URBAN DESIGN

PRELIMINARY REPORT

PART 1.0 OF VOLUME V

DESIGN STRATEGY STATEMENT

JANUARY 1973

MINNESOTA
EXPERIMENTAL
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PREFACE

This preliminary report on urban design was organized by Neil Pinney who has served as Director of Design for MXC.

Mr. Pinney, a member of the American Institute of Architects, holds the degree of Master of Architecture in Urban Design from Harvard University and has substantial urban design and architectural experience. The ideas presented here have provided the basic planning framework for the project and have given direction and focus to a range of concepts across the spectrum of urban and environmental systems.

This report is the first of six dealing with a design strategy for MXC. They document, by describing the advanced design of separate systems, results of an integrated design strategy process that occurred between April and December of 1972. Direction of the design strategy team was divided between Neil Pinney and James Alcott, the Executive Director of MXC Authority staff.

The complete set of reports are as follows:

VOLUME	
I	SITE SELECTION
II	ENVIRONMENTAL PLANNING STATEMENT
III	DEVELOPMENT RECOMMENDATIONS
IV	ECONOMIC BASE
V	DESIGN STRATEGY STATEMENT

PARTS

1.0 URBAN DESIGN
2.0 TRANSPORTATION
3.0 TELECOMMUNICATION
4.0 EDUCATION
5.0 HEALTH CARE
6.0 ENERGY AND WASTE MANAGEMENT

The reports are intended to set forth a series of related parameters within which future MXC planning and design can continue. Participants in the design strategy activity are as follows:

DESIGN STRATEGY TEAM

James Alcott, Economics
Dr. Ronald Barnes, Education
Karl Guenther, Transportation
Robert Hawkinson, Landscape Architecture
Konrad Kalba, Telecommunications
Joseph Kasper, Geography
Bruno LeFevre, Telecommunications
Dr. Evelyn Murphy, Health Care
Neil Pinney, Architecture and Urban Design
Richard Shackson, Transportation
John Swanson, Landscape Architecture and Environmental Design
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CONSULTANTS

John Baymiller, Architecture and Urban Design
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John Tester, Ecology
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Craig Johnson, Design Assistant
Gregory Fern, Graphics Consultant
Charles Konker, Graphics Consultant

ABSTRACT

MXC proposes to maintain an environment that is predominately rural but with an urban core and urban services. This would provide rural living in a dispersed rural sector of the new community for approximately 75% of the population and urban living in a dense compact urban sector for 25% of the population.

A fixed master plan has been avoided. Instead a process planning tree for evaluating alternate possibilities of systems and designs at various stages in time is used to establish guidelines for development. This will allow for a less rigidly predetermined development process to occur and for future residents to more easily understand and exercise their options in decisions effecting their environment.

A series of connected, domed, linear megastructures is proposed for the compact urban sector in lieu of mid and high rise buildings. These will blend more harmoniously with natural systems; provide more user responsive flexibility for housing and central pulbic functions; and offer large open sheltered spaces for activities during inclement weather.

The rural sector, which comprises the largest portion of the land, will be structured around hexagonal cell units for both conservation and development. The size of these units is based on efficient service areas and walking distance to the dispersed local activity center in each development cell. This will also allow villages now existing on the site to remain with their own area intact. Conservation land will also be maintained in the development cells so that a very low density population can relate visually and functionally to farming, ecological preserves, recreational open spaces, and major recreational attractions.

To shorten journeys to work, basic employment opportunities will be located in several types of places; they will be in centrally located offices and factories by major transportation routes, in decentralized areas throughout the site close to the dispersed activity and learning centers, and in many cases, directly in the home.

The use of high and low technology systems working together will help to make these opportunities possible. In lieu of an extensive street/freeway grid, an automated guideway and feeder road system will connect all areas of the site. New interactive telecommunications capabilities will allow individuals and institutions to access more information and enhance their scope of activities. New integrated methods of waste management and energy production and distribution such as non-polluting fuels from waste, and energy from the sun and wind at individual homes will help to make self sustaining, low density housing and decentralized activities feasible. This together with new construction and design practices will make possible the conservation

of energy and the reduction of all forms of pollution. All major infrastructure systems will be costed in terms of total cost (initial investment plus operating costs) and in terms of social and environmental factors.

Further design and analysis would develop more definite user needs criteria, develop and preevaluate these design systems more closely and would inventory and analyze the land resources for multiple compatible use at finer detail.

CONTENTS

FIGURES, TABLES AND MAPS

1.1.0 THE MXC PLANNING PROCESS

1.1.1 PLANNING PROCEDURE

The basic planning procedure has set about to:

1. Identify project goals and objectives
2. Generate alternative programs and plans to satisfy the goals and objectives
3. Anticipate the consequences of the alternative programs and plans
4. Evaluate the alternatives
5. From what is learned from the evaluation feed back to alter the goals or to modify programs and plans (Fig..100)

This procedure is divided into several time periods that relate to project planning phases (Fig..101). The first two steps of this procedure have been executed during the current design strategy phase.

It is advantageous to repeat this procedure several times over in the planning process as it better facilitates learning about the project and enables an increasingly higher level of specificity and quantification to be obtained from the conceptual phases to the development plan phase.

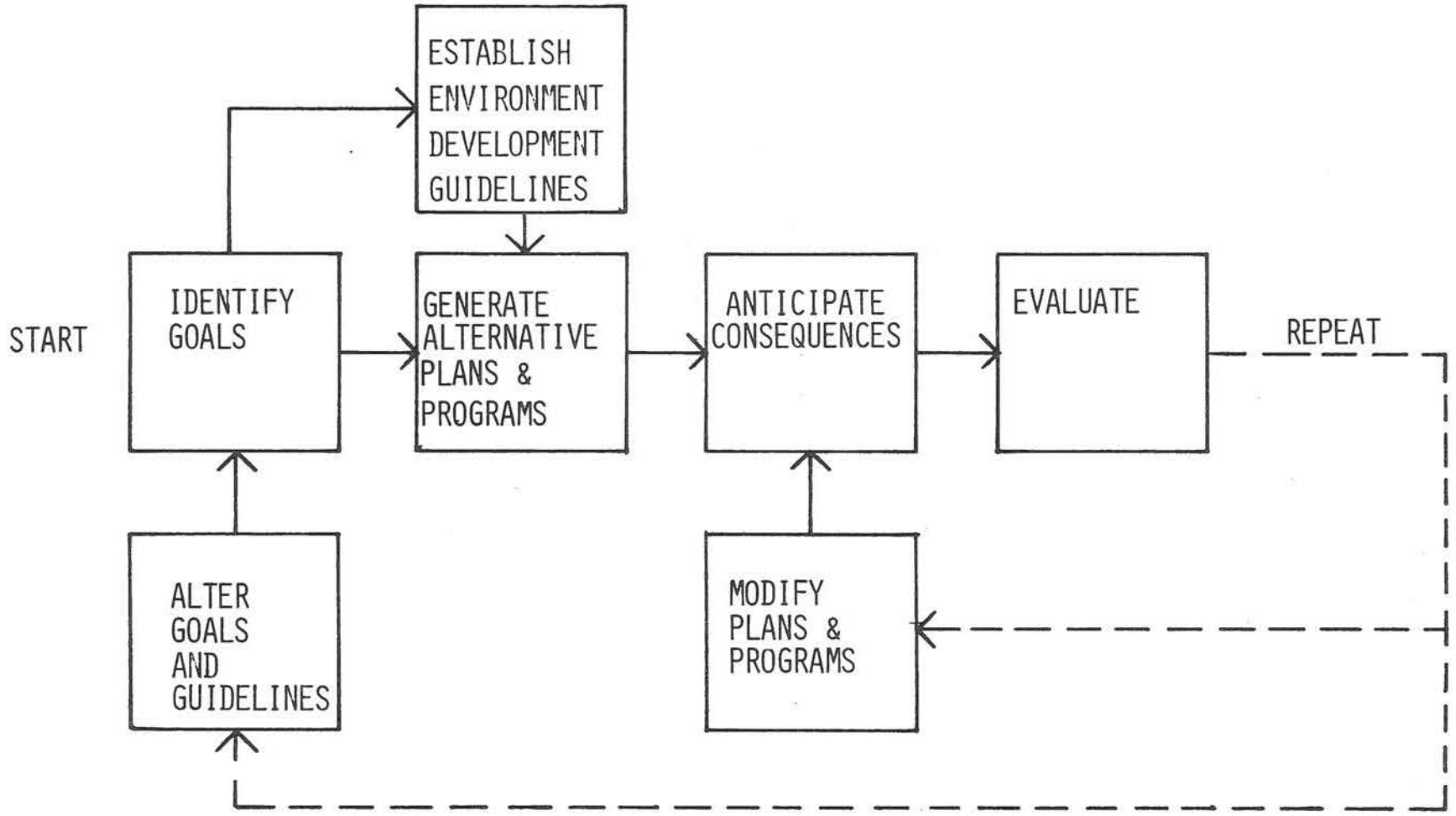

FIGURE .100

PLANNING PROCEDURE

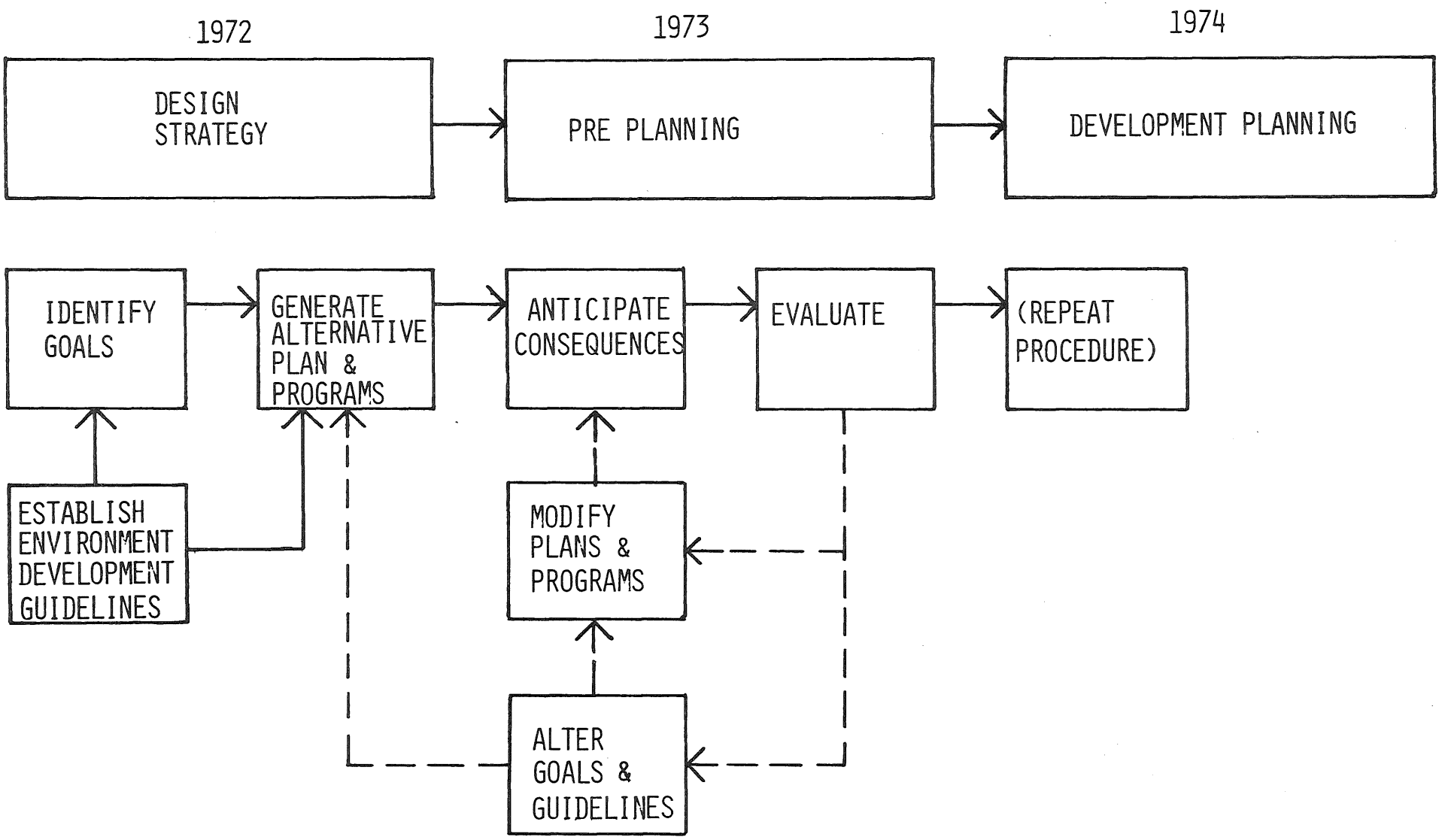

FIGURE .101
PLANNING PHASES AND TASK OUTLINE

1.1.2 DECISION PROCESS

Two major functions describe the MXC process: (i) planning and (ii) decision making. Planning has been a function of the MXC Authority staff, the design strategy team, and outside consultants (including state agencies). Decision making has been a function of the MXC Authority members and the State Legislature (Fig..102). The goals and objectives have then been normatively developed between the planning and decision making functions.

It is anticipated that the next phase of planning will include participation of the kinds of people MXC would be built for so as the process can be sensitized to their personally expressed goals, objectives, and preferences. (In Figure .102, under phase III, they are noted as "users".) Since the real users, the residents of MXC, are unknown, surrogate users would be substituted. A surrogate user group whose demographic characteristics closely resemble the anticipated population of MXC would be useful as a sounding board and test group. Newly devised methods of testing user preferences through multi-dimensional scaling would yield valuable information that could be applied in the establishment of criteria for performance of a variety of systems.

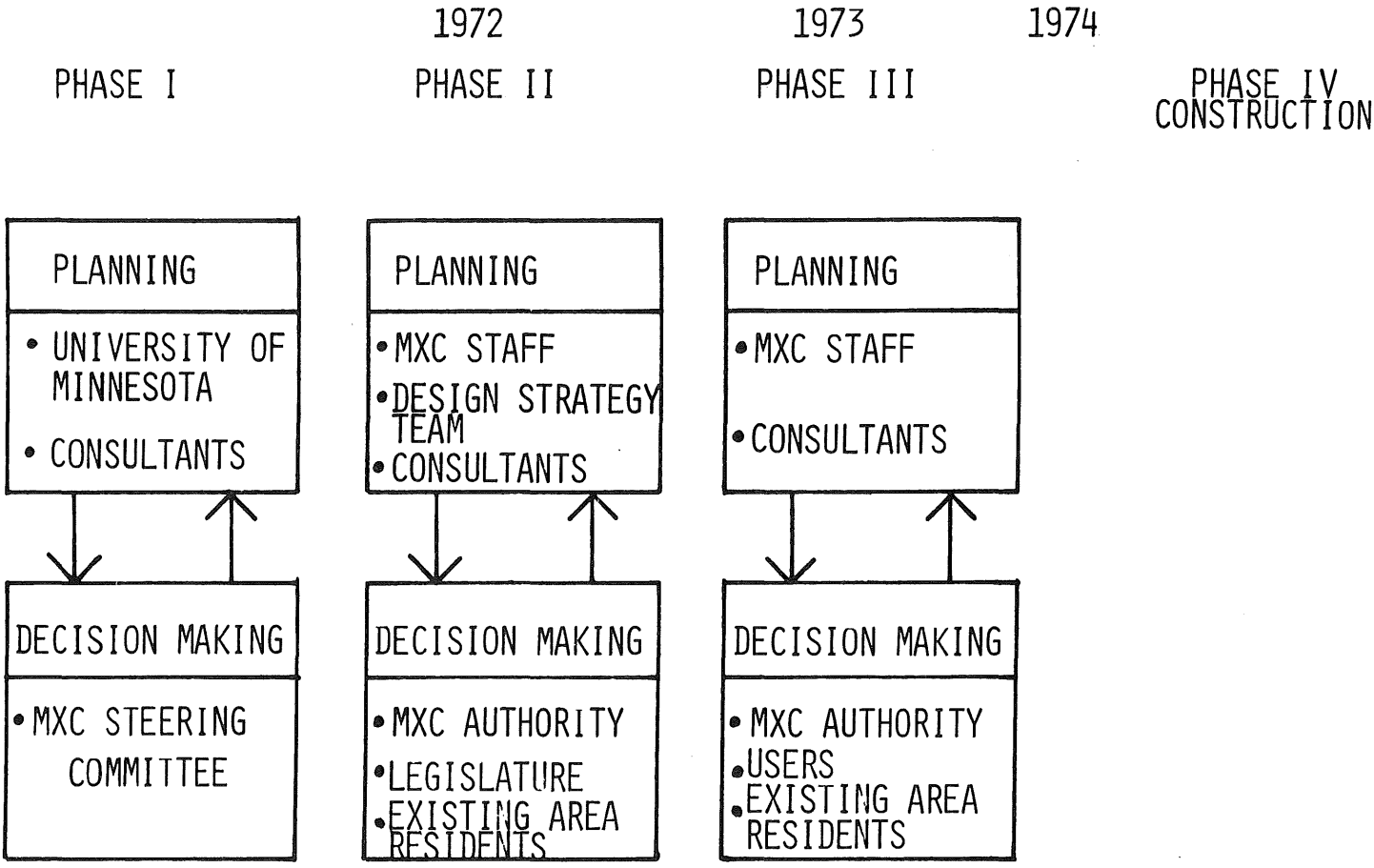

FIGURE .102

RELATIONSHIP BETWEEN PLANNING AND DECISION MAKING

A more formally structured way of eliciting user response will be through the proposed citizens advisory group and by having existing local citizens represented on the board of directors of the Development Corporation.

1.1.3 ADVANCED DESIGN OF SYSTEMS

Since this past phase of planning has centered around site selection, the work of the design strategy team has been advanced design of those systems that could be advantageously integrated on the various sites given the goals and objectives of the project and the constraints and opportunities of both the sites and systems themselves.

At this phase of planning, even though user needs or preferences have not been specifically researched or potential residents built into the planning process -- the suggested systems, while not being new inventions from MXC, have been generated to achieve greater levels of service to users. At the phase when users do become engaged in the preliminary decision process, it is anticipated that they will respond favorably. The suggested systems are generally optimal by themselves and in the interaction of the design strategy team, attention has been directed toward systems synthesis or integration.

The costs of some proposed systems may be higher than conventional ones in their initial capital investment. This higher cost would be incurred only to achieve lower social costs and operating or life-cycle costs. The computation of this would be aided by an expanded accounting method that would include social, environmental, and energy unit costs

that are normally omitted from the equation, but that must eventually be borne by society. The systems would be, in a word, cost-effective.

The major systems that have been researched are those with the greatest potential effect on infrastructure or settlement pattern and macroform. That is, the hard and soft network systems. They are:

1. Transportation
2. Telecommunications
3. Education
4. Health care
5. Energy/waste management

1.2.0 LAND USE

The basic rationale of land use could be described as dynamic conservation.

Dynamic conservation is the achievement of harmonious balance between stewardship of the natural systems on or contracting the site and the way in which we as humans alter the site for our own use -- especially how we integrate physical urban systems. The Environmental Planning Statement (Volume II) discusses the questions of man's effect on the land from a natural systems point of view. This section discusses ways of combining our understanding of use of land with what we are starting to understand about how evolving social humankind want to relate to the land, to each other, to work, and to play.

Among the urban systems that impinge most on land use is housing. This together with other private and public buildings and the transportation systems that serve them are the big land users in settled areas. Built form, especially housing and how it uses and relates to land, is ultimately the determinant of the nature and quality of the man-made environment. Existing processes of development and how MXC is proposed to be developed differently are considered below.

1.2.1 EXISTING CONTEXT IN THE UNITED STATES

The primary pattern of housing distribution in this century has been suburbanization -- the accretion of ring upon ring or radical fingers of housing development generating along roads out from central city cores.* This has been characterized in physical terms by single family and multiple family units of average densities of around four to six dwelling units per acre, and in economic terms by middle to upper income level housing and traditionally limited but now expanding job opportunities within the suburbanized areas themselves.**

The living choices, then, have been the traditional but deteriorating central city core with its immediately adjacent gray areas, and the suburbs.

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* This process has been almost totally inadvertant, having been made possible by the wide availability of the automobile and telephone, and further stimulated by FHA guaranteed loan home financing in the mid 1930's. It was not intended nor foreseen at that time that massive suburbanization of the United States would occur.

** Because of more advantageous economic conditions, industries (and jobs) have been recently moving into suburban areas requiring a reverse commuting from central cities for many of the workers that are needed. This creates a condition where the suburbs are now finding themselves with the beginning of an economic base but are unwilling to supply the housing needs of lower income worker's families.

A few recent new communities have offered another choice. While they are generally structured on the same gross housing densities as the suburbs, there are two important differences: (i) groups of dwellings are more closely packed with the remaining space dedicated to common greenways; and (ii) there is an employment base in the community itself. So, aside from an appearance of more open space, the new communities have thus far been largely suburban in character with in fact, the same densities as the suburbs.

The options for choice of living areas for most Americans have been in the most deteriorating or dull kind of urban or suburban oriented environments that are neither socially, economically, nor environmentally satisfactory.

1.2.2 THE DENSE/DISPERSED LAND USE STRATEGY

MXC is being designed to offer living and housing opportunities not found in any of the previously described models.

In a predominately rural state in a region of the nation which is also predominately rural and agricultural, we propose a rurally oriented new community with an urban core and urban services. Where densities equivalent to quarter acre lots are found in suburbs and new communities, MXC will avoid this middle range density which in its land coverage is so destructive of natural systems such as soils, water, and wildlife. The MXC land use strategy below is described as DENSE/DISPERSED, and has attributes of both urbanity and ruralness.*

Recent authoritative studies have offered evidence supporting this strategy.** They have shown that between 1/4 and 1/3 of American adults, 18 and older, prefer to live in a rural area, and that 19% to 30% prefer to live in a small town or village. Only part of the significance of these findings is that more Americans are now preferring rural living but cannot achieve it, the other part implicit in this is that

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* "Rural", as used here, means country open space including farming activity.

** They are:

1. William Watts and Lloyd A. Free (eds.), Potomac Associates, Washington, D. C. : State of the Nation, Universe Books, New York, 1972.
2. Presidential Commission on Population Growth and the American Future, 1972.
3. New York Times, December 17, 1972, George Gallup, Recent Survey, American Institute of Public Opinion, Princeton, New Jersey.

urban areas, once the great attractors of rural people, have now largely lost their attractive power for the population at large. The congestion, increased crime, and general deterioration of urban services have probably been instrumental in this change of attitude.

MXC's opportunity in land use, then, lies in two main areas. That of providing:

1. A model urban sector that can reattract those who find the excitement and urbanity of city life rewarding.

2. A model rural sector that will offer rural living opportunities to those who now want that way of life while supplying them with essential services that existing rural areas may not be able to handle.

