ENVIRONMENTAL QUALITY EVALUATION AND IMPACT ANALYSIS METHODOLOGY :

AN INVESTIGATION INTO THE IMPLICATIONS OF THESE LAND-USE PLANNING METHODS ON THE PLANNING AND DESIGN OF LEAF RAPIDS, MANITOBA

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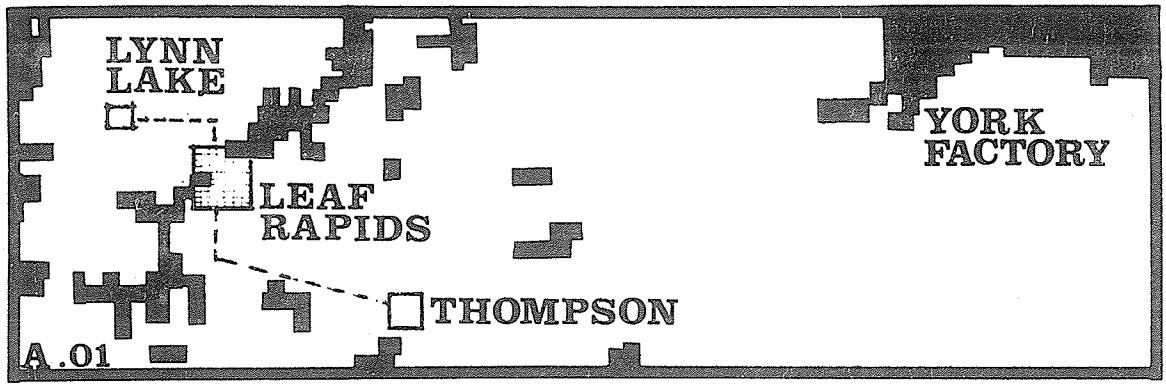
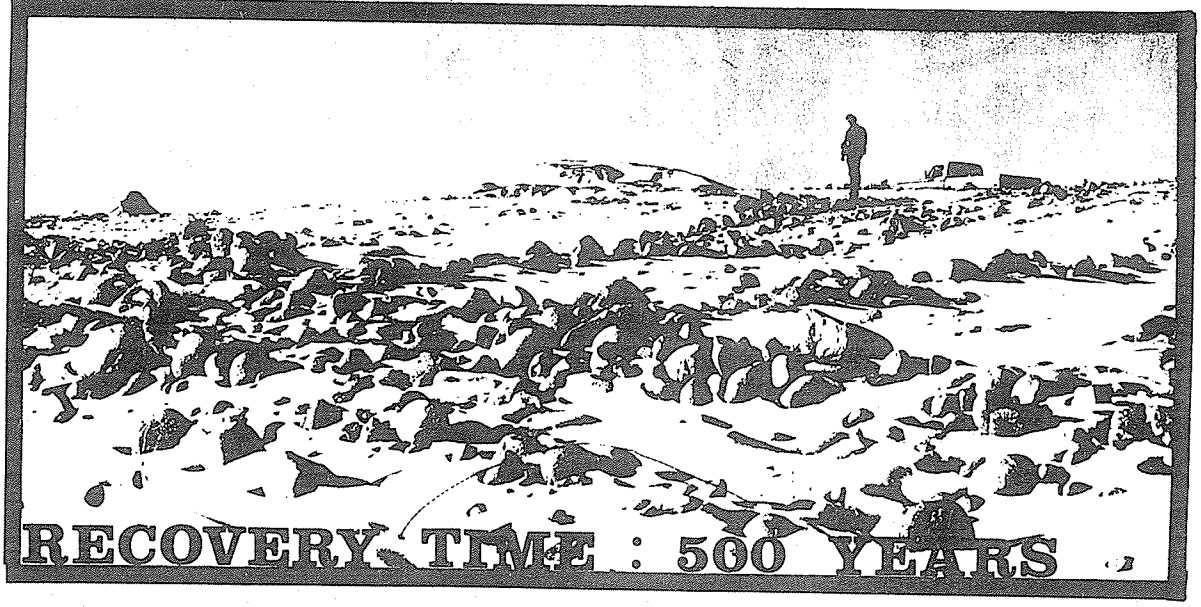
ABSTRACT



Nowhere is the dichotomy between 20th Century technology and 19th Century planning techniques more obvious than in the north. In an attempt to resolve this discrepancy, this thesis has endeavored to develop techniques that would allow for optimum utilization of the natural resources. Through the use of computer technology a process of suspended judgement has been developed which enables one to predict in quantitative and qualitative terms the relative positive and negative implications of proposed community designs within a given environmental context. The ability to anticipate environmental consequences of proposed designs provides an opportunity to adjust design proposals in order to minimize the undesired impacts on the environment while optimizing the intrinsic positive attributes of the site. This technique has been used to evaluate possible townsites and to develop a plan for the Leaf Rapids Community in northern Manitoba.

PREFACE



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The many professional experts who gave freely of their time and expertise.

My Wife whose constant support made the work enjoyable.

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INTRODUCTION

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INTRODUCTION
SCOPE
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INTRODUCTION

Aesthetic values of scenic quality, clean air and water have always been considered desirable luxuries but secondary to economic development and growth. The integral nature of both economic and natural environments is only now being understood by planners, with the result that there is greater emphasis on respecting the integrity of the natural environment. Planning methods which have been applied to northern communities have been incapable of establishing growth and development without gross destruction of the natural environment and commensurate losses in perceptual amenities. The multitude of conflicts arising between man's actions and the processes of the natural environment reflect his present inability to respond to the delicate ecological context in which he now finds himself. The solution to these problems are far too complex to be handled by typical planning teams and far too critical to be left to the discretion of Bulldozer operators. It is the contention of this thesis that an interdisciplinary systems approach is an essential ingredient of future community planning teams and forms the keystone in the methodology developed in this study.

Community planners involved in subarctic design have long focused on short term engineering and economic efficiency standards, which are important considerations but do not represent comprehensive planning criteria. It is the intent of this thesis to investigate additional planning criteria which would result from the inclusion of the natural environment as an important design component of a northern community. Of major concern is the interface between the natural environment and the aesthetic, perceptual, constructural, and economic elements of the community.

The intangible aspects of the natural environment have always been difficult to interject into planning decisions at a primary level due to an inability to adequately quantify the important planning implications of these factors. Therefore this has necessitated the construction and use of measurement techniques which are able to quantify these previously intangible factors into forms that have viable planning and design uses. This ultimately manifested into the development of qualitative and impact analysis techniques which are able to assess the attractiveness of a natural environment under a given parameters and to predict possible

positive or negative consequences of development proposals. These techniques are used to locate specific areas which exhibit optimal resource characteristics for given land use requirements. Essentially, this allows the planner to maximize the positive attributes of the site while minimizing the negative consequences.

A large proportion of this thesis is devoted to the application of the previously mentioned techniques to the proposed Leaf Rapids community area. The results were used to define and evaluate potential community sites. A specific site was chosen and an intensive analysis of the resource base was used to specify areas of the site which could best support specific community functions while avoiding unnecessary perturbation of the natural environment. As a result, community plans were proposed and evaluated for there attractiveness and impact on the environment.

SCOPE

The investigation into qualitative and impact methodologies is an attempt at the refinement of one specific area of a more comprehensive study, that being the construction of a "habitability model" for northern communities. The habitability model was initiated by Professor Carl Nelson and was later joined by myself as a research assistant.

A general goal of the model is the identification of more appropriate community structures whereby the man-made physical environment is in a more "symbiotic" relationship with the natural environment. At the same time it is hoped that the model will provide techniques, methods and programs for man-made physical environments that will provide predictably for the needs and aspirations of northern inhabitants.

More specifically this means the identification of the components of "quality of life" and development of measurement techniques that will assist in evaluating qualities to which the population would aspire. By identifying these qualitative attributes and having the methods to measure them it is the intention of the model eventually to be able to pre-determine and

specify the physical form characteristics necessary to achieve these qualities.

While the ultimate capability of this model clearly exists, it was felt that the duration of the thesis would only allow for the refinement of one area of this much larger project. Environmental quality evaluation and impact analysis was selected for development for several reasons:

1) The relative inaccessibility of the northern regions has spared the ecology from any large scale damage. With the ever increasing thrust northward, the northern regions await, more vulnerable that any wilderness ever populated; its fate rests directly on the understanding of the consequences of man's actions within this new context. The speed at which the north is being developed lends a sense of urgency to the problem-solving.

2) The degree of understanding of the natural environment and the development of analytic tools within the natural sciences has attained a level in which there can be significant planning ramifications to their findings. Thus the gap between the natural sciences and planning is at a stage that it can be readily bridged and meaningful co-operation initiated.

3) The recent development at Harvard University of computer graphic techniques offered a unique vehicle by which the complexities of eco-systems and the perceptual and aesthetic aspects of the natural environment could be quantified and used for community planning purposes.

In the application of the measurement techniques to a specific northern context, the scale of the area to be covered was delimited by the following factors:

1) The Sherritt-Gordon proposal for the development of the Leaf Rapids townsite was accepted as it represented a recent and realistic program. Within the program the regional consider-

ations had been evaluated and the intent of the town predetermined. The types and quantities of land use inputs were also established. These constraints limited the approach to manipulating existing building rather than creating totally new physical structures.

2) The general area around Leaf Rapids was accepted as an inevitable study area due to the lack of any detailed information outside this area.

3) The information that was available within the study area occurred in a wide variety of scales and depths and itself imposed limitations as to what could be analysed. This limitation was accepted for it did reflect realistic constraints for any future study and became an input into the evolution of the analysis techniques.

The general scope of the study once established, it was necessary to develop general guidelines which would structure the thought process throughout the thesis. This resulted in the development of a conceptual frame which included ecological and methodological frameworks.

ECOLOGICAL FRAMEWORK

The brain to brawn ratio of the dinosaur was comparatively low and when his environment changed he failed to adapt and eventually became extinct. He was replaced by another species (man) which had a very high brain to brawn ratio, thus enabling him to adapt readily. Man flourished so much he became the dominant species. As he invented tools (extensions of himself) his brain to brawn ratio began to drop. With the advent of extremely powerful tools man's brain to brawn ratio has decreased to a perilously low level. This problem, combined with an ever increasing population causes man to face the dilemma of possible extinction in that the world in changing or being changed in such a way that he will not be able to adapt fast

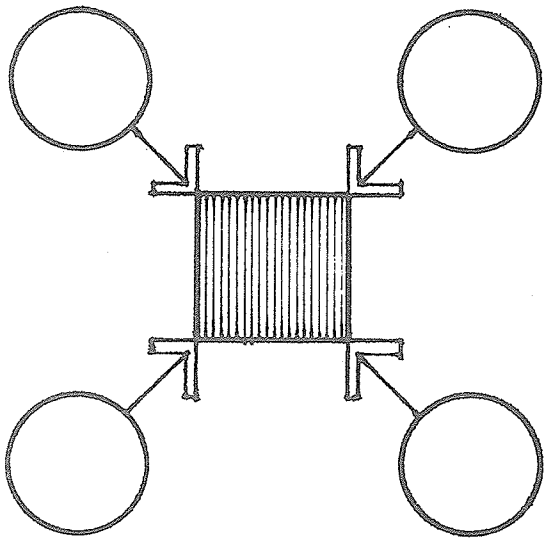
enough. Hopefully man's brain to brawn ratio has not decreased to the extent where he does not have the ability to adjust his massive powers in line with the logical consequences of his actions.

