherst and establish environmental setbacks on all waterways to preserve the purity of the town water supply and avoid erosion and pollution created by indiscriminate clearing and earth removal near streams and waterways.

4. Establish the Amherst Land Trust, a private, non-profit organization which can help the town maintain open space by acquiring land through gift or purchase, and by restricting the use and development of certain land by acquiring conservation easements, deed restrictions or development rights.

5. Establish a lower density of development in the still largely undeveloped northern area of the town where soils are less suitable for development. Utilize Open Space Development to create imaginative plans for the optimum use of developable lands.

6. Retard development in the still largely undeveloped eastern area of the town until road accesses and other town services are upgraded to accommodate a higher density. Utilize Open Space Development to create imaginative plans for the optimum use of developable lands.

7. To balance the lower density of housing in the northern rural area of town, make provisions under suitable controls for a limited number of multiple-family dwellings in those few areas of town where soils and drainage conditions will permit a higher density.

These seven steps represent only the immediate actions which should be undertaken to implement the Master Plan. The actual functioning of the Amherst Land Trust, the exact location of open lands and easements required for a trail system, the means by which the town can provide water service and fire protection to the industrial zone, and many other significant details remain to be resolved. At this stage the important fact is that the Master Plan has taken form and substance in a statement of purpose and goals to be achieved. The implementation is up to all of us.

APPENDIX D:

PREPARING AN EXISTING LAND USE MAP

An existing land use map identifies and shows the location of all natural and man-made uses in a community. It is a necessary step in the preparation of a future land use plan, and may be useful in locating desirable growth patterns to complement existing development. It also provides a basis for examining municipal facility and service needs, and planning for their construction, operation and financing. Housing needs and conditions studies, population distribution studies, utility forecasts, and planning for transportation improvements are some of the other activities aided by having an existing land use map.

Preparation of the map can easily be undertaken by the planning team. The steps outlined below provide a simplified procedure for preparation of an existing land use map.

1. Materials. Obtain paper prints (heavy paper) of the community base map, preferably without topography (see Chapter 1 for a description of base map preparation). The base map print can be a blue line or black line ozalid copy with plenty of extra space for notations. Many existing land features and other helpful information appear on the base map itself:

   - Roads/streets/highways/railways (with names).
   - Lakes, major wetlands (with names).
   - Rivers, streams, creeks (with names).
   - Utility rights-of-way (such as power lines).

- Names of points of high elevation (mountains, hills).
- Names of villages, crossroads, settlements within the town.
- Name of municipality, north point, scale, preparation date.

The base map should be folded carefully so that portions of the print can be referred to easily, and the exposed portion is of manageable size. A large handheld clipboard makes a convenient writing surface. The individual who is to record information should have several soft lead or colored pencils, an eraser, an engineer's scale, a list of land use classifications, and a small pencil sharpener or knife. (Land use classifications and symbols are shown on the opposite page.)

2. Tax Maps. The community's tax map, if completed, provides a valuable source of information in locating uses and their associated land areas. The land use survey team may find it easier to use paper prints of tax map sheets as work maps, since property ownership lines often help delineate use areas. (If overlay sheets are developed during the preparation of the future land use plan, property ownerships can be shown when this information is available.)

3. Survey Travel Routes. Those conducting the windshield survey (see Chapter 8) should select their routes carefully to save time and fuel, to make sure that all sites in each part of the community are covered, and to guarantee that the entire community is surveyed. This step is particularly important if more than one survey team is used to collect land use information. A base map or aerial photographs can be used to help lay out routes.

4. Land Use Classifications. Land use classifications are usually indicated by the use of symbols and/or in a color code. A simplified system like the following one should be adequate for most small communities; suggested symbols and colors are shown along with the list of uses. A planning team should decide on the system to be used before starting the survey.

LAND USE CLASSIFICATIONS FOR A SMALL TOWN

Use Group	Includes	Abbreviation	Color
Residential	Low density, single family development	R1	Yellow
Residential	High density multiple-unit dwellings	Rh	Brown
Residential	Mobile Homes	Rm	Tan
Agricultural	Land in active agricultural use	A	Olive
Industrial	Manufacturing, both light and heavy	Ind	Purple
Commercial	Retail shops, stores	C	Red
Governmental	Town offices, facilities	G	Gray
Institutional	Schools, hospitals, churches, cemeteries	Inst	Dark blue
Recreation	Beaches, play-fields, courts, trails, public parks	Rc	Green
Forest	Wooded land areas	F	Light Green*
Open Land	Inactive agricultural land not forested, wetland	O	White
Surface Water	Surface water	W	Blue

* For clarity on the Existing Land Use Map for Anytown, Forest is indicated by a pattern.