The integration on one site of these two sectors would be mutually supportive in that those who desire a small town or countrified life want it within range of a large metropolitan area, and those who prefer to be based in the city like to have access to a rural environment. The Presidential Commission on Population Growth and the American Future (1972) reported that:

> "People want the best of both worlds - the serene and clean environment of rural areas and the opportunity and excitement of the metropolis."

The high population centers and corridors in the United States, because of their dense existing land use, cannot satisfy this demand except for only an affluent few.

The reports continued:

> "Ironically, people moving to such areas typically find that they soon lose their more desirable aspect -- semi-rural areas rapidly become suburban."

In order to keep MXC from becoming suburban in its form and to preserve the land's desirable natural attributes (and those of the developed community itself), there would need to be well observed land use controls and zoning. (These are described in Volume II Development Recommendations under "Techniques of Acquisition and Control".)

Planning and design assumptions for MXC have thus far been based on the following percentages of population in each sector:

URBAN SECTOR POPULATION	between 25% and 30%
RURAL SECTOR POPULATION	between 75% and 70% (of this, 50% relating directly to activity centers and 50% relating directly to rural land.)

The program development of the dense/dispersed strategy would define settlement patterns and dwelling unit densities that retain the integrity of these two clear choices so as to provide definite options for those who choose to live in a rural area or an urban area.

1.2.3 LAND USE ALLOCATION AND SCHEMATIC SITE PLANS

A resource inventory data base has been collected for each site. It documents general soil patterns in terms of associations and texture; vegetation, in terms of forest cover and non-cover; hydrological systems (marsh, lakes, and floodplains) and watersheds; geological patterns; existing land use; slope orientation; topographic form as flat, rolling or rough land; patterns of waterbodies; accessibility in terms of vehicular and rail transportation and population concentration; and land ownership as public and private.

Following data collection, analysis maps document opportunities and constraints of each site as rough and rolling land, east, west, northern and flat slopes with vegetation cover and slopes with southern orientation (opportunities for development) as well as lakes, marsh,floodplain, agricultural land, east, west, northern and flat slopes unvegetated, state and national forests and soils - primarily organic, clays and fragipan layers - (constraints for development). Overlayed with each other, the opportunities and constraints maps reveal areas suitable for development without infringing on other resources. Maps similar to these could also be generated for wildlife habitats, conservation, recreation, agricultural and forest production, etc., although it is not done separately in this analysis.

The inventory and analysis has served as the initial base upon which an environmental evaluation has been generated through the expertise of various disciplines within the domain of land, hydrological, biological, and atmospheric systems.

Specific areas have been identified on two sites as being suitable for:

- High priority rural sector dwelling site zones
- Conservation* zones and recreation resources
- Urban sector
- Major industry, assembly, warehousing, and break-bulk operations
- Air transport facility

The maps in Figures .200 and .201 show the summary land use suitability. These suitability maps are for the gross scale of the entire site and do not indicate compatible multiple land use in the open space. To keep housing density low so as to preserve rural atmosphere, housing zones will be thinly distributed in zones compatible for that use in the open space.

Schematic site plans illustrate the control zone, major elements of development and their general functional relationships for the two sites (Figs..202 and .203). These maps show (i) the relation of basic employment and major industry to major population concentrations (urban

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* Conservation includes preservation of farming, outstanding natural and historical features, and highly valuable natural systems including wildlife.

Lake Region Land Use Suitability Analysis

106,300 Acres Open Space (Marsh-Floodplain, Lakes, Inadeq. Bear., Agric)

36,900 Acres Suitable for Rural and Urban Sector

4,200 Acres Suitable for Industry, Airport and Rural and Urban Sector

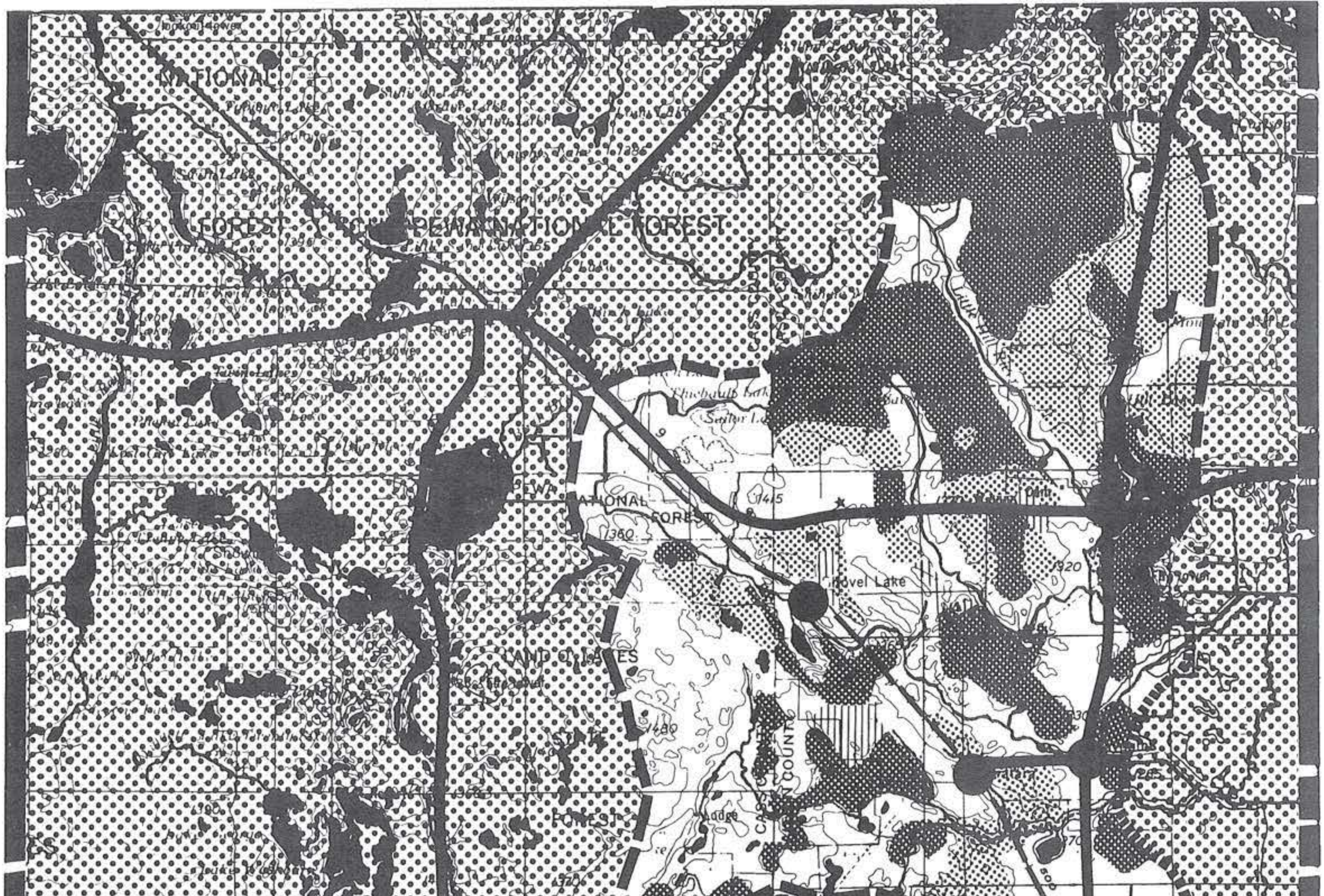
18,600 Acres Suitable for Industry and Airport

260 sq.mi. Watershed Boundary

Site Sub-Watershed Outlet Boundary

0 1 5 10 Miles

FIGURE .200



Pine Moraine Region Analysis

Land Use Suitability

2400Ac. Suitable for Industry and Airport

218sq.mi. Site Sub-Watershed Boundary

Site Sub-Watershed Outlet Boundary

69,120Acres Open Space (Marsh-Floodplain, Lakes, Inadeq. Bear., Agric)

41,280Ac. Suitable for Rural and Urban Sector

26,720Ac. Suitable for Industry Airport and Rural and Urban Sector

0 1 5 Miles 10

FIGURE .201

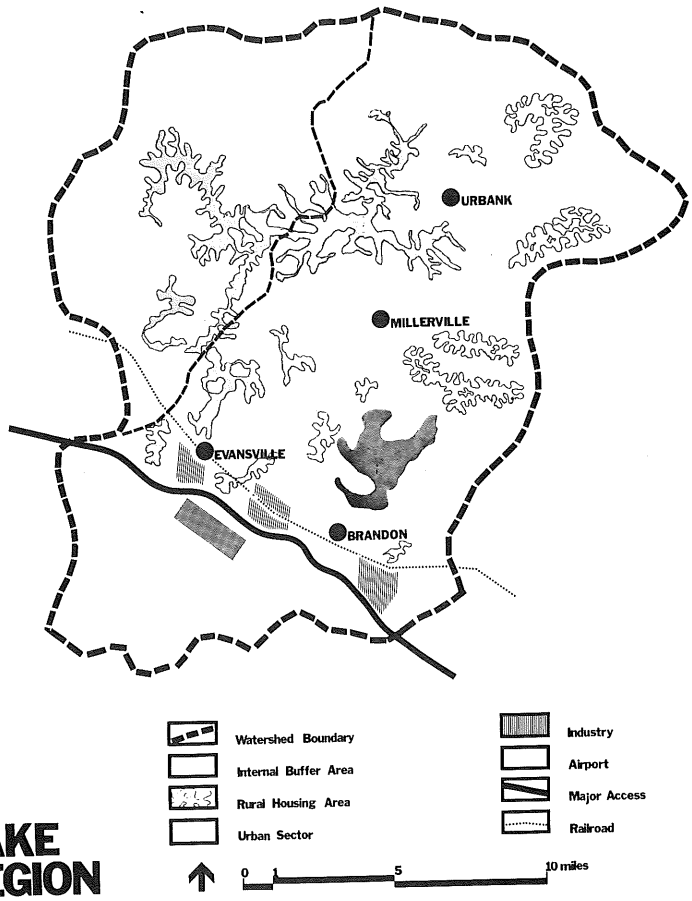


FIGURE .202
SCHEMATIC SITE PLAN

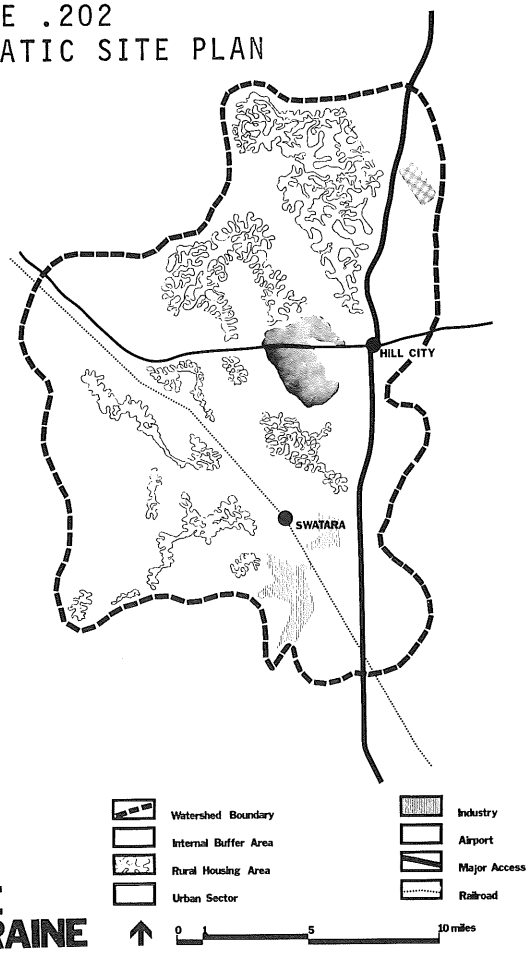


FIGURE .203
SCHEMATIC SITE PLAN

sector) and vehicle access; and (ii) the relation of an air transport facility to those other uses for accessibility and noise pattern envelopes on approach zones.

The following sections on urban sector and rural sector form determinants describe the rationale and procedures for arriving at preliminary concepts of macroform and details of settlement pattern.

1.3.0 URBAN SECTOR FORM DETERMINANTS

1.3.1 URBAN SECTOR REQUIREMENTS

From Phase I studies, three general relevant requirements for the urban form have been continued. They are that:

- the population living and working here be dense (comparable to central city densities)
- the urban organization be compact
- public shelter be provided over large areas

The two major functional groups in this sector of the community are housing and central public functions. A few broadly based but key requirements and general criteria for both these groups have been identified and are as follows:

1. CENTRAL PUBLIC FUNCTIONS

   The urban sector should provide large, sheltered internal environmental spaces for activity systems relating to public and private functions of working, shopping, learning, playing, etc.

   This should serve a range of needs for portions of residents who live

   - in the urban sector itself
   - in the rural sector
   - outside MXC

   The needs served would be of the scale and nature of which are not served by their local activity centers or small towns. The urban sector, then, should contain the necessary ingredients of central public functions of government and religion as well as those noted above. It should be the most accessible and visually prominent activity center in the community and surrounding area.

2. HOUSING

For the population living in the urban sector there should be a support system for dwellings. This system should combine:

. structural support for a variety of dwelling systems and dwelling related network and nodal activity systems (such as access networks, tot lots, gathering spaces, etc.)

. life support for a range of resident needs that can be delivered and piped (such as energy, water, bulk goods, waste, etc.)

1.3.2 GENERAL CRITERIA

SHELTERED INTERNAL ENVIRONMENT AND STRUCTURES

- The sheltered internal space should be sized to accommodate central public function activities that can be beneficially accomplished outdoors (pedestrian and vehicle circulation, open shopping, open learning centers, public gathering places, cafes, etc.)
- It should utilize natural systems for warm and cool space conditioning that is energy conservative.
- It should utilize waste heat from total energy processes for space conditioning.
- It should utilize natural ambient daylight for internal task illumination during the day.
- Secondary shelter structures for indoor public and private functions should physically relate, and have direct access to, both the internal space and the outside natural environment.
- Access to functions should be direct, by public and private transit (within approximately 300 feet horizontal distance).
- It should be responsive to user needs (including those of handicapped persons).

SUPPORT SYSTEM AND HOUSING

- Each dwelling should physically relate directly to both the internal space and to the outside natural environment.
- Preferred housing orientation should be toward the South, Southeast, or Southwest. Secondary preferred orientation should be West or East.
- Each dwelling should have a private outside terrace open to the sky, shielded from neighbor's views.
- Access to dwellings by vehicles should be direct (within approximately fifty feet horizontal distance and one level vertical distance).

- Parking for personal and visitor vehicles should be closely accessible in time (less than five minutes).
- Access to dwellings by pedestrian access ways should be direct (within one level vertical distance and direct horizontal distance).
- Each dwelling should have an entrance court shared with several other dwellings so as to aid in public safety and security; and to encourage neighboring relationships.
- Dwelling adaptability should be facilitated by the support system.
- Most desired shelter related systems (play and meeting spaces, convenience store, etc.) should be capable of short access from the dwelling.
- Individual occupant dwelling expression should be facilitated by the support system.

Several types of architectural forms have been broadly examined as to how they might satisfy these requirements and criteria. Among these have been:

1. One large dome covering the entire city.
2. High and midrise buildings.
3. Megastructure with dome/gallery enclosure network.

They are very briefly discussed in the following subsections.

1.3. ALTERNATIVE FORMS

DOMES

Preliminary cost-benefit studies have shown the unfeasibility of doming the entire urban sector. Domes cannot be built in sections. For their structural integrity they must be built as complete units. This requires all of the capital investment in the shelter structure to be at the beginning -- in the first stage or two of the community's growth. Thus, the investment, not being spread over the duration of the project development, puts serious strain on financing. This and other cost or problem areas noted below have at this point eliminated the city-under-a-dome concept from further analysis.

- The rain and snow run-off of a massive dome creates major problems of water handling and impondment.*
- The problems of microclimates such as precipitation, heat and cold, internal to a large dome itself requires massive energy, intensive air and space conditioning equipment.
- The necessity for insulation materials used for thermal control would be reduced or eliminated, but would be required just the same for acoustical control.

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* This problem exists no matter what urban sector structure is used, but a dome eliminates 100% of the land it occupies from absorbing precipitation which strains existing land and hydrological systems.

. The unknown psychological impact of living and working 100% of the time in a large domed and conditioned environment are unknown, but could be negative.**

HIGH RISE BUILDINGS

High rise and midrise buildings for housing, and to a degree, for office space, have through the years proved inadequate to meet user needs of all but a few societal groups. The main criticisms are that:

1. They do not provide continguous access from shelter to desired shelter related systems such as nature, semi-public and public activity systems.

2. The dwelling units are unresponsive to the residents needs for dwelling adaptability (adding, subtracting or altering major elements), and personal expression in the dwelling design (house identity).

These drawbacks and others are major enough to seriously question whether there should not be alternatives to the high or mid-rise building form in MXC.

A combination of structuring and sheltering the MXC compact urban area is needed and is explored in the following sub-section.

** Inhabitants who adapt to a mid-west prairie environment have a visual reference scale which relates to large horizon distances. The psychologist Mayer Spivack notes that small distances are perceptually measured in terms of a larger reference. Life internal to city sized domes in Minnesota would be without this needed larger end of a visual reference scale unless the dome is completely transparent. Even then there is the sense of an intervening structural framework or membrane that may cause degrees of feeling "hemmed in".

1.3.4 IMPLICATIONS FOR NEW URBAN FORM - MEGASTRUCTURE WITH DOME AND GALLERY NETWORK

Combinations of the general criteria in 1.3.2 begin to suggest a specific macroform for the urban sector.

1. Supply three dimensional networks of public infrastructure instead of just at ground. This includes utilities, walkway, transit and other forms of access.

2. Where the housing and other enclosed shelter structures should relate to both the outside environment and internal common space, in other words, at the edge between them, an enclosure form more finger-like than massive is in order, as this geometry yields less area of enclosed space for equal length of edge contact. (Compare Figure .300 with .301.) The finger-like form more economically satisfies the criteria that only those activities that can be beneficially accomplished outdoors would be publicly sheltered. This would be inside-outdoor space, and would be enclosed when needed to protect against inclement weather. This form has a major advantage in its capability to be open ended and to grow as the community grows (Figure .302), in staged segments.

3. Direct access to dwellings and other functions for private and public transit vehicles suggests the efficiency of continuous linear organizations more horizontal than vertical (Figure .303).

4. That preferred housing orientation be southerly suggests that housing be on only one side of the enclosure (Figure .304).

5. Combination of East and West oriented housing will allow it to be on both sides of the enclosure.

6. That each dwelling have an outdoor terrace open to the sky suggests a vertically inclined housing support structure (Figure .305).

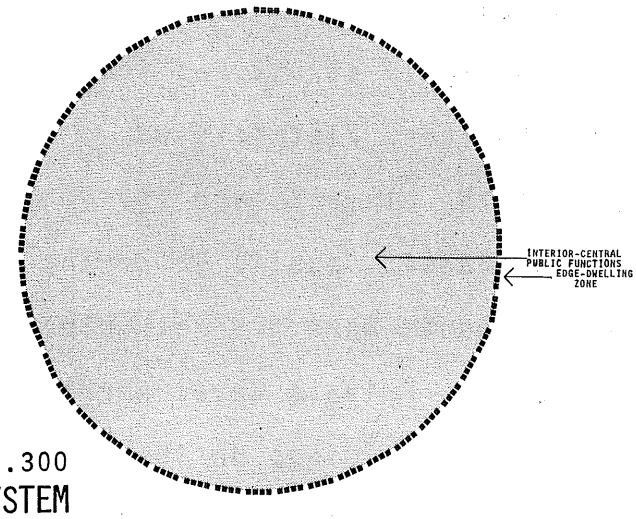

FIGURE .300
DOME SYSTEM

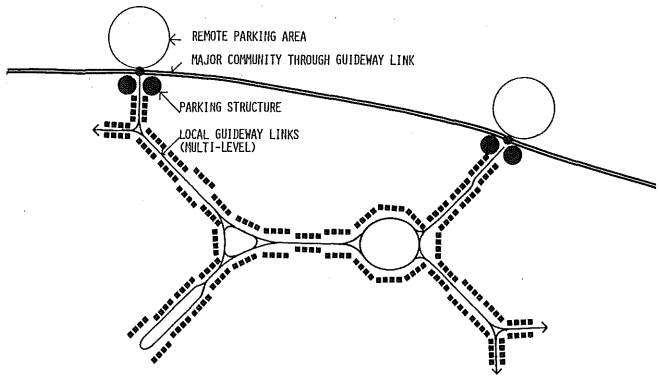

FIGURE .303
TRANSPORTATION SYSTEM INTEGRATION

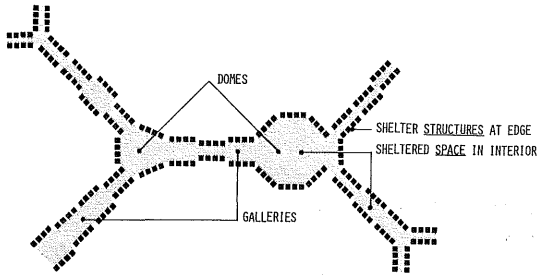

FIGURE .301
DOME/GALLERY SYSTEM

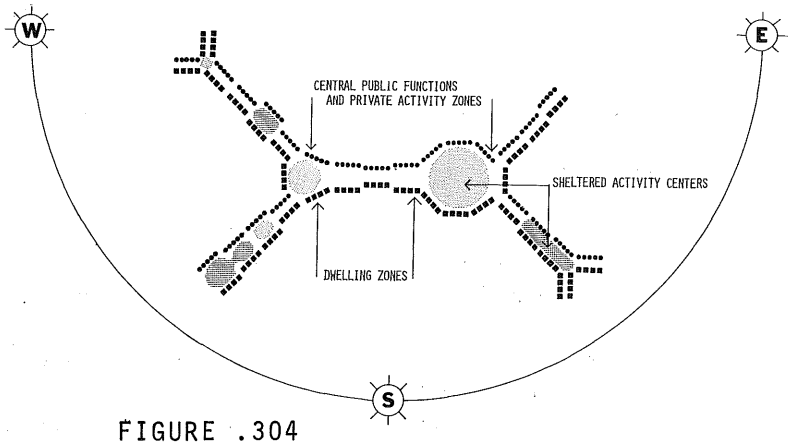

FIGURE .304
SOLAR ORIENTATION USE

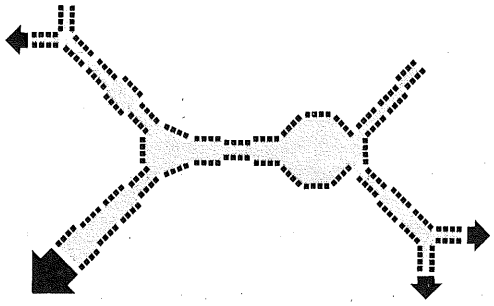

FIGURE .302
GROWTH POSSIBILITIES

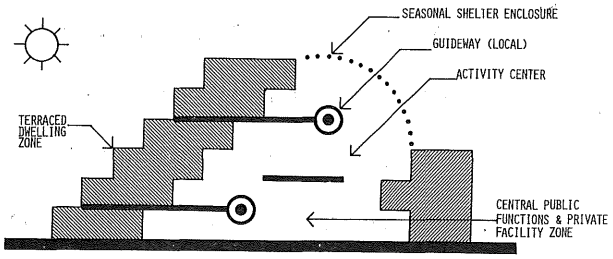

FIGURE .305
SCHEMATIC CROSS SECTION OF SUPPORT SYSTEM

By and large, these urban form implications point to a support system that is markedly more highly structured than the central city areas and central business districts we are accustomed to. Although many of the elements are the same: sidewalks, utilities, public transit, public gathering spaces, etc., traditionally these elements have been structured on a flat plan, two-dimensional basis.* Private development within this framework such as high rise buildings on their own parcels have supplied their own structural support and internal vertical access in the form of elevators.