This thesis is based on two basic premises:

A) Man does not wish to become extinct.

B) There is a serious need to re-align man's conceptual and methodological framework concerning his context within the environment.

For 350 years man has been obsessed with the idea of himself being the central organism and that it is indeed his right to overcome and subdue nature for his own gain. This situation has been compounded more recently by major planning decisions being based solely on economic need or hope of gain. Added to the economic factor has been the technological and engineering efficiency ------- both relatively short term private criteria measured by tangible "cash flow." The long run social and environmental intangibles have been given little or no consideration within the decision making process.



MAN

ECO-SYSTEM COMPONENTS

HISTORICAL VIEW

F.01

There is no need to expound on what type of environment this kind of progress has left us with for we are approaching the saturation point of hearing about the horrors of environmental abuse.

The exposure of this environmental abuse became more blatantly obvious with the advent of measurement techniques that enabled us for the first time to measure the workings of eco-systems and environmental quality and the effects of man on these systems. A major problem has always been that these values could never be readily described in the same currencies as cost of a cubic yard of fill.

Thus we have an awareness of the problem, a changing public conceptual orientation away from absolute egocentricity, emerging measurement techniques for measuring environmental quality, and a void for any new conceptual framework to replace the old one. The following models represent two compatible frameworks that could structure our planning decisions in the future.

The discipline of geography introduced the concept of "human ecology" in 1922 defining it as the relationship of people to place. More recently a medical doctor working as a specialist in housing, Dr. Leonard Dahl, presented an excellent definition of human ecology.

> " 'Ecology' may be defined as that inter-intra confrontation of biological, psychological, physiological, social, and historical factors that embrace one's family, school, neighborhood, the many overlapping communities that teach values, defenses, and offenses, the meaning of oneself and one's existence. Ecology contends that as man creates and alters his environment, he in turn is affected by that environment. For example, many of the pressing social and economic problems of the aging today exist because of advances made in the field of medicine. Ecology connotes wholeness--that all has effect on all else, that education is tied to housing to transportation, to employ, to discrimination and on and on."[1]

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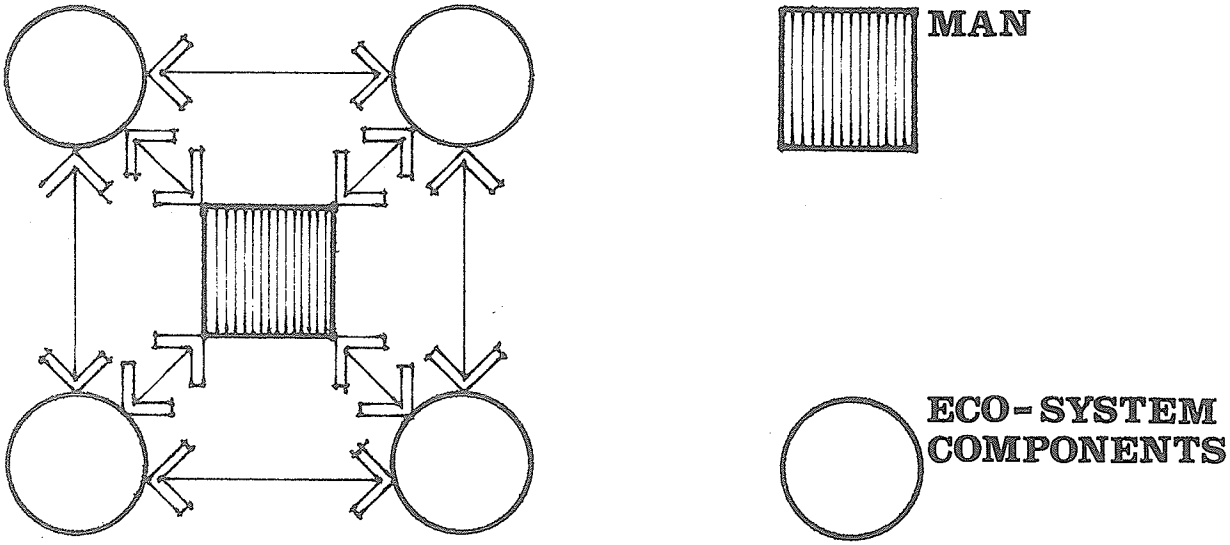
[1] Duhl, Leonard. - The Parameters of Urban Planning, in the Symposium, Planning for Diversity and Choice. 1968.

Man is still the central "organism" and the crops as well as the land become part of his environment. The major difference from the historical view is that human ecologists are concerned with the secondary consequences of their actions. By understanding the limiting factors and opportunities inherent within the interrelationships between environmental components and between man and his environment, he can plan his responses to optimize the use of his surroundings.



HUMAN ECOLOGY MODEL

F.02

Ecological principles suggest another view of man in his relationship with and use of the environment. Land-use generally implies an interrelationship between three components, specifically, land, crop and man.* There are few areas of land which do not support some form of living organisms. Thus one can say that land is never idle, it is always supporting living organisms, even though man does not utilize them as crops and may rate them as an inferior type of production. Basic principles of land use can be established on the capability of the land to produce living

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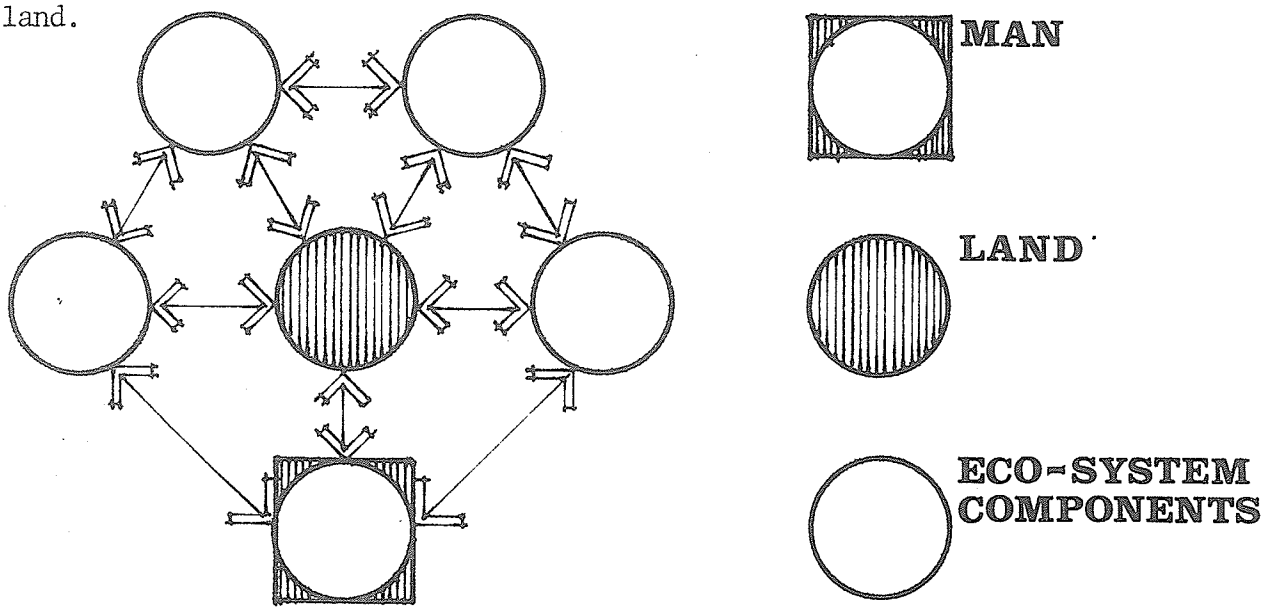
* This concept was forwarded by Hills, G.A. - The Ecological Basis for Land-use planning, 1961.

organisms of various kinds under various combinations of circumstances. Within these terms the basic feature of land use is biological productivity. Land (the combined physiological components of terrain and climate) imposes limits on the kind, quantity and quality of crops that may be produced, thus constituting a basic control over land use. Crops successively occupy the land and are viewed as part of the environment that is controlled. Man, too, is part of the environment if the view point is strictly one of plant and animal ecology. Thus man's utilization of the natural resources is a function of the limitations imposed by the land.



F.03 **ECOLOGICAL MODEL**

In this model man is not the central figure but one component of many in a large interacting cybernetic system*. The ultimate goal of this concept would be to have man in a totally "symbiotic" relationship with the environment in which occupation of a site would be as a biological

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* cybernetic system influences the future, or bridges time, in the sense that the present state sets limits or patterns for future states. Any cybernetic system, through the theory of its parts, restricts the immensely large numbers of a priori possible states and as a consequence carries information.

succession** of an area and one in which the feedback loop of the human components would include wastes that would only be food for other biotic organisms.

Although the idea of a totally symbiotic relationship with the environment seems appealing, it is seriously doubted whether man would be prepared to play his role consistently in order to achieve a symbiotic state. If this argument is taken to a logical extreme one could hypothesize that during the course of an ecological cycle it would become apparent that man would have to succumb to environmental pressures that would mean his demise. It is hard to believe that man could be so objective, so altruistic that he could assume a docile role, withholding his massive powers and accepting his fate as a natural consequence even though it would be optimal for the eco-system as a whole. It seems unrealistic to expect that man could accept such a peripheral role after conceiving of himself as the centroidal figure for so long.

** Succession is the occupation of an area by organisms involved in an incessant process of action and reaction which in time results in changes in both the environment and the community, both undergoing continuous reciprocal influence and adjustment. The important point being that it is an orderly and direct change.

Both definitions emanate from a series of papers compiled in a book by Margalef, R. - Perspectives in Ecological Theory, University of Chicago Press, 1968.

Thus a compromise can be established in which the ecological planning framework would include both concepts. The principles of the human ecologist can be superimposed upon the ecologically oriented principles. The concept of a totally symbiotic community is the hypothetical optimum.

Accepting this general ecological framework, a new planning orientation presents itself, one that participates in, rather than subjugates, the environment. The new orientation leads into an area in which a substantial amount of work has been accomplished, but the methodological chaos has not allowed efficient use of the information by community planners. In order to assist in structuring a consistent approach to qualitative and impact analysis and to aid in evaluating planning and design decisions, an ecological model was sought. By using an ecological model, the whole range of measurements within both the natural and man-made milieus would have a consistent framework. In evaluating the ecological models for their appropriateness, little was found in energy systems ecology, analysis of food pyramids, relations defined in terms of predator-prey, competition, or those other analytic devices so efficious for plant and animal ecology. Rather, a multi-faceted criteria for measuring eco-systems was found to be a most appropriate model. Health was selected as an encompassing criterion and a model postulated by Ian McHarg (landscape architect) has been accepted. Although this model is very general in its application to planning communities it does afford important relational criteria from which eventually not only will communities be compared to each other but also to the surrounding environment. The development of this type of <u>abstract</u> relational tool for planning, which considers the holistic properties of a community, is imperative; for how do you measure human despair, loss of aesthetic attributes, or ecological breakdown in dollars and cents. Thus the following model has been accepted as a comparative analytical tool for this study.

	simplicity		complexity
	uniformity		diversity
	independence		interdependence
ILL-HEALTH	instability	HEALTH	(symbiosis)
	low number of species		stability (steady state)
	high entropy		high number of species
			low entropy
RETROGRESSION		EVOLUTION	

An example most obvious is life and death. Life is the evolution of a single egg into the complexity of an organism. Death is retrogression of a complex organism into a few simple elements. If the model is true it allows examination of a variety of community structures in these terms.

