

Housing for an Expanding Rural Town

The Relationship of the Housing
Elements to the Landscape of a
Rural Site

by Hildegard E. Nelson

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ABSTRACT

This project is an attempt to work out a method of dealing with the natural elements of a rural site as components in the design process. A specific site, in the town of Marshfield, Mass., and a specific program, housing for 100 living groups of different sizes, were determined in the beginning. The goal was a 40th scale site plan providing living places for the 100 families. The way the site will be changed to accommodate its new inhabitants was determined by considering the restriction/potential for use of the site itself, as well as the demands placed on the site by the people coming onto it. The demands on the site were understood by predicting some of the activities and physical needs of the people. The restrictions/potential for use were mapped as they changed over the site by:

1. Breaking down the natural system of the site into separate components;
2. Gathering information on these components;
3. Applying criteria for use/non-use of these components;
4. Mapping areas of varying potential for use over the site with respect to these separate components.
5. Combining these maps into a composite map.

This composite map gives the zones of highest potential for receiving housing. It does not give an automatic solution for the site plan, but rather provides a design tool. Zones for housing and the open spaces related to them--for roads, parking, leaching fields, private and shared outdoor space, were located using this map. The 40th scale site plan goes beyond locating these zones to the design of: the configuration of the groups of housing, their entrance locations, orientation of roof slopes, parking areas, and the configuration of shared outdoor spaces.

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THE PROBLEM AND SETTING OUT TO SOLVE IT

This project is an attempt to work out a design process which strengthens the importance of the natural elements of a rural site as elements in the design process. The reasons are several. Firstly, these elements are seen as the working components in the larger system of the site. Each element functions to support the others, so that an understanding of these elements can increase the understanding of how the natural system works as a whole and how changes in one element will produce certain consequences in the site. Providing places for people to move into and live on the site, in the form of housing and related facilities, means changing the existing conditions of the site. Decisions as to how the site will be changed to accommodate and contribute to these demands will be made with some knowledge of the consequences of these changes. A choice relating to housing will include a choice of natural consequences. Secondly, the elements of the site are resources which are valuable in some way to the people who will live on the site and to people of a wider area. These are resources which could be used in the design process to contribute to the housing and its related demands, or could be valued as a resource which is best left unchanged by the influence of new inhabitants. A choice relating to the housing site plan will include a

choice of which resources from the site will be used and to what extent.

Changes in the site resources and in the larger system of which they are a part in some cases can be predicted and measured precisely and quantitatively, but the means and the knowledge to do so were not available for this project. However, basic goals for the use of the site were formed, and steps towards changing the site could be chosen according to the degree to which they contributed to these goals:

1. The site's role in the workings of the larger region should not be disrupted. One goal, then, is to maintain the 'status quo' at the edge of the site, so that the interchange between the site and what is around it is maintained as well. This assumes that sustaining the conditions at the edge will sustain the site's place within the region.
2. 'Equilibrium' of the conditions within the site itself should be maintained. This does not mean that the site remains unchanged, but that the constantly changing conditions should still evolve from the balanced interaction of the different natural components.
3. The use of the site's resources for accommodating housing should be appropriate and efficient. This means that the use of resources should be selective, with priority given to using those elements of the site

which contribute in particularly satisfying ways to the housing and at the same time are less valuable as a resource by themselves or less crucial in maintaining the existing site equilibrium. Priority should be given to not using those resources which are vulnerable to an increasing depletion by exposure to or influence from housing, or which play an important role in maintaining the existing working of the site.

Method of Selecting Which Site Resources Should be Used

Designing a site plan which achieves these goals should use a process which selects only certain of the site's resources for use. Needed: A map of the site which locates areas of varying potential, or restrictiveness, for use in receiving housing, according to the different combination of resources within each area.

Steps leading to the making of this map:

1. Breakdown of the overall system into natural 'components'
2. Investigation of each of these components, or resources

Gathering information on these elements:

Mapping the variations of each element--
How do they vary over the site?

How do they contribute to the larger system, and
how are they valued as a site resource?

3. Applying criteria to the use of each of these components

Discovering how each component should be used/not used
to satisfy the demands of new housing and the goals
for maintaining conditions on the site.

4. Mapping the corresponding restrictions/potential for use of different parts of the site with respect to each component.

5. Combining these separate restriction/potential maps for each component into one map, the map mentioned above, which will show the areas of varying potential in receiving housing, according to the combination and relationship of resources which exist within them.

The Design Process

Designing a site plan for new housing on a rural site will rely on these 'information maps' and 'potential use maps' as a base for much of the decision making.

Design decisions at three scales:

Location: Locating the zones for the different elements, built form, open space, roads, will be done using the resource maps as a guide.

Configuration of housing groups: Configuration of the outdoor spaces and the blocks of housing for each group of people on the site.

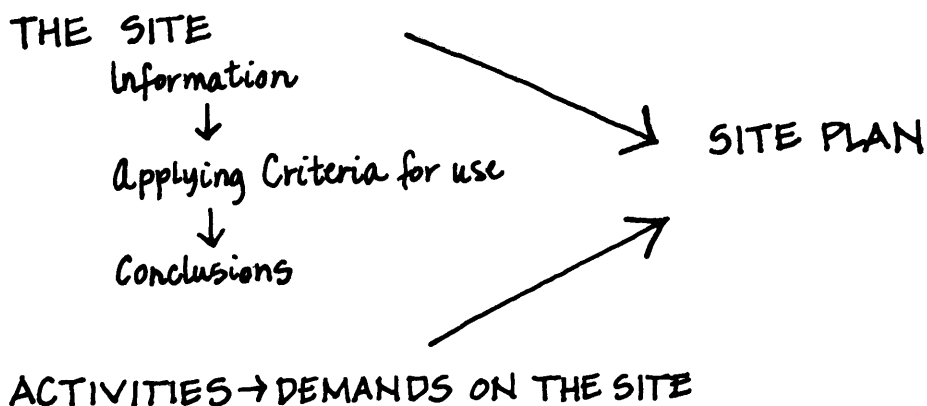
Architectural scale: Design of the actual built form, involving relationships between building/natural elements: tree/window, ground level/wall, ground form/entrance relationships.

This project carried out the design at the first two scales. The third level scale of design was not done here, but would be the next step if the project were continued.

Demands on the site/site restrictions:

What are the activities, places, people, buildings, and other elements which the site will have to accommodate to become a place for people to live? A site plan will be the result of the needs of the people moving onto the site as well as the restrictions, qualities of the site itself. An under-

standing of housing components and their qualities is an important part of the design process.



Choosing a Site/Housing Program

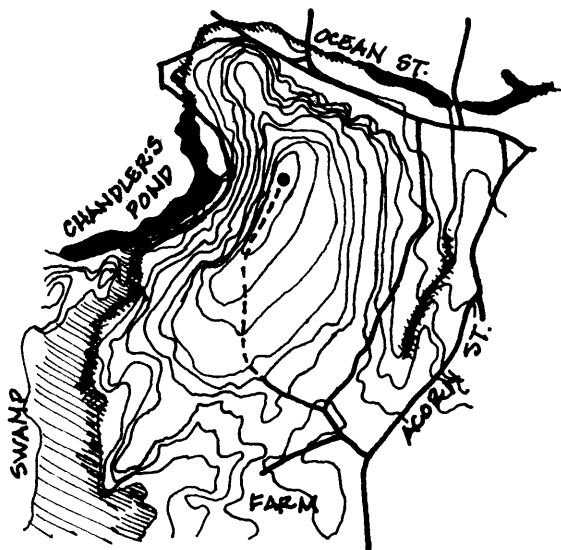
I chose as my goal the design of a site plan for 100 units of housing on a particular site, using the design process outlined here. The site selected is an area in the town of Marshfield, Massachusetts, bounded by Ocean St., or Route 139, on the north, Acorn St., a residential street, on the east side, farmland and swamp on the south, and a lake and a swamp on the west. The site was chosen for this study for several reasons:

1. It was part of a regional land use study already undertaken, and contained areas within it designated as appropriate for 'high density' housing. Hopefully, my project would enable me to learn something about the usefulness, or validity,

of such a regional study. The project would really be an attempt at the next step in implementing the results of a regional plan.

2. The site is varied--with places that are swampy and dry, flat and steep, heavily forested and open; containing all the stages of forest succession from open meadows to oak forest; used for a variety of purposes--residential, agricultural, recreational; bounded by or containing streets of differing amounts of traffic and density of use.

3. The site is within a town which could still be considered rural, but which is rapidly growing and subject to the demands of expansion, where housing is in demand, and where an investigation of the methods of development might be valuable. Even though the project could be of some use to the town of Marshfield, it should be made clear that this was not the primary aim. The site plan was never meant to be implemented, but was meant to be an exercise which might be valuable in learning how to deal more sensibly with other to-be-implemented projects in the future.



THE SITE AND ITS BOUNDARIES
MARSHFIELD, MASS.

WHAT ARE THE DEMANDS ON THE SITE?

The needs that a place for living will have to fulfill will be different for each different group of people. And a particular group of people sharing a site will possess a wide range of daily activities and needs to correspond with the variety within the group. Ideally, providing for the needs of a specific group of people would mean knowing who these people are who will live on the site, so that their way of living could be known and understood as the design process took place. This would mean designing with, instead of for, the future inhabitants. In most cases of new housing, to know who the future inhabitants will be is impossible. As a substitute for this, there is the choice of attempting to predict as carefully as possible what type or types of people, families, or groups will live there. Will there be large families with many children, elderly couples, working people, artists, communes, single people? How many of each? A variety of information is necessary to answer some of these questions. Looking at what kinds of jobs are available in the vicinity, what kinds of transportation exist to take people in and out of the site for jobs which might be further away, what kinds of people live in and around the site, that is, what kinds of people have been attracted to the site already, are ways of obtaining a picture of who might want to come to the site in the future. Observing and understanding how the present inhabitants live

on the site may provide an understanding of what kinds of activities the site will receive from its new inhabitants.

This was the primary method used in defining the demands on the site in Marshfield. Since the plan for housing is not intended to be impemented, a real, specific group of people who would be coming to the site was not known and worked with. And since the primary aim of the thesis was not a detailed study of user needs, careful analyses of who the future inhabitants might be was not undertaken either. Instead, observations of the existing activities and uses of the area within and adjacent to the chosen site were collected and sorted out to form a picture of the future demands. Where observations were inadequate or missing, logical assumptions were made. Considered most important for this exercise was the time limit set upon observation and investigation of needs, which were then organized into a set of demands which could simply be accepted, used in the design process, and held up against the design for its evaluation in the end. Considered more important than a thorough investigation of user needs was the investigation of methods of how to balance these needs with the 'needs' of the site itself.

The wide range of activities and needs will have implications for all the different scales of design, from the organization of the spaces of the site, or site plan, to the relating of one house unit to another, to the design of inside spaces, to the design of furniture and implements of work. Since the scale of design for this project was not intended

to go beyond that of the site plan and relationship of units, emphasis was placed on investigating the activities which have implications for the design at those scales. A more detailed understanding of uses of interior spaces and furniture would come in an extension of this project, but not within it.

Certain assumptions were made from the start which should be made clear. Some of these have been stated previously: Places for one hundred families should be provided; the analysis of the site restrictions may modify this number, but to provide for this many families will be the initial goal. It was also assumed that the majority of these families or living groups will consist of four to five people; smaller proportions of the total number of units will be for families of from one to three people and for larger families of six and more people. Each living group would require a different amount of living space, not just according to the numbers within the group, but also according to the activities and work of the individuals within the group.

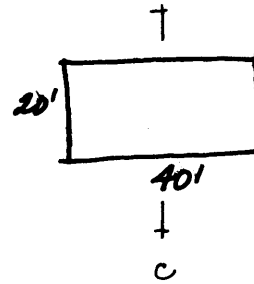
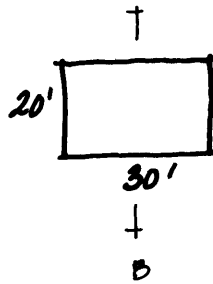
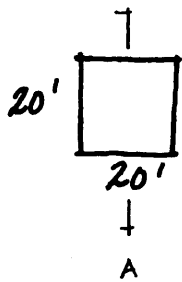
A set of 'building blocks', which give a choice of the amount of living space for the different groups, were determined after a preliminary investigation of interior space requirements. Decisions concerning the choice of these building blocks, their location on the site and their relation to one another and to the elements of the site, comprise the design of the site plan. The number of kinds of these building blocks is minimized to simplify the design process, but the

choice is kept large enough to provide for the different sizes of living groups mentioned above. The building blocks, their dimensions, and the amounts of each are shown in figure 3.

Certain assumptions were made about the density of these pieces on the site. In actuality, the site is zoned for a particular density, but to accept this restriction would mean accepting a particular attitude towards the use of the site which is contradictory to the premise with which this project was undertaken--that the density, or proximity of living groups is a decision in the design process, is determined by the lives of the people who live on the site and by the nature of the site itself, and thus can vary throughout the different parts of the site. However, it was accepted that the overall density of units on the entire site should not conflict with the existing town zoning laws, even though the density of houses within the site may vary. This means that the one hundred families will have the ownership or use of at least fifty acres of land. But rather than each unit being limited to its own half-acre plot of land, the joint use of some land, compression of the built forms on the site, a variety of relationships between living groups, and the continuity of the open spaces all become possible.

This possibility of joint use, with or without joint ownership, of outside spaces or land was also an initial assumption. The joint use of a piece of land may be encouraged by placing individually-owned parts of the land in a

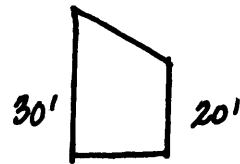
'BUILDING BLOCKS'



PLAN



SECTION



RELATIVE AMOUNTS EACH TYPE

SMALL LIVING GROUP
1-3 PEOPLE

MEDIUM
4-5 PEOPLE

LARGE
6 PEOPLE AND MORE

1 STOREY A OR B

1-STOREY C OR
2-STOREY A

2 STOREY B OR C

25% UNITS

50% UNITS

25% UNITS

proximity or relationship to each other which encourages use by all the individual owners, by arranging for the joint ownership of the entire piece as a whole by a group of the inhabitants, by the joint leasing of the land by the inhabitants, or by some combination of these alternatives. Working out the details of joint use of the land would require social, financial, and legal investigations which were not carried out here. Rather, it was assumed that these arrangements would be possible and that the joint use of areas of the site would be feasible.

Observing and relating activities on the site was just the first step in the design of the spaces on the site. I moved from the definition of activities to the grouping of activities, relating those which might occur in close proximity, within sight of each other, or within the same space; to the definition of the place which could provide the shared setting for a set of related activities; to the statement or understanding of the qualities necessary to the place, or the requirements that must be satisfied there, to encourage and enhance the range of activities; to the definition of the spatial and architectural alternatives and of the alternatives for relationships between the defined places on the site; to the application of a set of values to these alternatives; to the selection of particular alternatives for use in the site plan.

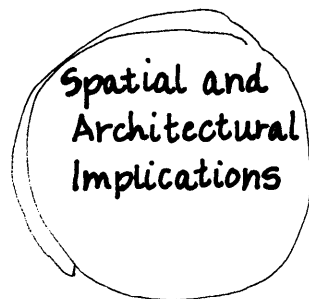
The design process started with these steps and contin-

ued from them. The first steps will be summarized here in a series of diagrams, which primarily clarify the demands on the site. Presentation of the design process and results will wait for the complete presentation of site restrictions as well, which were considered along with the site demands.