The main ways that MXC proposed to depart from this pattern are to:

1. Supply three dimensional networks of public infrastructure instead of just at ground. This includes utilities, walkways, transit and other forms of access.
2. Expand the concept and state of the art of public infrastructure to include structural support systems for both public and private buildings, and large enclosure systems.

Preliminary user and economic studies have indicated advantages in both these proposed objectives. This support/shelter is a megastructure network system concept. Its form in the landscape, rather than being grid-like as present streets are, would be open-ended and branch-like so as to compliment open space and natural systems (see Illustrative Development Plans, Section 1.5.0).

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*Recent breaks from this pattern are using skywalks connecting second floor levels of downtown areas. The Twin Cities have been most sucessful in implementing this.

1.4.0 RURAL SECTOR FORM DETERMINANTS

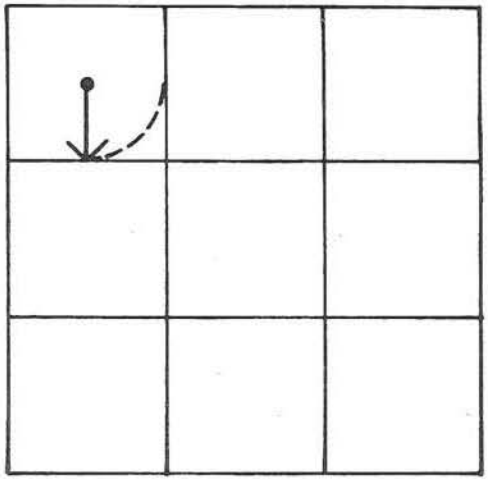
1.4.1 PLANNING RURAL SECTOR SERVICE AREAS

THE PLANNING GRID SYSTEM

Advanced planning of MXC service systems has applied a planning grid to the site to delimit conservation areas and workable service areas or development "cells".

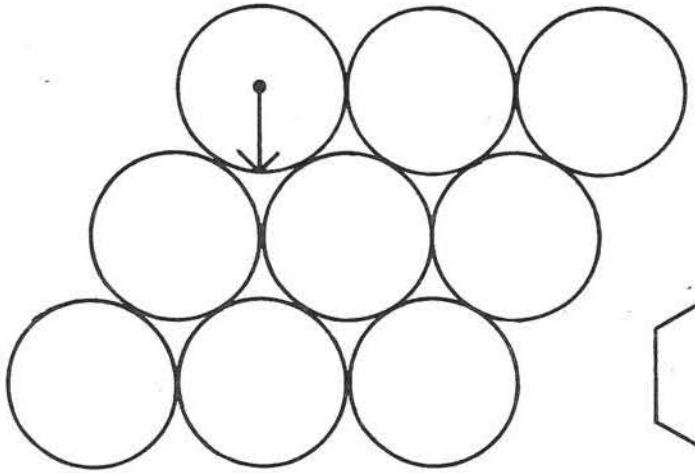
The grid is based on a hexagonal pattern as this is the most optimal for areal division of an undifferentiated landscape and population (Fig..400). In empirical analysis of the hierarchies of existing urban centers, this system has been found by Christaller (1933) and other researchers in central place theory, to be a useful way of describing the behavioral dynamics of larger and smaller centers over wide geographical areas (Fig..401). As it has in the past been used as a descriptor, it is used here as a planning tool.

The daily, weekly, and monthly activity systems of work, play, education, shopping, etc., will occur throughout the community, but chiefly in three main classes of place. These activities will occur (i) in the urban sector; (ii) in the activity centers dispersed in the rural sector; and (iii) to some degree, in the dwelling itself. Some of the activities occuring in these three places will overlap. Place-of-activity trade-offs are explored in Subsection 1.4.6.



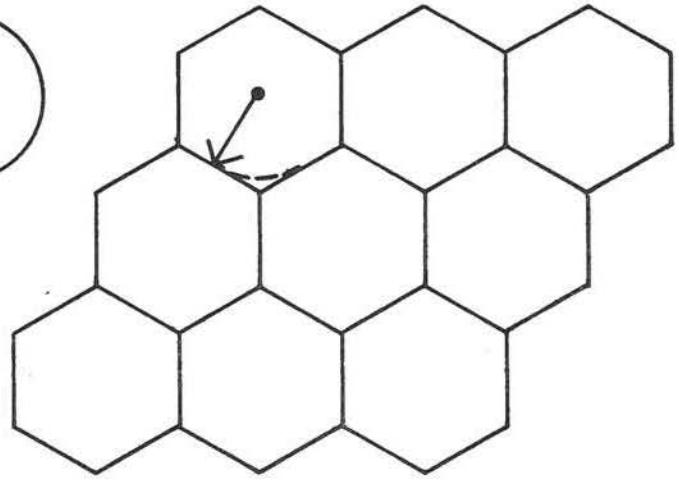
Square Grid

Corners not covered for equal access.



Circular Pattern

Some areas are not reached, or overlap occurs.



Hexagon

Maximizes equal access, best for close packed pattern.

FIGURE .400

FORMATION OF PLANNING GRID

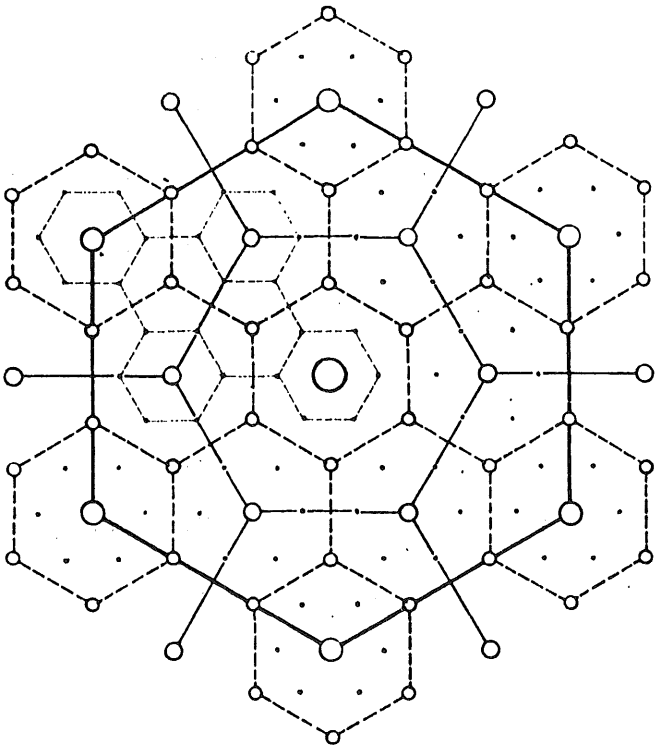


FIGURE .401
CHRISTALLER'S HEXAGONAL SYSTEM OF URBAN CENTERS

This section concentrates on the rural sector activity centers.

THE PLANNING CELL UNIT

Most of the year, the sites offer enjoyable walking environments and as an MXC objective, walking would be encouraged. The fundamental unit division of the MXC grid is based on a walking distance of 1 kilometer (approximately 5/8 mile). Given a pleasant path environment, this has been found in both American and English new community experience to be an acceptable distance for most people to walk. The 1 kilometer distance is measured from the most remote dwelling location at the outer limit of each hexagon to a desired facility at the center (Fig..402). The hex unit development cell is then 2 kilometers (approximately 1-1/4 mile) wide from side to side.*

The planning grid system has proved useful for preliminary planning purposes for the extensive MXC sites. Two variable sets alter the uniformity of this system in its actual site-specific application.

1. Those site elements that eliminate areas of the site from development and therefore from becoming <u>new</u> service areas.
2. Those factors that tend to alter or transform the uniform hexagonal geometry of the grid.

---

* This subsection develops the concept of the basic hex unit. There can be subdivisions within this basix hex unit as well as agglomerations of the unit to form larger service areas as noted in Section 1.4.6 <u>Activity Centers</u>.

875 ACRES
363 HECTARES

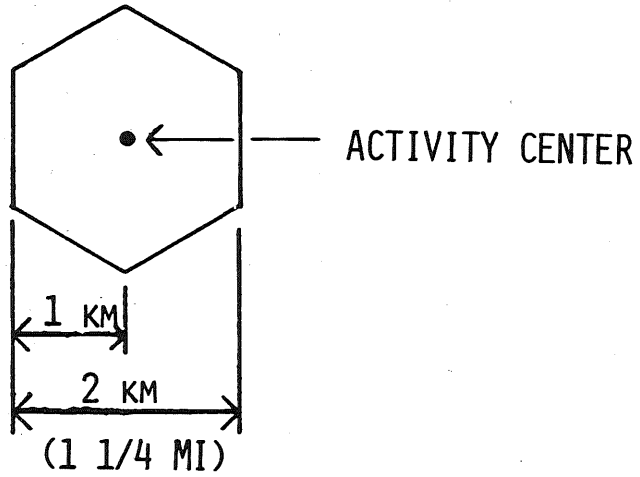


FIGURE .402
BASIC DEVELOPMENT UNIT

Under the first, the elements that would eliminate site areas from designation in the planning grid as development cells, are generally functions that are about as large as a planning grid cell itself and include:

- Large lakes
- Hydrology (large aquifers, flood plains, marsh areas)
- Existing and appropriate wildlife management areas
- Large highly productive agricultural areas

Small scale functions of farming, fishing, hunting, reforestation, and recreation places and trails would be accommodated within the development cells themselves.

Under the second set, the factors that would tend to alter or transform the uniform hexagonal geometry of the planning grid are:

- Attitudes and values of the inhabitants (both existing and new population) would tend to shape the service areas so as to create subculture units, or areas perceived as neighborhoods and villages.
- These units would be defined in both physical and non-physical terms. Physical barriers such as bosks of trees, wind rows, rivers, streams and lakes, fences, major movement system channels, etc., can be utilized or physically designed to form perceived boundary conditions and help to define a sense-of-place. This is the raw material that groups would use to help them generate a cohesiveness or identity in the physical setting. In short, the design process can provide activity centers and can identify and zone hospitable areas but the users generate the neighborhoods.

No matter how the geometry of the basic hex is transformed, the criterion of desirable walking distance to basic facilities would be maintained. Further, the sense-of-place or sense of identity to a place will be altered with the use of advanced telecommunication capabilities. As an objective, it would be desirable to provide a range of clearly defined options that would satisfy the need for the choices between place identity and a more diffuse, remote reference group -- a non-place realm that would be satisfied or achieved by remote access through transportation and telecommunications.

1.4.2 CLASSIFICATION OF PLANNING GRID CELLS

CONSERVATION AND DEVELOPMENT

For clarification, there are four basic types of cells in the planning grid system:

1. SMALL CONSERVATION CELL (includes agriculture, recreation, and ecological preserve)
2. SMALL DEVELOPMENT CELL (includes development, agriculture, recreation, and ecological preserve)
3. SMALL EXISTING TOWN CELL (includes existing development and functions same as 2)
4. LARGE MOVEMENT SYSTEM CELL (includes conservation and development cells)

Preliminary but careful ecological inventory and analysis of two sites has disclosed cell areas suitable for either designation as conservation or development. Of the rural sector site areas on two sites these are the proportions:*

---

* For a description of the process that was employed to select the final candidate sites, see Volume I, Site Selection Recommendations.

SITE	CONSERVATION CELLS	DEVELOPMENT CELLS
LAKE REGION	1/3	2/3
PINE MORAINE REGION	1/2	1/2

Table .403
PROPORTION OF CONSERVATION TO DEVELOPMENT CELLS

HOW DO THE EXISTING VILLAGES FIT IN?

As a major guiding principle of MXC is to respect the rural land, an objective is also to strive to preserve the integrity of the existing towns and villages which range in population between 100 and 500 people. One way that would further this objective would be to include the immediate service area of the village within the MXC planning grid and to work with the village in designating contiguous cells as either conservation or development where appropriate and desired (Fig..404).*

LARGE MOVEMENT SYSTEM NETWORK CELLS

The major movement system network, an automated guideway, schematically relates in geometry to the planning grid.** This movement system network grid itself is somewhat smaller

---

* The villages can be considered existing activity centers and are considered in this way in Subsection 1.4.6.

** See Transportation Part 2 for a description of the guideway system as well as a presentation of advantages of three-way intersections and the hexagonal network.

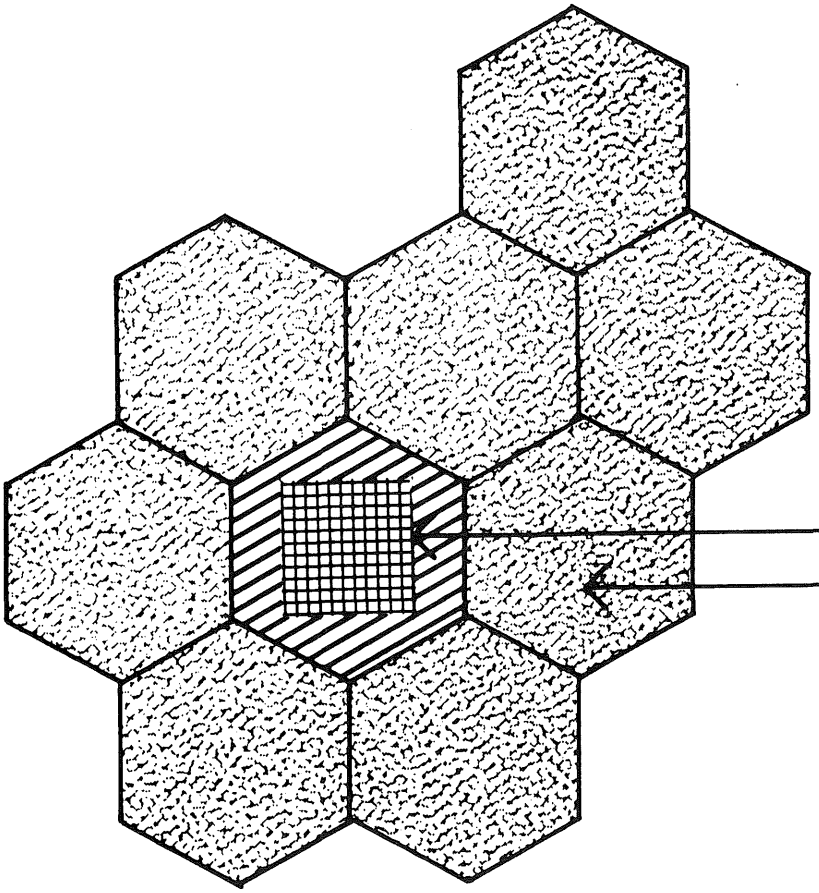


FIGURE .404

EXISTING VILLAGE SERVICE AREA AND BUFFER

in the Lake Region Site (Fig..405) than in the Pine Moraine Region Site (Fig..406) as the Lake Site has proportionally fewer conservation to development cells, as was seen in Table .403 (although the development would be less intense within those cells).

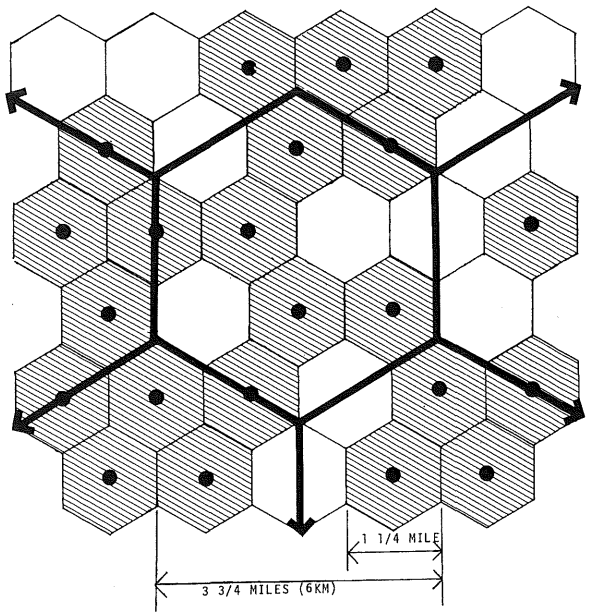


FIGURE .405
LAKE DISTRICT SITE MOVEMENT SYSTEM NETWORK CELL

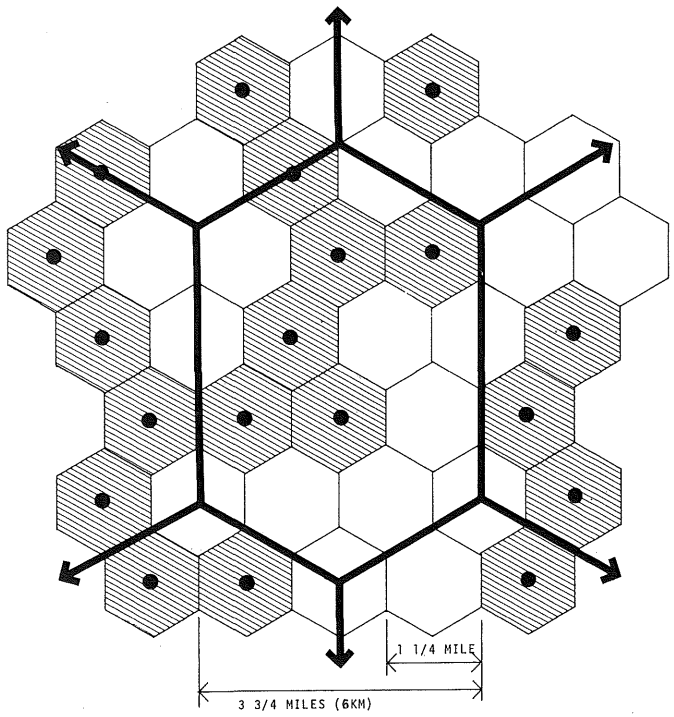


FIGURE .406
PINE MORAINE SITE MOVEMENT SYSTEM NETWORK CELL

1.4.3 INTERNAL STRUCTURE OF DEVELOPMENT CELLS

The following schematically illustrates elements of the method for structuring development within the cells.

CONSTRAINT AND OPPORTUNITY AREAS

The actual building areas within development cells are defined by identifying and eliminating constraint areas (Fig..407), and then by identifying and including the high amenity buildable zones in the interstices between the constraint areas (Fig..408). These interstitial development zones are then accessed by a feeder-road network system connected by junctions to the guideway (Fig..409).

OPEN SPACE/BUILT FORM NETWORK SYSTEMS

One of the basic innovations in design is that which would assure the retention of the rural quality of the site by guiding the development of MXC and the interweaving relationship between built-form and open space.

Traditionally, open space has been spot placed in cities as parks, or more recently it has ringed cities as green-belts or divided them as green wedges. An excellent concept that has been used repeatedly in most new towns is a system of interlocking fingers (sometimes called "Radburn Plan" after the 1930's Radburn New Jersey development). This combines cul-de-sac access roads where dwellings back up to common green areas which act as walking trails free of traffic

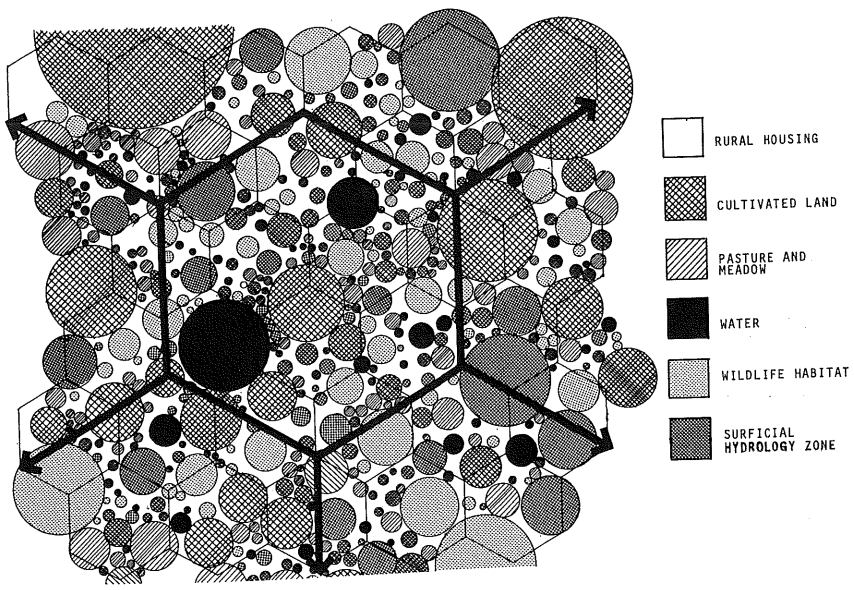


FIGURE .407
SCHEMATIC CONSTRIANT AREAS

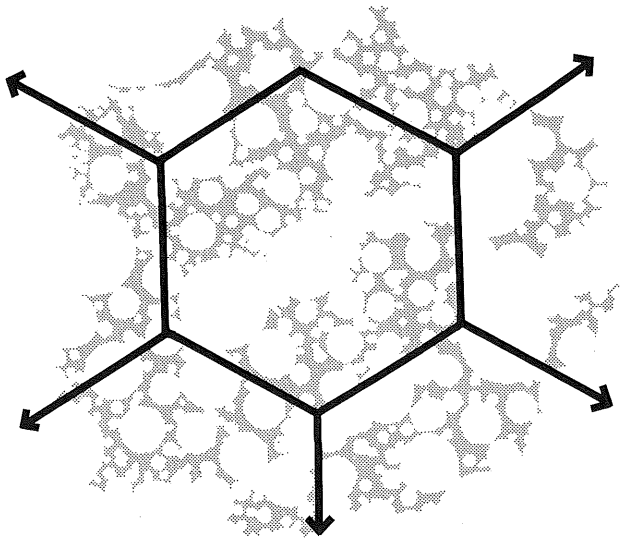


FIGURE .408
INTERSTITIAL DEVELOPMENT AREAS

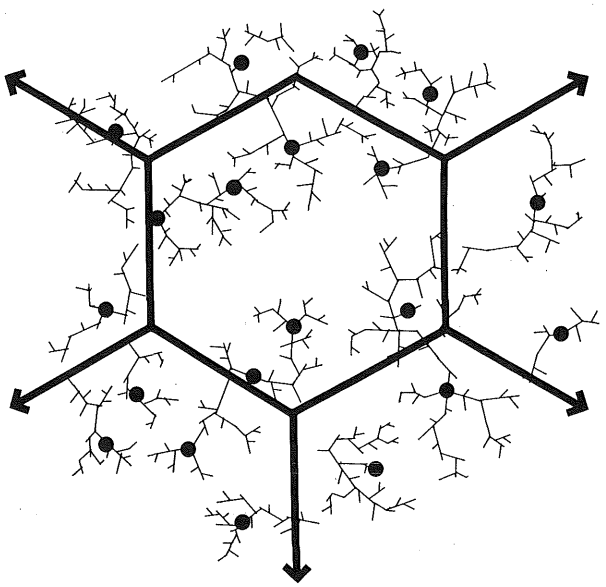


FIGURE .409
ACCESS NETWORK SYSTEM

crossings to schools or stores (shown as dots in Figure .410). These devices for the most part were generated from abstract geometrical notions of relatively dense settlement form and as such, none of them in the form they have been used in are adequate in planning and designing genuine rural housing areas.