The model suggests moving towards simplicity, uniformity, instability with a low number of species and high entropy is retrogressing: any system moving in that direction is moving towards ill health.

Conversely, complexity, diversity, stability, (steady state), with a high number of species and low entropy are indicators of health and systems moving in this direction are evolving.

This model does not put any value judgement on health or ill-health being a positive or negative attribute. The value placed on health or ill-health will be stated as a goal of the community plan. Also the criteria for the variables within the model will be established both by subjective interpretation by professionals in the field and feedback from the conditions of other communities. Further research in this area should increase the accuracy of such predictive and comparative measurements.

[2] McHARG, I. - DESIGN WITH NATURE, THE NATURAL HISTORY PRESS, 1969. P. 187

For example: In a community where the stated goal is stability and permanency and analysis of the community indicates a high mobility rate causing many adjustments to be made (high entropy) and leaving only married couples (uniformity) the situation could be construed as ill-health and a negative trend.

Conversely in a community where the stated objective was planned obsolescence and after analysis - similar trends such as instability, high entropy and uniformity are observed. This situation would again be construed as ill-health but a positive trend.

The structuring concept of the health of the life support system also provides an opportunity for tentatively defining "environmental quality." An ecologist suggests it can be defined as: "A beautiful environment is one that is functioning properly; where energy from sunlight, water, minerals, and soils are channeled into the production of wood and grass, and wildlife, farm crops, or garden flowers; where their populations are not cut off from those natural scenes that can recreate, inspire, and sustain them. Malfunction, whether reflected in congested traffic and polluted air, water that is fit neither for drinking nor swimming, decaying neighborhoods, or eroding hill sides, is ugliness; it reflects a breakdown in both man-made and natural order and a decline in both human and environmental health.[3]"

Thus, one can conclude that environmental quality for man then implies a related concern with a balance to provide optimum conditions for the survival of all living organisms, known or not known, with which man might favorably interact in some direct or indirect way. It follows that in addition to caring for man's physical requirements, there must also be a concern with the aspects of interaction related to man's intellectual, perceptual and spiritual wellbeing.

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[3] From Sea to Shining Sea, the president's council on Recreation and Natural Beauty, Washington D.C., 1968. P. 120

Thus, negative impact can be defined roughly as an unwanted breakdown in these natural or manmade systems due to physical intervention, which ultimately affects the health of the community as a whole.

The ecological method provides much that is relevant to planning theory and methods. In many of Lou Kahn's* lectures on form and design he uses expressions such as 'existence will' and 'the place is because it is in the process of becoming.' These expressions reveal a design theory quite analogous to many ecological principles.

Lou Kahn suggests that, by being, the place or creature has form. Form has no shape or dimension. Form merely has a nature, a characteristic. It has inseparable parts. If you take one part away the form is gone. Form and process are indivisible aspects of a single phenomenon. The ecological method allows one to understand form as an explicit point in evolutionary process. An analogy Kahn uses to explain this concept is that:

> Cup is form and begins from the cupped hands. Design is the creation of the cup transmutted by the artist, but never denying its formal origins. Form has existence but doesn't have presence, and design is toward presence.

Previous planning methods have not embodied the idea of the cupped hand as giving form to the cup, the earth and its processes as giving form to their works. The result being the exploitation of a pliant earth and docile plants to make much that is arbitrary, capricious and inconsequential.

Hopefully this new understanding of our context within the ecological system will not only give relevance to our place but also inspirational form to our design.

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* Professor Kahn is a noted architect and aesthetician.

METHODOLOGICAL FRAMEWORK

One of the major methodological problems involves the translation of vast amounts of varied information from both the natural sciences and the physical planners into a form that planners and designers can use. In order to facilitate the translation of this information into a consistent and meaningful form, a land-use planning method has been adopted. This method has already proven an effective organizational tool at a regional scale and there seems to be an equal potential at a smaller planning scale. The following definitions will attempt to articulate more clearly the meaning of land use planning.

> "Land use usually implies an interrelationship between three factors, namely, land, crop,and man. Land is the place where crops are grown. The crops which are actually produced indicate the various degrees to which the potential of the land has been developed, either by nature alone or through man's intervention.[4]"

A definition of "planning" that is applicable with the land use context is:

> "The process of preparing in advance and in a reasonably systematic fashion recommendations for policies and courses of action, with careful attention to their probable by - products or side effects, to achieve objectives in the common life or urban or regional localities or communities.[5]"

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[4] Hills, G.A. - The Ecological Basis for Land-use Planning, Ontario Department of Lands and Forests, Research Report number 46, December 1961. P. 6.

[5] Coleman Woodbury - The Role of the Regional Planner in Preserving Habitats and Scenic Values, Future Environments of North America, Natural History Press, New York, 1966. P. 32.

In attempting to bring these two definitions together one could state that land-use planning for physical designers would be:

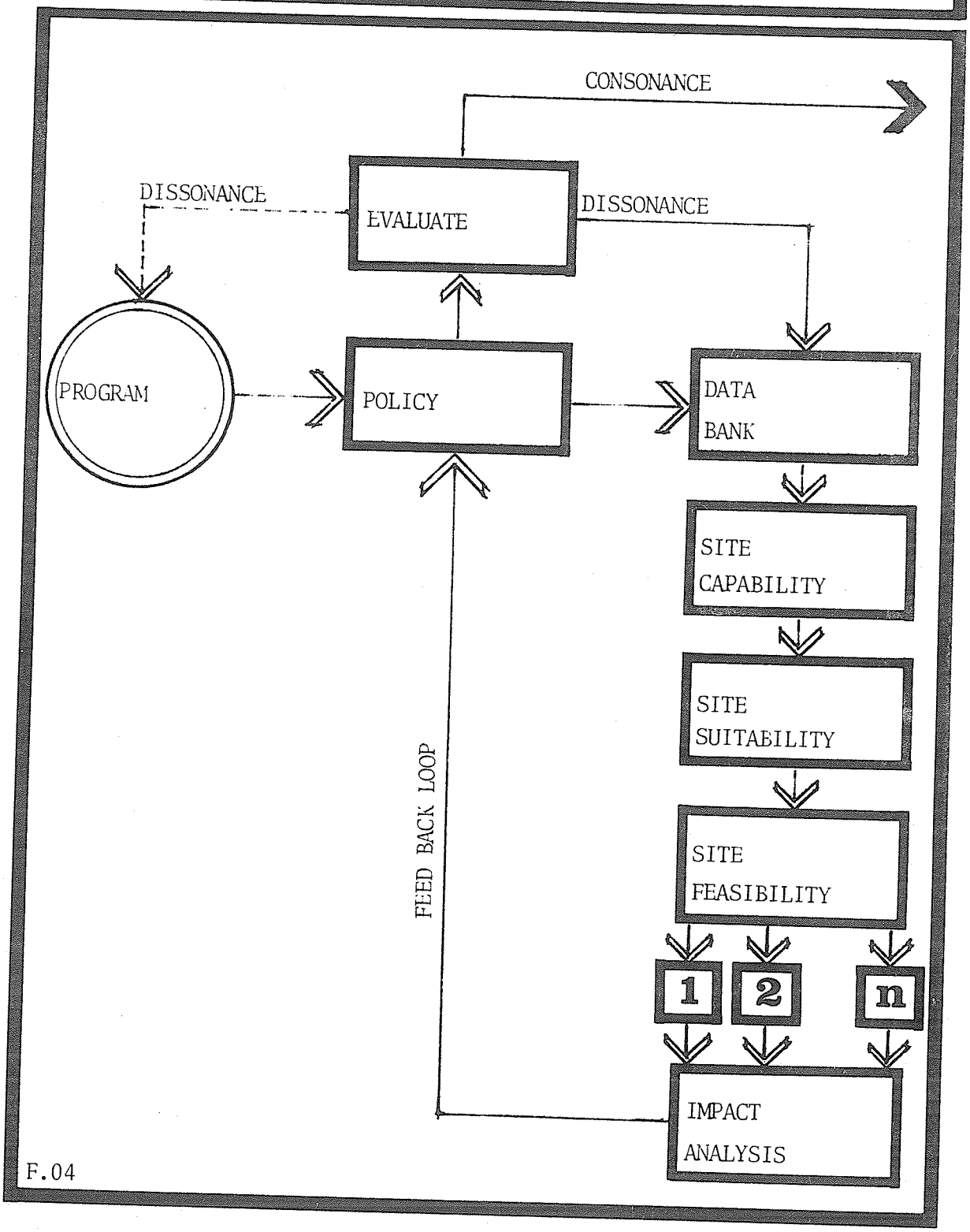
> A systematic analysis of potential uses of each site in accordance with intrinsic site characteristics and accepted objectives resulting in recommendations concerning activity allocations.

Thus the land-use planning method is consistent with the overall efforts to achieve a "goodness of fit" between the man made and natural milieus. The land-use planning method as it would apply to community planners is diagrammed on the following page. The diagram is intended to indicate the basic components involved, and the linkages that might provide a working framework for study and implementation.

PROGRAM

The program can generally be defined as 'the problem as given'. The problems result from an expressed need for change in the existing condition as a result of historic precedent, present demands, or projected needs. At this time in the development of this land-use planning method, the problem definitions are made outside the method and are accepted as working criteria. The exclusion of this part of the process does not preclude its relevance but rather reflects different problems being solved. The Proposal for the Development of Leaf Rapids Townsite (1970) prepared for Sherritt-Gordon Mines Limited, articulates the physical requirements of the community and was accepted as the program.

ELEMENTS & LINKAGES OF THE LAND-USE PLANNING METHOD



F.04

POLICY

The development of policies involves the construction of theoretical frameworks which structure the less tangible (subjective) aspirations of community life. These policies provide a consistent and coherent format from which specific planning and design decisions can be based. Policies result from a compilation of interdisciplinary and lay responses to a particular environmental context given desired land uses.

The professional input would result from knowledge accrued from an educational and experiential base which would include unique disciplinary interpretations of environmental quality.

In the particular case of the Leaf Rapids development, where the major population source would be from Lynn Lake, a preferential questionnaire could maximize the "fit" of the qualitative aspirations of the future populations with the physical development of the town. This type of involvement by residents at the ground floor of policy decision making would allow more relevant solutions to the real problems faced by the future residents.

DATA BANK

The data bank consists of a storage of all relevant site information to be combined and correlated at a later date. This contains descriptive and objective inventory based on identifying zones of homogenous character or the presence of a single variable. Site data does not necessarily need to be based on information at one point in time. An understanding of the natural environment allows prediction of maturation rate of vegetation etc. assuming a normal ecological evolution. Therefore, planners with this type of data base can transcend the particular point in time in the evolutionary process and make future planning decisions in accordance with interpolated information.

SITE CAPABILITY

Site capability represents the inherent potential of the combined physio-

graphic features of an area to produce specific goods and services under specified types and intensities of economic and technical controls. Capability models are constructed and specify the resource characteristics (data level combinations) necessary to achieve the goods and services desired. For example, foundation capability, vegetation capability.