The diagrams include the 'social' needs--opportunities for interaction, privacy, work, play--and the 'physical' needs--light, air, heat, electricity, waste removal, and protection from uncomfortable or severe environmental conditions. Together, they comprise the demands of the inhabitants which the site must fulfill in a variety of ways.

FORMAT FOR DETERMINING DEMANDS ON SITE

Activities



|| THE PLACE ||

Qualities of place
Requirements
Dimensions



ARRIVING

LEAVING

WELCOMING FRIENDS

BRINGING THINGS INSIDE AND OUTSIDE

WATCHING STREET GAMES

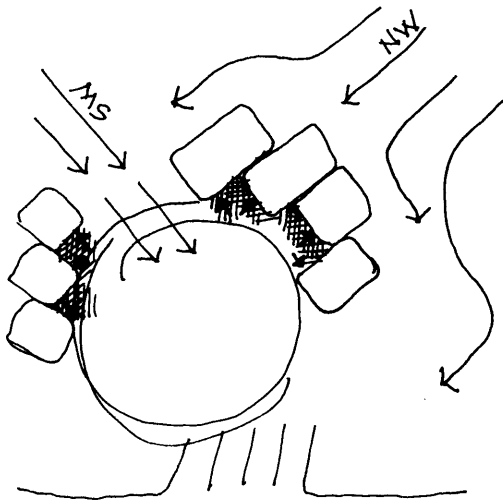
HANGING AROUND, GATHERING

BE OUTSIDE, BUT STILL BE PROTECTED

BE OUTSIDE, BUT STILL HAVE SOME ASSOCIATION

WITH INSIDE

ENTRANCE



Protection from NW wind
(winter wind)

Entrances onto shared
public space

Not more than 150' from
car to doorstep

Each house not closer than
20' to street

Entrances away from areas
of snow accumulation

Each family has its own
ground entrance



'DOORSTEP' ACTIVITIES

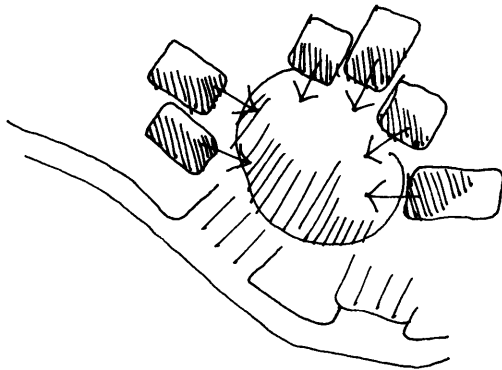
SMALLER-SPACE GAMES--FRISBEE, CROQUET....

CAR ACTIVITIES

CHILDREN'S PLAY--TRICYCLES, GROUP GAMES

EXTENSION OF 'ENTRANCE ACTIVITY' SPACE

SHARED OUTDOOR ENTRANCE/PLAY



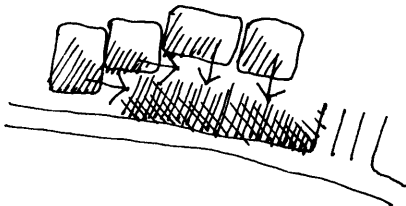
Doorsteps look onto shared space

One side of each house looks onto shared space--children playing, friends arriving

Shared space adjacent to parking area
Cars in view
Paved area accessible to play

Shared space protected from prevailing NW winter wind

Size of shared outdoor space about equal to area of ground floor space within each housing group



LARGER SPACE GAMES

KICKBALL, BASEBALL

RUNNING

OUTDOOR PERFORMANCES

PICNICS

LARGE GATHERINGS

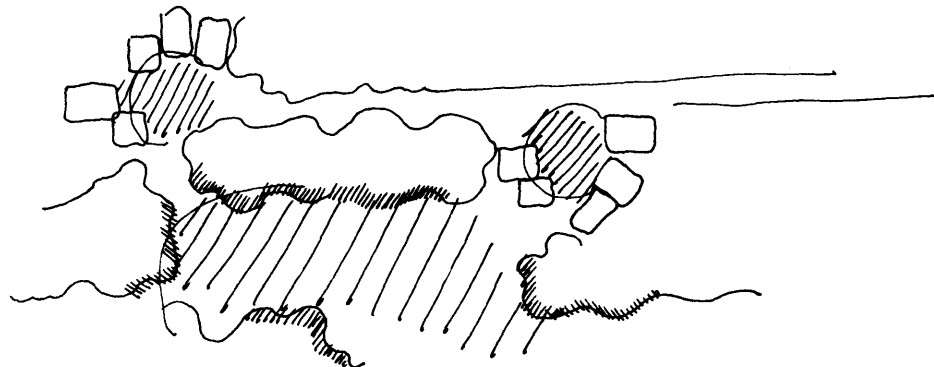
OPEN SPACES FOR
LARGE GROUPS

Each space accessible to several housing clusters; a way to link, relate housing groups

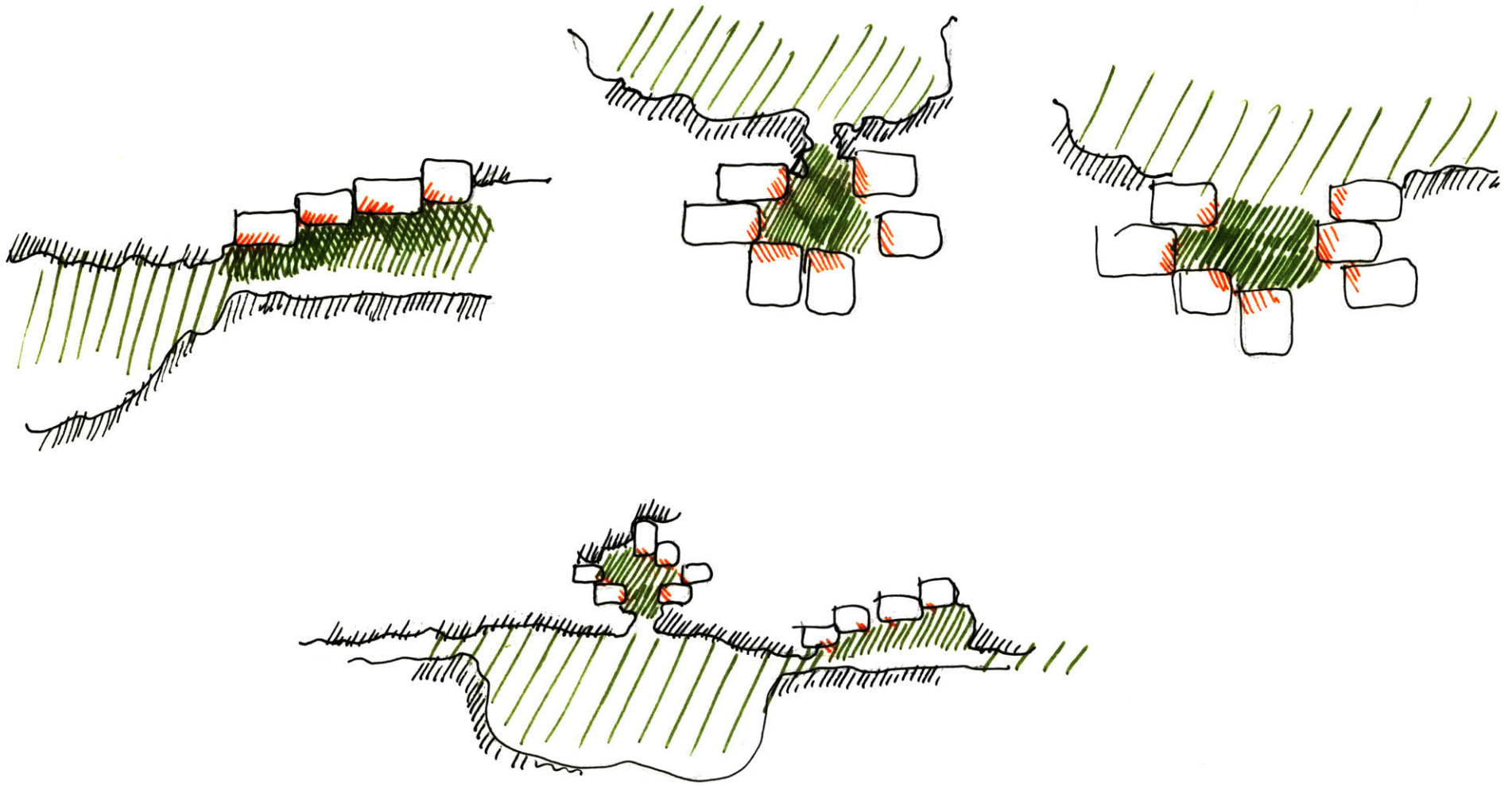
Range of sizes to accommodate different sizes of groups and activities

Maximum use of open spaces which must be formed for other purposes (sewage leaching fields)

'Small playgrounds'



SHARED OUTDOOR ENTRANCE SPACE ALTERNATIVES RELATED TO OPEN SPACE SEQUENCE ON SITE



WASHING CARS

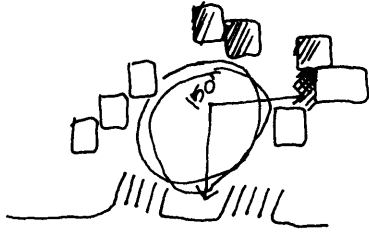
REPAIRING CARS

LEANING AGAINST, SITTING ON

ARRIVING

LEAVING

CARS, PARKING



Distance from parking to farthest entrance not greater than 150 feet

Majority of entrances not greater than 60 feet away

1.5 cars per family or unit

Parking on same side of road as houses

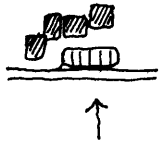
Not more than 7 cars in one paved parking area

Minimum intrusion of parking into shared outdoor entrance space

Paved parking area accessible, adjacent to shared outdoor entrance space for games, play

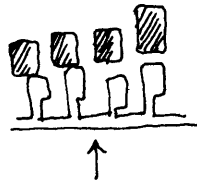
PARKING ALTERNATIVES

RELATED TO CLUSTER ALTERNATIVES



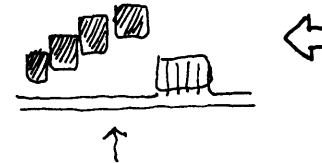
Cars fill up shared space

Cars form edge, buffer along road
Minimum pavement



More paving needed
Shared space broken up

Parking closest to entrances
Each family has closer control over car

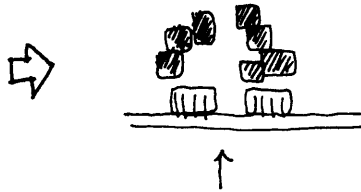


Greater distance from cars to entrances

Leaves shared space unbroken
Froms edge to shared space

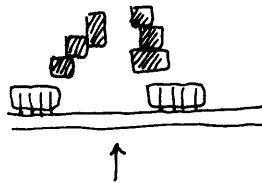
DISADVANTAGES

ADVANTAGES



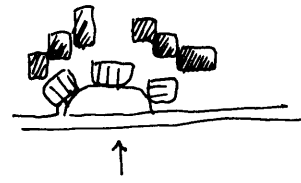
Street edge taken predominantly by cars

Cars form buffer along road
Minimum pavement
Shared space not broken up



Distance to entrances increased

More of shared space can extend to street
Shared space not broken up

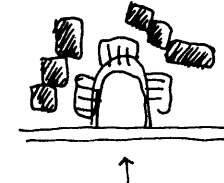


Shared space broken up
Amount of paving increased

Cars closer to entrances
Parked cars safer from traffic

DISADVANTAGES

ADVANTAGES



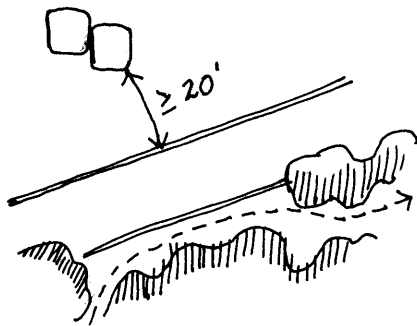
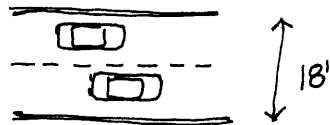
INHABITANTS AND FRIENDS COMING
INTO THE SITE, MOVING THROUGH,
LEAVING

TRANSPORTING PEOPLE, THINGS

BRINGING IN SUPPLIES, SERVICES

BICYCLING

ROADS



18' wide

3'8" wide pedestrian path
along at least one side
Adjacent along some stretches,
separate along others

At least 20' between roads
and houses



Predominant sustained grade:

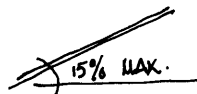
3%

Maximum sustained grade:

5%

Maximum steep grade:

15%

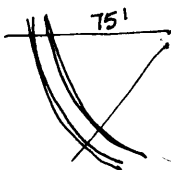


Drainage

Ditch parallel to road:

Minimum grade for move-
ment of water: .5%

Maximum grade before soil
erosion: 3%



Intersections: at least 60°

Curves: minimum centerline
radii: 75'

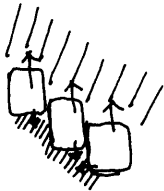
EATING OUT

DRYING CLOTHES

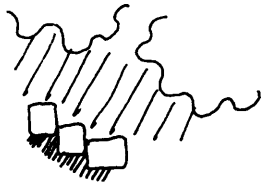
SUNBATHING

CAMPING OUT

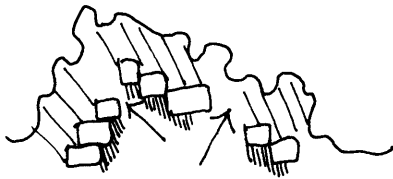
PRIVATE OUTDOOR SPACE



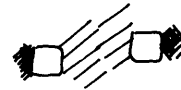
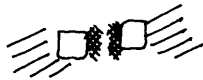
Private outdoor space separate from active shared entrance space



Private outdoor connection to woods



Openings between houses for pedestrian access from shared entrance space to woods

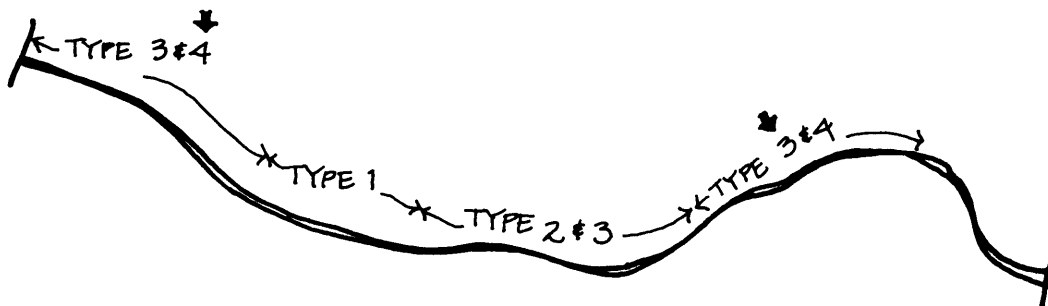
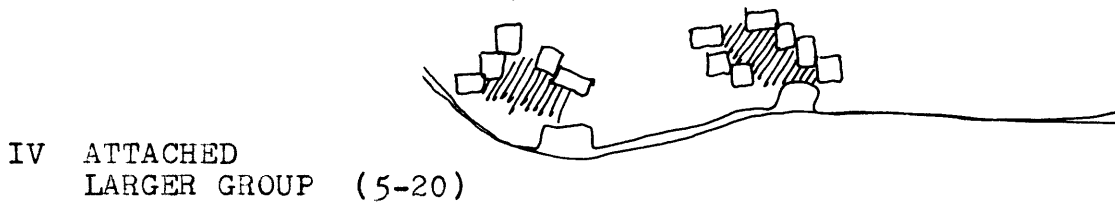
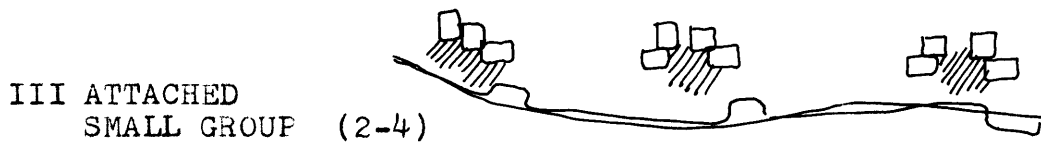
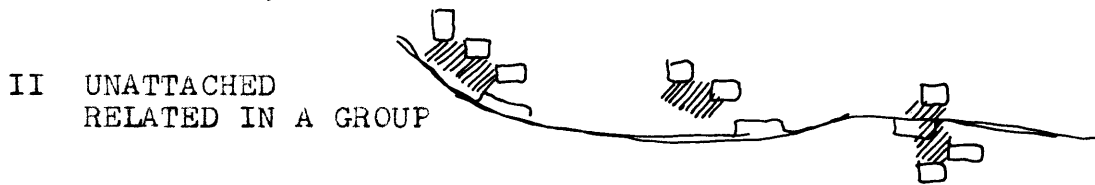


Entrances can be adjacent to entrances;
Private spaces can be adjacent to private spaces.