In schematic design tests, MXC has applied an interlocking fingers system. This has proved highly effective for differentiating between open-space systems and built-form systems. It preserves the integrity of each system by avoiding crossings as does the Radburn Plan but compared in a similar scale (Fig..411) the size of the open space areas would be extensive enough to preserve rural character in MXC.

ACTIVITY CENTER, CORE AND SERVICE AREAS

At the approximate center of each development cell and buildable area is a core area. This contains an activity center that serves the entire cell and becomes a village-like focus for people living in the immediate vicinity. Several of these are diagrammed in approximate location to each other in Figure .412.* The exact locations of each activity center depends on local conditions of natural systems, characteristics of potential access, and potential demand.

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* See Section 1.4.6. for a more developed description of activity centers.

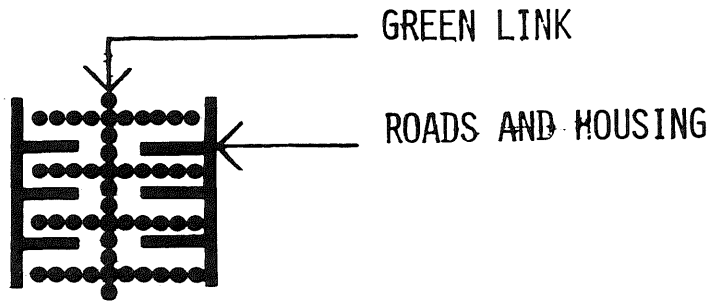


FIGURE .410
FINGERS CONCEPT - RADBURN APPLICATION

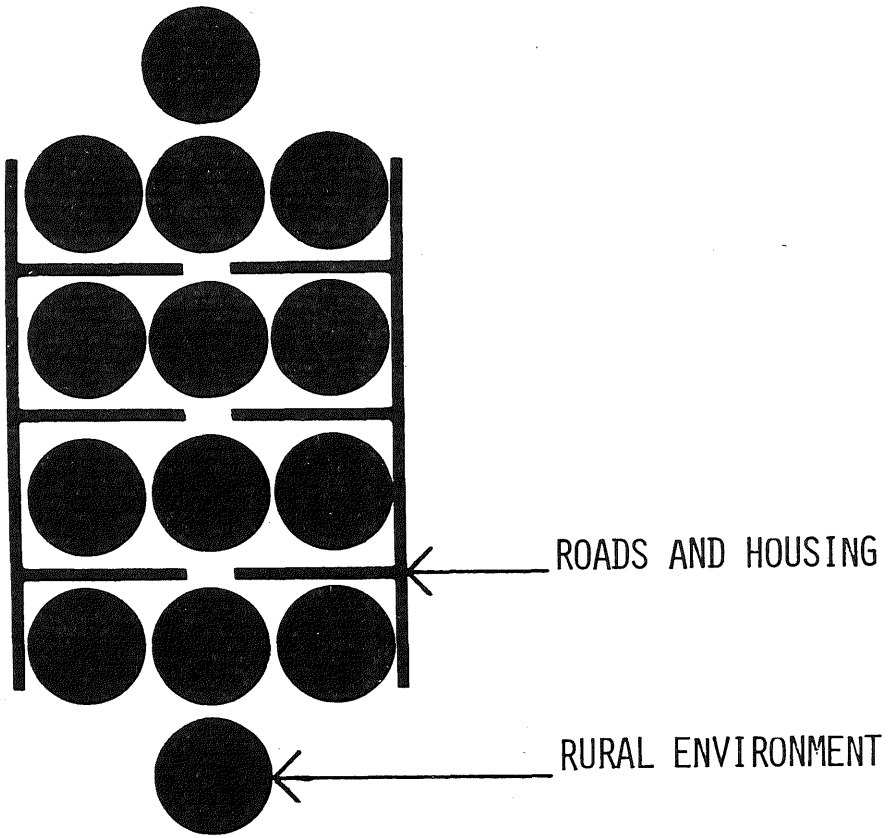
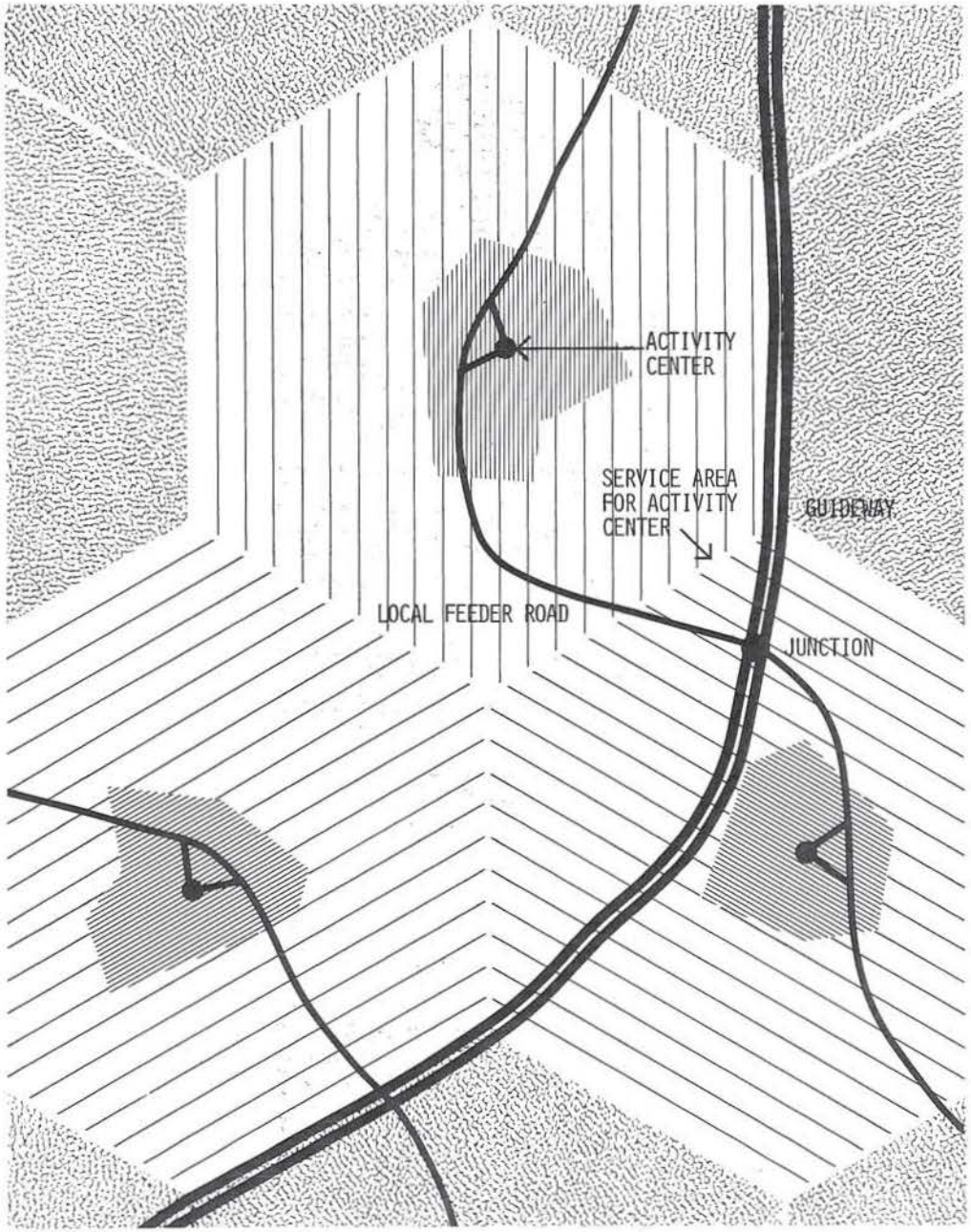


FIGURE .411
FINGERS CONCEPT - MXC APPLICATION



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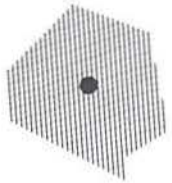
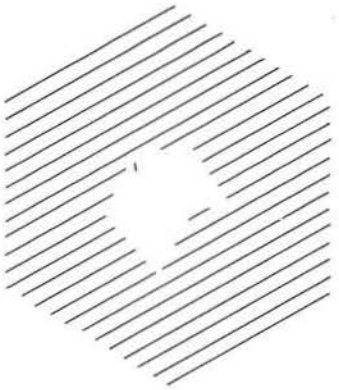
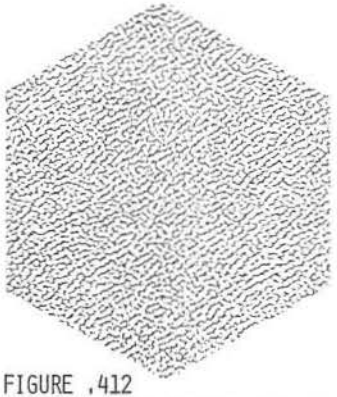


AREAS CONTAINING POPULATIONS OF APPROXIMATELY 300 PERSONS LIVING IN PERCEPTUAL PROXIMITY TO AN ACTIVITY CENTER



SERVICE AREAS POTENTIALLY CONTAINING POPULATIONS OF APPROXIMATELY 300 PERSONS LIVING IN PERCEPTUAL PROXIMITY TO RURAL ENVIRONMENT BUT WITHIN WALKING PROXIMITY TO AN ACTIVITY CENTER



CONSERVATION CELLS

FIGURE .412
POPULATION IN DEVELOPMENT CELLS

1.4.4 HOUSING DENSITIES

The foregoing subsections have described the general design mechanics of the structure of the rural sector. In the remaining subsections, elements dealing broadly with user needs and ecological requirements and how they would effect design are explored.

HOW TO DEFINE RURAL CHARACTER?

As a priority in the process of dwelling site design, a major area of attention has been in the definition of what constitutes rural housing densities given the existence of rural land characterized by farms, lakes, and forest.

In a first attempt to establish criteria for this, elements of behavioral psychology and perception have been of major concern. Defensible quantification of criteria has not yet been firmly established but main variables are identified (Table .413) and working assumptions established.

NEIGHBORING DISTANCE (longitudinal distance between each dwelling along access roads)

NEEDS

. Security and safety
. Communality
. Privacy

VARIABLES

. Sound of neighbors voices talking and shouting
. Sight of neighbors in day to day activity
. Feeling of being seen or heard by neighbors

MODIFIER

. Existence of natural screens such as land forms of vegetative cover between dwellings

RURAL DISTANCE (latitudinal distance between each dwelling and rows or clusters of dwellings across open space)

NEEDS

. Visual remoteness from built structures and domestic activity
. Visual and physical access to natural or agricultural open space

VARIABLES

. Perceived detail of form and activity of nearest houses or other structures
. Perceived level of natural or agricultural open space compared to non-rural areas

MODIFIER

. Existence of natural screens and land slope between dwellings or other built form

TABLE .413

RURAL HOUSING DENSITY CRITERIA

NEIGHBORING AND RURAL DISTANCE

For neighboring distance, preliminary study shows that needs for security, communality and privacy can be achieved from dwelling distances of zero (row houses) to forty feet. For rural distance, preliminary data from empirical observation on the Lake District site shows that this can be achieved with distances of between 100 feet and 1/2 mile depending on the nature of the intervening terrain and vegetative cover. This has provided guidelines for first dwelling density test studies.

Thick vegetation between dwellings provides a screening function for both neighboring and rural view-shed distances. This is especially effective when found in combination with slopes where the residents in dwellings on the upper part of a slope can look out between the trees free over the roof tops of the lower dwellings. In these cases, intervening view-shed distances can be reduced closer to the 100 foot figure while on open fields 3/8 to 1/2 mile distances should be maintained.

Rather than using the previously shown straight finger patterns, because of the large space between dwellings and the requirements of the terrain such as drainage patterns and slopes, a dendritic or branching system becomes advantageous. In the schematic representation of this in Figure .414, the dots represent housing development on this system.

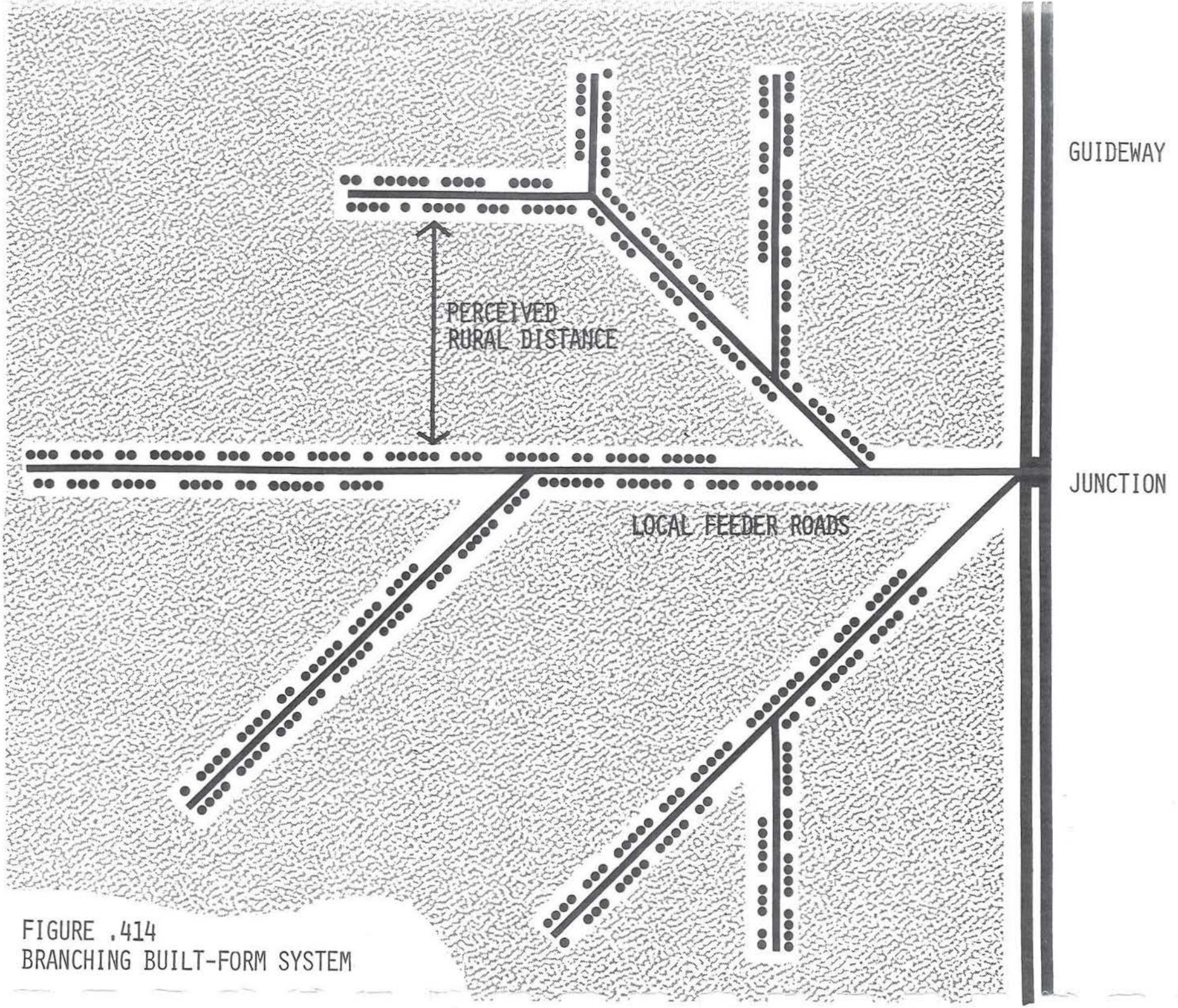


FIGURE .414
BRANCHING BUILT-FORM SYSTEM

1.4.5 ILLUSTRATIVE DENSITY STUDIES

A number of densities of dwelling units to land area were tested through design.

Three representative test designs are presented here. A preliminary analysis was done for a fairly typical 2000 acre detail study area on one site (Fig..415).

The analysis first inventoried the existing condition of the site (Fig..416). Potential land use and relative developable densities were then generated. These are shown in Figures .417 and .418.

ILLUSTRATIVE SITE PLANS

From the concepts and analysis described above, and shown schematically in the preceeding pages, site plans were designed. These display alternative densities in developing the site. Three plans, 1, 2, and 3, are shown in Figures .419, .420, and .421 respectively. The small black rectangles represent buildings. Table .422 shows essential gross data of each plan. A measure commonly used to compare development schemes is dwelling units per acre (in row G of the table).*

---

* Often the density measure is computed differently for different community development plans. Between plans there are inconsistencies as to what land constitutes net development, whether it is the actual lot itself, the lot plus roads and walks, or that plus all public areas relating to domestic use. Different developments relate these differently, so there is no precise basis for comparison.

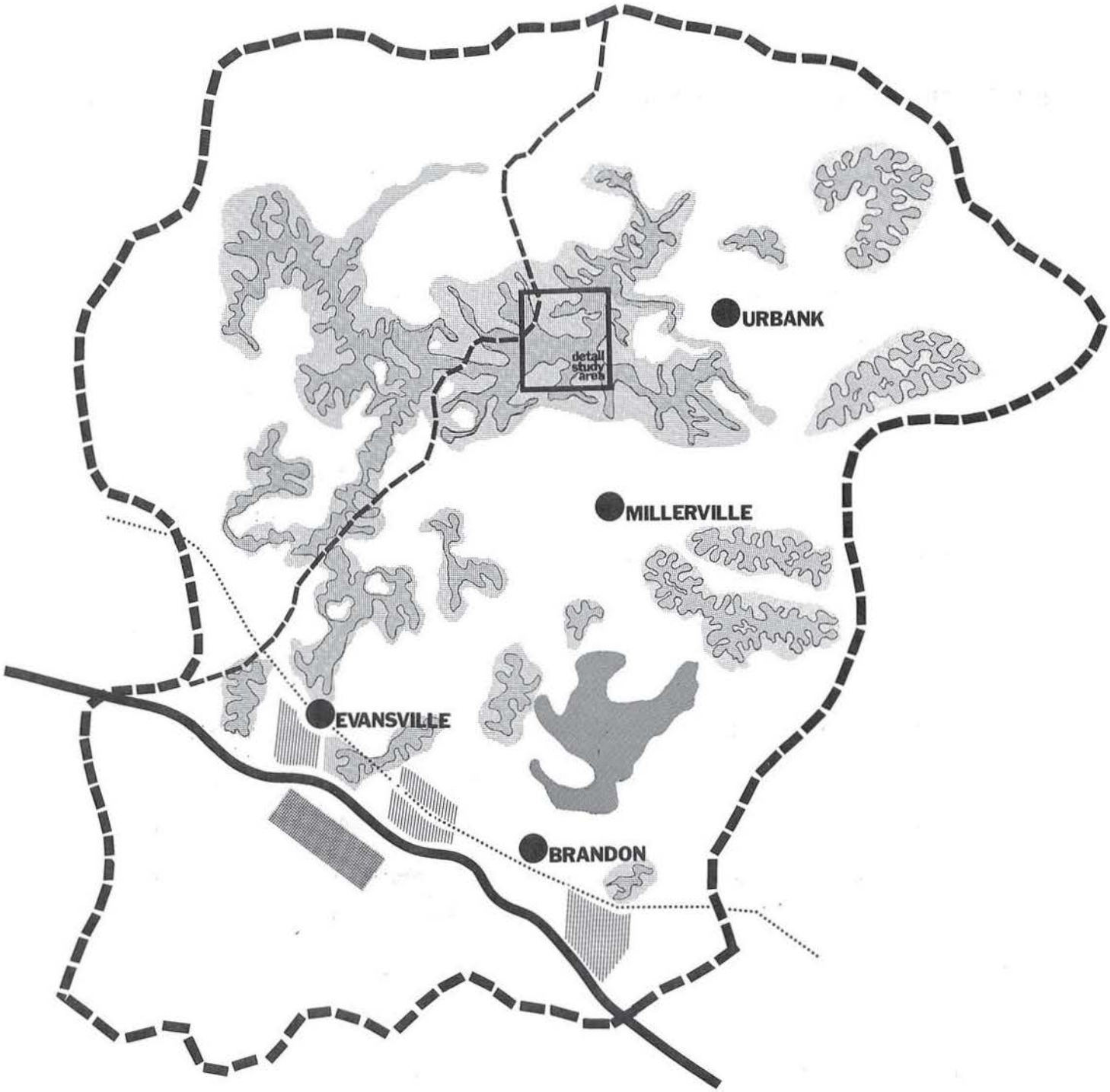
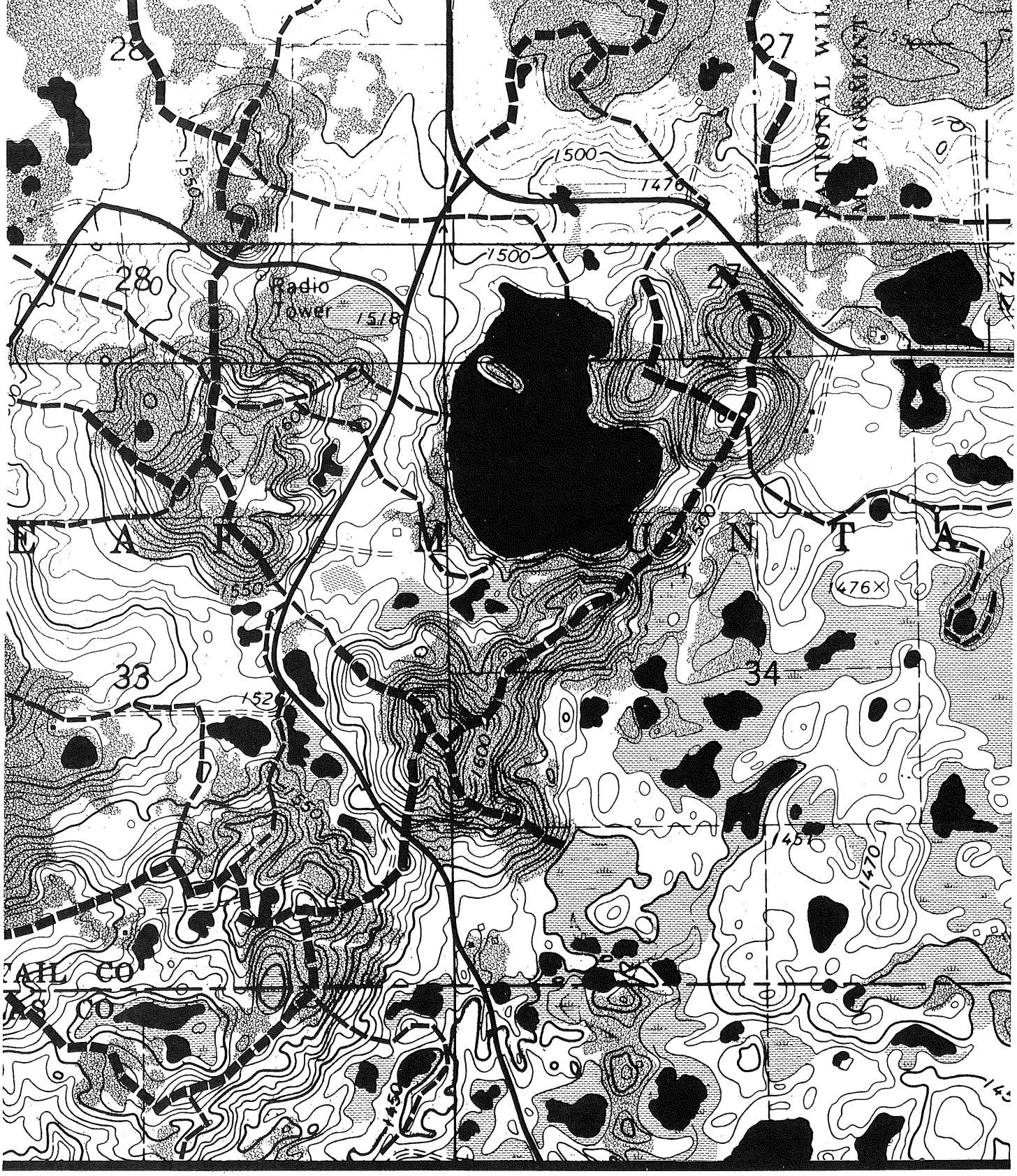