SITE SUITABILITY

Site suitability is the capacity of the site in its present condition to produce necessary resource capability combinations for specific land uses. For example, residential suitability, industrial suitability. This category recommends a particular 'fit' between function and site; thus activity allocation priorities are established.

SITE FEASIBILITY

The programatic requirements and site suitabilities provide a basis for combining community activities into functional community plans. Therefore, site feasibilities result from a heuristic combination of these variables culminating in a design proposal.

Depending on the circumstances, the planning proposals can be carried one step further by formulating construction standards and specifications in accordance with the environmental milieu and construction practices. By suggesting alternative standards negative impact could be reduced and aid in the design alternative achieving an acceptable impact rating.

IMPACT ANALYSIS

It is the purpose of impact measurement to measure the deleterious effects to the environment by man's physical intervention. Impact measurements require three stages of analysis:

1) Activities are grouped according to the kind and severity of change or impact they may cause to the site resource system.

2) The resource systems are identified in terms of those key variables which identify areas of sufficiently different

character. These site types are described in terms of potential areas of vulnerability with respect to specific activities.

3) The location of the activities within the feasibility proposal are compared to the areas of resource vulnerability and evaluated for potential impact.

The total combined impact of a feasibility proposal (plan) is fed back to the previously established environmental policies. If the evaluation of the impacts of a design alternative prove not to be in accordance with the environmental policy criteria several options are open:

1) The design alternative is revised and re-cycled until it reduces its impact to a level acceptable to the policy criteria.

2) The design alternative can be abandoned if it becomes clear it has no chance of minimizing its impact rating to an acceptable level.

3) If through many attempts at design synthesis it becomes clear that no design alternative will be able to be accepted under the given conditions there is potential for re-evaluation of the program and of the environmental policies.

The impact ratings of design proposals are compared with their environment/benefit ratings. This rating quantifies the degree to which the design proposal has capitalized upon the intrinsic natural resources of the site. A lower environment/benefit rating increases the potential of aesthetic, perceptual, ecological and economic damage by not using the most suitable areas for development.

COMPUTER AIDED DESIGN

The computer aided decision making process is an essential tool for environmentally concerned planners. "TIME" is becoming an increasingly more important consideration in the decision making process. For example, as building practices increased their efficiency through technological improvements the time required to complete the same amount of work has decreased greatly. Correspondingly, owners, industry, and government are looking for a similar decrease in the planning and design stages. Therefore planners are being forced to make design decisions involving increasingly more complex problems in less time, often with unfortunate consequences.

Environmentally motivated design adds the complexity of all the interrelationships of the eco-system. As scientific expertise in the natural sciences increases, the amount of sophisticated information to be handled becomes immense and there are no design methods able to handle this kind or volume of information. This further development will compound problems of already overtaxed, outdated planning methods.

The computer acts as a bookkeeper for many variables. Its main advantage is that is is able to optimize many complex interrelated variables in a very short time. But like any data handling system, the information one gets out is only as good as the information and values that are fed in. Computerized data banks and quick information manipulation capabilities also allow for the potential of 'dynamic analysis'. Most of the currently used planning analysis methods can be considered "static" in that, for a given proposed use the resources are evaluated on a singular basis. Changes in data caused by time or the intervention of man are typically not considered for technical reasons. Therefore, variables which are dynamic are not included, nor does the system allow multiple analysis of a problem under differing assumptions. The most common style of static analysis is that of the "overlay" methods or "sieving" to identify areas with combinations of sought after resources. The liabilities of the system are an inability to deal with a large number of variables in one analysis, and unfortunately, an inability to differentially weight the relative significance of different variables. The level of technical sophistication in

these static resource analysis methods to predict ecological or other damage to the natural environment is much below the level employed by the natural sciences.

"Dynamic analysis" methods have essentially the same direction as static methods but they ask a different question, namely, what if.....? If the prediction of consequences of alternative sources of action measured in a wide range of values is necessary, they are an essential analytic tool. These methods allow for dynamic variables and multiple analysis of a problem under varying assumptions because once the program is set up, only minor changes are required to re-run the analysis under different criteria. The dynamic character of these methods and their analytic flexibilities require sophisticated data handling mechanisms typically derived from computer technology.

It is one of the intents of this thesis to investigate the potential application of dynamic analysis techniques within the context of environmentally motivated community planning.

POLICY FORMULATION

2

POLICY DECISIONS RELATED TO THE DEVELOPMENT OF LEAF RAPIDS TOWNSITE :

PART A: GENERAL POLICY
PART B: SPECIFIC POLICY

SYNOPSIS: Both the general and specific goals are developed to structure a wide range of objective and subjective criteria into a holistic form. The organization within the general and specific policies creates a consistent conceptual framework upon which all planning decisions, planning assumptions and building guidelines are based. Design proposals which are not consistent with this basic conceptual framework are not accepted as viable alternatives.

PART A: GENERAL COMMUNITY DEVELOPMENT POLICY

The proposal for the development of the Leaf Rapids townsite prepared for Sherritt Gordon Mines stated that Sherritt would prefer to see the town developed as a new support center for northern Manitoba rather than creating a community that would satisfy only the company's needs. It was stated in the proposal that;

> "such a center could house a range of transportation, education, recreation, health and social service facilities required to meet the needs of both the indigenous and newly arrived population supported by developments in the field of mining, tourism, recreation, forestry and transportation"[6]

Referring to the proposed town, it was further advanced that:

> "It should be designed and intended as a home for families of varying backgrounds moving into an area for a variety of economic, social and personal reasons."[7]

The company would also like to see the turnover rate in staff kept at a very low level. Consistent with this desire is Sherritt's policy to engage married personnel. With this in mind their proposal suggests a concept of how a community might facilitate these desires.

> "The important ingredients in the establishment of a new community and particularly during the initial years of development, are those facilities and amenities which the Company recognizes as being essential to the retention of staff and their families in the new location. These include retail outlets, recreation facilities, school accomodation, religious institutions, a community administration and public safety centre, and a satisfactory medical facility."[8]

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[6] Henderson, D.G. - A Proposal for the Development of Leaf Rapids Townsite, 1970, Page 4

[7] Ibid., Page 7

[8] Ibid., Page 3

Considering these objectives within the context of McHarg's model defining health, one could reasonably assume that the proposed goal and positive trend of the town of Leaf Rapids would be towards an evolutionary state of health.* Thus as a general thesis the criteria defining the state of health within a system will form the basic format for policy decisions. This method should afford an important relational tool by which economic, social, mental and environmental components of a community can be compared in a 'holistic' fashion.

Angus Hills, a noted expert on land-use planning, has advanced a framework for organizing community components into a simple but comprehensive form. He proposes that the development of human eco-systems is controlled by an interrelationship of human welfare, institutional and environmental features. (Note the graphic representation on the following page.) Professor Hills suggests emphatically that no satisfactory classification and evaluation of land can be made, or no sound management or land-use decisions can be made without consideration of these three features which interact with each other to control geographic production. (the ability of the land to produce desired commodities).

The point that this diagram emphasizes, which is important to this study, is that in all land-use considerations, human welfare, institutional and environmental features exert in an integral fashion some degree of control on each other. Therefore the ability to achieve optimum resource usage by any feasibility proposal is contingent upon the understanding of the inter-relationship that exists between the three groups.

It should be noted that the term 'expedient' as used in the diagram can have two connotations:

1) a derogatory one meaning 'makeshift'.

2) a respectable one meaning 'fit'.

It is implied that which ever one of these definitions is applicable will

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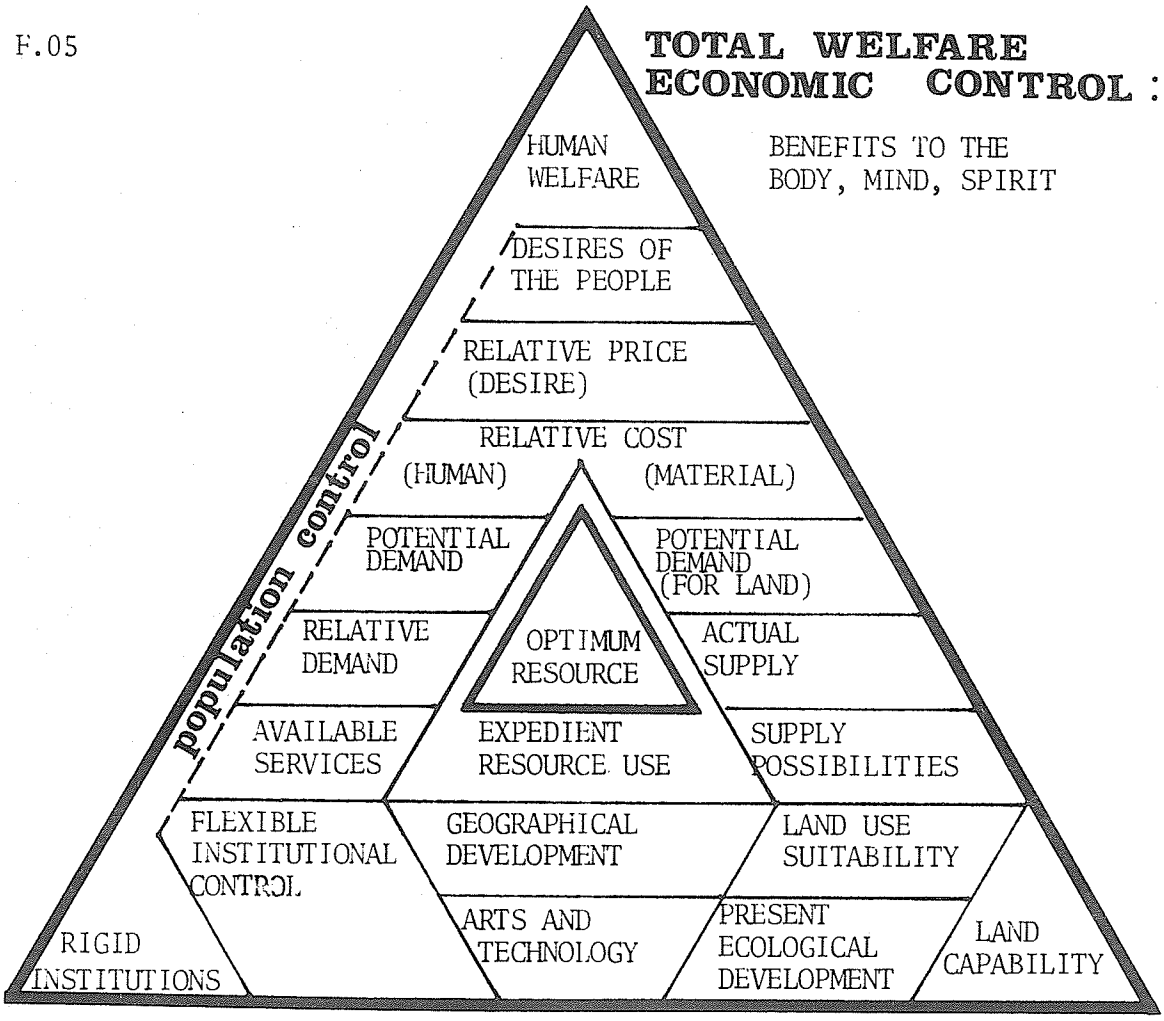
* Refer to Page 10

THREE DIMENSIONAL FRAME FOR INTEGRATING GRADIENTS OF PHYSICAL, INSTITUTIONAL & WELFARE CONTROLS

F.05



Adapted from a diagram by, Hills, G.A., Developing a Better Environment, 1969, P. 25.

depend on whether the goals are planned as stop gap measures avoiding the real problems or planned in accordance with the needs and constraints of each group. This study will attempt to achieve an understanding of the relationship between the three land-use controls necessary to facilitate a good 'fit' or a healthy state.