Several land use types which ofen cause classification problems include:

Use	Suggested Classification
Lumberyard	Commercial
Sawmill	Industrial (light)
Lumberyard/Sawmill	Record dominant use or both separately
Sand and Gravel mining	Industrial (light or heavy depending on size of operation)
Shoe Manufacturer	Industrial (light)
Granite quarry	Industrial (heavy)
Woolen mill	Industrial (heavy)
Craftsman (at home)	Residential (unless it is a larger enterprise--then, industrial or commercial)
Architect/Attorney	Commercial (professional)
Amusement Park	Commercial
Swings/Picnic Area	Recreation
Greenhouse	Agricultural
Florist	Commercial

5. The Windshield Survey. Information is recorded on the paper work map prints using a soft lead pencil or colored pencils. Several points should be remembered:

   a. In recording land uses, lines should be drawn on the map to show the approximate extent of each use. Locate structures as accurately as possible on the work map, and label sites as to their use (letter code, color). Include the directly related, surrounding yard/land area in the same use class. For example, a single family residence in a rural area should be recorded as a residential use of land approximately one acre in size (200' by 200').

b. Accuracy is important, since preparation of the future land use plan may involve proposals to extend existing uses to adjacent land area.

c. A USGS topographic map can be very helpful in orientation, as can a highway series map (available from the New Hampshire Department of Public Works and Highways).

6. Road Classifications. While conducting the windshield survey, it is wise to note any new roads which may have been constructed and add them to the base map; names should be corrected as necessary. In addition, to help in understanding the traffic circulation patterns in the community, it is helpful to differentiate among the various kinds of streets and roads. The Handbook of Subdivision Practice, published by the Office of Comprehensive Planning, suggests the following categories: arterial, major collector, minor collector, and local service. The following table shows suggested minimum measurements for those classifications, as a guide in classifying community roads; they may be modified slightly if necessary. When noting those classifications on the map, a different color or a different line width or pattern should be used to indicate the various kinds of roads. Dirt or unimproved roads may be identified by a separate symbol.

Classification	Right-of-Way Width (Feet)
Arterial	100
Major Collector	80
Minor Collector	60
Local Service	50

In general, any state or Federal highway should be considered an arterial road. Collectors carry the traffic in and between developed areas: major collectors carry heavier traffic flow, and may also provide traffic flow between developed areas; minor collectors flow into major collectors, and carry the traffic generated on local service roads.

7. Recording the Data. When the survey team returns to the office, it should transfer the rough information obtained in the field to a clean paper print. This does not result in the final existing land use map, but a master work map on which all of the information is accurately recorded for review and checking.

8. Aerial Photographs. Compare the field data with aerial photographs of the community if available. This helps confirm the location of uses identified in the field, and allows an inspection of backland and inaccessible areas. More exact boundaries of fields and forested lands can be delineated. Examples of uses which can be confirmed in this manner--without training in photo interpretation--include the location of agricultural uses (active land), extensive gravel pit operations, and lumbering activities.

9. Review and Consultation. When all of the information recorded on the master work map has been checked, other town officials (such as the board of selectmen, road agent, and building inspector) should be given an opportunity to review the map to confirm its completeness and accuracy based on their knowledge of the community.

10. Final Map Preparation. Transfer the existing land use information from the master work map to a mylar base map. This is usually done in ink on the mylar surface. Symbols or distinctive shading may be used, allowing the mylar original to be reproduced through photographic or blueline/blackline ozalid processes. Paper prints or duplicate mylar sheets can be colored, using markers or pencils, to make the existing land use map more readable and easily understandable.

11. Keeping the Existing Land Use Map Up-To-Date. The existing land use map can be maintained in up-to-date condition in several ways. If a building permit system exists in the community, all new structures and improvements will be on record in the building inspector's office; this information can be easily transferred to the existing land use work map or a card system for periodic updating of the map. Other commonly used methods involve an annual or biennial windshield survey and updating from new aerial photographs. Regional planning commissions may also be asked to assist in updating the information.