FIGURE .415

DETAIL STUDY AREA



LAND INVENTORY

MXC DETAIL AREA

FIGURE .416

POTENTIAL LAND USE

MXC

DETAIL AREA

0 1/16 1/8 1/4 1/2 mile

330 660 1320 2640 feet

- Major Ridge Lines
- Guideway
- Developable Land South Orientation
- North Orientation
- Open Space Agriculture
- Recreation
- Preservation, Grassland, Drainage

FIGURE .417

DEVELOPABLE DENSITIES

MXC

DETAIL AREA

0 1/16 1/8 1/4 1/2 mile
330 660 1320 2640 feet

1	Lower
2	Moderate
3	Higher
S	South Orient. W/ Vegetation
N	North Orient. W/ Vegetation
	South Orient. W/O Vegetation
RF	North Orient. W/Reforestation

FIGURE .418


ILLUSTRATIVE DENSITIES
MXC
DETAIL AREA
0
1/16
1/8
1/4
1/2 mile
330
660
1320
2640 feet
Activity Center
Employment
Guideway
Feeder Roads
.20
DWELLING UNITS/ACRE

FIGURE .419

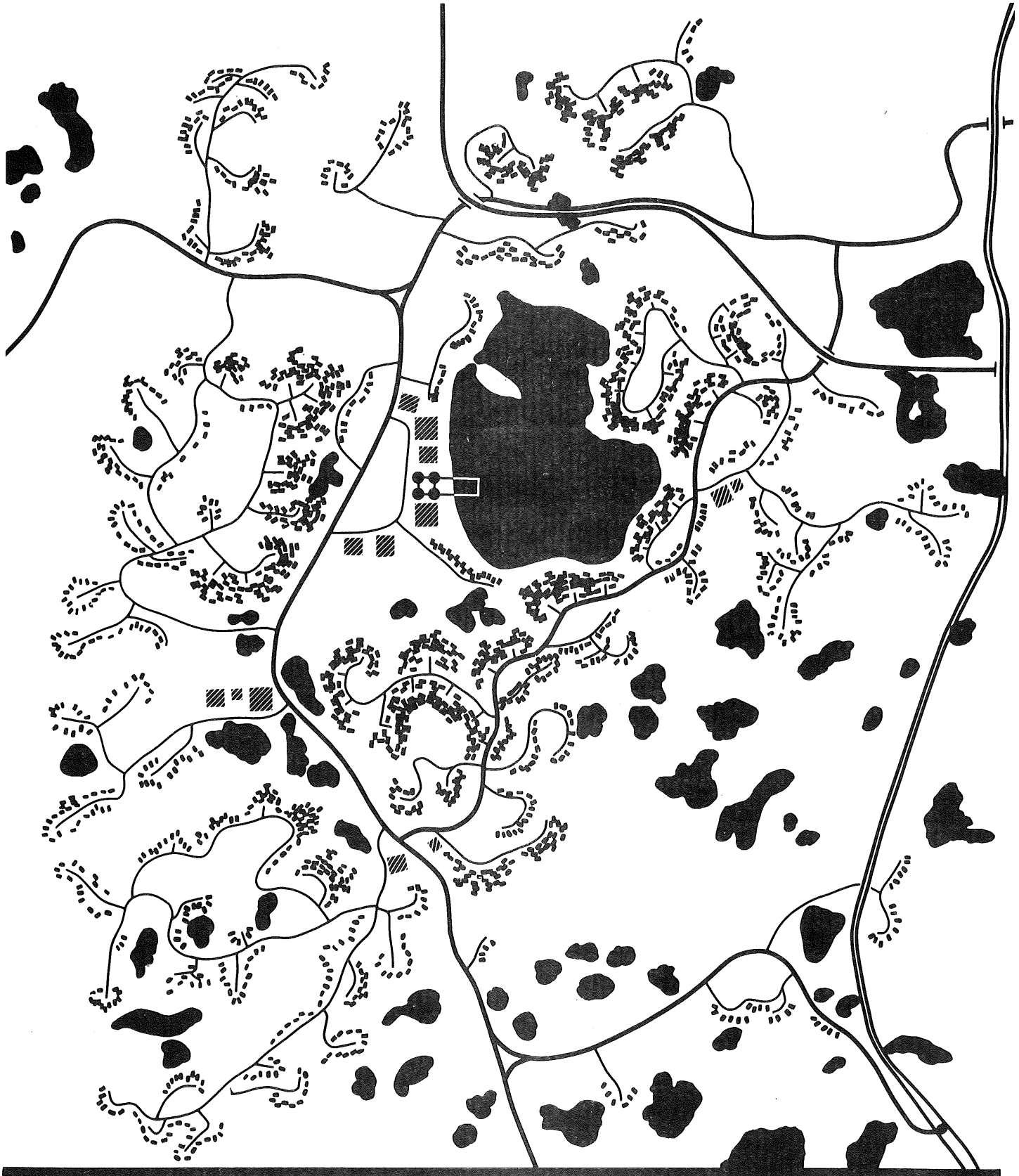

ILLUSTRATIVE DENSITIES
MXC
DETAIL AREA
0
1/16
1/8
1/4
1/2 mile
330
660
1320
2640 feet
Activity Center
Employment
Guideway
Feeder Roads
2
.90
DWELLING UNITS/ACRE

FIGURE .420

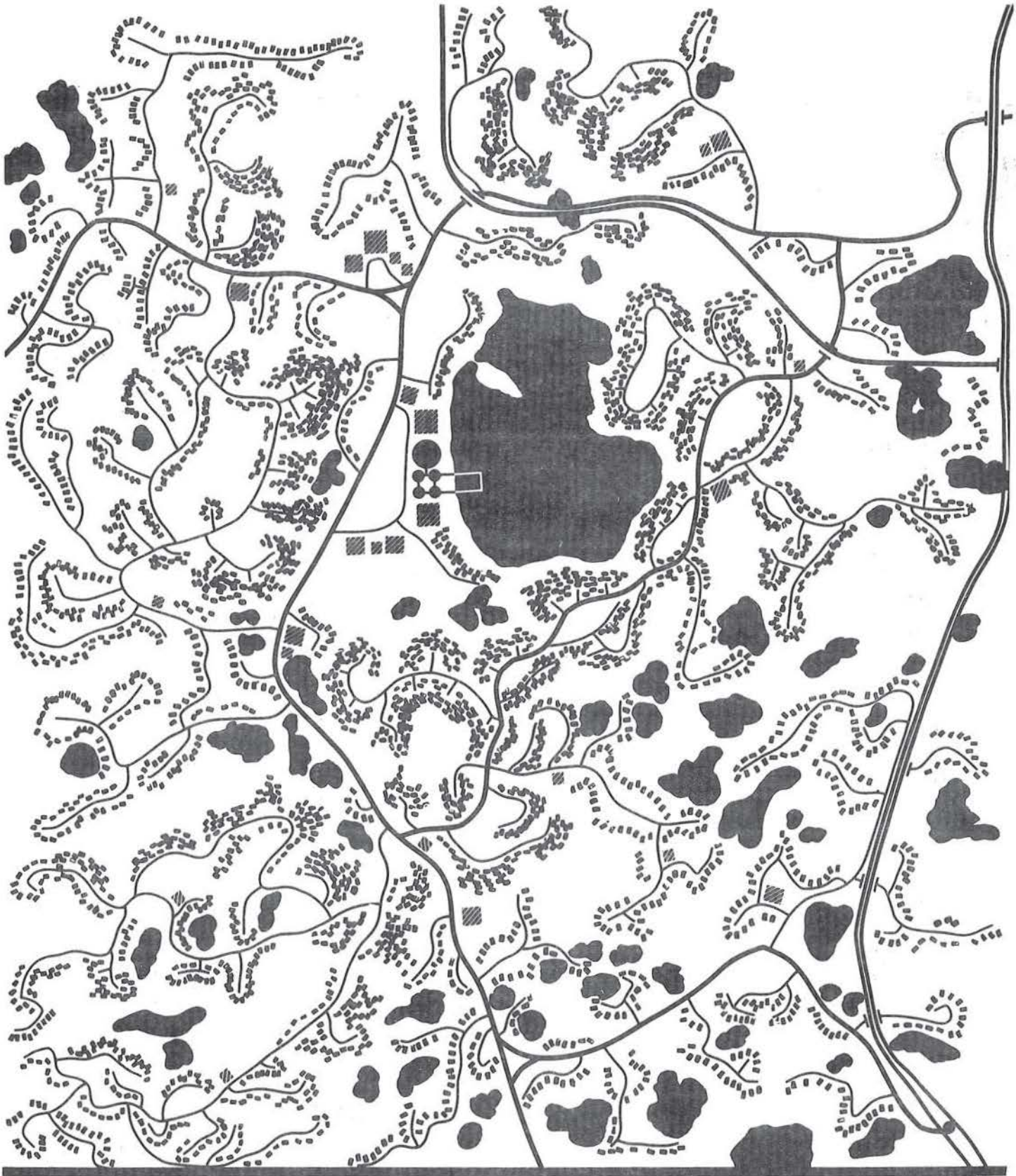

ILLUSTRATIVE DENSITIES
MXC
DETAIL AREA
0 1/16 1/8 1/4 1/2mile
330 660 1320 2640 feet
Activity Center
Employment
Guideway
Feeder Roads
3
1.70
DWELLING UNITS/ACRE

FIGURE 421

		PLAN 1	2	3
LAND SIZE	A. Acres on map*	2,000	2,000	2,000
	B. Acres in cell*	875	875	875
	C. Hectares on map	820	820	820
	D. Hectares in cell	360	360	360
POPULATION	E. on map	1,260	5,700	10,700
	F. in cell	550	2,500	4,700
DENSITY	G. Dwelling units per acre	.20	.90	1.70
	H. Population per acre**	.63	2.85	5.35
	I. Dwelling units per hectare	.49	2.20	4.15
	J. Population per hectare**	1.54	6.95	13.00
TOTAL DWELLING UNITS	K. on map	400	1,800	3,400
OPEN SCALE RATIO	L. Ratio of built-on land to total land	1 to 30.0	1 to 6.5	1 to 3.4

TABLE .422

ILLUSTRATIVE DENSITY IN RURAL SECTOR

* On map refers to the total illustrated site plan. In cell refers to the service area of the hexagonal development cell. For convenience for those using metric measure, figures are given in hectares as well as acres.

** Population per dwelling unit is computed at 3.15 persons. (Thompson, et al. 1971)

These densities are computed for the gross land area which in Plans 1 and 2 include considerable portions of conservation, recreation, and agriculture.

Another measure useful for comparison is row L, the ratio of built-on land to total land.* This shows the relative proportions of built-on land (lots) to open spaces.

These studies as shown here are meant to document and display some of the detailed design thinking behind the dispersed rural development concept. It should be emphasized that at present there is not sufficient analysis to suggest comprehensive policies on the maintenance of rural land with extensive new development. This would come later -- in the next phase of design. The studies, however, speak for themselves and some generalizations can be made.

---

* Built-on land is computed at 7000 square feet per dwelling unit -- about 1/6 of an acre. This is a conservative figure (meaning generous), and would allow a householder a bit of personal territory to call his own.

CONSTRAINT AREAS

In Plans 1 and 2 the constraint areas from the site analysis were respected. (These are mostly agriculture and wetlands.) The dwelling distribution in Plan 3, however, was forced to occupy areas identified as ecologically sensitive -- especially in the South-east (lower right) portion of the detail study area.

AVOIDING CONCENTRATION

Concentrating densities in selected areas by the use of garden apartments of high or mid-rise building would allow densities to thin out elsewhere, thereby relieving sensitive areas from development.* But as this would destroy the rural or village character of the landscape, in no case was high or mid-rise building considered in the design test, although in Plans 2 and 3 dense cluster units were applied. By any rural atmosphere criterion, however, neither dense cluster housing nor mid and high-rise building would be acceptable. This would very likely hold for both the village proximity dwellings and rurally oriented dwellings.

If the general density structure of these plans are visually compared to those of some suburbs or new communities, it will appear that Plans 2 and especially 3 are very similar to them. Neither of these plans would satisfy the objective of retaining the rural quality of the territory.

---

* Even though the sensitive areas would be free from construction, very large adjacent populations, if they had access to this land for recreation use, would place severe strain on its tolerance to intrusion.

Plan 3 is almost totally subidvided and developed. The density of this plan is about 3 1/2 or 4 dwelling units per net acre. This is typical of many suburbs and new communities, which, according to the Metropolitan Council's figures, include those in the developing area around the Twin Cities.

THE RURAL DENSITY

Plan 1 is the closest tested to maintaining a perceived rural environment (with present criteria). This is a density of .20 dwelling units per gross acre or the equivalent of one dwelling units every five acres. At this phase of design analysis, then, this is about the median density that would be optimum in preserving the rural quality of the living environment in the rural sector.

It should be clarified that this is not large lot zoning. Each dwelling would not be at the center of its own five acre parcel. The one dwelling unit per five acres is a gross figure for total development-cell land. The plan shows that most dwellings are kept within sloped and tree covered comfort zones (Fig..423), while organizing their zoning efficiently along linear infrastructure.

While there are proportionally more feet of infrastructure per dwelling in this plan, this is not relevant in itself as a cost factor. The need for piping and wiring is reduced or eliminated by energy, water sources and waste treatment autonomous to individual or groups of dwellings (see Energy and


ILLUSTRATIVE DENSITIES
MXC
DETAIL AREA
0 1/16 1/8 1/4 1/2mile
330 660 1320 2640 feet
Wooded Areas
.20 DWELLING UNITS/ACRE

FIGURE .423

Waste Management, Part 6), and the low flow rates on the feeder roads can allow them advantageously to be non-paved (see Transportation, Part 2).

In Plan 1, as noted, the amount of land controlled by each dwelling is relatively small.* This way, even though a householder in the rural sector does not own or control the intervening space between dwellings, in effect, he visually owns it and under some conditions, can use it. (Much of this land would be managed or its use influenced by the development entity.) To emphasize this point, residents and others can enjoy the rural space between dwellings as visual borrowed space, as well as being able to physically use it in well-placed trails, nature, re-creation, and agricultural areas (Fig..424).

AVOIDING RESTRICTIVE ZONING

As the rural sector dwelling sites are not large lots, the zoning statutes that guide the housing development would not be restrictive zoning, which is often a consequence of large lot zoning. The goals of MXC require it to be an open community. Through a housing assistance program, low and moderate income residents would be accomodated within the community.

---

* This can be ownership in fee simple or long term lease with renewal options. In the latter alternative, the increment on the land accrues to the community to allow it to finance services. (See Volume III on Techniques of Acquisition and Control.)


ILLUSTRATIVE DENSITIES
MXC
DETAIL AREA
0
1/16
1/8
1/4
1/2mile
330
660
1320
2640 feet
Pedestrian Paths
Neighborhood Parks
Active Recreation
Agriculture
Grassland
.20
DWELLING UNITS/ACRE

FIGURE .424

1.4.6 ACTIVITY CENTERS

EXISTING AND NEW CENTERS

As previously noted, existing resources on the sites include several villages, the integrity of which MXC development would endeavor to preserve. Their population ranges between 100 and 500 persons. Thirty or thirty-five percent of the total MXC new population would be housed in areas that are closely related to new activity centers (or villages). The general method for locating activity centers is described in Subsection 1.4.1, Planning Rural Sector Service Areas. To remind the reader, the majority of dwellings in the rural sector will be within 5/8 of a mile walking distance of a small activity center. These centers will include functions of employment, education, health care, convenience shopping and recreation and entertainment. The full mix of these various small scale facilities would be a force for mutual enrichment and economic support.

The number of functions, their exact mix and size is yet to be determined by future activity system demand models and economic studies that would include estimates on frequency of use. Some preliminary suggestions commensurate with the innovative thrust of the advanced systems design are described in this subsection.

DISTRIBUTION OF CENTERS

The areal distribution of activity centers in the rural sector would be dispersed equally throughout the site, and would be concentrated in the urban sector but would be distributed throughout the megastructure. It would be desirable that the centers in the rural sector not be completely autonomous but would draw upon the urban sector for major services and variety of services not found in the rural sector.

New activity centers would not only be unique in character and composition from each other but they would vary in size and accomodations. The two basic types are:

1. Convenience Center
2. Multi-service Center

An inventory at two sites disclosed convenience centers and "partial shopping centers" (which come closest to the multi-service center model). They have approximately those facilities listed in Table .425.

	ACTIVITY CENTERS					
	CONVENIENCE CENTER		PARTIAL SHOPPING CENTER			
VILLAGE	A	B	C	D	E	
	*	*	*	*	*	School
	*		**		**	Church
			*	*		Bank
		*	**		****	Grocery
			*	*		Hardware
			**	*	****	Cafe
			*	*	**	Bar or night club
	*		*		*	Liquor Store
			*		*	Post Office
			*	*	*	Fire Department
			*	*		Lumber Company
	*			*		General Store
				*	*	Drug Store
	*		*	***	***	Gas Station
			*			Car Wash
					*	Motel
				*		Bowling Alley
					*	Beauty Shop
			*	**		Grain Elevator

TABLE .425

EXISTING ACTIVITY CENTER FACILITIES

CONVENIENCE CENTERS

A new convenience center would be in the nature of a general store with a small number of selected popular items, food stuffs, liquors, drugs, notions, periodicals, hardware. There would be a miniature restaurant or snack bar for short order meals, possibly a pub, and a meeting room from group interaction. Possibly prescriptions could be obtained here. Learning facilities would be located in the same shelter or close by.

The activity center in Plan 1 (Fig..419) shows the approximate size of this facility. Places of employment and major active recreation areas would be located close by. The entire convenience center complex would be a multi-purpose moderately active node of attraction for all ages, at all times of day and evening.

MULTI-SERVICE CENTERS

Multi-service centers would contain functions of partial shopping centers. The following randomly lists some of the functions, services and commodities available there: *

- Club and meeting rooms
- Social meeting places
- Stage or theatrical space (indoors and outdoors)
- Laundromat and cleaning
- Lavatories, public
- Information booth
- Local government and political headquarters
- Automobile service station
- Private parking
- Public parking
- Unsupervised play spaces
- Supervised play spaces

---

* Many of these would be at the same scale as those in the existing villages and could be locally owned and operated.

- Community telecommunications facilities
- Legal and professional services
- Medium playing field
- Public bath
- Restaurant
- Bar
- Pool hall
- Gymnasium
- Swimming pool
- Tennis courts
- Beginning life center
- Educational resources center
- Health clinic or physician
- Convenience grocery store
- Delicatessen and bakery
- Drug store
- News and periodicals
- Hardware store
- Employment opportunities
- Vehicle stands for
  - Taxi bus (for quick call up)
  - Ambulance (helicopter ambulance every several service areas)
  - Mobile learning center adjunct
  - Mobile diagnostic and health care unit

EDUCATION, HEALTH AND SOCIAL SERVICES*

Multi-service Centers would focus on human services. Persons of all ages would go to the centers for a variety of reasons: to meet with teaching resource persons or learners for specific "curriculum type" meetings/seminars, for tutoring in subject areas, for community-centered discussions, and for personal conferences with health resource persons. Multi-service centers are the nearest equivalent to present day schools.

These Centers will be established to deal with personal problems, community problems and issues, equipped to hold

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* This is included here to convey the dimension and scope of the Center make-up. For a more comprehensive presentation of both the Learning and Health Care systems, see Parts 4 and 5.

seminars, and be staffed to meet the needs of the families regarding education, i.e., reading, writing, math, etc. However, learning and education in general will no longer be "channeled" by a teacher. Instead, tools, equipment, special facilities and resource people will be the key to knowledge in the new community.

The integration of human services suggest far more than the above. The following main areas would be included:

1. Human potential - Religious and psychological resource persons and programs to aid every resident in developing his or her physical, mental, and spiritual potential.
2. Prevention - As it is more effective to practice prevention than treatment, the following areas will be emphasized:
   - Pre-parent counseling.
   - Nutrition. For people who want information about food quality and supplements.
   - Pediatric examinations for children. There is concern that many children never receive an examination to detect neurological impairment or other learning disability problems.
   - Outreach Service programs. Human beings need to help one another. Outreach is a requisite for a community which strives to be self-organizing, especially in the human development and growth spectrum. Again the choice is between low cost preventive programs and the costly post-facto treatment programs of damage-repair and remediation.