The proposal for the development of Leaf Rapids* suggests as important ingredients of a healthy community only institutional goals. It appears that human welfare and environmental goals and their integral relationships to institutional goals have not been actively considered. This probably does not reflect a lack of concern for these goals, rather an inability of previous planning methods to discuss these goals in relation to institutional goals. The institutional goals established within the Leaf Rapids proposal seems totally consistent with requirements for an evolutionary community. But as experience has so often shown, functional adequacy and economic incentives are far from adequate in attaining a healthy community environment. Thus the general policy goals for the development of Leaf Rapids within this study will be a compilation of the established institutional goals and the auxiliary goals formulated from human welfare and environmental considerations. The following discussion, will attempt to expose the 'holistic' relationship of these variables within the context of achieving a healthy community.

One qualification should be made before beginning the discussion. Since this study is primarily concerned with environmental considerations, human welfare goals will be discussed as benefits accrued by the body, mind and spirit of the individual through the perception of and empathy with the natural environment. There is enough evidence and philosophy in our history to conclude that perception of a natural environment is an essential part of human existence, for we, as are all living things, are part of that environment and it is part of us.

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* Henderson, D.G. - A Proposal for the Development of the Leaf Rapids Townsite, 1970.

LEAF RAPIDS AS AN EVOLUTIONARY COMMUNITY

A stable, healthy community environment according to McHargs model (P.16) should be a function of the following criteria:

1) LOW ENTROPY

Entropy, as defined for this context, is transformation after energy input. Therefore an object exhibiting characteristics of low entropy would be less likely to suffer large transformations due to external or internal pressures than an object subject to high entropy.

ESTABLISHED INSTITUTIONAL GOALS

The economic and social base of a healthy community should be sufficiently broad so that any changes within these structures do not cause serious social or economic pressures. The proposed concept of a northern support center and all its ramifications combined with the desire to reduce the mobility rate of the work force is consistent with the requirements for a low entropic social and economic state.

HUMAN WELFARE CONSIDERATIONS

If the natural environment is a source of benefit to the body, mind, and spirit as has been proposed, there is a need to retain sufficient vegetation of low entropy so that changes will not alter the state of the vegetation to a degree where the original beneficial attributes are lost. Thus a community whose natural environmental benefits are lessened or lost increases the potential of residential disatisfaction and possible mobility. Therefore as the economic and social base is sufficiently broad to withstand change without causing deleterious effects, so should the environmental benefits be of sufficient stability to withstand a reasonable amount of change without losing its original attributes and negatively affecting human welfare.

ENVIRONMENTAL CONSIDERATIONS

In relative terms the eco-system of the Leaf Rapids area is subject to

very high rates of entropy in regards to the proposed land-use inputs.* This means relatively small amounts of energy can cause large scale transformations within the eco-system. In order to retain the integrity of the natural environment which satisfies human welfare needs, the entropy rate resulting from the meshing of the natural and man-made environments must remain as low as possible. Thus the location of land-use inputs should be directly related to the entropy rate or carrying capacity of the land.

AUXILIARY GOAL

In order to retain the integrity of the natural environment so that human welfare goals can be obtained the location of the land uses should be related to:

1) sufficient quantity of vegetation so that any changes will not cause severe changes to the perceptual benefits.

2) land uses should be located in areas of vegetation with a low entropy rate. This would tend to minimize a tenuous situation between the man-made and natural environments.

2) HIGH NUMBER OF SPECIES

ESTABLISHED INSTITUTIONAL GOALS

A high number of institutional types (commercial enterprises) tends to reduce the entropy rate within the economic and social community and the concept of a northern support center again fulfills an important health prerequisite. The logic behind this thinking is that an increase in the number of types of institutions will decrease the potential of any one change causing ill affects to them all, thus reducing the chances of large scale impacts or pressures.

* Hilderman. Ingmire. - Southern Indian Lake Recreation Study, Prepared for department of Tourism and Recreation. Parks Branch of Manitoba, 1969.

HUMAN WELFARE CONSIDERATIONS

A high number of natural environment types increases the potential of perceptual health in two ways:

1) an increase in the number of species of vegetation is a factor in reducing the potential of any large scale transformation of vegetation benefits that could be harmful to perceptual health.

2) increase in the number of types of vegetation increases the range of choice or diversity within the perceptual catalogue of experiences.

ENVIRONMENTAL CONSIDERATIONS

Reduction of large scale impacts on the natural environment can be facilitated by considering the relationship of the location and type of activity to the number of species of vegetation. The larger the number of different species of vegetation the less likely the land-use inputs and its associated activities will affect all of them. Thus, areas of high numbers of species will be less susceptible to large scale impacts, such as the major proportion of the vegetation dying off.

AUXILIARY GOAL

To bring about the optimization of the potential benefits of the site, land-use inputs should be located in such a way as to take advantage of the increased stability and perceptual diversity of areas of high numbers of species. Thus'the number of vegetation types' should form an integral part of the site suitability and the carrying capacity of the land.

3) DIVERSITY AND COMPLEXITY

ESTABLISHED INSTITUTIONAL GOALS

The increased diversity of a northern support center as opposed to a single enterprise town will allow the occupant or industry more possible options of choice at any point in time and decrease the need for residents

or industries to migrate elsewhere in search of a suitable economic or social climate. The approach to incorporate indigenous people and people from varying backgrounds reinforces the economic and social diversity in achieving an eudaemonic community state.

HUMAN WELFARE CONSIDERATIONS

A complex environment creates perceptual diversity which is essential for the big-brained human being. It is essential to provide the opposites in life for without unhappiness there can be no sensation of happiness. The relatively simple eco-system projects simple, uncomplex perceptual stimulations. The problem of visual over-stimulation rarely occurs and need not be considered at this time. This meagre perceptual atmosphere is compounded in many cases by sub-arctic communities not capitalizing on what natural perceptual amenities do exist resulting in an unhealthy mono-perceptual environment. These serious perceptual deficiencies and their implications will be discussed at greater length in Part B: perceptual diversity and complexity.

NATURAL ENVIRONMENT CONSIDERATIONS

The natural environment north of the 53rd latitude generally does not have a diverse or complex eco-system. This means, as does the high entropy rate and generally low number of species, that the eco-system as a whole is very susceptible to wide spread and permanent damage if any one part is overly disturbed. Areas with low degrees of eco-system complexity indicate unsatisfactory growing conditions and a very slow rate of natural succession. Areas of a more complex eco-system suggest a more conclusive environment and one could expect a faster natural succession to take place.

Therefore areas of low eco-system complexity are:

1) most susceptible to negative impact and will not regenerate in a reasonable time.

2) least useful for perceptual complexity and stimulation.

Areas of high eco-system complexity are:

1) less susceptible to impact and regeneration can be expected if the impact is not too severe.

2) most useful for perceptual stimulation.

AUXILIARY GOAL

In considering the interface between the natural and the man-made environments, the complexity of the vegetation should be considered as follows:

A) land-use inputs should not destroy complex eco-systems which offer rich perceptual stimulations.

B) areas of extremely low eco-system complexity, with low natural succession potential, and of little perceptual value should be considered as areas of potential expendability.

4) INTERDEPENDENCE

ESTABLISHED INSTITUTIONAL GOALS

The whole concept of community rests upon the premise that mutual inter-dependence results in a 'holistic' system in which the untimate strength of the community is a by-product of the inter-actions of the individual parts. The resultant strength of a twisted rope is greater than an un-twisted rope. The twisting of the fibers makes them co-operate and act as a system. By combining the institutional components into a northern support center, this will untimately manifest itself into a greater overall strength and health for the community. The outgrowth of such a system is that the community will be able to sustain more amenities to their mutual benefit than could otherwise have been sustained.

HUMAN WELFARE CONSIDERATIONS

Inter-dependence between human welfare and the natural environment is more difficult to discuss, for man's relationship with the environment is not

symbiotic. His overwhelming power and his concern for his own wellbeing requires a modified concept of interdependence with the natural environment.

Human welfare is dependent on the environment in the following ways:

1) the emotional and spiritual benefits accrued by man from his perception of and empathy with the natural environment, thus aiding in restoring and retaining healthy mental states.

2) the opportunity for 'holistic' combinations of man-made and the natural environments that could transcend into aesthetic expressions. (This subject will be discussed in greater detail in Part B).

3) The potential satisfaction that can be gained if a community has caused minimal perturbation of the environment. In this time of great pollution concern, knowing one is living in harmony with, rather than subjugating, the environment will be a source of pleasure.

Besides minor environmental modifications such as thinning or adding nutrients to the soil etc., the environment is much less dependent on man. The interdependence occurs in rather a negative manner. The health of the natural environment is directly related to man's actions. Actions which respect the integrity of the natural environment maintain a healthy ecosystem. Actions that abuse these principles result in ill-health. Consequently the health of the natural environment is dependent on man's actions. A healthy interdependence can be established by planning the interface between the natural and man-made environments in such a way as to make the physical and mental health of the community dependent upon the preservation of a healthy natural environment.

For example, vegetation that has a purpose such as buffer vegetation establishes an interdependent relationship. It is within the communities own interest to maintain the health of that buffer vegetation and thus a mutual interdependence arises from the purposeful role of the vegetation.

NATURAL ENVIRONMENT CONSIDERATIONS

The symbiotic state within the natural environment is the result of a complex web of interdependencies. In order to reduce the negative consequences of man's intervention into these systems, the interdependencies must be understood. Hence, before any final planning decision can be made, both the primary and secondary consequences of the feasibility proposals must be understood in relation to the whole system.

AUXILIARY GOALS

1) Vegetation should not be left or used indiscriminately so that there is no direct functional use for vegetation, thus its health is not of primary importance within the actions of man. Vegetation within the community should have meaning with respect to the functioning of the community. In this way an interdependent (holistic) relationship can be established.

2) Both primary and secondary consequences of actions to institutional, human welfare and ecological health should be understood before any meaningful planning decisions can be made.

PART B: SPECIFIC COMMUNITY DEVELOPMENT POLICY

1) TOURIST INDUSTRY

Although environmental resources aid both directly and indirectly in the health of the inhabitants and industries within the community, the tourist industry is especially dependent on health of the natural resources. If the proposed tourist industry is to be taken seriously, a very conscious and deliberate efforts should be made to introduce this aspect within the overall planning decisions of the community.

The significance of this industry to the evolution of the Leaf Rapids area has been estimated in several studies. The following statements from a Manitoba Hydro report adequately summarize the implications to the development of Leaf Rapids.