By following these or similar procedures, the planning board can obtain and maintain a readily available, accurate representation of the community's existing land uses. Then, as problems arise and decisions are made, the basic research is already complete; the community can move more easily and with more confidence in determining its future.

APPENDIX E:

THE LOCAL PUBLIC OPINION SURVEY

An early step in the land use planning process should be the determination of citizens' views about the community. Without a study of attitudes and opinions, erroneous assumptions may frustrate progress in the development of a land use plan. The planning team, therefore, needs to gain an understanding of public attitudes and opinions; this can be done by undertaking a public opinion survey.

Since the effectiveness of such a survey requires the cooperation of local town officials, it is important to meet with selectmen and other influential community leaders early in the planning of the survey. Often, informing local organizations about survey plans will also assist the planning team in recruiting volunteers when they are needed.

The planning team should determine the general subject areas which will be included in the survey; several are listed in the discussion of what should be included in the questionnaire later in this Appendix. It is important to realize that restricting the number of subject areas may result in more cooperation from those who are surveyed. Since the effort of making the survey will not vary greatly with the addition of two or perhaps five additional questions, however, the planning team may decide to get as much information as it can, in terms of reasonable survey length.

For each subject category, a list of questions should be prepared. Each should be directed to the immediate subject, in order not to confuse the person responding. Question order should flow logically by subject; once a given subject is introduced in the questionnaire, all related questions about that subject should follow. This, too, helps to keep the mind of the person responding on the subject matter without introducing distractions.

The planning team must determine to whom the questions will be addressed. Will the questionnaire go to all taxpayers, or all voters, or each mailing address in town? Or will only a representative sample, or only community lead-

ers be chosen? Obviously, there are strengths and weaknesses in any such decision the planning team makes. If the decision is to make a community-wide survey, the planning team may be involved with distribution and collection problems, and also tabulation problems when the responses are received. This kind of survey, however, will provide the planning team with the broadest cross-section of public opinion it can obtain. In a large community, a sample is probably necessary, since it is almost impossible to survey everyone in an urban area.

Asking questions of community leaders provides another kind of insight. Although the planning team will not have gained information directly from citizens, it will have learned what the elected and appointed officials who lead the community think about the community's needs. In addition, if the survey includes selected business leaders, the planning team can make some kind of appraisal about how the community is viewed as a place to conduct a business and work, and what kinds of changes may make the community even more attractive to business interests.

Then, the planning team must decide how the questions will be asked. Will the questions be asked orally by an interviewer, or be provided in written form to each person being asked to respond? Using the personal interview technique, in-depth questions can be asked; a better understanding of the citizen's thoughts may be gained, which will assist in later tabulation and interpretation of the responses. This technique, however, requires training for volunteer interviewers to assure consistency in approach. Using volunteer interviewers requires utilization of people who are willing to take the time and expend the effort in training and then in covering their assigned areas completely. Sometimes the presence of an interviewer inhibits the response of those who are answering the questions, particularly if the interviewer is a neighbor, so it may be wise to ask volunteers to cover homes in another part of the community. It is interesting to note that professional survey teams believe that the most valid findings are developed through the use of trained interviewers. Interviews can also be conducted by telephone; in this case special care should be taken to limit the number of questions to be asked, because lengthy telephone interviews are not usually successful.

Most planning teams use printed survey forms which people answer by themselves in the privacy of their own homes. For this kind of survey, the planning team has to make some decisions about the means of distribution and return of the survey forms. Obviously, the higher the response rate, the more likely that the findings will be valid, so it is important to use the best distribution and collection methods available.

One good way to get a high return involves neighborhood delivery and pick up. This requires the participation of local volunteers, such as the League of Women Voters, Boy and Girl Scouts, school groups, 4-H Clubs, local fraternal orders, or business organizations. In this method, each individual is assigned several streets or blocks with the responsibility for delivery of the forms, and pick-up of the completed forms within a certain period of time.

Delivery and return through the mail is more costly than using volunteers to deliver by hand, but it can be used when no active volunteer group is available. Sometimes postage costs can be reduced by using bulk mail permits; local business firms or banks may agree to include the survey forms in their regular mailings. Completed questionnaires can be returned by mail or deposited at key points in the community. To get a good response in this way it is necessary to publicize the project well, emphasizing the importance of returning the completed questionnaire; follow-up letters or phone calls may also be required.