Entrances and private spaces should not be adjacent.

ALTERNATIVES FOR COMBINING BLOCKS



Profile of new road and housing
(Relate to topography, drainage, climate, vegetation of site analysis)

ALTERNATIVES FOR WASTE REMOVAL

The town of Marshfield does not have a town system of waste treatment which new housing may 'hook onto'. This means providing each building or related groups of buildings with their own system.

CRITERIA APPLIED TO CHOICES

Amount of damage to site, or resource depletion

Dependability

Cost

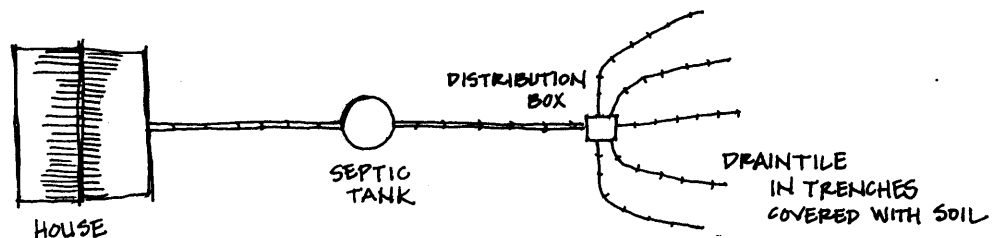
Healthfulness

Comfort

Ease of use, repair, installation

WHAT ARE THE CHOICES?

1. Waste directly into the soil
(The most primitive, 'out-house' method)
2. Waste into water which is carried to and spread over the soil
A septic tank with leaching field is an example of this method, and is the existing one in the town of Marshfield now.

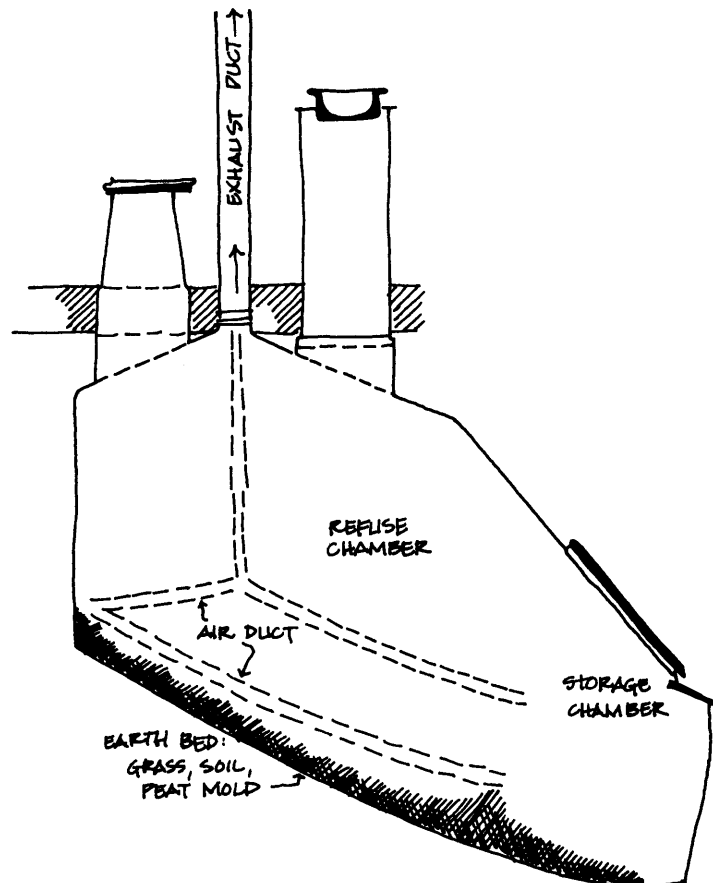


3. Variations of the septic tank/leaching field method, minimizing the amount of water used to transport wastes to the soil.

Differences in the 'receiving end', in the form of chemical toilets, trailer toilets, will make a difference in the 'disposing end', in the form of reduced sizes of leaching fields.

4. Waste into some sort of container, where the breakdown into useful nutrients will take place.

The Clivus System is an example of this method. Waste falls into a container--a "composter" which stimulates the natural processes to breakdown waste into water vapor and carbon dioxide, which escapes through a chimney, and humus, which falls into a storage chamber and can be used for fertilizer after aerobic breakdown has been completed.



5. A treatment plant to serve the 100 new families

Disposal of treated water into existing bodies of water on the site;

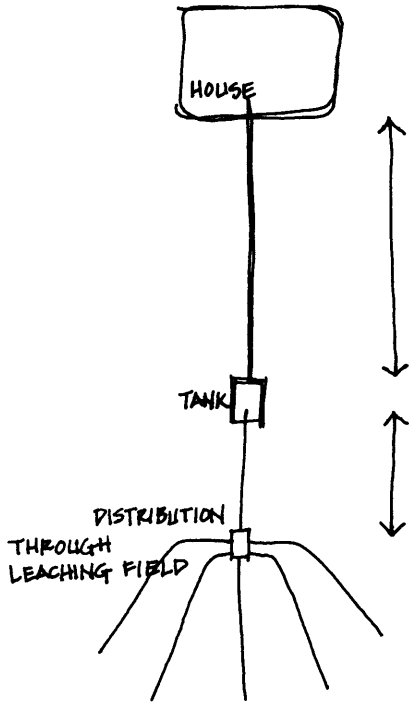
Reuse of treated water for cleaning, drinking, transporting wastes again.

THE CHOICE

Septic tanks with leaching fields were chosen as the method of sewage disposal for this site. The high cost of a sewage treatment plant for just 100 housing units would probably eliminate that method as a possible one. The Clivus system was investigated as a valuable alternative. However, at this time the cost of installing the system is about the same per family as a well-constructed septic tank/leaching field, many people may not be ready to accept the use of the system or willing to put in the labor to empty the storage bin, and the extra cost of service to do so may have to be provided. A good septic tank/leaching field system can satisfy all the above criteria, and sewage for several houses can be handled jointly.

WASTE REMOVAL

REQUIREMENTS FOR SEPTIC TANK/LEACHING FIELD

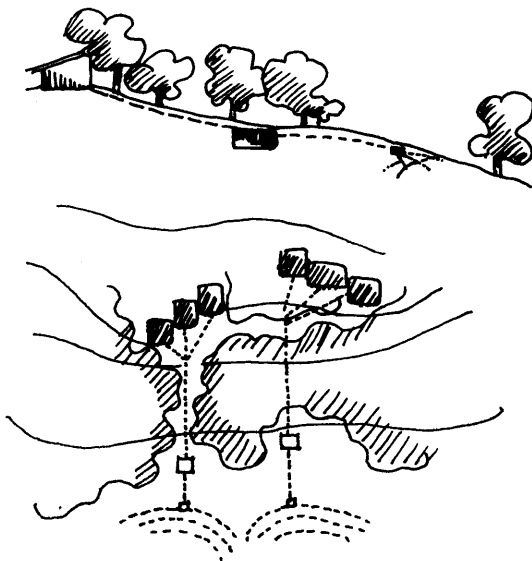


House uphill from tank and field

50'-100' distance from house to tank minimum
2" in 10" minimum slope

10' minimum distance from tank to field for small system (up to 4 houses)
40'-50' for larger system (up to...)
 $\frac{1}{2}$ " in 10' minimum slope

Open leaching field equal to ground floor area of house, for medium soil absorption
Usable as open recreation space
Soil which absorbs less water increases required size of leaching field



OPEN SPACE DOWNHILL FROM EACH HOUSE OR GROUP OF HOUSES
MINIMUM DISTANCE OF 60' FOR SMALL GROUP, 150' FOR LARGE GROUP

WHAT ARE THE RESTRICTIONS OF THE SITE?

Balancing the Demands with the Site Restrictions

An understanding of the ways different people--children, elderly, parents, teenagers--might use the site is the necessary first step in developing a sensitivity towards the ways the site can be changed to accommodate them. The site provides the elements of their 'transactional space'¹, places for interaction with others, places for self-interaction, as well as the places for the built form which will shelter and provide more private places within for them. The site is changed in some way to provide these. How the site is changed to provide for people is determined by a design process using the elements of the site itself in combination with man-made or man-chosen elements brought to the site.

The ways in which the site can be changed, or the choices of site plan, are virtually endless, but always begin as a result of definite choices, rational or otherwise, of those who develop, plan, design, and/or live there. The site plan is an expression of the values which these people hold toward the site, or of the balancing of conflicting or different values among the group which together determine the changing of the site. The values these people hold toward the site may vary with their stake in it or with their position relative to it--whether they are investing money in it, living in it, living next to it,

paying for a part of it--with their culture, or with their individual experience with the site or places like it.

We can look at Tea Rock Lane and its living places for examples of expressed values in the development of the site which has taken place already. The developer has taken 'the path of least site resistance', which is seen especially on the topographic information maps. The road follows the flattest path through the site to access points, to make for the minimum necessary amount of earth moving and grading. Houses are placed on areas of maximum soil absorption, which would allow for leaching fields of a smaller area, and for less problems with drainage around the building foundations and road. This minimizing of the energy and difficulties put into the producing of places for people to live is a goal which translates into terms of time spent and money spent. One value placed on the site plan, then, is how economically it can be fulfilled. This would include the purchasing of the land, changing it, and building upon it, and is often the factor which must be met to insure that the project is feasible.

When each element is mapped for variations throughout the site, and criteria for the use of certain aspects of this element are applied, values are assigned to these aspects in order to obtain the range of potential for their use. One of the factors used to determine the value assigned to each would be the amount of time and energy, or cost necessary to put housing in areas categorized as con-

taining that aspect. An example:

Mapping the element of steepness:

Four variations are mapped--0-3% slope,
 4-7% slope,
 8-15% slope,
 15-25% slope.

Criteria are applied: Priority should be given to building on areas that are flatter.

Therefore, the values assigned to the various categories of steepness are:

0-3% -- Highest potential for receiving housing

4-7%

8-15%

15-25%--Lowest potential for receiving housing

This range of potential can be translated into a range of cost necessary to build housing in each area of varying steepness.

The ultimate goal is the design of a site plan which would not conflict with the criteria placed upon the site itself while at the same time would fulfill the needs of the inhabitants; or beyond this, to use the elements of the site and the elements of people-habitation in ways which are beneficial to both.

Two Levels of Design: Locating the Housing on the Site;
 Design of the Housing Groups

Open spaces are needed for roads, parking, houses, play areas, leaching fields, family and group activities.

Where should these be located on the site? A pattern of open spaces exists on the site; the pattern of spaces needed for activities and shelter could partially or totally

work within this existing pattern of open space. If the existing open spaces cannot totally hold the demands on the site, then the extension of the site's open spaces becomes necessary. This becomes one of the primary problems in the design of the site plan: How will the open spaces of the site be expanded? Where will new open spaces be formed?

This is a problem of location. These 'developed' open spaces must be placed on the site so that, one, their placement in relation to each other satisfies relationships of activities, and, two, the changes made in the site to form these open spaces follows the set of priorities determined for the site itself.

Determining the configurations and dimensions of the housing groups and their outdoor spaces is the next step in the design process, involving design at another scale.

So the first body of information needed is that relating to the site as a whole--information which will enable the designer to designate which parts of the site will accept which proportions of new development. The procedure outlined earlier is to break down the site into its basic elements, or components, determine the potential for change over the entire site with respect to each of these elements, and then combine this information to form a composite picture for the entire site. This 'value map' will not provide an automatic solution for locating housing groups, but rather a set of possibilities to work with. Forming the

site plan is still a design problem, but one with a much greater input of information.

Locating the Housing: Information on the Site

The first step in determining the 'restrictedness' of each area of the site, which will then lead to the choice of housing location, is the breakdown of the site into its working parts, or systems, and gathering the information needed on each of these systems. The elements of the site chosen to be examined were those which influence the methods and cost of building; those which are particularly important to the working of the site as a whole, or which would have an effect extending beyond their own limits if they themselves were changed by development; those elements which are particularly vulnerable to change by development, especially those where even a small change might spark a larger set of changes; and those elements which are valued as resources for potential inhabitants, where their depletion should be minimized. The factors investigated are presented in related groups, and summarized in a set of drawings.

Landform

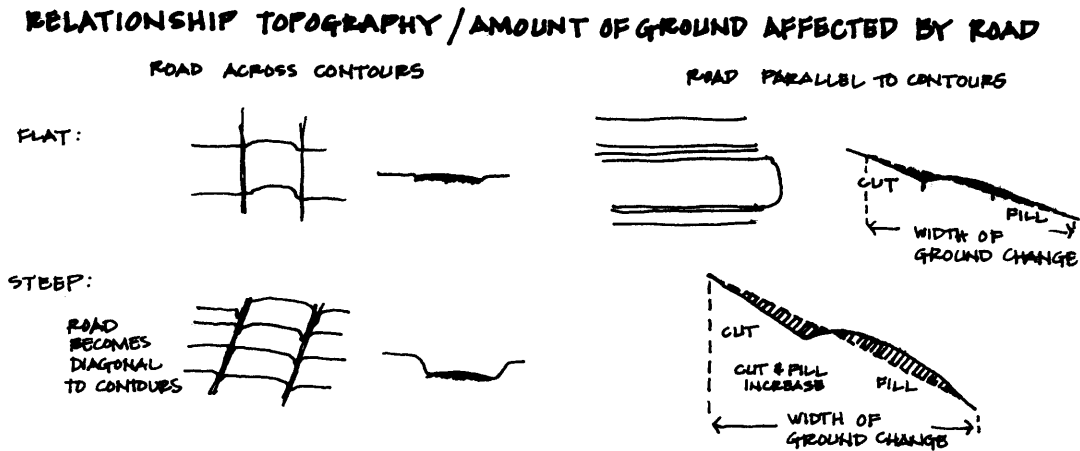
The shape of the land provides the base for much of the natural activity around it, on its surface and above and below its surface. The land, its geological base and its soils from surface to bedrock, is the support for what grows on the site, the movement of water through it, and how people can settle on it.