. Immunization programs. MXC would provide a basic immunization program that includes tetanus, measles, mumps, diptheria, DPT booster, Salk and vaccines and also data collection relative to disease history as well as history data on allergies, ear/hearing defects, diabetes, epilepsy, circulatory system conditions, orthopedic abnormalities operations, serious injuries, medication, etc.

. Dental care. To include early and full range treatment program from oral hygiene through orthodontic treatment.

3. Environmental monitoring - Activity centers would be a possible focus for environmental monitoring.

. Specifically, as learning centers for data collecting/ reporting centers on air and water pollution.

. On food contamination/degradation.

. On radiation.

4. Treatment programs - In the areas which especially draw together the learning and health care systems.

. Programs for special persons. Mentally retarded, emotionally disturbed, physically handicapped persons may need special programs. Resource persons will perform a variety of roles including those of tutors, recreation leaders, counselors, physical therapists and rehabilitation therapists, etc.

. Health center programs. Integrating treatment programs for the young, the aging, for those with mental and emotional problems, etc., will require a number of services which we will need to define, such as outpatient treatment

for minor illnesses, diagnosis and referral, maintenance programs, x-ray programs, weight control programs, treatment up to but not including surgery, etc.

5. Educational possibilities - All of these have implications for specific learning opportunities, among which are the following:

   . Vocational education, for work in the human services of health, nutrition, occupational therapy, recreation, rehabilitation, etc.

   . Training of paraprofessionals

   . Health and sex education

   . First aid training

   . Health consumership (especially food technology)

6. Social service

   . Family and individual problem counseling

   . Welfare information and administration

   . Career and avocational counseling

   . Job mart

   . Unemployment insurance information and administration

The Activity centers in Plans 2 and 3 (Figs..420 and .421) show the approximate relative size of multi-service centers. It should be noted that although these centers were sized to accommodate the population densities shown on their respective maps, either of them might be equally appropriate on Plan 1 (Fig..419) where they would service larger areas than the 2 kilometer development cell..

LOCATION OF BASIC EMPLOYMENT

MXC will experiment with smaller settings of employment. It is anticipated that some portion of industry (about 50%) will be decentralized and distributed throughout the site in the form of small (20 person average) feeder or finished product plants, or service industry offices. Many of these employment facilities will locate directly in activity centers and there become adjuncts of the learning system which will be in "family life" centers within the same activity center area. As learning system adjuncts, the business operations will have a constant labor force availability.

This decentralization of half the employment provides the possibility of reducing the journey to work to less than 1/2 mile walking distance for half those employees living on the site. There is an important trade-off here in that instead of moving people from home to shop or office, this system would move messages in the case of service industries; and in the case of manufacturing (small size and high value added products), it would move raw materials in and finished products out. If the plant is a small feeder plant, instead of shipping finished products out to markets, it would deliver finished piece goods to the main assembly plant located close to major transportation access (Fig..426).

There are advantages to this form of decentralization for both the employer and employee. The serious problems in many industries of low productivity, absenteeism and industrial sabotage, have been directly related to worker alienation.

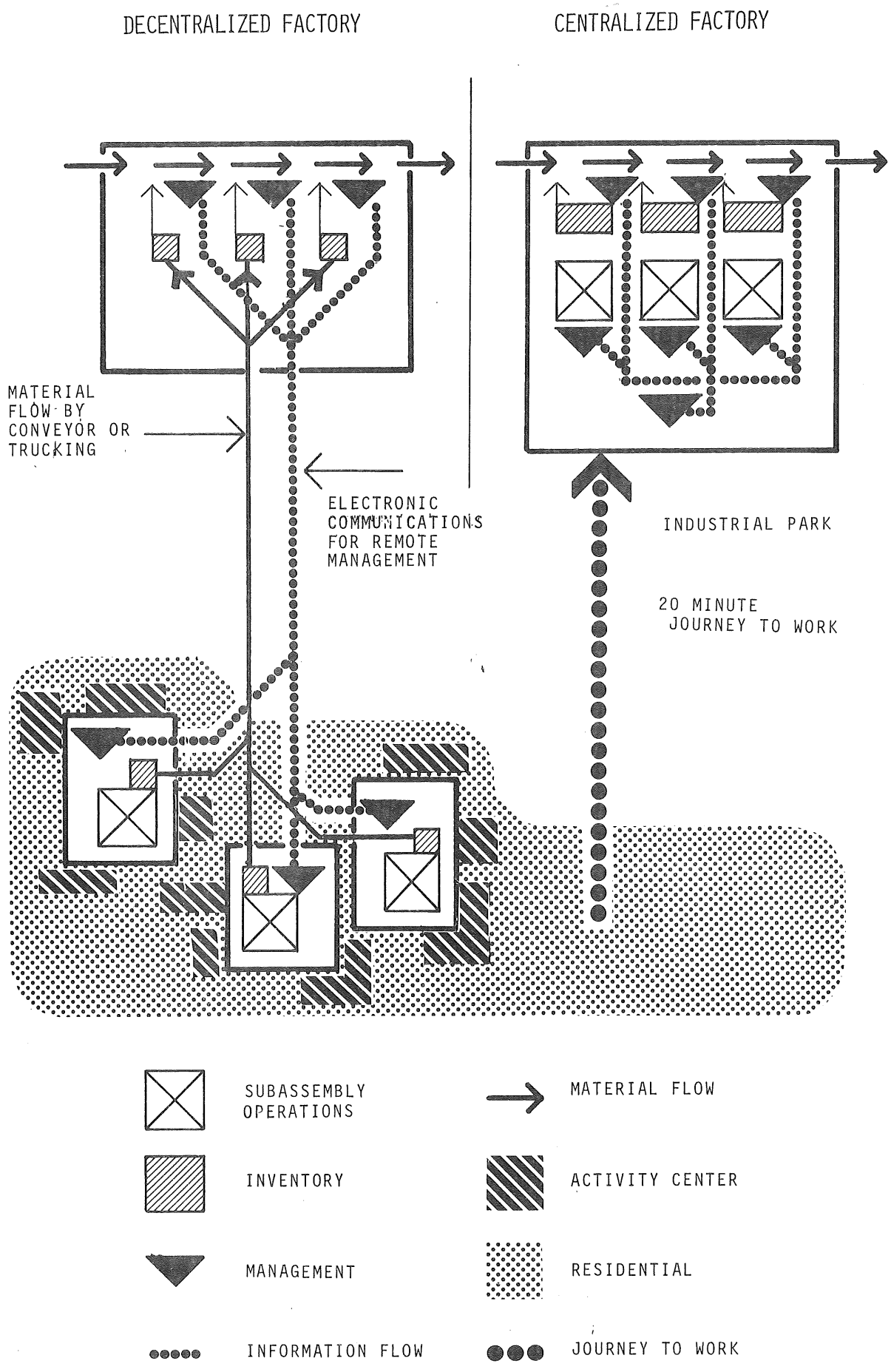


FIGURE .426

COMPARATIVE PLANT LAYOUTS IN THE COMMUNITY CONTEXT

To reduce alientation, some industries here and abroad are starting to explore job enlargement (making whole pieces or dealing with whole systems instead of parts), or job rotation (different types of jobs in series). But worker alientation is also caused in some cases by the impersonal giantism of most present work settings. Alientation and its resultant problems can be seen as a diseconomy of scale. This is a diseconomy that job enlargement and rotation will not in themselves alleviate. The objective is to disaggregate the large organization so that the employees can perceive a sense of control of their own working lives and environment and to do this economically. The Economic Base Study, Volume IV, shows industries in MXC will be labor intensive rather than capital intensive and as such would not benefit greatly by large scale centralized operations.

Some problems that may be encountered with decentralized employment operations can be overcome by a synergistic relationship with other MXC systems. Functions such as product inspection and quality control, inventory control, and management, can be economically accomplished by the telecommunication institutional network with its two way video and voice return and data processing capability. For example, it would be possible to inspect some products visually at a main assembly plant by a remote TV camera placed in the feeder plant. The functions of delivery of materials and products can be accomplished economically by the dual-mode guideway system. Energy, heat, the processing of industrial waste, and the control of noxious emmisions

can be offered as services to small plants or shops by miniature total-energy plants located at activity centers.

Briefly, then, in this design strategy phase of planning the integration of MXC systems is designed to benefit many user groups - residents, workers, industry and business alike.

INFLUENCE OF MOBILE SERVICES ON ACTIVITY CENTER ATTRACTION

User attraction to activity centers will be altered downward by accessing some of the services they offer by telecommunications and physical mobility. Traditional examples of mobile services are, of course, traveling carnivals, mobile medical diagnostic units, and delivery vehicles of all kinds. The types of services that are good candidates for mobility are those that require a great deal of complex or specialized equipment or commodities and whose function would be better applied by close physical proximity to populations but which need not be continuously located at all activity centers.

Table .427 lists some tentative preliminary suggestions for facilities or functions that might lend themselves to mobile, fixed, and fixed-adaptable modes. When a facility is mobile it might be designed as a break-off module that could be attached and detached to a fixed facility for a given period

	RURAL SECTOR (DISPERSED ACTIVITY CENTERS)			URBAN SECTOR (COMPACT ACTIVITY CENTERS)		
	MOBILE	FIXED	FIXED ADAPTABLE (time)	MOBILE	FIXED	FIXED ADAPTABLE (time)
DWELLING	.mobile homes on ground .houseboats	. inn's	.adaptable & expandable dwellings on ground	.mobile homes on support structures	.fixed dwellings hotel, motel, etc.	.sanctuaries .adaptable and expandable dwellings on supp. structure
WORK	.mobile units w/ specialized equipment going to work on demand.	.CATV .small work settings .on demand work (personal demand	.adaptable & expandable work shelters	.mobile units w/specialized equip. going to work on demand	.CATV .small work settings .on demand work (personal)	.adaptable & expandable work shelters
LEARNING	. learning resource units	.learning shelters	.adaptable & expandable learning shelters on ground	.mobile facilities in gallery stimulus centers	.learning shelters in gallerys and domes	.adaptable & expandable learning shelters in gallerys and domes
SHOPPING	.vehicle delivery of food and goods	.small convenience stores .go to source (farms, etc.)	.CATV .fairs .markets .weekly farmers types	.tube delivery of food and goods	.small convenience stores	.bazaar type shopping .CATV
ENTERTAINMENT	.carnivals .theatres .circuses .sequence of moving	.animal sanctuary (natural zoo) .video theatres .dance facilities	.holographic epic theatre outside	.indoor and outdoor carnivals .learning/movement system	.stimulus center .cinema & video theatres .dance facilities	.holographic epic theatre galleries and domes
RECREATION	.floating marina	.active & passive .small & large land related observ. towers	.trails seasonal & movable	.slides-nets .Tarzan type swinging vines	.observation platforms small & large (behavior settings	.paths .adaptable walkways .arboretum
HEALTH	.small clinics & diagnostic units located by demand	.small clinics	.small clinics	.small clinic & diagnostic units located by demand	.hospital or related dis-aggregated health centers	.hospital or related dis-aggregated health centers

TABLE .427

POSSIBLE ALTERNATIVE SPATIAL DISTRIBUTIONS OF FACILITIES

of time. A mobile diagnostic unit with special equipment might interface with a small convenience center in a service area for one week, then visit another center. Mobile learning-resource units might make the round of Learning Centers on a regular basis or on demand and also be able to interface with the physical structure of the Learning Centers as a kind of break-away room. Smaller versions of these could serve individual dwellings when unusual circumstances required it.

Design criteria for these mobile break-away units might advantageously direct them toward "mellow" design, more natural than machine-like -- using natural wood paneled vehicles for example, similar in concept to early station wagons.

NEW DWELLING RELATED FUNCTIONS INFLUENCE ON ACTIVITY CENTER ATTRACTION

In the rural sector questions of access to employment, services and recreation as well as access to tools and parts may be related to dwelling design.

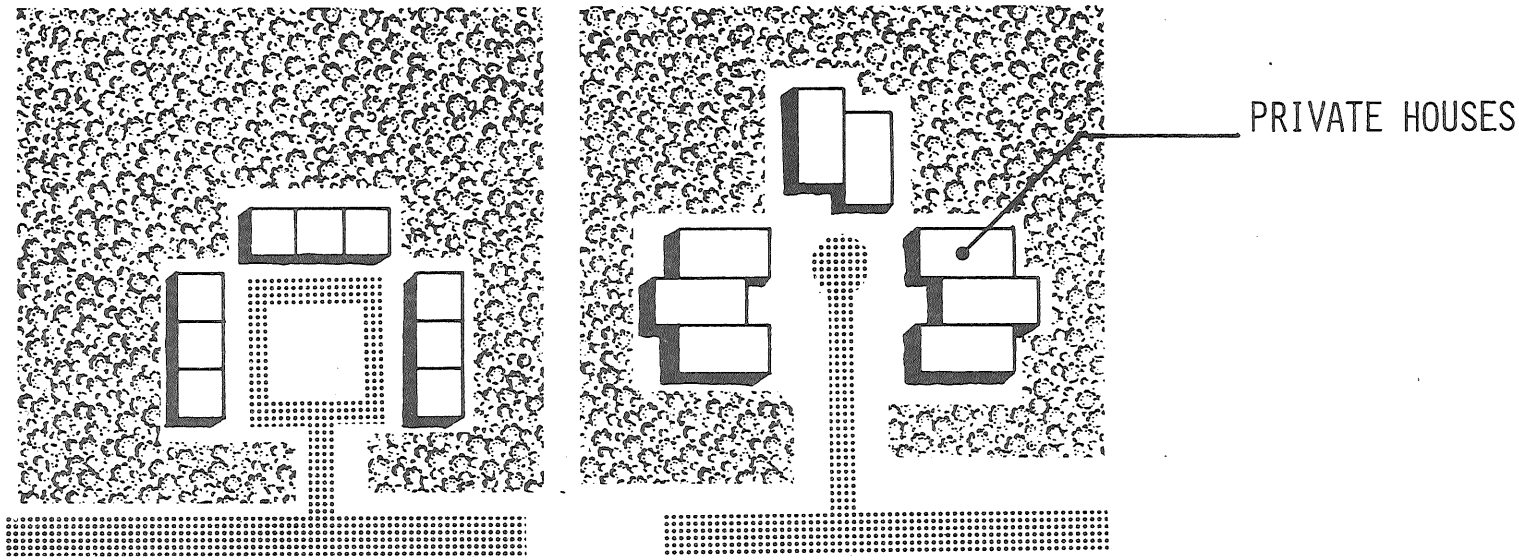
As the greatest MXC resource is the human one, the inhabitants of MXC would themselves take a major part in building the community. The manufactured housing industry at MXC will have the capability to produce kit-of-parts type of components easily handleable by two persons. This would facilitate the use of people as resources for building or altering their own dwellings. Two specific suggestions for new types of dwelling components are:

1. Easily added room components that can be used for any purpose including an at-home shop or office.

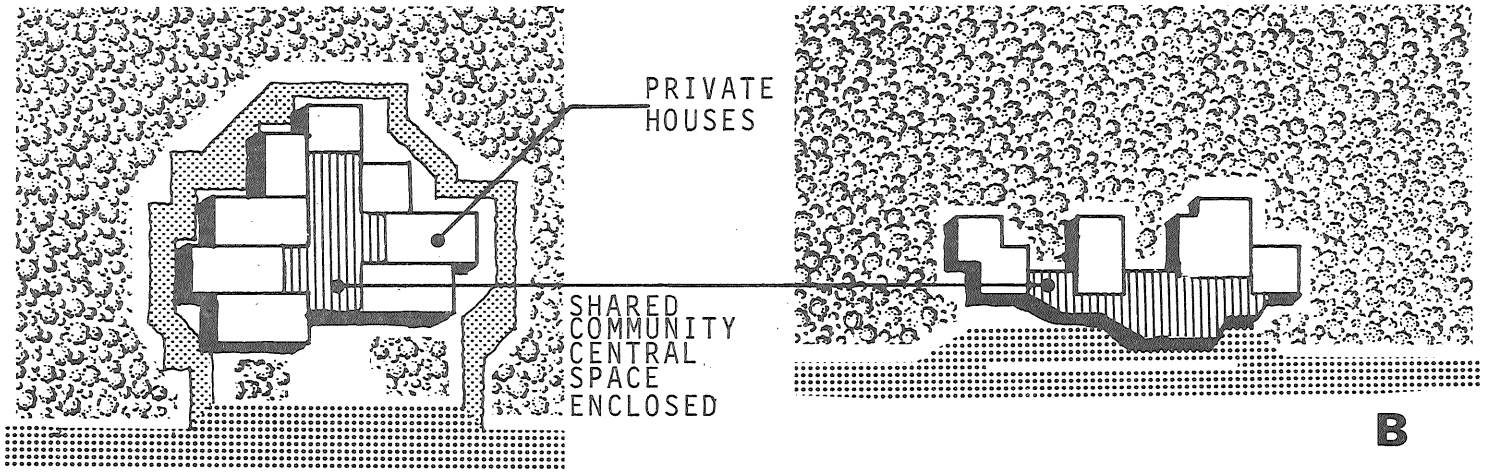
2. Provision of structurally flexible enclosures that can be mounted between or continguous to dwellings in rows or clusters (Fig..428).

This last would allow residents, if they wished, to share a common sheltered central area for year-round group activities that might range anywhere from a shared swimming pool through group meal preparation and meal-taking (Fig..429) to full cooperative or group living if so desired. Older or elderly people as well as younger often find this way of life attractive.

Through dwelling related resources the function of the MXC dwelling can be widely expanded. Within the dwelling itself, home employment, learning, shopping and health care could occur aided by the two way voice, video and data return capability on the MXC telecommunication institutional network. This capability is not only needed by shut-ins and handicapped persons but for the total population it can take care of daily or routine matters such as routine shopping, which for some people there is no real desire to leave the dwelling. It is also useful in periods of emergency or illness and for the reason that many residents would rather do some or all of their work at a shop or office at home rather than in a centrally located facility.



TYPICAL PATTERN - CAR IN CENTER - "NATURE" BEYOND



POSSIBLE PATTERN - SHARED ACTIVITY SPACE IN CENTER
CAR IN FRONT - "SOFT' CAR ACCESS
ON PERIMETER (IN "A" ONLY)
ENTRANCES THRU COMMUNITY SPACE
OR ON PERIMETER

FIGURE .428

ADDITIVE JOINTLY SHARED SHELTER

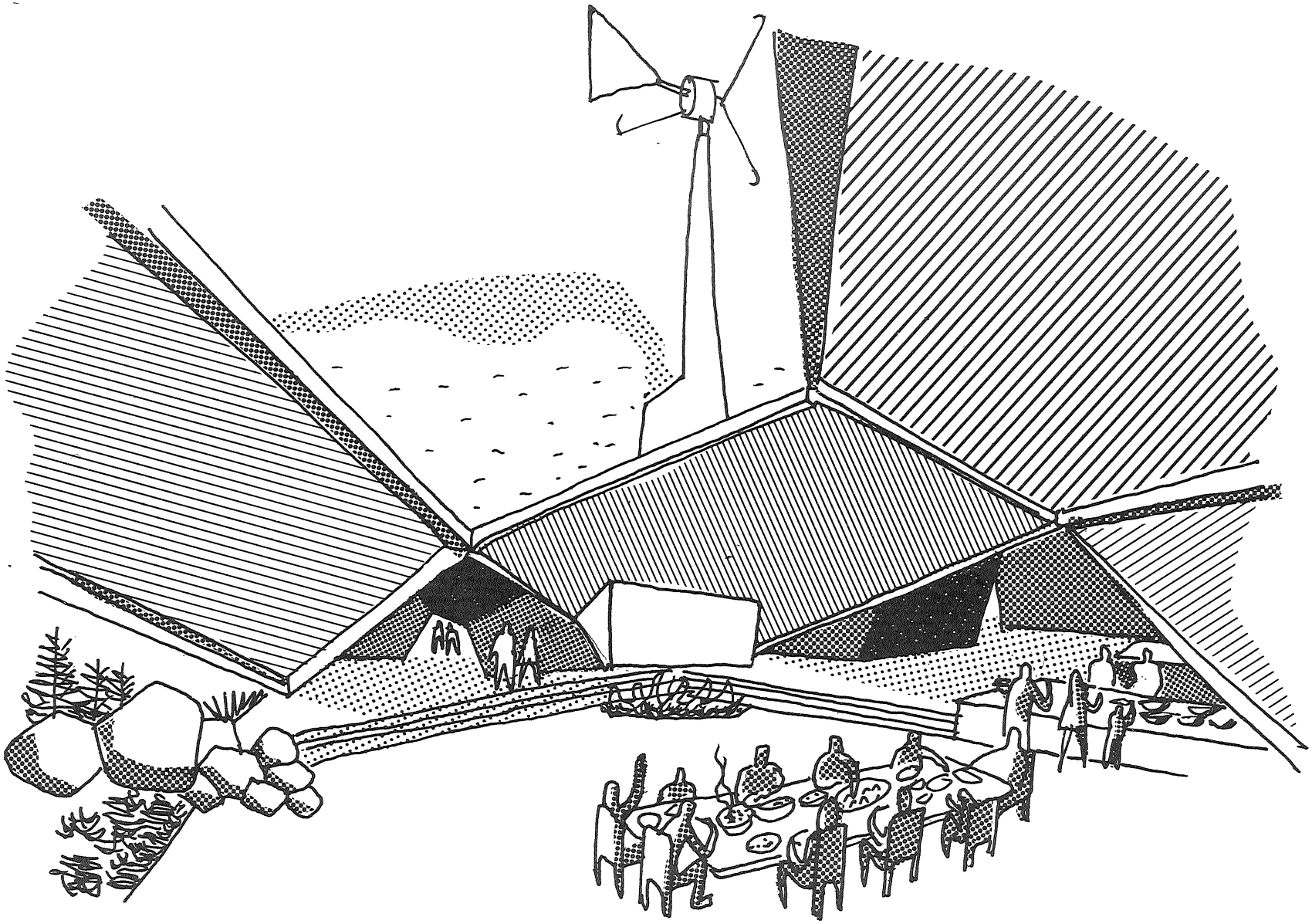


FIGURE 429

CENTRAL SHARED ACTIVITIES

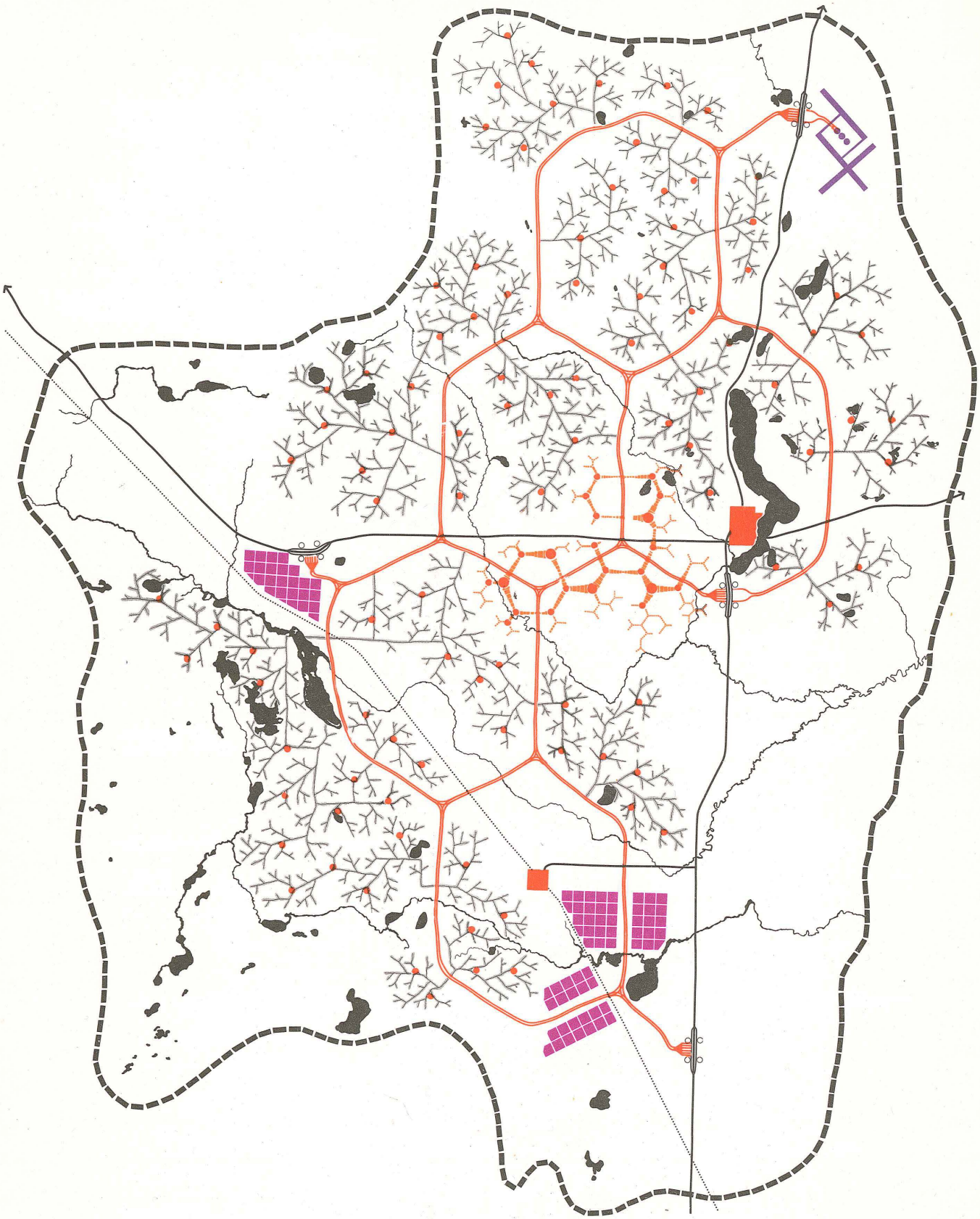
As mentioned earlier, activities in the rural sector conservation land continguous to the housing are of three basic types: (i) active recreation; (ii) passive recreation; and (iii) agriculture such as small allotment gardens. These will allow residents to play close to home and to be able to grow their own food if they wish.