Another method is the use of voluntary pick-up at publicized locations, such as the Post Office, general store, Town Hall, Town Clerk's office, banks, schools, and the like. Returns would be deposited at the same locations. This method, however, often produces the lowest number of returns, the greatest inconsistency in responses, and inadequate distribution of responses across socio-economic groups or geographic areas.

Attention should be paid to the kinds of questions which will be asked. Should they be multiple choice questions? Require "yes" or "no" answers? Allow space for brief written responses? Ask for comparisons and preferences among a list of items? Suggest responses or permit the person responding to supply any answer which seems appropriate to him or her? Sometimes it helps to list a number of possible answers, and leave enough space for "other" answers, too. In this way, the suggested list of answers stimulates thinking but does not limit the response to someone else's options. This kind of answer is more difficult to tabulate, but it does provide a more in-depth view of the citizen's preferences.

It is important to keep the length of the questionnaire reasonably short. No one should be asked to spend longer than half an hour to fill it out, if the responses are to be written. Half an hour is also a good length for an interview, although this kind of survey may be permitted to run slightly longer if necessary to obtain a complete response.

The planning team must decide how it will tabulate the answers, by hand or by computer, by volunteers or paid consultants. In a small community, there usually is no need to seek professional assistance; the larger the community and the more complex the survey, the more advisable it may be to seek the aid of professional firms in analyzing the information. If the tabulation is done with volunteers, each individual can be given the responsibility for certain questions or pages. The tabulator, using an unused survey form or a similar check-off sheet, examines the responses one by one, and marks the sheets to indicate the preferences of the persons who responded. Computer tabulation is becoming more feasible and less expensive; it is fast, and it permits cross-tabulation--a method of examining combinations of responses, which may provide the planning team with a more complete understanding of what the responses mean. If this tabulation method is seriously considered, the Office of Comprehensive Planning or regional planning commission should be contacted during the questionnaire preparation period.

After the questionnaire has been drafted, it should be presented to community officials before it is printed. This will give them an opportunity to make comments, and to permit any necessary changes to be made. The questionnaire should then be tested on a small number of respondents who have not been involved with preparations for the survey. In this way, the need for clarifications in wording or survey content or organization may be identified and corrections made before the questionnaire is distributed.

A cover letter should be prepared to accompany the survey explaining the purpose of the effort and noting, when such is the case, that it has the approval of town officials. The cover letter should be signed by the individuals or groups spearheading the project, i.e., the Planning Board chairman, the Board of Selectmen, planning team members, or any names which will stimulate confidence in the people at whom it is aimed. If an interview technique is being utilized or if neighborhood delivery is anticipated, the volunteers should carry letters identifying them as part of the project team.

When the survey results have been collected and analyzed, the findings should be summarized and made public. A summary may be printed in the next Annual Town Report or included in the local newspaper. If enough summaries are printed, they can be handed out at meetings or distributed at accessible locations in the community.

Obviously, the most important part of the project is deciding what should go in the questionnaire. Following is a list of suggestions, which should serve to stimulate the thoughts of the planning team as it designs a survey which will suit its community's needs.

What should be included in the questionnaire?

1. Background of the respondent. Including such questions is optional, but can aid in the analysis of returns. To avoid a negative response, it should be indicated that answering these questions is <u>not</u> required. Such questions include:

   - age
   - length of residence in community
   - employment in town, out of town
   - voter and/or property taxpayer status
   - income range

2. Desirability of living in town. Include multiple choice or open-ended questions on the most desirable and the least desirable aspects of community life.

3. Community qualities which should be preserved, improved or eliminated.

4. Community growth rate. Is the town growing too slowly, too rapidly, just enough? What is a desirable rate of growth over the next ten years?