> RECREATION
>
> "The recreation potential of the study area is a resource of major significance. Within two years, major lakes in the area will be accessible by road and inevitably tourism will play a large role in the development of the area. All indications are that the demand for recreation is growing and will continue to grow at rates well in excess of most other sections of the economy. Recent trends in North America indicate a growth rate of 10% - 12%. The fact that part and campsite usage in both Manitoba and Saskatchewan has been increasing at higher rates is of particular relevance.
>
> Major areas of development will be dependent on both accessibility and the physical features of the landscape. That section of the Churchill River extending from Sisipuk Lake on the Saskatchewan border to Opachuanau Lake at the south end of Southern Indian Lake will, in all probability, be the area where most of the development will occur. The new road from Thompson to Lynn Lake will make much of this area accessible by automobile. In addition, a road extending from Lac La Ronge to Reindeer Lake is

> approaching completion. Consequently, it seems possible that, by 1980, a motorist will be able to drive north from Lac La Ronge, in Saskatchewan to Brochet and Lynn Lake, and then south through Thompson. Such a "circle" route would further enhance the recreation potential of the study area."[9]

Other studies of the area based on Canada Land Inventory classifications for outdoor recreation by M.A. Borys[10] and studies based on professional expertise such as the study carried out by Mr. G. Hilderman[11] both reiterated the realistic potential of a healthy tourist industry. What this means in accrued benefits to the health of a community has been expressed very well by Angus Hills.

> "In many areas of Ontario the fact is overlooked that a rural landscape could be a tourist attraction such as are the farmlands along the St. Lawrence River in the Province of Quebec. It is true the farmers themselves are not paid for the landscapes copped* by tourists. However, not only do the local inhabitants receive their reward in terms of renewed health and spirit from a pleasing landscape, but the total economy of the area is strengthened. The appearance of many settlements in Ontario especially in the north is depressing. This aspect of rural economy should not be neglected in projects planned under the Agricultural Rehabilitation Development Act".[12]

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9 MANITOBA HYDRO - Churchill River diversion study of alternative proposals. Unpublished report 1969 Page 65

10 Borys, A. - The Churchill River Centering on Pawistik: A Regional Study with Particular Emphasis on Recreational Land Use and Potentials, Masters Thesis, U. of M., 1967.

11 Hilderman, Ingmine. - Southern Indian Lake Recreation Study, prepared for the Dept. of Tourism and Recreation Parks Branch of Manitoba, 1969.

12 Hills, G.A. - The Ecological Basis for Land Use Planning, Ontario Dept. of Lands and Forests, Research Report Number 46, Dec. 1961. Pgs. 123 and 124.

* copped as defined by Angus Hills refers to the capture of sensory impressions or sensations.

Although the circumstances are slightly different the basic principles are still very applicable. In development of any land use, whether it be agricultural, highway construction or community development, it must be recognized that these land-uses impinge upon the environment. The interface of these activities with the natural environment must be regarded as an integral component of the planning decisions if a healthy tourist industry is to establish itself. If the community of Leaf Rapids is to capitalize on the tourist industry the visual image of the town becomes a very important planning criteria not only in drawing tourist visitation but creating the motivation to remain. Unfortunately, most northern towns both planned and unplanned have such bland and depressing images that there is a reverse tendency, tourists vacate these communities as soon as possible and the benefits from a healthy tourist industry are lost. One can conclude, therefore, that the ability to understand the ecological constraints of the area and the ability to handle visual information becomes an important asset in planning communities which then can take advantage of the added economic strength through tourism.

SPECIFIC COMMUNITY GOALS

The visual images projected by the various land-use inputs of the community within the context of the natural environment must be given primary consideration if a rich and distinctive community image is to be developed and a tourist industry is to flourish.

2) VISUAL IMAGES AND PLANNING FORMS

When working within a methodological framework that allows qualitative value judgements to be introduced one expects both subjective and objective inputs. It is important to articulate when subjective information is being introduced in order to allow for compensations to be made regarding differing opinions. It is hoped that this procedure will retain an acceptable level of objectivity concerning the analytic capabilities of techniques which will be developed in this study.

The following discussion concerning the images and forms of communities can be described as subjective input as it is a result of professional

training and opinions, combined with personal experience and is thus not able to exhibit actual corroborating facts. Such opinions can vary from professional to professional.

Ralf Erskine's many years involved with northern European planning has led him to believe that northerners are very conscious of living at the outer edge of the happenings which are central to the interests of the time. They long to belong to these happenings and one of the methods for maintaining the emotional threads of contact is by imitating the styles and thoughts of the innovations in the southern capitals even if the styles serve no useful purpose in their own unique context.

Recent research into northern towns suggests that visual images projected by the physical inputs of the community should not be so foreign that the inhabitants would have difficulty relating to them, resulting in alienation from a major source of security. One such study conducted by Dr. Matthiasson notes that;

> "----although traditional models of community structure derived from empirical studies of southern towns and cities are not adequate for northern community planning, too great a deviation from them will make for a poor fit between community and resident, and result in resident dissatisfaction and eventual out-migration.[13]

This is a situation that must be seriously considered by planners for it is a potent rational for visual, stylistic, and planning preferences of the future inhabitants.

It is the Professional opinion of this author that the imposition of southern styles and planning concepts on subarctic contexts is not only visually but also environmentally quite inappropriate. The result is usually that

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[13] Matthiasson, J.S. - Resident Perceptions of Quality of life in Resource Frontier Communities. Series 2: Research Reports No 2., Center for Settlement Studies, University of Manitoba, 1970. P. 2

the northern communities become a rather pale and sad shadow of their southern counterparts.* In attempting to emulate southern images the meanings of those images are lost in their new context. It must be understood that the innovators in the southern capitals responded in an aesthetic way to their own particular functional, environmental, and economic constraints. In the subarctic context the style of image not only loses its functional, environmental and economic reasons for existence, but also the original aesthetic response loses its meaning and becomes capricious. The lack of concern and understanding of the northern situation and its sensitive eco-systems usually causes irreparable damage, compounding an already bad situation. The result of emulation with no concern for context usually emphasizes the negative differences between the northern and southern communities rather than emphasizing the positive similarities and differences.

This second class existence for subarctic residents need not exist. By understanding the unique requirements of subarctic, boreal forest habitation innovative, functional, eco-sensitive and economically viable solutions can be procured which can result in a novel first class living environment. An original aesthetic expression can be achieved through responding sensitively to the earth and its processes as Lou Kahn suggests. (P. 19). This will give inspirational form to the design. Expanding this thought further; by limiting the pre-conceptions of existing southern communities and by taking advantage of intrinsic natural resources one can optimize environmental features of the site while minimizing the negative effects on the eco-system. This approach to the design of the community will allow the environmental constraints to suggest design solutions which will allow the aesthetic responses to have <u>meaning</u>.

The planner must resolve the conflict created by the residents' need for imitative imagery and the need to respect the environment and give meaning

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*suburban images and planning concepts originated in the south western United States, particularly Arizona and California.

to the design solutions. The Sherritt program, from which this study originates, has specified building types which satisfy the imitative needs of the residents. By combining these building types in a way that is more sensitive to the environment, it is felt a realistic compromise can be established. Hence the following goals.

SPECIFIC COMMUNITY GOALS

1. Residents of the community should be consulted as to what types of vegetation they would prefer to have around their residences. But the vegetation types offered should be indicative of the indigenous vegetation types that are able to visually and ecologically support that type of land-use input. (Subsequent planting of vegetation by residents, if consistent with the visual guidelines, can further enhance the desirability and personality of lots, while complimenting the total visual image of the community.)

2. In responding to environmental constraints the planner must find a "fit" between substantial new additions of community components in such a way that the functions and structures can be absorbed or blend into the landscape without disrupting the natural visual rhythms and balances. Thus land-use inputs should be classified as to their visual impact and located in areas that will elicit a visual result consistent with the desired impact profile or visual image of the whole town.

3) PERCEPTUAL DIVERSITY AND COMPLEXITY

This discussion is basically an extension of thoughts developed in Part A: Diversity and complexity. Further discussion was felt necessary to expand upon and explain in greater detail these thoughts due to their importance to the health of the community as a whole. Many subarctic communities suffer from an acute lack of perceptual stimulation. This problem can be reduced significantly through the innovative use of natural vegetation and appears to be a realistic solution within present program constraints.

Once more it is pertinent to return to Lou Kahn concepts (P. 13) to explain the foundation and functioning of this design theory. Within this theory,

form and process are indivisible aspects of a single phenomenon. A process that takes advantage of the diversity and complexity of the natural environment will increase the richness of forms from which the planner can draw upon to create the design. The ecological problems and constraints of the Leaf Rapids area are easily defined and they suggest clearly many form ramifications which can be transmitted by the designer into perceptually rich planning concepts. The following example results from an analysis of the sensitive environmental condition of the Leaf Rapids area. In this fragile ecology two approaches to land-use inputs were found to be appropriate. (This will be discussed in more detail later but what is important to understand now is how these constraints can lead to rich planning solutions.)

> With cognizance of the general and specific goals established to this point it was found that the stable vegetation of the site could withstand small point impacts over a large area.* The distance between would be defined by the carrying capacity of that site.
>
> Secondly, the unstable environment was found to be so sensitive that even close proximity to land-use inputs would cause retrogression. These areas would suffer impact whether they were actively used or not.

Therefore by locating necessary large land-use impacts such as multi-family units, commercial, and industrial complexes on these areas the negative impacts would be concentrated.

The trend being established is that small point inputs should spread out while large inputs should be brought together to concentrate the impact. These environmental constraints can have significant spatial and scaler implications.

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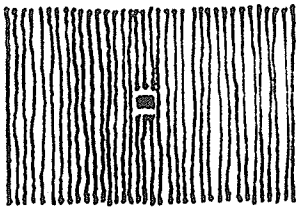
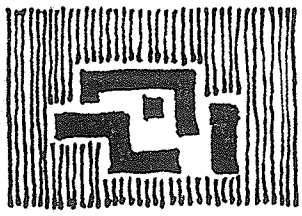
* Conclusions drawn as a result of discussions with Parks Branch Planners, Landscape architects, and professors of Forestry.

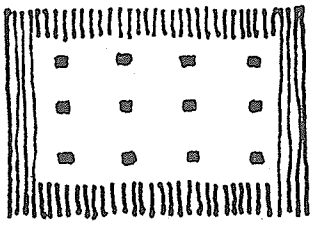


1) The small point input (residential unit) is absorbed in the vast sea of the environment and achieves a small intimate scale thru contract with the other extreme.



2) The clustering of multi-family units achieves a large monolithic and dynamic scale as compared to the observer and vegetation.

These inputs compared to each other accentuate both the intimate and grand qualities of each and in each case the scale is decisively carried out. Intimacy and the awe of grand scale are both universal sensations that can be capitalized on to create a rich and diverse perceptual environment. This is one example of many potential ways of capitalizing upon the environment to create healthier living conditions.



3) In contrast, many northern communities have lost their vegetation and insensitive planning techniques such as consistent setbacks etc. have resulted in a mono-spatial and mono-perceptual environment where visual diversity and either perceptual extreme is non existent. This impoverished visual field is one of the major causes of the bland, depressing atmosphere of northern communities.

F.06

SPECIFIC COMMUNITY GOALS

1. The solutions to environmental problems should be considered as a source of unique opportunities to create a diverse and rich perceptual environment.