A topographic map of the site was obtained from the U.S. Geological Survey, giving contour intervals of ten feet. Information needed to interpolate intermediate contours was obtained from analysis of aerial photographs of the site and from observations of particular areas where a special knowledge of the ground level changes was needed. A contour model of the site and some of the area surrounding it was made as a particularly useful design tool, showing three-dimensionally the pattern of slopes, flatter areas, and valleys.

Slope

The steepness of the different parts of the site is one of the most important or influential factors in the existing and potential development. An investigation of the existing development on the landform information drawing illustrates this idea. Most of the roads follow the naturally flat pathways of the site. Route 139 moves alongside the flat river basin at the northern base of the main hill of the site. Tea Rock Lane, which is the residential access road into the site, comes off of Route 139 and follows the valley along

the eastern part of the hill. The western slope is the steepest; this part has been left forested, with people inhabiting it only further down the slope, where the steepness is less and the road is built primarily parallel to the contours of the hill. Building roads in these areas, where the groundform naturally supports the desired and necessary form of the road, makes sense in terms of the reduced energy and cost put into the making of the road, and in terms of the reduced effect on the site.



Each part of the site was placed into one of four

categories of steepness:	Flat	0-3% slope
	Rolling	4-7%
	Hilly, moderately steep	8-15%
	Steep	15-25%

Zones from flat to steep as they exist on the site are shown in the value map for steepness. One of the reasons the site is an interesting one to study is the variety of topography it contains. A flat swampy area fills the southwest corner of the site. The hill which takes up the predominant portion has slopes of all orientations. The slope facing north and northwest is the steepest, shown at 15 to 25% and greater.

The northern edge of the hill along Ocean Street is also predominantly very steep. Two large gouges have been bulldozed out of the hill here, flattening the ground close to the highway to make way for commercial buildings, and at the same time steepening the hill behind the flat spaces. The consequences of a drastic change made upon the site's topography can be evidenced here. The surface runoff of water from the slope has been increased so much, not just because of the increase in steepness, but because of the stripping of vegetation that went along with it, that the soil has eroded into gullies and washed down over the flat area and onto the highway. This has increased the difficulty of building on the flat slope, the difficulty of replacing the vegetational resources taken off the slope, and the difficulty of maintaining the highway.

Soil

The make-up of the soil is critical for the growth of vegetation, the flow and retention of water, and the stabilization of the site's surface shape. Vegetation types can provide the key indicators of soil conditions--uniformity of plant cover in undisturbed areas can usually indicate uniformity or similarity of soils.² The soil itself is a product as well as a producer of these environmental conditions. As plant growth, drainage patterns, microclimate, and topography change, soil make-up constantly changes as well. Richen gives one relevant example.³ On a slope, water runoff may

bring about soils coarse in texture, removing the finer surface material to a lower area.



FROM: BUSHBY, P. 49

This may have implications for locating areas of varying soil absorption. The relationship which was considered the most important for study here was that of soil with water retention. The soil provides the 'base' for the roads, buildings, and open space activities to be placed upon it. And the absorption of the soil is the critical soil factor in determining the location of these.

A primary consideration is the location of the leaching fields. This is where further amounts of water are added to the soil to be absorbed, so the ability of a certain type of soil to absorb water would be a requirement for locating leaching fields there. As the soil absorption decreases, locating leaching fields there will mean extra cost in the form of an increase in the size of the fields.

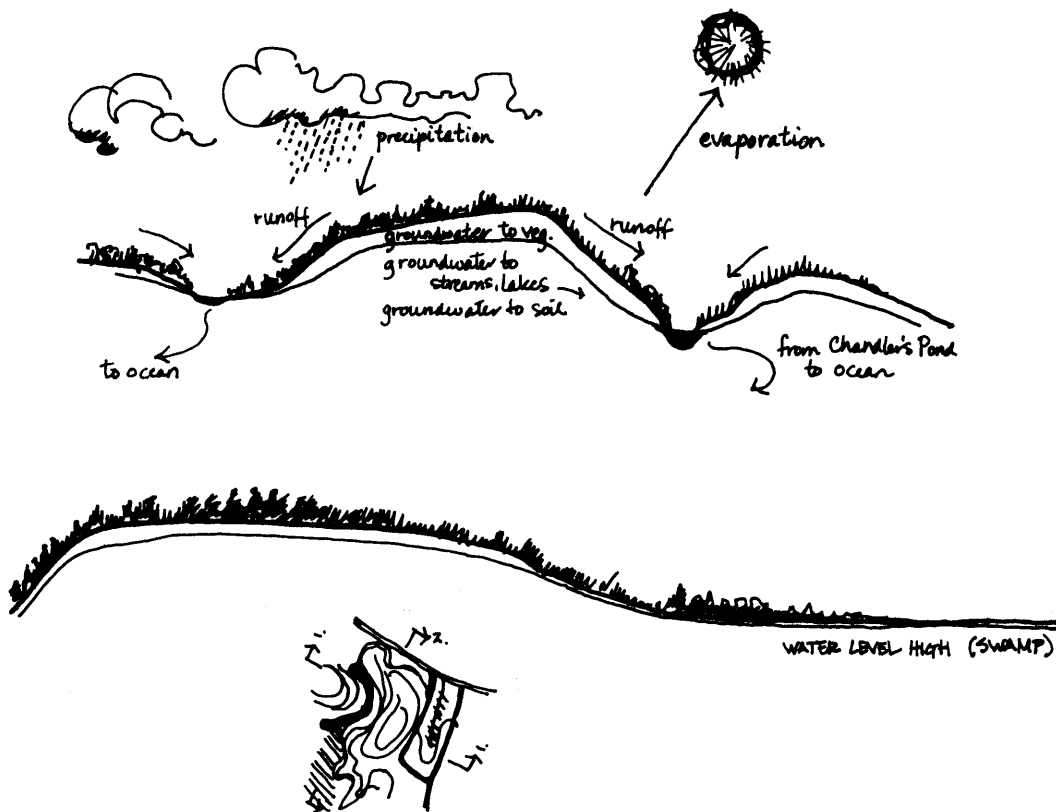
The soil absorption was mapped in three categories, good, moderate, poor, which were adequate for planning at this scale. Soil borings and a more exact mapping would have to be done for a design which went to the next scale.

The areas with low absorption are: 1) the swampy soils at the south base of the hill and east of Tea Rock Lane, 2) the soil of the top half of the west slope and at the lake edge (due to the steepness and the compactness of the soil), 3) the cropland along Tea Rock Lane (due to the compactness of the soil).

Drainage

The soil absorption is just one element in the drainage system of the site. This system determines the pattern of water which moves through the site, which in turn is part of a larger hydrological cycle.

CROSS SECTIONS OF SITE SHOWING HYDROLOGICAL CYCLE



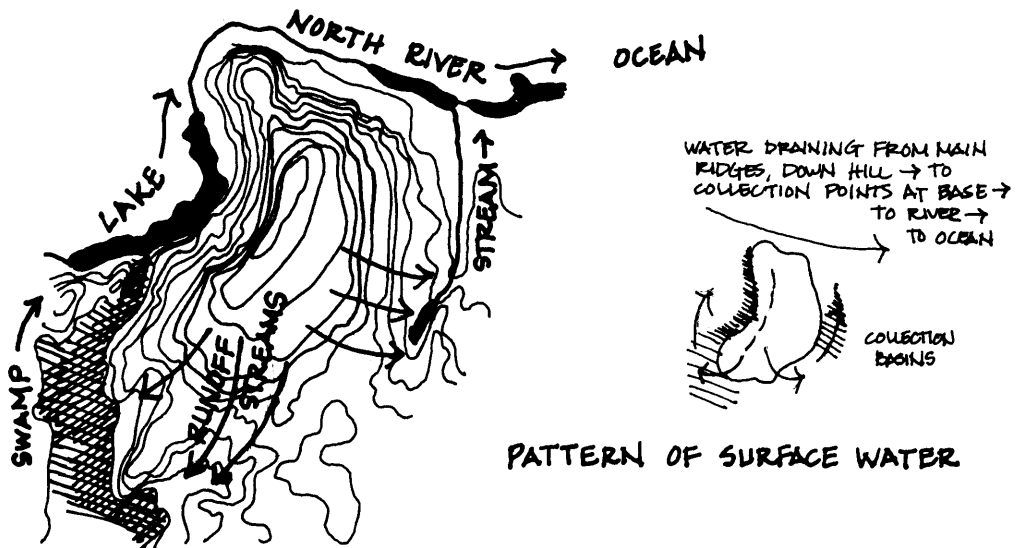
The three major areas where surface water collects on the site are: the lake on the west side

the swamp and streams in the south and west

the swamp and streams in the east

These collection points are formed in natural basins in the landform, as water is shed from the slopes of the hill.

From these collection points, water moves around the hill into the North River, and then flows into the ocean, about three miles away.



Collection points are also formed by the seeping of water in areas at the base of slopes. Two spots such as this were found on the site and marked on the drainage information drawing.

How does water move down the hill into these collection points? Drainage channels are visible in the shape of the land, and were marked on the information drawing. In some cases, these channels collected enough water from the ground above that they contained moving streams of water, especially

in places nearer the swampy ground, where the groundwater level was high.

The amount of surface runoff towards these collection points that occurs in each part of the site will vary with:
 soil: As the soil absorption becomes poorer, runoff increases.

(Compare areas of poor soil absorption with areas of high runoff on the information maps.)

steepness: As the steepness increases, the surface runoff increases. (Look at the effect of increasing the steepness of the hill along Route 139.)

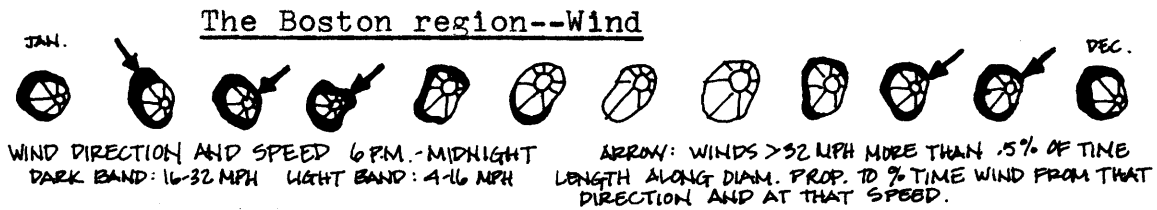
placement of the area within the site: The ridges (marked on the map) are drier-soil areas while flat and basin-shaped areas at the foot of slopes will collect more water, for an increase in runoff. (Look at the high runoff areas in the swampy parts of the site.)

vegetation: Vegetation stores large amounts of water. The taking of water from the soil into the roots reduces the amount of possible surface runoff. Removing vegetation will increase the surface runoff.

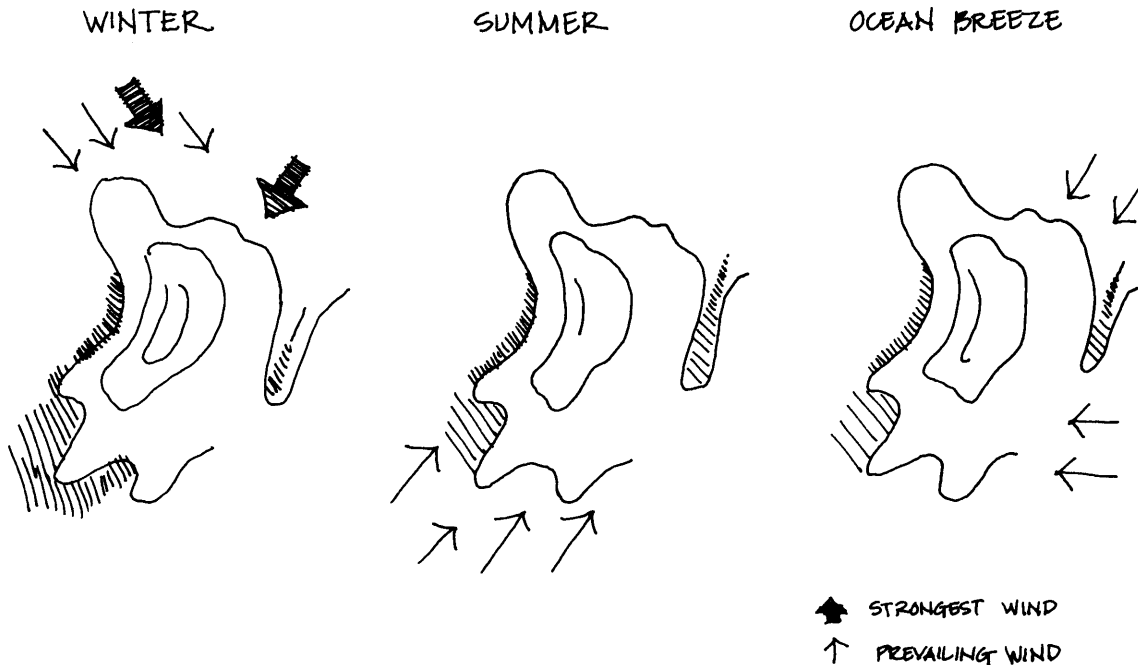
Climate

Air movement, moisture, light, and heat vary so much over the site that they may play an important part in determining where people might want to live there. Wind and radiation characteristics for the wider region 'enter' the site and are changed by its shape, or topography, its covering of trees, vegetation, and soil, and its bodies of water. One way to learn about the microclimate of the site is to learn about

the larger climate patterns and see how these will most likely be changed within the site. People already living on and using the site, especially the farmers growing crops, might know of many of the microclimatic conditions which affect their work and comfort--wind strengths and directions and cold pockets, for example. Vegetation on different parts of the site can indicate certain things about the microclimate which influence how they will grow.