5. Types of development that should be encouraged or discouraged (residential, commercial, industrial).

6. Locations within the town where growth could or should occur, by type.

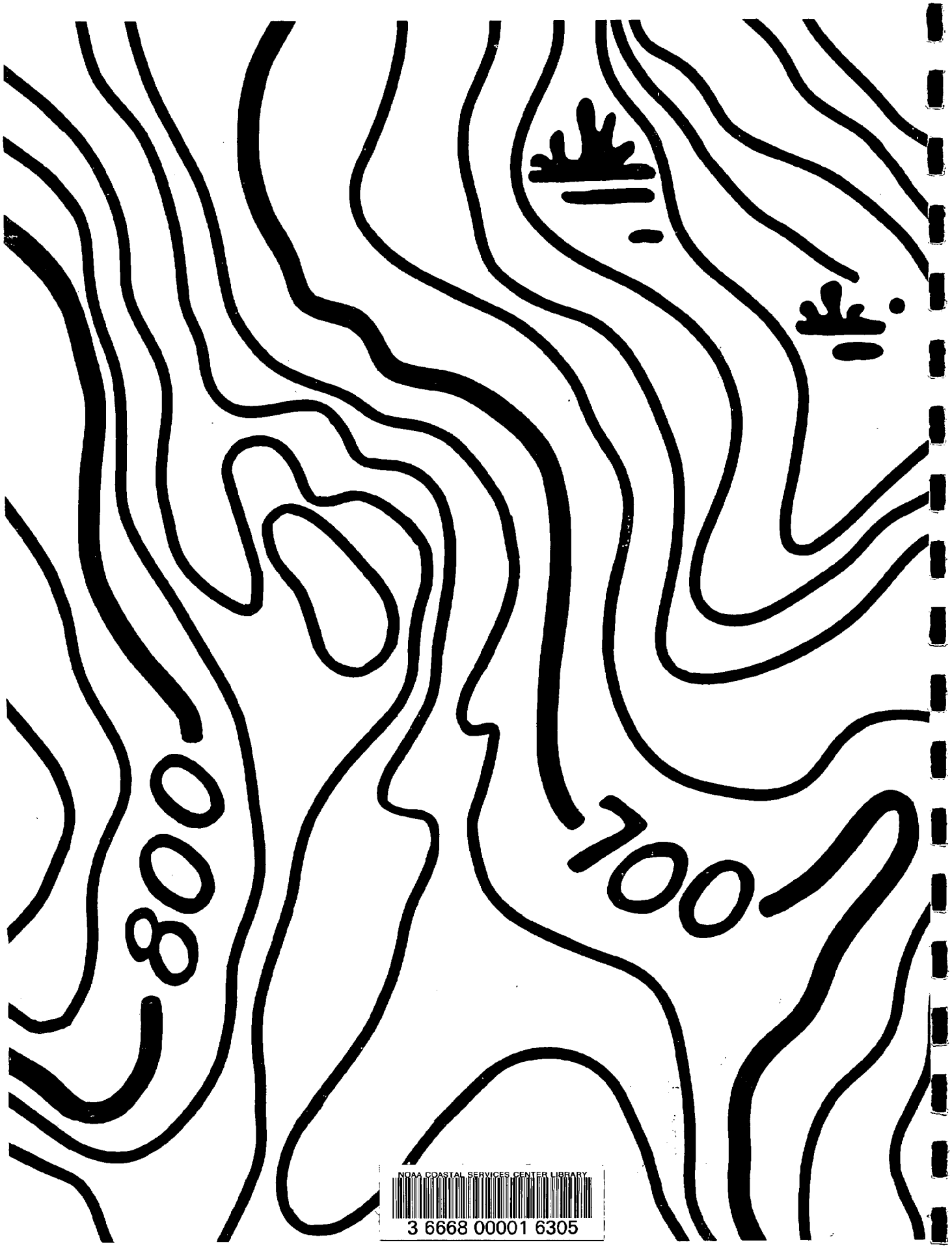
7. Open space concerns relating to the use and management of wetlands, higher elevations, flood hazard areas, erosion-prone soils, stream/river banks; preservation of wildland; scenic roads; transfer of development rights; other similar items.

8. Desirability of more local planning for various purposes: to encourage, to guide, or to control growth; to study critical areas; to protect historic/special features; for other selected reasons.

9. Other related questions:

   - establishment or expansion of historic districts.
   - land acquisition program for key parcels/areas.
   - site plan review authority.
   - road (Class 6) upgrading.
   - additional or revised zoning districts.
   - adequacy of existing community services, community facilities, recreation facilities.

10. Interest in participating in a citizens planning advisory group or planning work group.



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