2. The retention and protection of the natural environment should be considered as a necessary spatial and scalar component assuming existing land-use input types. (This will also establish meaningful roles for landscape features which reinforce the interdependency between man and the environment.)

3. The degree of land-use input any vegetation is subjected to should be related to the visual carrying capacity of the land so that the site does not become so over-used that the original perceptual quality of the vegetation is not destroyed (extension of entropy, and high number of species goals.)

4) PERCEPTUAL CONTROL

The major proportion of our perceptual experiences of any town both as resident and especially as tourist emanates from the circulation route. Therefore the resulting visual impressions and stimulations one receives of a community are mostly contingent upon what happens on either side of the circulation route. In the past short term, pragmatic criteria have formed the basis for the location of all circulation routes.

Lynn Lake is quite a typical example of poor perceptual planning. The vegetation in the Lynn Lake area is affected greatly by the perma frost and is quite visually uncomplex but the town is nestled in between three very scenic lakes. The circulation routes have been laid out in such a way that there is no perception of any of the lakes and only fleeting glimpses of an already uncomplex vegetation. One receives an image of only buildings rather densely located and all of the same sensory impression. The resulting impression of the town for the residents and potential tourists is much less perceptually rewarding than could have been achieved. This situation interjects many problems into the developing of an economically viable tourist trade.

One can conclude therefore that apart from the sheer pragmatic requirements of circulation routes, there is a great responsibility to provide diversity of perceptual stimulation. Circulation routes should consist of a series of individual spatial events through which the traveller experiences extremes of individuality and yet receives an overall impression of visual

continuity. With these concepts in mind the following goals have been established.

SPECIFIC COMMUNITY GOALS

1. Generally the location of circulation routes should take into consideration:

A) visual access to unique environmental features that would add diversity to the perceptual experience and express the exclusive character of the area.

B) avoidance of visual access to perceptual nuisances such as borrow pits, junk yards, industries or any visual images not consistent with the overall desired visual impact.

2. The individuality and uniqueness will be introduced by the varied combinations of land-use inputs, therefore it is necessary that the natural vegetation provide the visual continuity and the absorptive quality allowing the potential of distinct spatial events.

These two goals become quite important for the overall perceptual image of a town as perceived by tourists and a resulting tourist industry. The tourist industry of the north does not depend on Cathedrals or ancient ruins but healthy, beautiful and stimulating natural environment. That should be enhanced, not destroyed, by development.

RESOURCE ANALYSIS

3

LEVEL A: SITE LOCATION

DATA BANK
SITE CAPABILITY
SITE SUITABILITY
POTENTIAL SITES
SITE EVALUATION

SYNOPSIS: The objective of this area of study is to develop some of the tools and techniques necessary to initiate environmental implications into the site planning and design process. The techniques have been developed for application at two scales: level A, community siting, level B, community design. Level A is developed in this section and involves the examination of the resource base to determine areas of optimal resource characteristics for community development. This assists in locating and rating potential sites according to their 'attractiveness' under given land-use requirements.

LEVEL A: COMMUNITY SITE LOCATION ANALYSIS

The limiting factors to the size of the study area in level A were the site constraints forwarded in the Sherritt-Gordon Program.[14] The program specified that the proposed community site locations should:

- be located within easy driving distance of the mine site. (maximum 20 miles one way.)

- have access to a provincial or trunk highway. (site location should not necessitate the construction of new access roads.)

- be in proximity to an adequate potable water supply.

- have the capacity to receive sewage treatment discharge or sewage lagoon construction.

- have soil conditions satisfactory for building construction and the installation of utilities preferably free from permafrost, muskeg and high water tables.

- have a natural vegetation cover that would possibly contribute to a pleasant living environment.

- be in proximity to sites which might be suitable for recreation and summer resort purposes.

- not encroach upon the maximum high water demand which might be created by Hydro developments at South Indian Lake.

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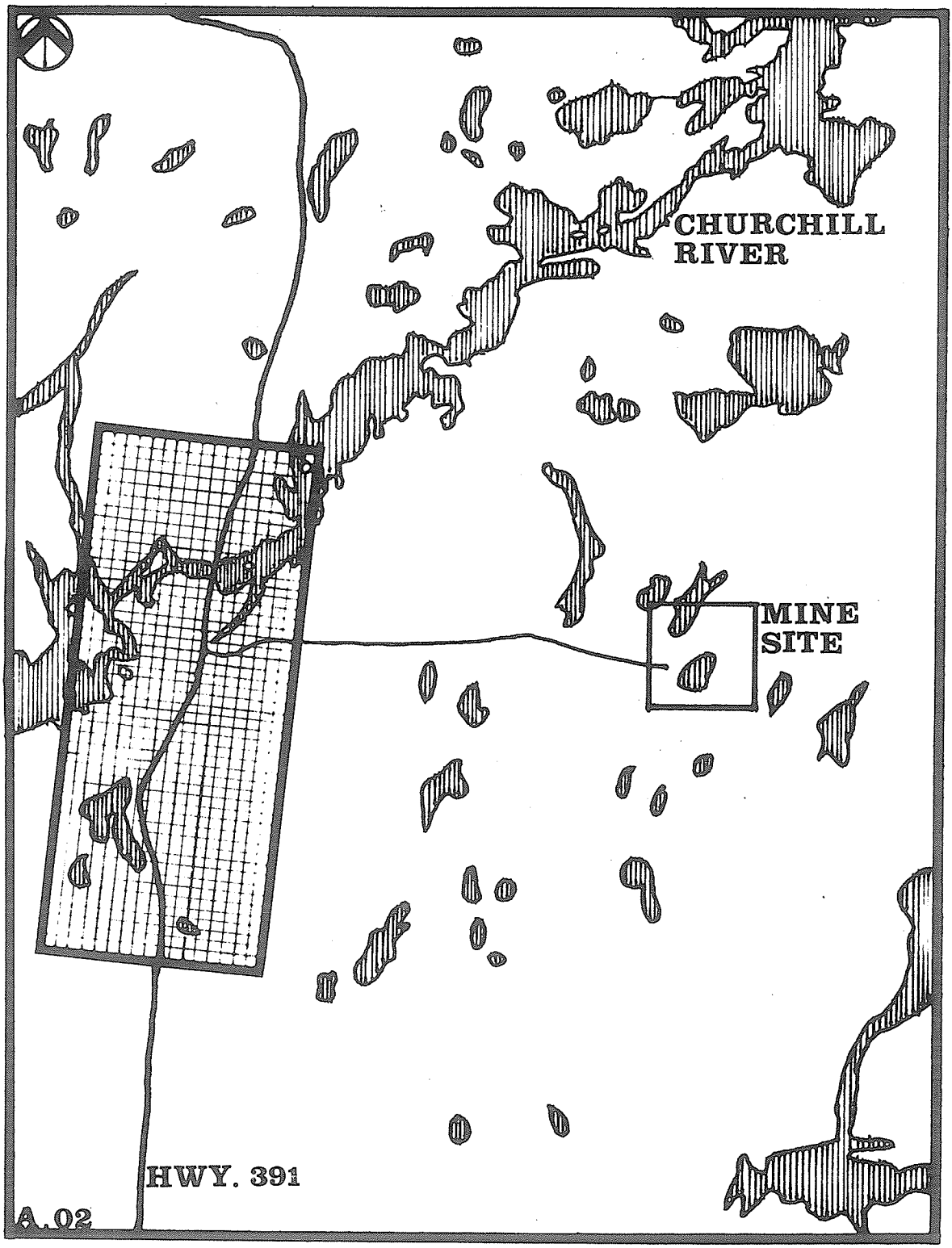
[14] Henderson, D. G. - A proposal for the development of Leaf Rapids Townsite, unpublished report 1970. p. 10, 11.

The previous criteria were used to screen a 20 mile radius around the mine site. This resulted in a substantial limitation of possible development areas. The subsequent map (A.02) delimits an area, which could possibly provide viable sites, given the program requirements.

In addition to satisfying the Sherritt-Gordon criteria, other resource amenities are necessary to assist in achieving the stated policy goals. This has necessitated additional resource base information such as: surficial land forms, vegetation, stability, and visual access to feature landscapes. This additional resource information formed the data bank upon which the site capability and site suitability models were based.

LEVEL A : STUDY AREA

SCALE : ONE CELL EQUALS 36 ACRES



DATA BANK

The function of the data bank at level A is to classify and store objective resource base information.

The data has been received in a variety of scales and a broad range of detail. This information has been subjected to a preliminary screening to determine the premises that generated the particular data and to a leveling off of detail to a uniform depth and consistency. This is then a determining factor in the scale of the data grid cell for which the level of information is appropriate. A balance is found between the level of information and the number of grid cells that is efficient and economically practical considering the data bank handling process. One grid cell equaling 36 acres was found to be the most appropriate size for this scale of analysis.

The site information has been subdivided into distinct data categories. The data categories and internal organization of each is representative of the range and type of condition present at this scale of analysis. The information in each data category has been organized into ten level ordinal scales which assign relative order, not magnitude, to the variables. A ten level scale facilitates consistency in compiling data categories and ease of handling information. It should be noted that the 0 - 9 scale throughout the whole study will always mean from least to most, or from smallest to largest, and when specific values are applied in capability or suitability sections it will always be ordered from the least compatible to most compatible or whatever meaning is appropriate to the topic.

DATA CATEGORIES

1) SURFICIAL LAND FORMS

In a report[15] for the Canadian National Railways a terrain classification

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[15] Ruttan Rail Line Route Location - Underwood McLellan and Associates Ltd. 1971.

system has been established by Underwood McLellan for the general vicinity of Leaf Rapids. Within this report the terrain around the Leaf Rapids area was interpreted using the classification system and the resultant information forms a data bank category for level A analysis.

TERRAIN CLASSIFICATION

GROUP ONE: Organic terrain (including open swamps), highly permafrost affected in most areas. This may include some shallow granular deposits and some permafrost affected clays adjacent to the organic area.

GROUP TWO: Primarily exposed bedrock and areas having generally less than 10 feet of overburden cover.

GROUP THREE: Predominately lacustrine clay areas, shallow deposits over bedrock on highs, generally greater than 10 feet deep in lows and often permafrost affected. Some silt and till areas with occasional rock outcroppings on highs may occur.

GROUP FOUR: Predominately clay - till areas, may occasionally include smaller granular deposits. Generally less than 20 feet deep with some small rock outcrop on highs.

GROUP FIVE: Large granular deposits, such as eskers and kames, generally in excess of 20 feet thick.

SURFICIAL LAND FORMS

0	Water
1	Group one
2	
3	Group two
4	
5	Group three
6	
7	Group four
8	
9	Group five

Source of Data

1) air photo interpretation
2) field survey

2) VEGETATION STABILITY

Vegetation stability is a complex phenomenon ranging from ecological to psychological considerations. Thus, the components are too many and too varied to all be considered separately within the scope of this problem. As a result the many factors have been combined into nine levels of vegetation stability which make a more suitable and convenient package to manipulate. The subsequent discussion will attempt to articulate the many inputs and suggest an objective rationale for the development of the nine levels of vegetation stability. The vegetation characteristics and the resultant levels refer specifically to the Leaf Rapids area.