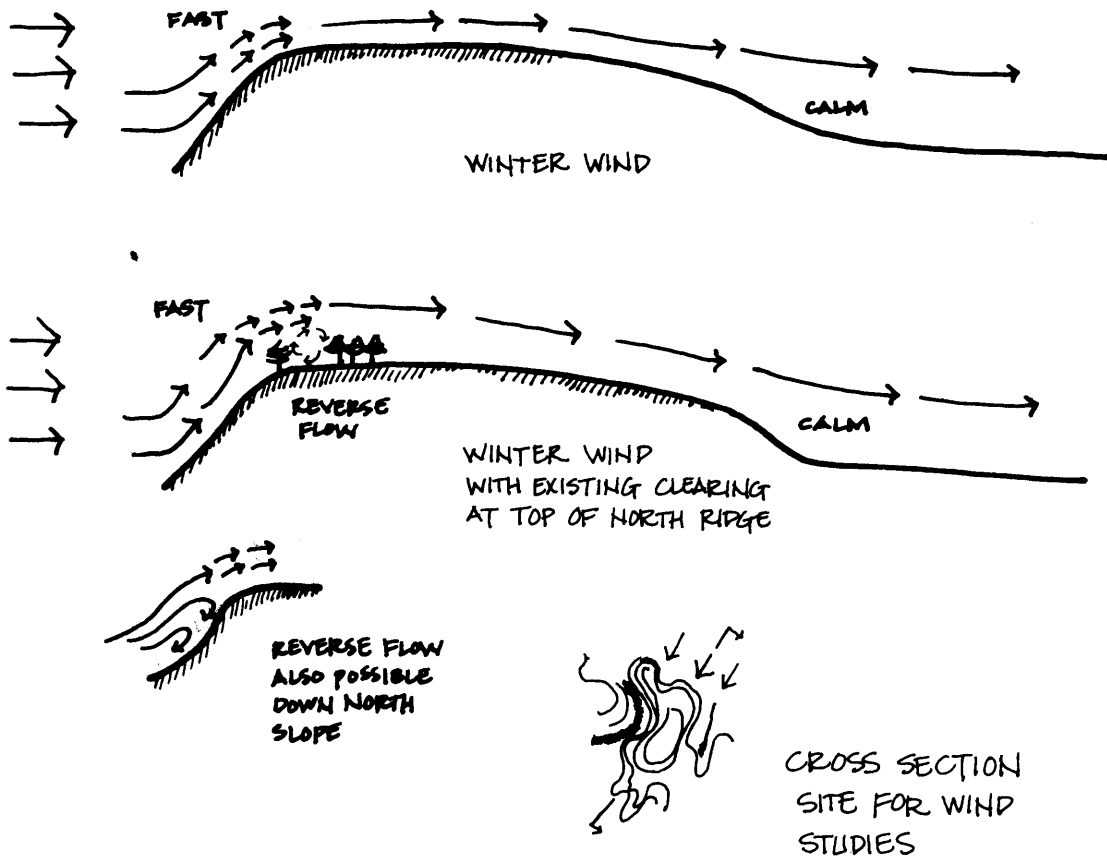


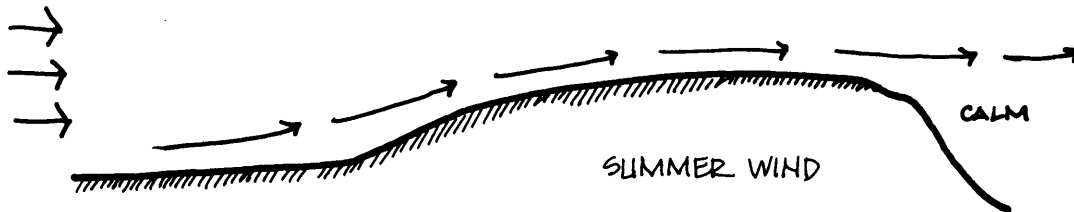
- Prevailing winter wind: W, NW
- Strongest winter wind: NE, NW
- Prevailing summer wind: SW, S
- Ocean breeze: NE, E



The Wind on the Site

In order to get some idea of how the wind changes as it enters and moves across the site, simple experiments were done with a 'water table'; a thin sheet of water moving evenly across a smooth surface acts as the moving air coming from a particular direction, and pieces placed in configurations resembling the shape and features of the site are placed within this flow to see how it is altered. The primary interest was in the prevailing winds and in the severe winter winds.





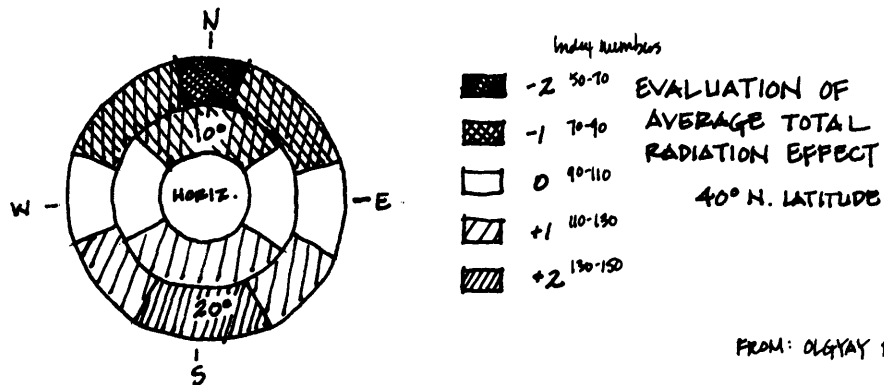
Sunlight and Heat

"During the day, slopes facing in different directions and at different angles receive very different amounts of heat radiation. This is the most important factor in differentiating climate according to location. At night, on the other hand, it is the cold air which moves downhill and, independently of slope orientation, produces a variation of climate according to zones of elevation."⁴

Directions and angle of slope/sunlight:

The amount of direct radiation received by a slope will depend on the position of the sun (or the time of day and season) the degree of cloudiness, and the direction and angle of the slope. Measurements made by Geiger show proportions of insolation received by slopes of varying orientation, with the angle kept constant. The temperature maximum 'near the ground' for the day is usually in the southwest.⁵ This is because the ground temperature depends on the condition of

the ground as well as the intensity of insolation. The morning sun rises on a moist ground, and a great part of the solar energy radiated in the morning is used up in evaporation. But in the afternoon when the sun shines primarily on the southwestern slopes, the ground can become comparatively dry and most of the absorbed heat energy is applied toward raising the temperature.



TOTAL % MAX. POSSIBLE RADIATION FOR 10° SLOPE DEPENDS ON SEASON, ORIENTATION:

SLOPE DIRECTION:	MIDSUMMER	EQUINOX	MIDWINTER
NORTH	95%	55%	15%
EAST OR WEST	100	60	25
SOUTH	100	70	35

The influence of the steepness, or angle of each slope, on the amount of heat it receives was also measured by Geiger.⁶ The intensity, always greatest at noon, is greatest on that slope which is perpendicular to the sun. The maximum is therefore on a flatter slope in the summer, when the sun is high, and on steeper slopes in the winter, when the sun is low.

Elevation on the slope:

At night cold air from high ground flows to lower places, and

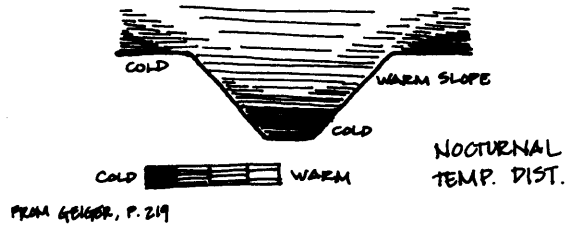
is replaced by warmer air from above these lower places. The flow of cold air may be blocked by landforms, trees, or some other impediment, to form cold pockets.



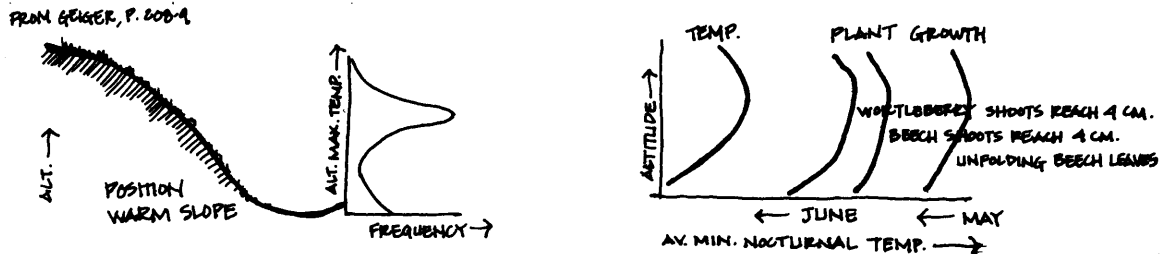
"Concave land forms are always cold islands at night."

"Objects which impede the flow of air may be of great importance to the distribution of nocturnal temperatures."7

In valleys, cold air layers form at the top and the base of the hill, so that the middle and upper slope becomes the warmest zone.



The effect on plant life is an indicator of this warm slope zone.



Choosing a location for housing on the site where the microclimate works to the advantage of the inhabitants means finding the zone where the combined effect of wind and sun

give the maximum heat and heat retention in the winter months and minimum heat and heat retention in the summer. The most probable zone for this site is on the upper or middle southeast slope.

Vegetation

Open spaces

One of the primary set of decisions in changing the site is where to make open spaces where vegetation now exists.

These open spaces will contain the housing, roads and parking, private and shared outdoor spaces. The goal, which would minimize the changing of the existing forest, is to use the existing open spaces on the site to accommodate these as much as possible. These open spaces may come as scattered bits in the vegetation texture of the site, but still could be connected in some sort of usable sequence.

The actual bits of open space within the forest were mapped using an aerial photograph of the site. The pattern was confirmed as much as possible by exploring on foot. The pattern of openings/covering is shown as the base for the vegetation drawings, with the dark hatching showing the forest edge of clearings. These clearings have occurred as a result of man's use of the site in the past; that is, they are originally man-made, and then changed over time as the cycle of regrowth in the forest began again.

Formation of existing open spaces:

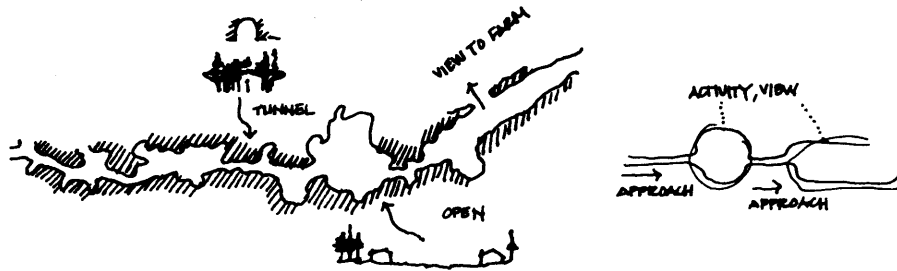
1. Logging: The most extensive series of openings were

cut to obtain wood for lumber. The type of openings these operations left are winding and passage-like, with ways cleared to give access to the logging trucks and machinery. These access ways often act like 'core passageways' with several branches off of them, reaching out to other stands of timber.

2. Farm edges: At one time or another almost every place on the site was probably used for farmland. One late 18th century map shows most of the hill as cropland.⁸ Extensive stretches of stone walls cutting through the site are indicators of land that was once used for farming. Along the boundaries of some of these farm fields were lines of elm trees. Now the fields themselves have grown into forest, and the previously treed strips have become open, since the elms have died. Some of these huge elm skeletons are still standing in the forest.

Open space sequence along Tea Rock Lane

The open spaces of the site plan will form some sort of sequence through the site. Not only will this pattern of open spaces help determine certain activity relationships and places of encounter, but will form a frame for the approach to the next center of activity and/or housing. The changing experience walking down Tea Rock Lane is an example. The forest edge moves in closely to the road edge, forming a tunnel in some spots, and moves away to bring houses, farmland, or meadows into the 'street space' in other spots.



Stages of Succession

When a part of the site is cleared, the type of vegetation in this part changes over time toward a particular type of forest community. The stages in this progression, or the stages of succession, are characterized by particular groupings of plants. By mapping these groupings on the site, we can get a picture of which parts of the site have progressed to which levels towards the 'climax' community. It will take a longer amount of time to replace a community 'higher up' in the stages of succession for a particular part of the site. The stages of succession which were mapped were:



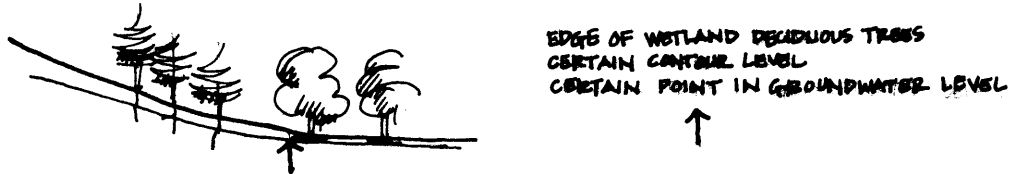
General patterns observed:

The mixed oak/pine forests are higher on the slopes.

The pine forests are closer to Tea Rock Lane and on the northern side of the hill.

The swamp maples, birches, and poplars, because of their mat root system, must grow in ground with a much higher water table than the pines or oaks. The close correlation

of ground water level and the growth of these wetland trees can be seen on the forest type map and on the topography map.



Age of each forest type

Also important in selecting which vegetation will be changed for new development is the relative maturity of each forest type. This can be quantitatively measured by things such as trunk diameter and crown expanse, but such a careful survey was not done here. Certain groups of trees were categorized by observation as being more valuable to preserve, because of the general height, trunk size and fullness of crown of the group.

Existing Use

Connecting and relating to the inhabitants, services, businesses that are already on or adjacent to the site is a complex design problem. Existing places/people may want to share facilities and spaces with the new inhabitants, to remain separate by distance and visual boundaries, or to remain in proximity but retain visual privacy. The choice of these alternatives will express the attitude of the present inhabitants to newcomers and the compatibility or incompatibility of certain existing uses with new ones. Forming certain relationships with the existing uses may

determine the kind and frequency of 'people encounters', the availability of resources and facilities for more people, and the efficiency of use of resources and services.

The information drawing shows the pattern of different functions on and adjacent to the site:

Residential along Tea Rock Lane

Agricultural along the northern end of Tea Rock Lane, on the eastern slope; off of Baker's Lane, on the southern slope; at the base of the western slope.

A recreational camp on the western edge of the lake.

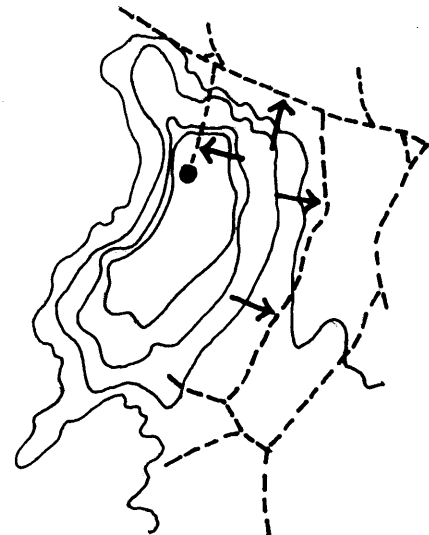
Commercial, especially quick food stops and gas stations, along Marshfield's main road, Ocean Street; several of these are recent, some are just in progress; this edge of the site is changing rapidly.