As it was seen that the influence of mobile services could reduce the attraction of people to activity centers, the new dwelling related functions noted here would also tend to have this effect. People will find they can do more and more things at home -- individually and together. And when they do leave their own dwellings, it may be to go to another group of dwellings rather than an activity center.

As an alternative to the usual fixed, inflexible, master plan, the framework of options for residents to shape their own living patterns would be wide and would provide them great flexibility.

Further analysis is, however, required to establish criteria by which preliminary allocation of facilities and resources between types of centers and dwellings can be made (see Further Design Analysis, Section 1.7.0).

1.5.0 ILLUSTRATIVE DEVELOPMENT PLANS



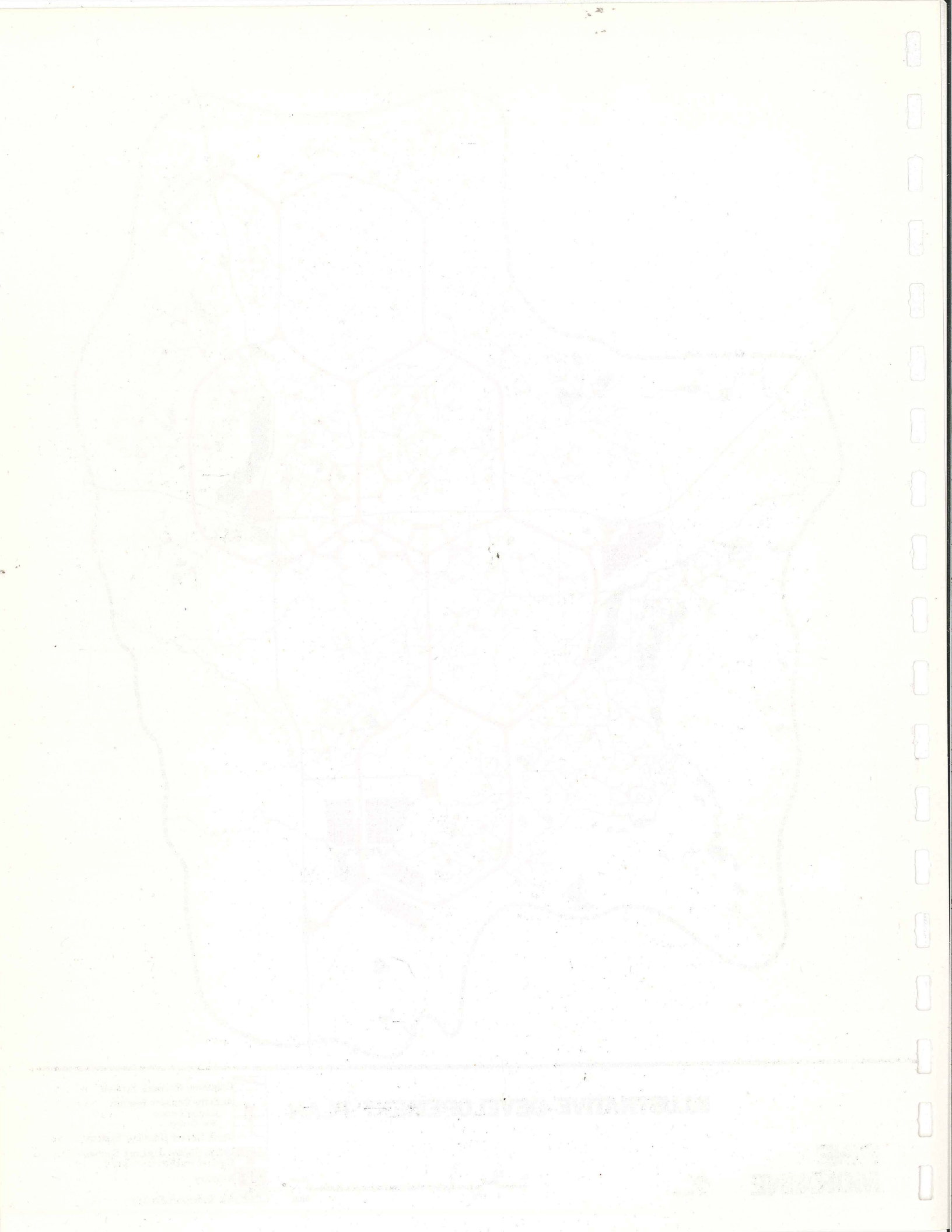
ILLUSTRATIVE DEVELOPEMENT PLAN

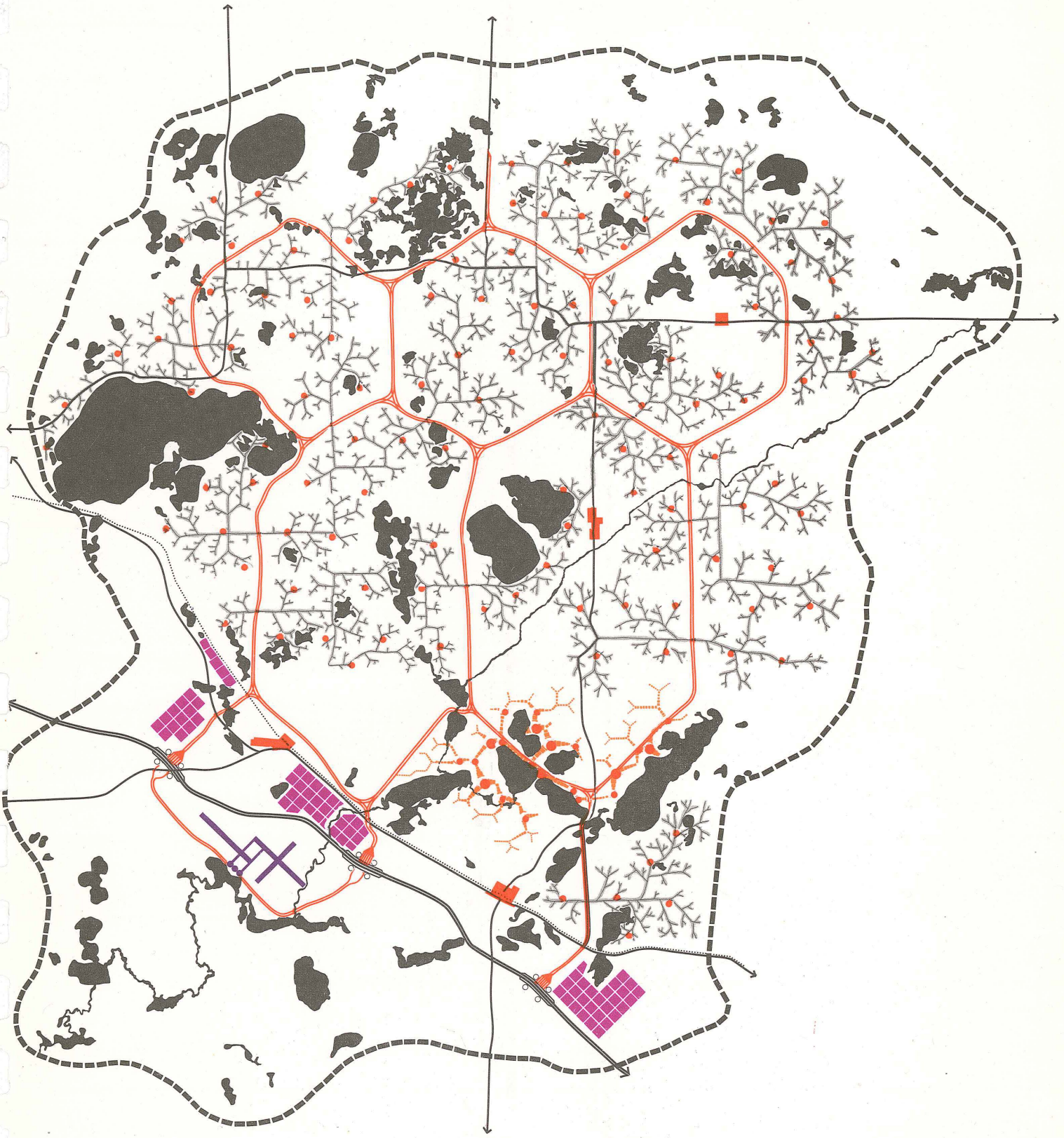
PINE MORAINE

North

0 5/8 1 5 mi
1 1 3/5 8km

- Guideway Network System
- Activity Centers System
  - Existing Centers
  - New Centers
- Rural Sector Dwelling System
- Urban Sector Support System
- Central Public Functions
- Industry
- Air Transport Facility





ILLUSTRATIVE DEVELOPMENT PLAN

LAKE REGION

North

0 5/8 1 5mi
1 1 3/5 8km

- Guideway Network System
- Activity Center System
  - Existing Centers
  - New Centers
- Rural Sector Dwelling System
- Urban Sector Support System
- Central Public Functions
- Industry
- Air Transport Facility

1.6.0 GROWTH STAGING

1.6.1 DESIGN ASSUMPTIONS AND CONSTRAINTS

The major staging design assumptions are described as three variables:

1. Size of final or target population
2. Length of development period
3. Development pace or growth rate

Early studies established preliminary working assumptions on the first two variables

1. Target population: 250,000 inhabitants
2. Development period: 10 or 12 years

Although subject to much more analysis, current calculation for staging and sizing of site areas have used the figure of 250,000 inhabitants and 12 years for the development period. The first assumption has been useful to size the site and the second to relate development to technological forecasting of probable years of emerging technologies. A normal growth distribution was assumed, but could be skewed in either direction by unduly heavy buyer acceptance in the early or late stages (or the reverse).

Future research and experience may well alter these variables but they represent at present the most constraining set of parameters.

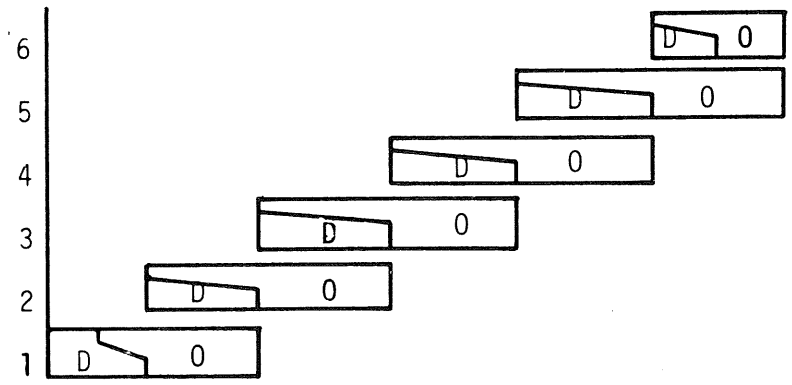
1.6.2 SITE DEVELOPMENT STAGING

Two main elements of staging consideration are the:

1. Opening up of housing areas on the site
2. Installation of infrastructure and other physical and social systems.

For preliminary calculations six equal two-year stages are used. This equals a twelve year development period.

MODULES



STAGES

CODE D = DEVELOP (INSTALL BASIC INFRASTRUCTURE)
O = OCCUPY (RESIDENTS MOVE IN)

FIGURE .600
SITE DEVELOPMENT STAGING

Areal development would be by modules, each comprising a given number of (i) 2 kilometer development cells; (ii) increments of urban sector support system; (iii) industrial segments; and (iv) recreation areas. Overlapping staging would occur. This way one module is being developed while the occupancy of a previously developed one is being completed -- a continuously overlapping process (Fig..600).

HOUSING AREAS

In a normal growth distribution the first and last two stages of land development would be small in comparison while the middle two stages would be very large (Table .601). The maps in Figure .602 show infrastructure beind added and rural sector housing modules developing (or growing in the case of the urban sector) for the Lake Region site.

SYSTEMS

MXC presents unique staging problems given the agenda of high innovation of physical and social systems. High initial capital investment on all systems is expected and testing system performance is a step in gaining sensitivity to a given system's reliability and future direction.

Planning decisions are inseparable from political process. Over an MXC six stage period, at the end of the first two stages, one quarter of the target population will have had an opportunity to evaluate performance on a variety of systems and would at that time be a viable political force in the

POPULATION

ADDITIVE	20,000	45,000	77,500	72,500	31,000	4,000
CUMULATIVE	20,000	65,000	142,500	215,000	246,000	250,000
STAGE	1	2	3	4	5	6

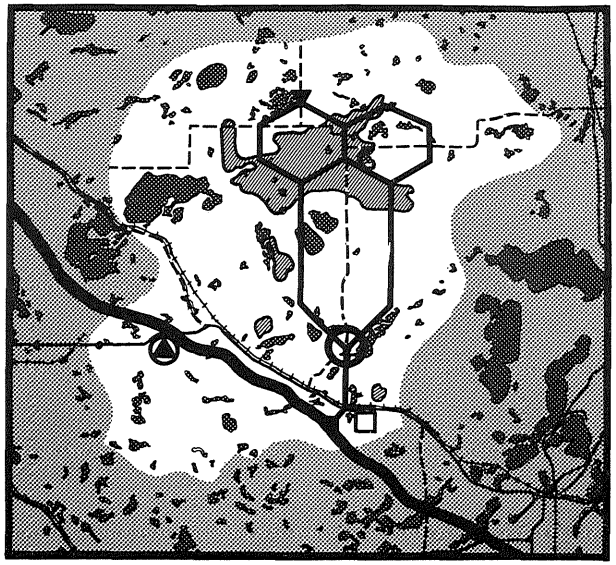
TABLE .601

POPULATION BY STAGE

(250,000 TARGET POPULATION)

1

2



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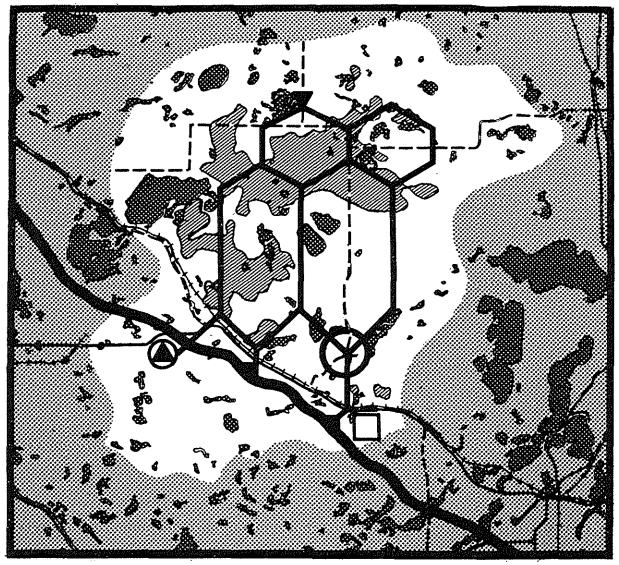

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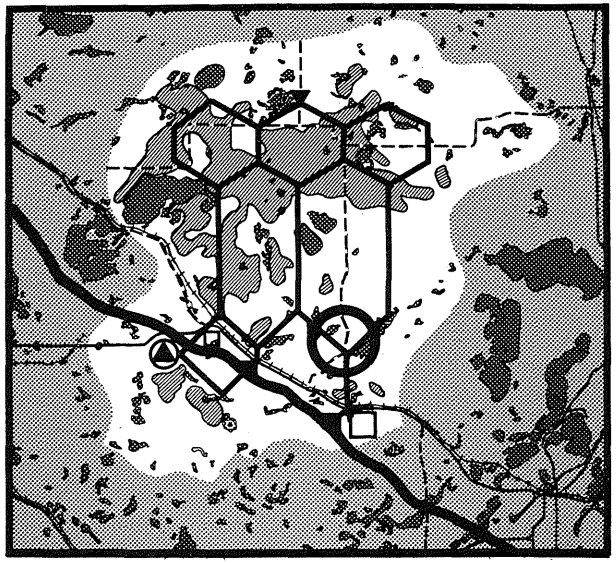

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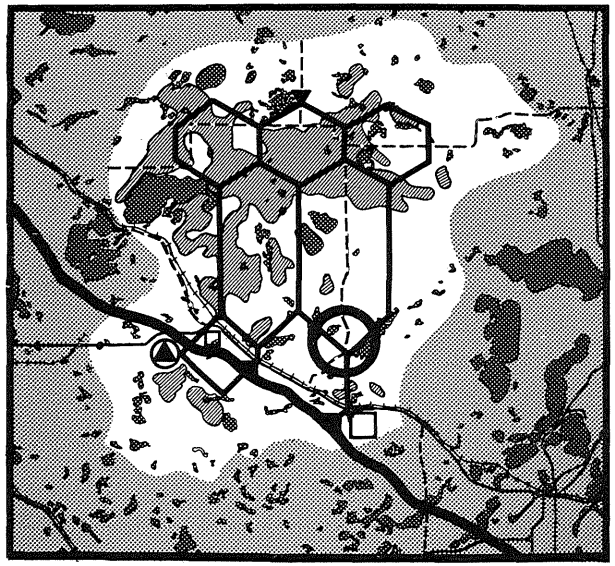
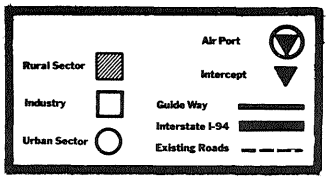


6

Figure 602

Lake Region Site Staging



community. Possibly at this time (and at later times) a mechanism for citizen feedback such as a referendum would occur for residents to exercise their right of participatory democracy.

The first two stages, then, would serve as a test period. The MXC planning and development sequence of operations can be diagrammed as seen in Figure .603.

Staging, then, in its artifically induced increments of growth in the case of community development, relate in reality to:

1. Reducing risk in experimental or conventional installations by structuring a process for their evaluation and change.
2. Differentiating discrete areas of development so as to allow freedom from construction activity on other portions of the site.
3. Allowing development capability of infrastructure* and housing delivery to keep pace with market demand.

The crucial economic questions fundamental to staging such as attraction of industry and provision of employment are discussed in Volume IV Economic Base Study.

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* Infrastructure as defined here is public service networks and modes of transportation, telecommunication, education, health care, and urban sector support systems. (See Subsection 1.3.3 for a description of the support system.)

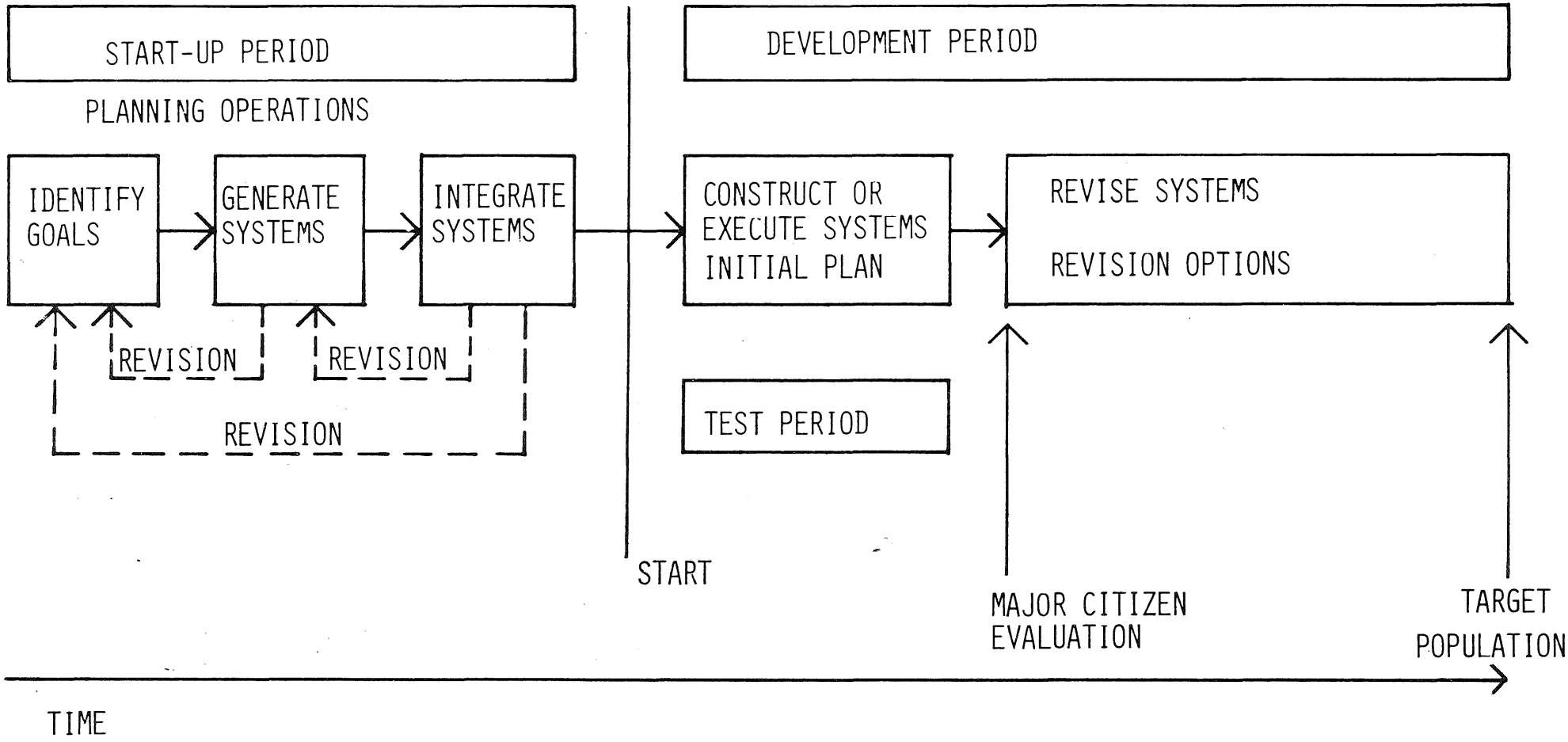

FIGURE .603

MXC PLANNING AND DEVELOPMENT SEQUENCE

1.6.3 PROCESS PLANNING

A major problem in planning is how to define options without freezing them into irreversible decisions. This is why master plans have seldom been successfully followed. A master plan displays an end product but does not define the various paths to arrive at it nor does it show plausible alternative end products. However, some framework, defined by discrete time periods and alternative decisions, is necessary to effectuate a successful design and development process.

New community planning is characterized by a long time frame -- usually ten to thirty years. For periods of that duration, it is difficult to forecast (and impossible to forecast with certainty) future events and changes in societal values and attitudes that would alter present views of how an urban system would normatively grow and change. This does not diminish the value that forecasting can have in the planning process. Many components of an urban system such as housing area design can be open ended and indeterminate. However, the development of those systems such as major infrastructure that even in highly innovative planning would require large capital investment with sunk costs in physical facilities or programs, is benefited by probablistic forecasting.

Rather than display here the complex structure of decision trees that result from such analysis, elements central to the process of community design in MXC are identified. They are:

1. Effect on settlement pattern by location and size of:
   - .Social Service Systems Facilities (Fig..604)
   - .Work Location and Size Options (Fig..605)

2. Technology of network service systems (Fig..606)
   - .Transportation
   - .Telecommunications
   - .Energy/Waste Management

3. Urban Sector population and Structure Options (Fig..607)

These diagrams simply outline revision options that are possible after having tested a preferred initial plan or system. And the revision options are simply choices between staying with the initial plan, going back to a more conventional or standard system, or utilizing a newly developed system or technology that is presently unknown or little understood. A more developed example of this is the alternative possibilities of the major movement system (Fig..608) and how it relates to forecasts of technology development, and plausible internal MXC decisions for revising the system.*

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* All possible alternatives and combinations are not shown. The analysis collapses the full set of alternatives to a manageable number that are most probable or desirable.

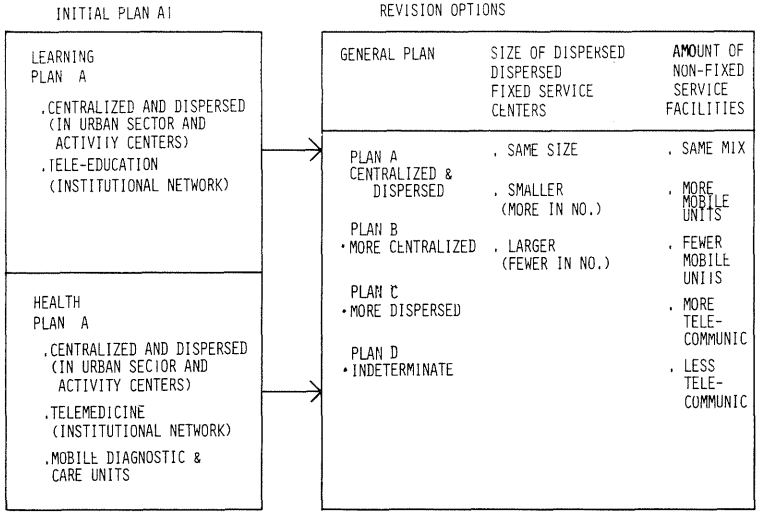

FIGURE .604

SOCIAL SERVICE SYSTEMS FACILITY LOCATION AND SIZE OPTIONS

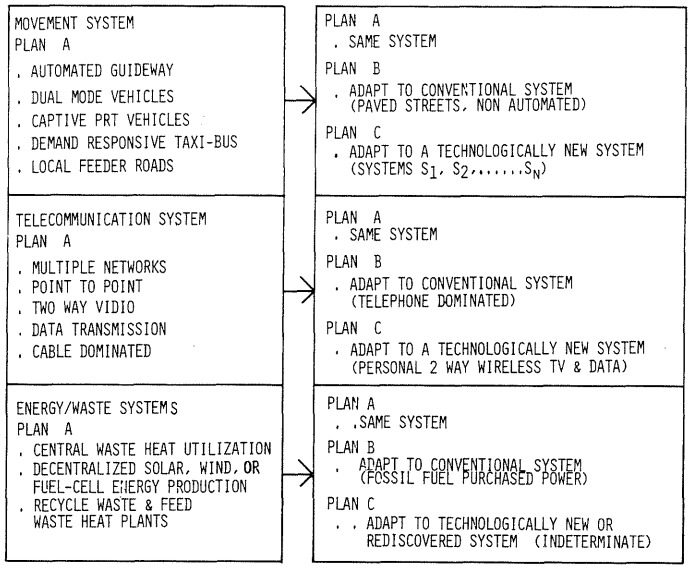

FIGURE .606

NETWORK SERVICE SYSTEM TECHNOLOGY OPTIONS

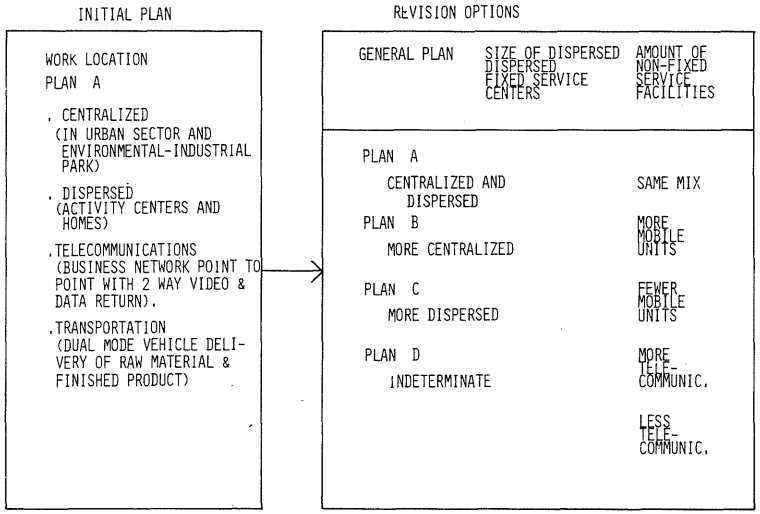

FIGURE .605

WORK LOCATION AND SIZE OPTIONS

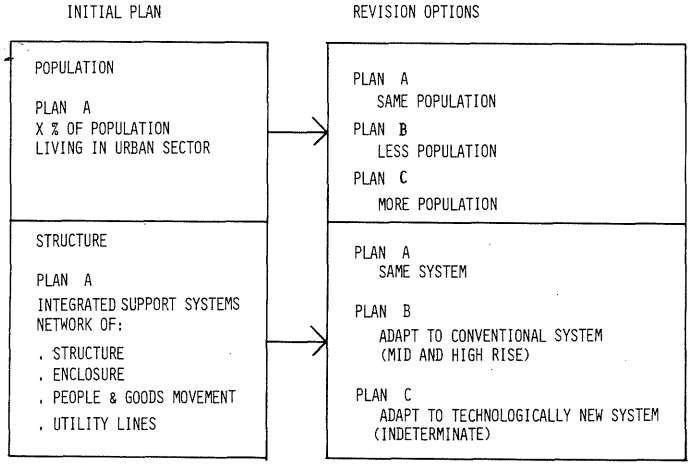

FIGURE .607

URBAN SECTOR POPULATION AND SIZE OPTIONS

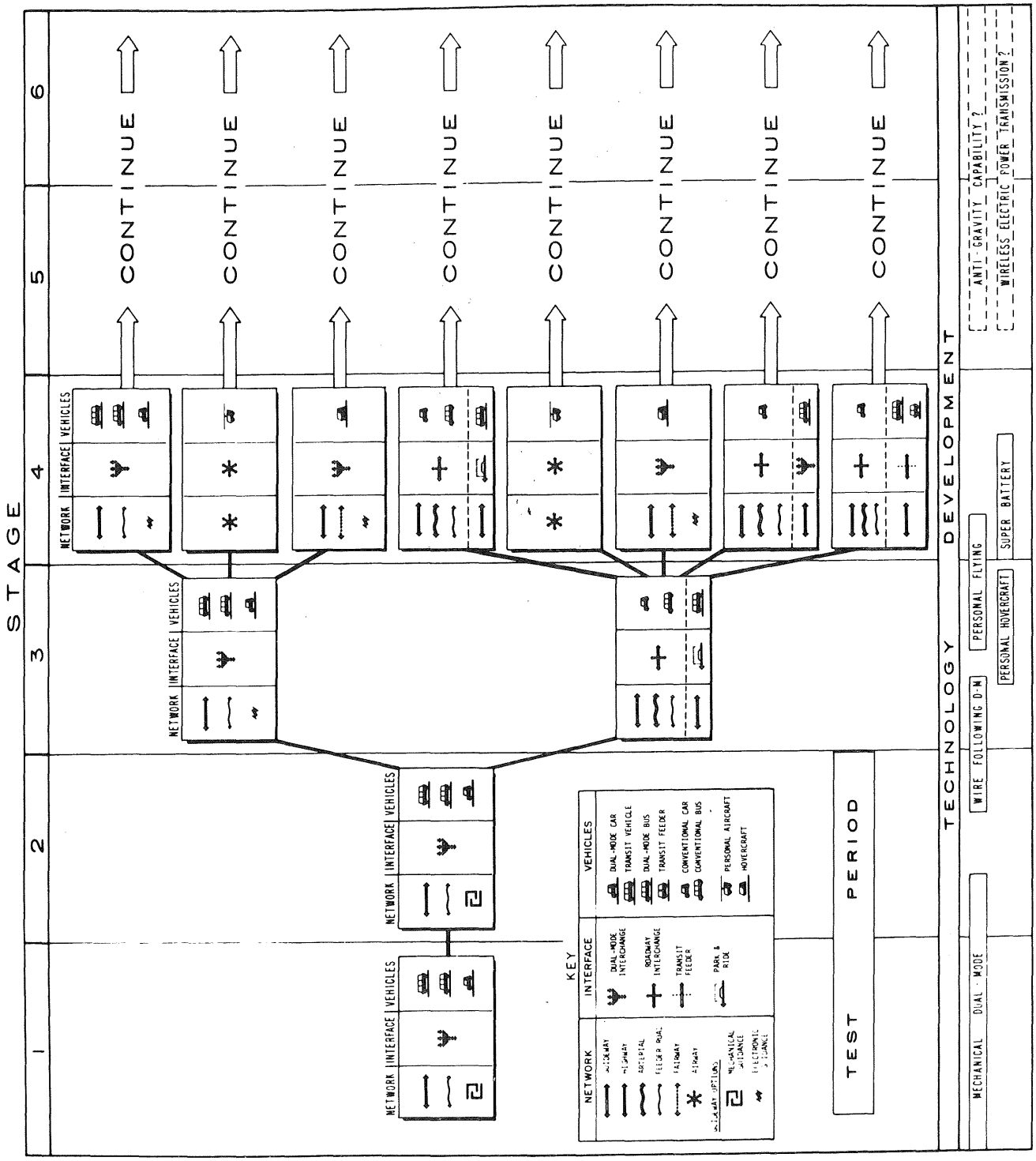

FIGURE .608

INTERNAL MAJOR MOVEMENT SYSTEM

1.6.4 LOGIC FRAMEWORK - THE PROCESS PLANNING TREE

The system staging is shown schematically (Fig..609). This method helps not only to array alternatives and their paths but in later stages with different plausible plans, to test the validity of that segment of the system (in this case an automated guideway) installed during the first or test period for its compatibility with the system. While this process planning tree displays a limited set of alternatives of a single system set, combinations of many systems could be analyzed and finally displayed in the same way to become a process tool for preplanning and later for facilitating on-going community decision making as the community grows.

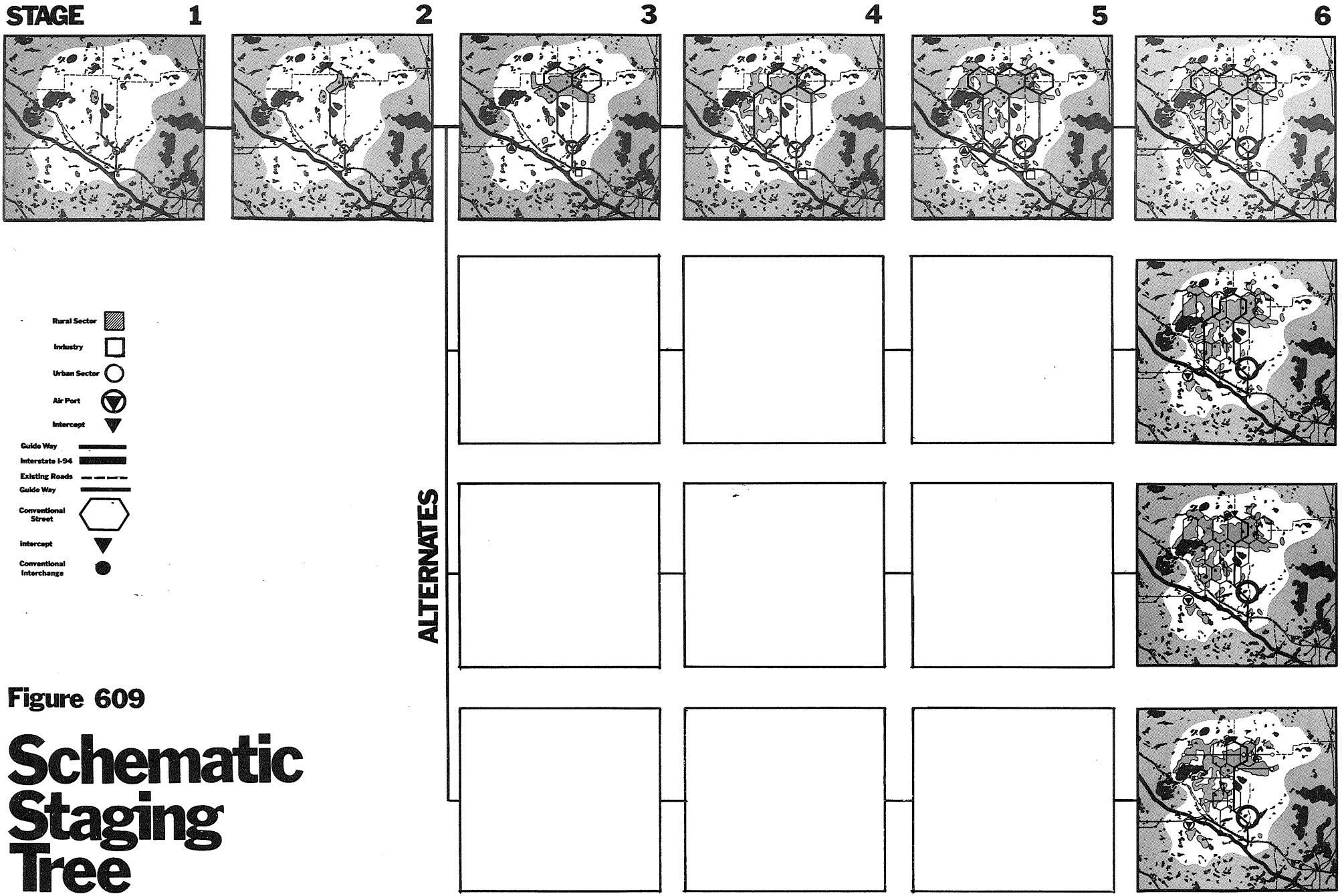

Figure 609

Schematic Staging Tree

1.7.0 FURTHER DESIGN ANALYSIS

1.7.1 ESTABLISHING ENVIRONMENTAL CRITERIA

DETAILED ENVIRONMENTAL INVENTORY

Existing environmental conditions and processes are critical determinants in preplanning and development planning phases. A complete inventory of natural resources requires extensive field survey, aerial photo interpretation, and mapping. Such detailed inventory is more comprehensive, accurate and definitive than the reconnaissance inventories for Site Selection and the Environmental Planning Statement. Included for the MXC site would be inventories for topography, slope, soil, geology, surface and ground water, biological conditions, micro-climate, and other important factors. In addition, social and economic characteristics would be investigated such as land use, ownership, population, life style, economic base, and public opinion. All of these factors would be described in quantitative terms and would be mapped to show geographic distribution.

ENVIRONMENTAL SYSTEMS MODEL

Since the environment is a system of interacting natural, physical, and man-made elements a simulation model is necessary to describe the relationships. Such a model would establish current conditions and would enable the testing of alternative plans for environmental effects.

An environmental systems model would ideally be a computer simulation of ecological functions. Availability of time and funds determine the scope and depth of such an approach.

1.7.2 ESTABLISHING DESIGN CRITERIA

URBAN SECTOR SUPPORT SYSTEMS

Systems integration in the highly compact and complex support systems structure of the urban sector should be simulated through physical and computer models. Major areas of detailed design attention should be given to these subsystems and their integration:

- Structural support systems
- Enclosure systems (physical and energy)
- Access network systems (pedestrian and guideway)
- Integration of public structures with private shelter structures or enclosures
- Utility delivery systems (ducts and pipes)

In the area of human concern, testing a simulated support system environment with potential user groups would (i) yield valuable data on the psycho-social effects of this innovative system; (ii) help in establishing user needs criteria; and (iii) together with the simulation models, it would help in evaluating the megastructure concept for MXC.

RURAL DENSITIES

A firmer basis for establishing rural density criteria should be made. This would involve more empirical research on the selected site by measuring what constitutes acceptable "rural" distances to various types of people at various times of day, seasons of the year, conditions of microclimate,

particular character of the view shed, and "quality" of viewed built-form.

RURAL HOUSING

With the selection of an MXC site, an excellent opportunity would be offered to test and evaluate the integration of new housing, energy, waste management, and telecommunications technologies. A small portion of a test site could be allocated to the construction of several dwellings.

The dwellings could be metered and data recorded from system performance. The occupants could themselves be part of the experiment so that their reactions to new environments and systems are recorded.*

Some candidate systems for testing are inflatable, foam sprayed, earth formed or industrialized modular housing; wind and solar energy; sewage reduction; and ties in with other CATV systems.

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* The occupants would not be experimented with, they would probably be more in the role of participant-observer.

1.7.3 EVALUATION

In evaluating urban design and individual systems either a simple method of cost trade-offs, or a more complex system of total accounting (including social costs) could be used (the latter with greater advantage). It is assumed that for a system to come under evaluation it will have been previously screened to satisfy MXC goals and objectives, including that of transferability (that capability to apply the system on a general basis in other cities or rural areas from the experience gained in the test-bed application at MXC).

TECHNOLOGICAL AND PROGRAMMATIC ASSESSMENT

Assessing technology or social programs for the following variables would facilitate both their pre-evaluation and post-evaluation (relative to the time of system installation).

SYSTEM EVALUATION VARIABLES

. Contribute to human basic and growth needs

. Pollution output - air, water, noise

. Contribution or drain on revenue base

. Contribution to Gross State Product*

. Congruence with steady-state growth*

. Satisfaction in user groups, U_1 , U_2 , ...U_n

by least cost[x]
by maximum performance[x] (accessibility, level of service, etc.)

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* All variables have potential conflict especially those shown starred or x'ed.

Some of the foregoing evaluation variables are of more interest in the pre-development decision making than they would be to user-residents. For example, in the pre-development period it may be of more interest to decision makers in a partly publicly sponsored project to understand the effects of a combination of systems on gross state product and how this may be resolved with the effects on steady-state growth (which through an emerging sensitivity may very probably become a policy issue). The user-residents, on the other hand, after having lived with a system for several years, will place more emphasis on their satisfaction with system performance and their out of pocket cost to use it.*

DEMAND FUNCTIONS

In the next phase of evaluation understanding the related demand functions of: (i) the urban sector central public functions, (ii) dispersed activity centers (both convenience and multi-service); and (iii) the MXC dwelling with its expanded capability will require a well developed user needs study, and demand model. With this data applied to a financial model,criteria can be established for incremental future time periods for allocation of facilities and resources between the different centers and dwellings.

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* Potential imbalances such as this can be adjusted for by weighting the variables as to their overall importance. This could be done by a small group of representatives of user groups, developers, financial backers and planners in a collective bargaining procedure and would make the evaluation more credible and useful as part of the voters learning process at a time of possible ratification.

FURTHER STAGING ANALYSIS

Further staging design will adjust the figures used here. A migration model will for example aid in adjusting the target population for the MXC site. Carefully forecasted absorption rates will establish a better base for the length of the development period. The absorption rate- after all - indicates that combination of abilities to make or install housing and infrastructure and to attract residents who occupy (and may themselves build) their housing.

The process planning tree would develop analysis of alternative systems and system combinations. For example, the combinations of variables listed under "Revision Options" (Figs..604 to .608) can be evaluated through decision analysis techniques by assigning probabilities to them and utility figures based on a multi-attributed analysis of those system variables listed in the sub-section, Technological and Programmatic Assessment.

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