Existing water system

The town of Marshfield gets its water supply from nine wells, where the water is then pumped and stored in water towers. One is located in the highest place on this site. From there water is distributed through a series of pipes. The alternatives for connecting to this water system are probably two:

At a pipe coming from the tower;

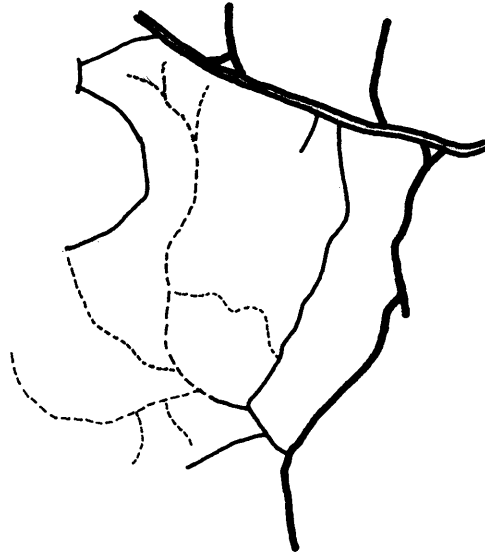
At a pipe in one of the existing residential or commercial



CONNECTIONS TO WATER SYSTEM
POSSIBLE NEAR TOWER, AT ROADS

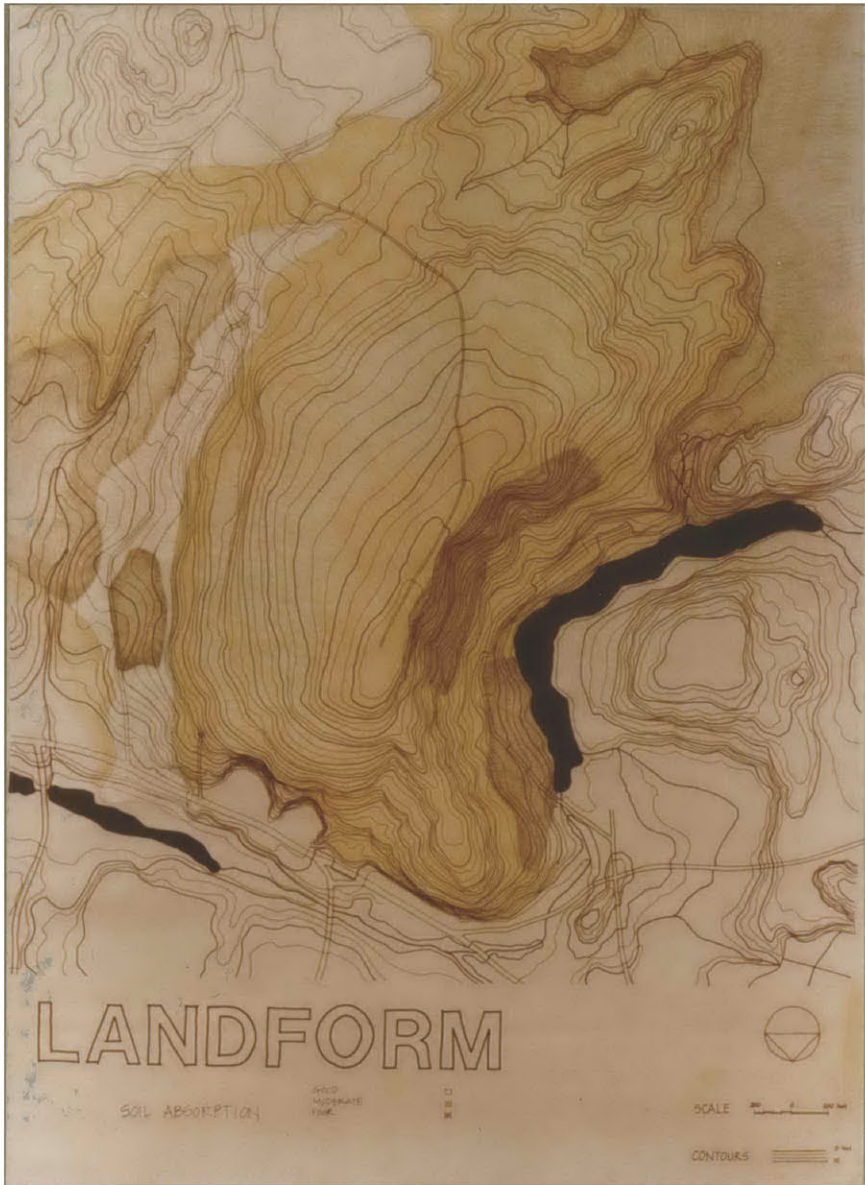
streets.

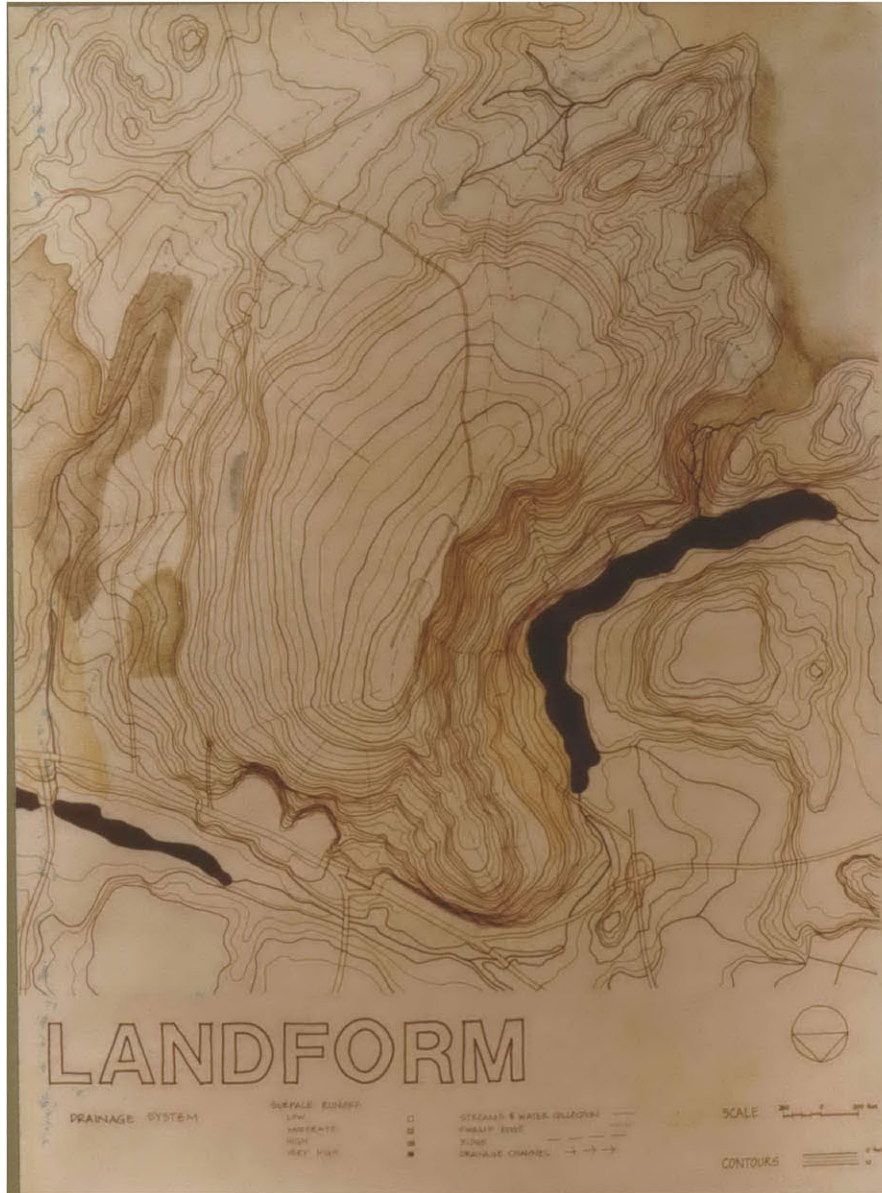
Existing roads, paths

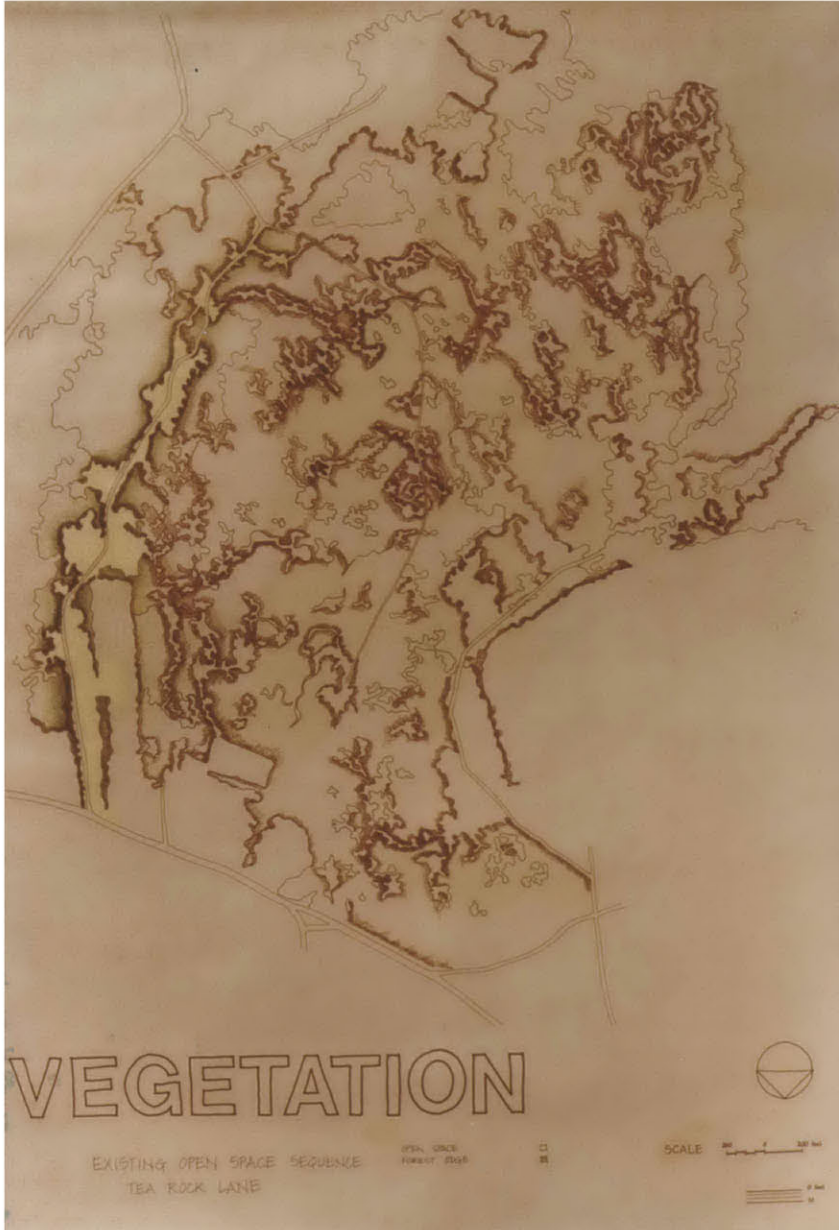


- ==== 4 LANE HIGHWAY
- MAIN RESIDENTIAL ROAD; 'FEEDER' TO OTHERS
- RESIDENTIAL ROAD
- TRAIL

HIERARCHY OF PATHS
AND ROADS

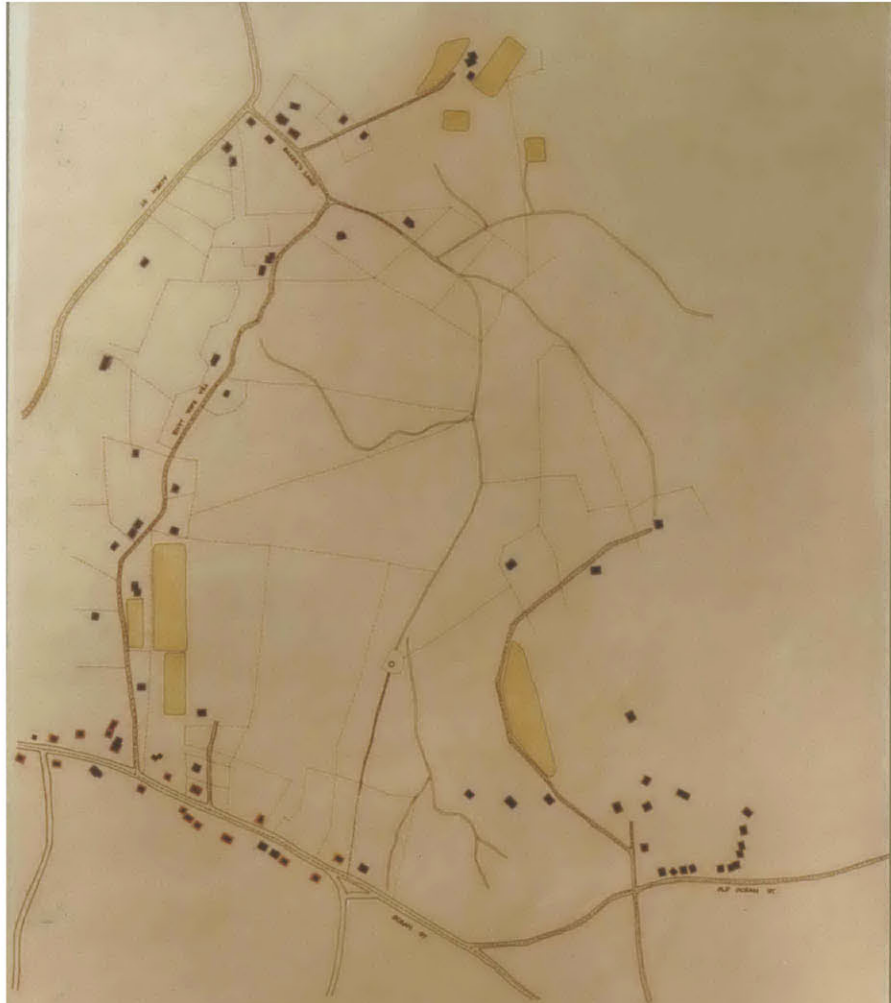












EXISTING USE

- | | | | |
|-------------|---|----------------|---|
| RESIDENTIAL | ■ | PROPERTY LINES | — |
| COMMERCIAL | ■ | ALASKA LINES | ○ |
| GOV. BLDG. | ■ | | |
| IND. BLDG. | ■ | | |
| EDUCATIONAL | ■ | | |
| RECREATION | ■ | | |
| TRANSPORT | ■ | | |



Applying Criteria to the Information

The information gathered on the elements of the site was not necessarily detailed or documented down to a fine scale, but the basic concepts of how these elements worked to contribute to the larger system of the site were emphasized. This enabled, at least, the carrying out of the next step towards the value mapping. Working with some understanding of each factor, the criteria for the use of these factors to help provide for housing can be applied. These criteria describe the actions which should be taken with respect to each of the resources, in order to use those parts or pieces of that resource which are most appropriate, efficient, or valuable in receiving or contributing to the housing elements, and in order to avoid using those segments of that resource which would bring about the most or greater relative amount of change in that resource and thus in the larger working of the site. Many of these actions have been stated already in conjunction with the information given for a resource. The list will be completed and summarized here. The basis for these criteria still comes from the information and understanding gained of these site elements described in the previous section.

LANDFORM

Slope: Development should take place as much as possible on the 'flat' or 'rolling' areas.
Ground changes on slopes of 15%-25% should be avoided.

Soil absorption: Housing and their leaching fields should be located in areas of at least moderate soil absorption; high soil absorption areas are preferred.

Development should not take place in areas of poor soil absorption.

Drainage: Building on or below the ground surface where surface water collects, even temporarily, should be avoided.

Disturbance of the existing drainage channels, by changing the existing ground levels which form them, or by changing the flow of water which runs through them, should be avoided.

Building should not take place where the groundwater level is high; this includes swampy, undrained areas.

Climate: Housing should be located in the places on the site which receive maximum heat, or sunlight, combined with wind protection and minimum heat loss in the winter, and minimum heat gain and exposure to breezes in the summer. This gives priority for receiving housing to:

land midway up the southeast slope

and means avoiding:

the northern slope, where the winter wind

increases its speed at the top of the steep ridge;

basins forming cold pockets at the base of slopes.

Vegetation: Minimize the removal of existing vegetation.

Or, maximize the use of existing open space for houses, recreation and outdoor space, roads, and parking, and leaching fields. When the removal or affecting of vegetation becomes important or necessary to extend this system of open spaces, priority for not developing certain areas should be given to places containing:

vegetation sensitive to very particular environmental conditions; this would include areas of swamp maples, birches, and poplars, where small changes in the slope of the ground and water level in the ground may kill the trees;

vegetation which takes a greater amount of time to be replaced, to 'regrow'; this would include: groups of trees in the later stages of succession; or the oak/pine forest;

mature stands of trees;

vegetation which fulfills a special function which would be difficult to accomplish in some other way if that vegetation was removed or partially removed; this would include:

vegetation reducing runoff on steep slopes;

vegetation providing visual privacy
for existing housing, farms;
vegetation forming the edge to a spa-
tial sequence on the site which
should be preserved.

Existing use:

The new housing should be located so that:
connections to the town's water and electrical
supply are simple and economical;
services such as trash and garbage collection
provided by the town can be carried out effici-
ently;
the existing sense of privacy resulting from
edges of vegetation and from ground level changes
will not be disrupted.

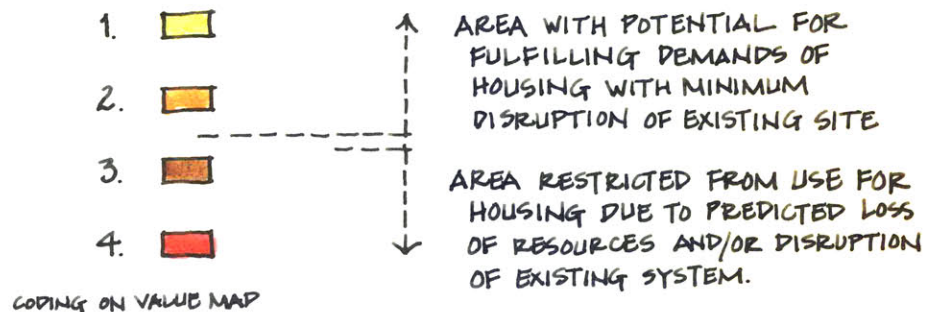
New roads should be located so that the increase of
traffic along Tea Rock Lane is minimized. This
means: inhabitants should be able to enter the
site from more than one entrance spot;
there should be more than one connection
from new roads to Tea Rock Lane.

Use of space adjacent to or a part of existing use-
ful cropland or farms should be avoided.

Mapping the Site Restrictions and Potential

Once certain information about the resources of the site has been combined with criteria for their use, the information maps can be used to make the 'value maps'. Certain zones of a resource have been located. These zones of the various aspects of a particular resource become zones with particular levels of vulnerability to or potential for development. Thus each of the information maps can be translated into a map of site restrictions and potential resulting from that isolated factor.

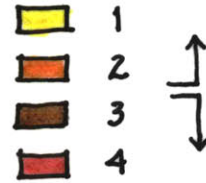
The levels range from a potential for receiving the housing elements to severe restrictions. The degrees between these two extremes could be numerous and finely distinguished, but for this study, the categories were kept as few as possible. There are two distinctions at either end of the range of levels:



VALUES ASSIGNED TO CATEGORIES OF EACH FACTOR

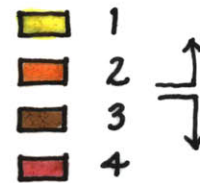
SLOPE

0-3%
4-7%
8-15%
16-25%



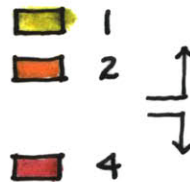
SOIL, DRAINAGE

HIGH SOIL ABSORPTION
MODERATE SOIL ABSORPTION
DRAINAGE CHANNELS
LOW SOIL ABSORPTION, HIGH SURFACE RUNOFF,
HIGH WATER TABLE



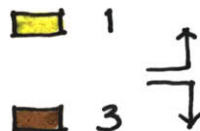
CLIMATE

MIDWAY UP SOUTHEAST SLOPE
SOUTH SLOPE; MIDWAY UP EAST SLOPE
COLD POCKETS IN VALLEYS AND BASINS,
TOPS OF STEEP RIDGES WHERE WINTER WIND
INCREASES SPEED,
THE NORTHERN SLOPE



VEGETATION

EXISTING OPEN SPACES
VEGETATION WHICH TAKES A GREATER AMOUNT
OF TIME TO BE REPLACED, TO 'REGROW':
LATER STAGES OF SUCCESSION
MATURE STANDS



VEGETATION WHICH FULFILLS A SPECIAL
FUNCTION WHICH IS DIFFICULT TO ACCOM-
PLISH OTHERWISE

VEGETATION REDUCING RUNOFF ON
STEEP SLOPES

VEGETATION PROVIDING VISUAL PRIVACY
FOR EXISTING HOUSES, FARMS

VEGETATION SENSITIVE TO PARTICULAR
SET OF ENVIRONMENTAL CONDITIONS
SWAMP MAPLES, POPLARS



EXISTING USE

AREAS ADJACENT TO EXISTING ROADS,
PATHS



SPACE ADJACENT TO AND IN CLOSE USE
WITH EXISTING RESIDENTIAL AND
COMMERCIAL BUILDINGS



FARMLAND IN USE





SLOPE



SOIL, DRAINAGE



CLIMATE














EXISTING USE

'Composite Value Map'

The maps showing the restrictions over the site for single factors were combined by overlaying them; the overlapping results for each part were combined into a single value, so that the restrictions over the site were a result of a combination of all the factors.

Decisions had to be made as to which final value would be assigned to which combination of values in the overlays. This is because the range of values was not expanded, which is one alternative, but was left at four, to correspond to the single factor value maps.

COMBINATION OF SINGLE VALUES		FINAL VALUE
most restricted:		
any 4 among overlays 	----->	4 
any 3 with 2's 	----->	3 
with 1's 	----->	2 
any 2 with 2's 	----->	
with 1's 	----->	1 

This method assumes that each factor is weighted with equal importance in determining the final value. This was suitable for this study; a severe restriction coming from any one of the factors resulted in a final value of severely restricted, so that any 'trouble spots' were not 'diluted'. Various methods for giving different importance to different site factors in the composite map have been used before. A discussion of those can be found in Richen, "Inter-factor Analysis".



COMBINATION

DESIGN

Locating the Housing Elements

The composite value map gives a pattern of zones with the highest potential for locating the elements of housing. The problem now is to choose a pattern within that set of choices, a pattern which relates housing, open spaces, roads, and leaching fields in a certain way.

The choice was made through a design process in which the possibilities were discovered and evaluated. Photo 13 illustrates a step in the design process. The sketch was done as an overlay on a map of the site; zones of buildings, of open space, of roads, and of leaching fields were roughed in, so that they coincided with certain zones on the site value map, and maintained certain relationships to each other and to the existing access and inhabitants. This sketch does not show the pattern for the final site plan, but is compared with it. (See photo 14)

Other considerations in the design process:

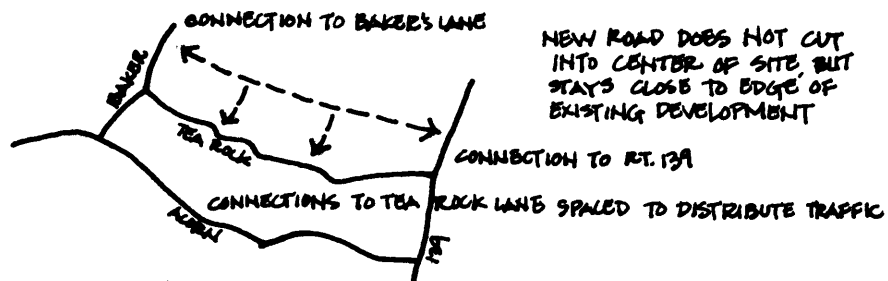
Access

The new roads must connect in some way to the existing ones: Ocean St. on the north, Tea Rock Lane on the east, Baker's Lane in the south. The possibility of connecting to roads to the west of the site was eliminated to start with, since the connection would have to cross a swamp, a lake, or a 25% slope, and would be of a much greater distance than connections from the other directions. How were the access

points chosen?

1. A list of the possible 'entrances' and 'exits' for the site was made.
2. Sketches of how the new paths would move through the site for each set of access points were made, working with the zones of the 'composite map'.
3. Criteria which access points and new roads should fulfill, stated previously, were applied to each set of possibilities.

The final configuration of the new road has connections at Ocean Street and Baker's Lane and two connections with Tea Rock Lane.



Grouping the Housing Units

Alternative ways of grouping the housing units were investigated. Each of these alternatives, however, still attempts to link most groups of units by some focus towards, or connection to shared outdoor space.

Sketches illustrating three alternatives are shown in

Photo 17: Linearly attached

Photo 16: Tight clusters around shared space

Photo 15: Combinations of above alternatives

The variety of site conditions leads to the combining of various ways of grouping the units. As conditions of open

space, soil, vegetation, slope... change along the site, the type of housing group changes as well. Photo 15 is more typical of the final site plan.

Designing the Housing Groups

Designed so far:

Zones of housing, parking, roads, leaching fields, open spaces;

The new road--how it moves through the site, how it connects to existing access roads;

Ways of grouping the housing units;

Open space sequence along the road.

The next step: Design decisions at the next scale:

The number of units per group;

The combination of building blocks for each different group;

Configuration of the housing groups--how the building blocks go together;

Configuration of the shared entry/play space;

Configuration of parking areas;

Entrance locations for each family;

Orientalion of roof slopes.

These design decisions necessitate information on the site and how it works at a finer scale than has been gathered and used so far. Wind patterns through trees, around building blocks, sunlight and shade, small areas of trees--are all elements in the design of the housing at this scale. Sun and wind studies using the building blocks and groups of trees, rather than the shape of the site, as was done before, were carried out.

DESIGN PROCESS - ILLUSTRATIONS

ZONES FOR HOUSING, LEACHING FIELDS, ROADS

PHOTO 13

ALTERNATIVES FOR GROUPING HOUSING WITHIN
THESE ZONES:

TIGHTLY CLUSTERED, FOCUS INWARD

16

LINEAR

17

COMBINING THESE TWO ALTERNATIVES

15

NEW SEQUENCE OF OPEN SPACES: DIAGRAM

TOP OF 17

FINAL SITE PLAN NEW HOUSING

FOLDOUT

FINAL SITE PLAN NEW HOUSING

14

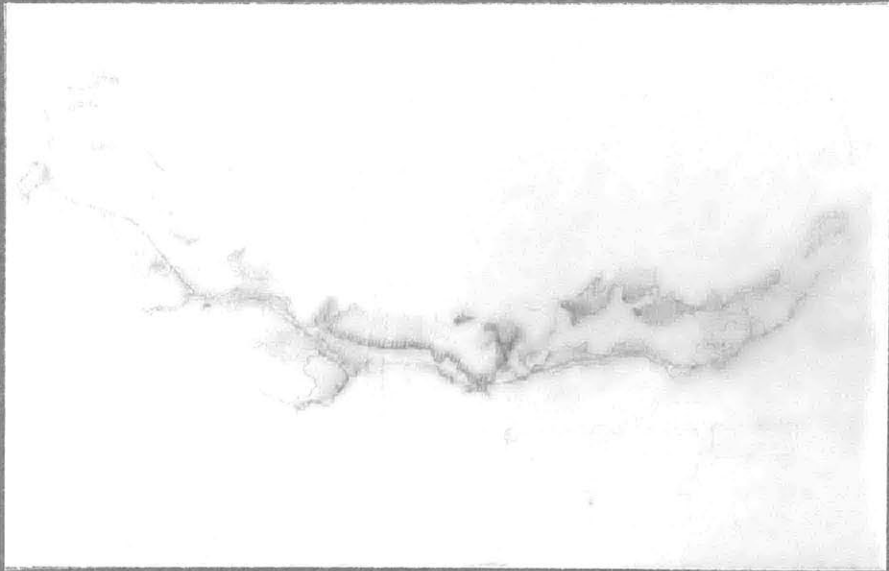
OPEN SPACES RELATED TO HOUSING

🌳 FOREST EDGE TO OPEN SPACE

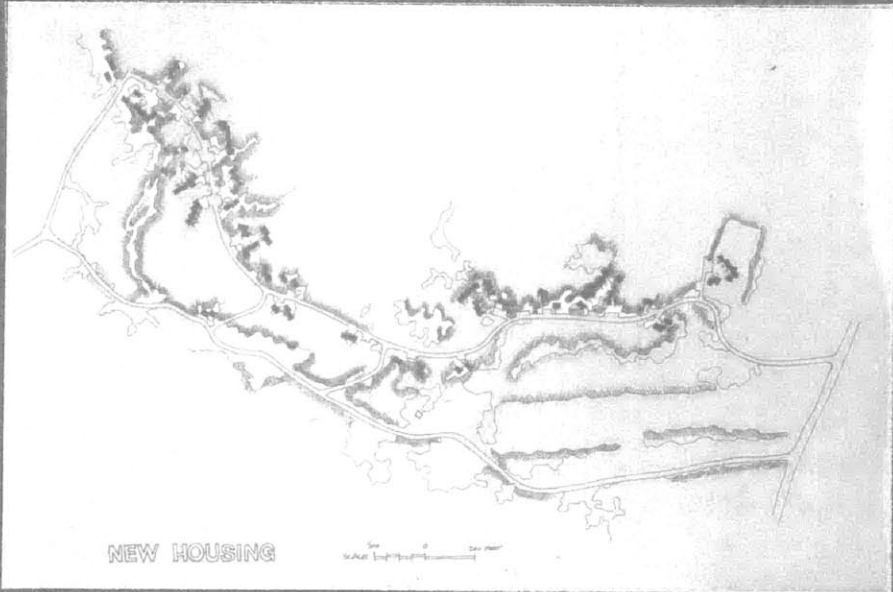
→ ENTRANCE

MODELS - FINAL SITE PLAN 200TH SCALE

PIECE OF FINAL SITE PLAN 40TH SCALE



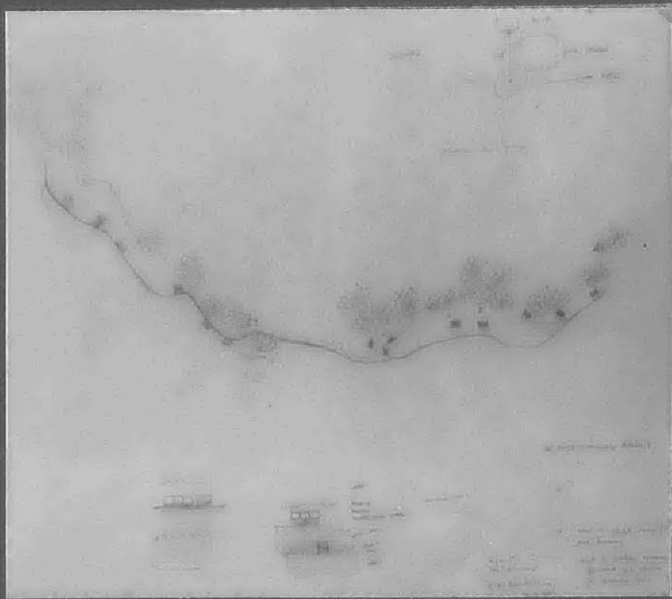
13



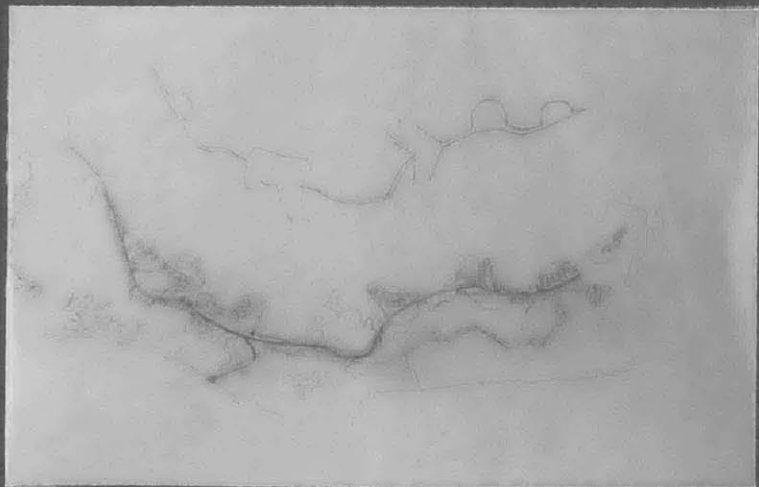
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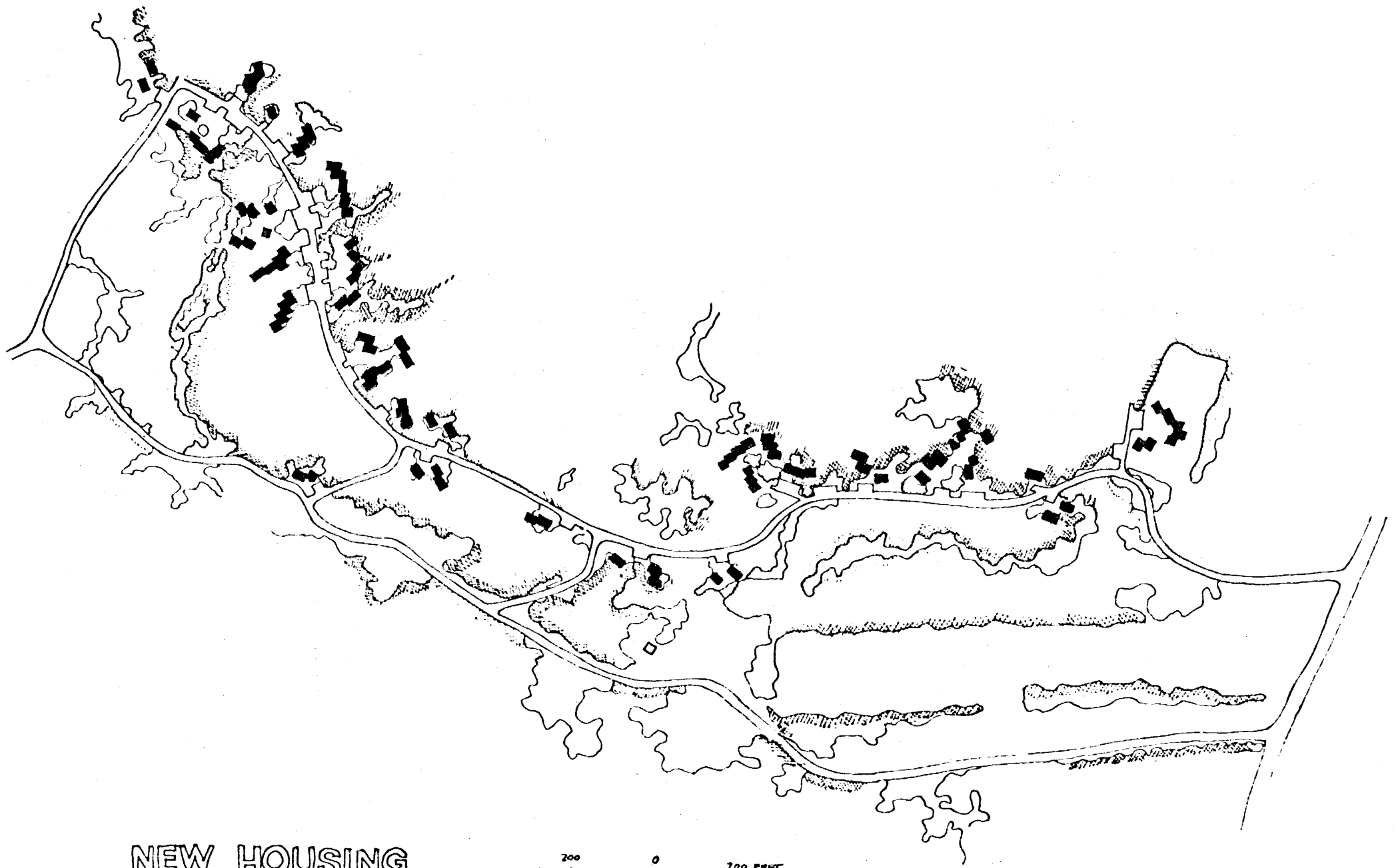
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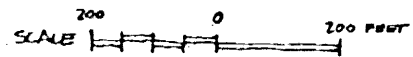
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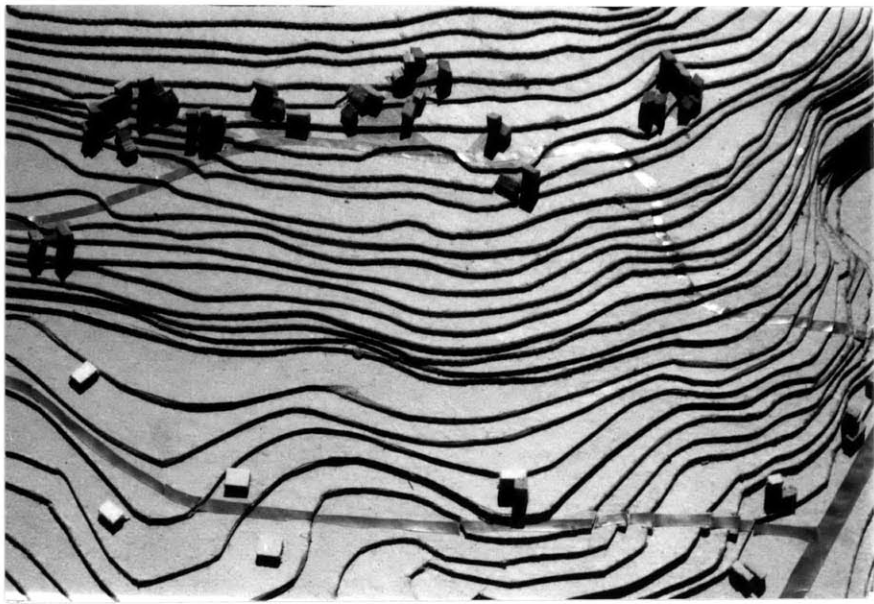
17



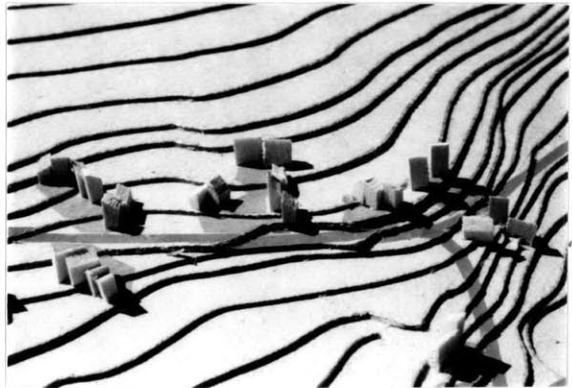
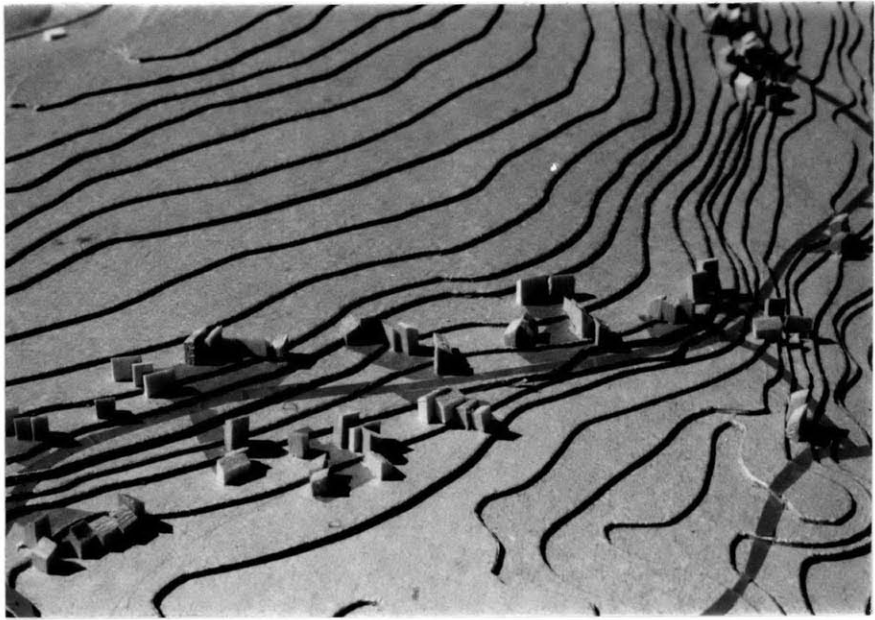
NEW HOUSING







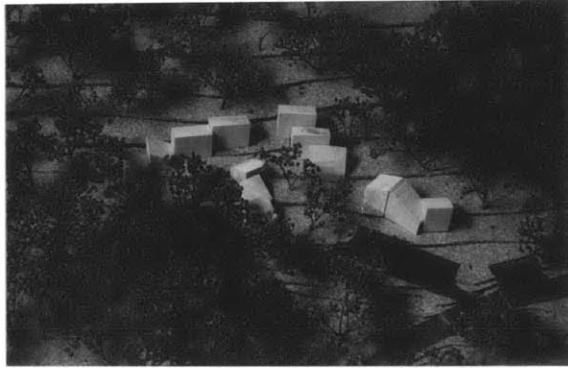












BIBLIOGRAPHY

Regional Analysis and Methods

McHarg, Ian, Design with Nature, Natural History Press, New York, 1969.

Steinitz, Carl, Comparative Study of Resource Analysis Methods, Dept. of Landscape Architecture, Harvard Graduate School of Fine Arts.

Strandberg, Carl H., Aerial Discovery Manual, John Wiley and Sons, Inc., N.Y., 1967.

Site Analysis and Planning

Eckbo, Garret, The Landscape We See, McGraw Hill, N.Y., 1969.

"Ecological Architecture: Planning the Organic Environment", Progressive Architecture, May, 1966, pg. 122.

Katz, Robert D., Design of the Housing Site--A Critique of American Practice, Univ. of Illinois, 1966.

Lynch, Kevin, Site Planning, M.I.T. Press, Cambridge, Mass., 1962.

Richen, J. David, Development of an Operational Method of Site Analysis, Dept. of City and Regional Planning, Univ. Calif., Berkeley, 1967.

Rubenstein, Harvey M., A Guide to Site and Environmental Planning, John Wiley and Sons, Inc., N.Y., 1969.

Segal, "Changing Trends in Site Layout", Archit. Design, Sept., 1967.

Simonds, John O., Landscape Architecture, McGraw-Hill, Inc., N.Y., 1961.

Natural Factors

Kershaw, Kenneth A., Quantitative and Dynamic Ecology, Edward Arnold, London, 1964.

Smith, R. L., Ecology and Field Biology, Harper and Row, N.Y., 1966.

Landform and Hydrology

Bloom, Arthur L., The Surface of the Earth, Prentice-Hall, Inc., N.Y., 1969.

Kazmann, Raphael G., Modern Hydrology, Harper and Row, N.Y., 1965.

Kudnitskii, Dmitrii M., Hydrological Interpretation of Aerial Photography, Oldbourne Press, London, 1966.

Linsley, Ray K., Applied Hydrology, McGraw-Hill, N.Y., 1949.

Munzer, Oscar, Hydrology, Dover Press, N.Y., 1949.

Twidale, C.R., Structural Landforms, Australia Nat. Univ. Press, Australia, 1971.

Climate

Geiger, Rudolf, The Climate Near the Ground, Harvard Univ. Press, Cambridge, Mass., 1959.

Olgay, Victor, Design with Climate, Princeton Univ. Press, N.J., 1963.

Olgay, Victor, Solar Control and Shading Devices, Princeton Univ. Press, N.J.

Wright, Frank Lloyd, The Natural House, Horizon Press, N.Y., 1954.

Vegetation

Gleason, The Natural Geography of Plants, Col. Univ. Press, N.Y., 1964.

Oosting, The Study of Plant Communities, W.H. Freeman, San Francisco, 1956.

Petrides, George A., Field Guide to Trees and Shrubs, Houghton Mifflin, Cambridge, Mass., 1958.

Preston, Richard J., North American Trees, M.I.T. Press, Cambridge, Mass., 1948.

Housing

Alexander, Christopher, Houses Generated by Patterns, Center for Environmental Structure, Berkeley, Calif., 1969.

Brown, "The Form of Housing", Architectural Design, Mar., 1966.

- Hoffman, H., Low-rise Group Housing, Stuttgart, Hatje, 1967.
- Huntoon, Maxwell C., "P.U.D.: What it Is"
- Kramer, Karl, One Family Houses in Groups, Stuttgart, 1966.
- Nicholls, "In the Townscape", Archit. Review, Nov., 1967,
pg. 355.
- Pawley, Martin, Architecture vs. Housing, Praeger, N.Y., 1971.
- Prouve, Jean, Industrial Architecture, Editions D'Arch.
Artemis, Zurich, 1971.
- Rapoport, Amos, House Form and Culture, Prentice-Hall, N.J.,
1969.
- Rich, Peter, "Notes on Low-rise, High Density Housing,"
- Wallace, "Planned Privacy", Journal of Housing, Jan., 1956,
pg. 13.

Waste Removal

- Bender, William, Soils and Septic Tanks, U.S. Soil Conserv.
Service, Wash., D.C., 1971.
- Mass. Health Research Instit., Inc., Operating Manual for
Small, Extended Aeration, Activated Sludge Treatment
Plants, N.E. Interstate Water Pollution Control Comm.,
Mass., 1961.
- "The Clivus System", Northwest Passage, Mar., 1972, pg. 30.
- Wagner, Excreta Disposal for Rural Areas and Small Communities,
WHO, Geneva, 1958.