GENERAL DISCUSSION

CONIFEROUS TREES

The coniferous trees in the area include black spruce, which is the climax species, jack pine, white spruce and very few tamarack. In terms of stability the conifers share many similarities:

1) Root structures are very shallow and are very susceptible to damage during construction:

a) root pruning
b) change of grade can either over-expose or smother the root system.

2) Due to shallow roots, conifers depend on each other for support against the lateral forces such as wind and when thinned or opened up suddenly the trees are quite susceptible to windthrow. It has been estimated that a domino-like effect could occur up to 1/4 of a mile back from the original opening.*

3) Water table changes affect the shallow-rooted conifer trees greatly

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* Estimations resulted from discussions with experts from the Parks Branch and the Department of Forestry U. of M.

and gravel eskers are very susceptible to very sudden and dramatic changes in water tables especially during excavation or cut and fill operations.

4) Young coniferous trees are more fragile than young deciduous trees and have many more natural insect and animal enemies.

5) Coniferous trees are more stable when left in large clumps especially when their natural edges are retained.

6) Mature coniferous trees standing fairly isolated and obviously supporting themselves against lateral forces have more stable root structures and are thus more stable than similar trees in a dense stand.

7) Black spruce, in particular, grow in poorly drained areas or areas with high perched water tables and are much more susceptible to damage due to construction which will affect water tables.

DECIDUOUS TREES

The deciduous trees most prominent in the area are white birch and trembling aspen.

1) Deciduous trees are not only more hardy when young with fewer natural enemies but grow approximately two times as fast which increases their rebound potential.

2) Mature deciduous trees have a deeper and more well developed root structure than the conifers and this gives them greater stability in the sandy soil.

3) For 3/4 of the year the deciduous trees are without leaves and this reduces the lateral forces on the tree.

4) White birch and aspen are usually found growing in areas with clay content in the soil, clay soils create a time lag in the drop of water table depths and thus allows the vegetation more time to adjust to the change.

5) Deciduous trees are more prized by northern inhabitants due to their relative scarcity and links with southern images and are thus afforded greater respect and attention.

MIXED SPECIES OF TREES

Many areas of the site have a combination of both coniferous and deciduous trees.

1) An area with a high number of species lowers the entropy rate thus increasing its stability. A mixed vegetation indicates a greater stability, for if the environment is changed it is less likely it will be deleterious to all the types.

2) A mixed vegetation stand on this site usually indicates good topsoil and environmental conditions which are more condusive to stability.

AUXILIARY CONSIDERATIONS

1) The lack of good understory regeneration seems to indicate poor environmental conditions and a low rebound potential.

2) During construction, older, more mature trees command more respect than younger trees from construction crews. The removal of large trees due to their bulk increases the inconvenience and effort. Younger trees are more easily moved and weigh less on the conscience if destroyed.

The previous criteria have been classified into the following nine levels of vegetation stability as a result of a concensus of expert opinions.

VEGETATION STABILITY CLASSIFICATION

GROUP ONE: Low vegetation cover including underbrush, herbacious plants, muskeg and bog.

GROUP TWO: Underdeveloped, dwarf or stagnating coniferous trees (low number of species).

GROUP THREE: Young coniferous trees in dense stand. (low number of species).

GROUP FOUR: Over mature coniferous trees in dense stand (low number of species) NOTE: There is a special hazard to development due to high potential of winds causing large trees to fall onto buildings.

GROUP FIVE: Open black spruce, white spruce and jackpine forest with no understory regeneration. (medium number of species) - openness indicates a more stable root structure but lack of understory suggest poor top soil conditions and low rebound potential.

GROUP SIX: Open black spruce, white spruce and jackpine forest with good understory regeneration.

GROUP SEVEN: Open or closed deciduous stand, with or without understory regeneration. (represents small proportion of trees on site.)

GROUP EIGHT: Mixed deciduous and coniferous trees with no understory regeneration (high number of species).

GROUP NINE: Mixed deciduous and coniferous trees with healthy understory regeneration. This would include a mix of species and ages which maximizes the chances of some trees being able to adapt to a changed environment (high number of species).

VEGETATION STABILITY

0 Water
1 Group one
2 Group two
3 Group three
4 Group four
5 Group five
6 Group six
7 Group seven
8 Group eight
9 Group nine

Sources of data

1) field survey
2) air photo interpretation

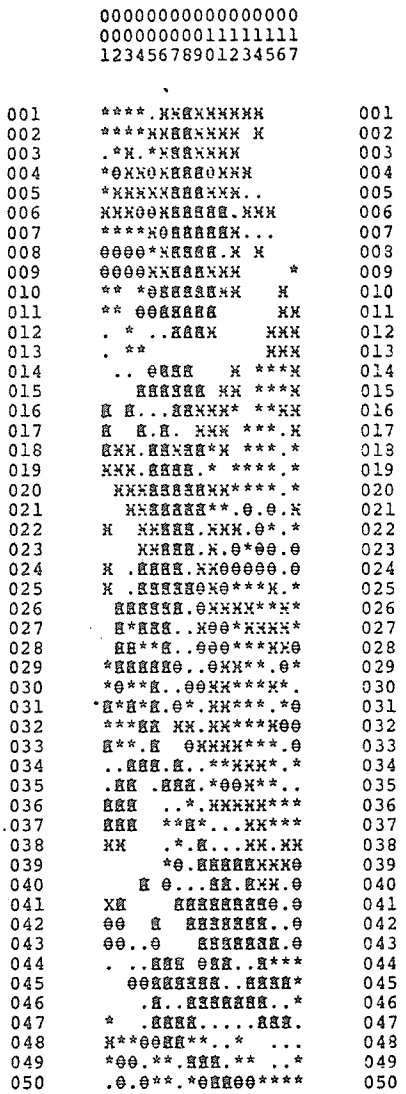
3) Visual Access to Feature Landscape

An inventory of the feature landscape types which exist within the boundaries of the study area was taken. The subsequent taxonomy represents a realistic reflection of the feature landscapes that were found. Due to the size of the grid cell (36 acres) it should be noted that only direct visual access to the landscape type within the cell received a rating.

0 water
1 no features outside normal
2
3 view of marshlands
4
5 view of stream (riverlet)
6
7 visual access to a ravine, hill, kettle
8
9 visual access to water (ponds, rivers, lakes).

Source of data

1) field survey
2) air photo interpretation



COMMUNITY SITING DATA BANK
LAND USE CODE:

SURFICIAL LAND FORMS

WATER
1 GROUP ONE
2
3 GROUP TWO
4
5 GROUP THREE
6
7 GROUP FOUR
8
9 GROUP FIVE

LEAF RAPIDS PLANNING STUDY
DAVID JOHNS M. ARCH. 1972
ONE SYMBOL EQUALS 36 ACRES

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS		.....	+++++++++	*********	XXXXXXXXX	XXXXXXXXX	XXXXXXX	0000000	0000000	XXXXXXX
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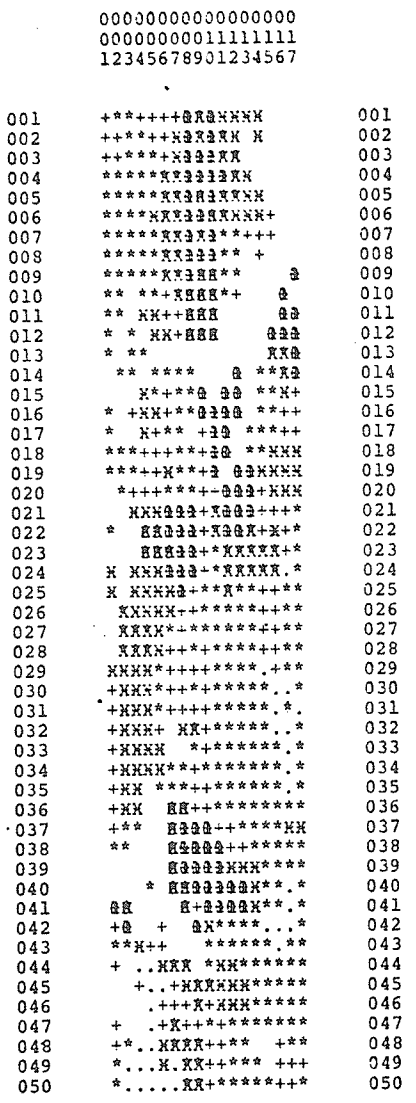

COMMUNITY SITING DATA BANK
LAND USE CODE:

VEGETATION STABILITY

WATER
1 GROUP ONE
2 GROUP TWO
3 GROUP THREE
4 GROUP FOUR
5 GROUP FIVE
6 GROUP SIX
7 GROUP SEVEN
8 GROUP EIGHT
9 GROUP NINE

LEAF RAPIDS PLANNING STUDY
DAVID JOHNS M. ARCH. 1972
ONE SYMBOL EQUALS 36 ACRES

LEVELS	0	1	2	3	4	5	6	7	8	9
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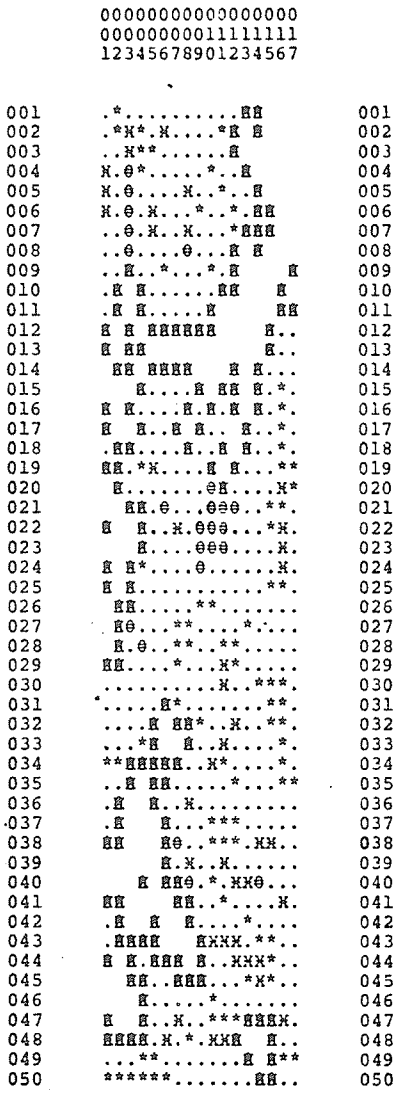

COMMUNITY SITING DATA BANK
LAND USE CODE:

VISUAL ACCESS

WATER
1 NO FEATURES OUTSIDE NORMAL
2
3 VIEW OF MARSHLANDS
4
5 VIEW OF STREAM (RIVERLET)
6
7 VISUAL ACCESS : RAVINE, HILL, KETTLE
8
9 VISUAL ACCESS TO WATER
(PONDS, RIVERS, LAKES)

LEAF RAPIDS PLANNING STUDY
DAVID JOHNS M. ARCH. 1972
ONE SYMBOL EQUALS 36 ACRES

LEVELS	0	1	2	3	4	5	6	7	8	9
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		.....	+++++++++	*********	XXXXXXXX	XXXXXXXX	XXXXXXXX	00000000	00000000	00000000

SITE CAPABILITY STUDIES

The 'capability' of the resource base is a function of its intrinsic capacity to satisfy specified demands associated with the siting of a community.

FOUNDATION CAPABILITY

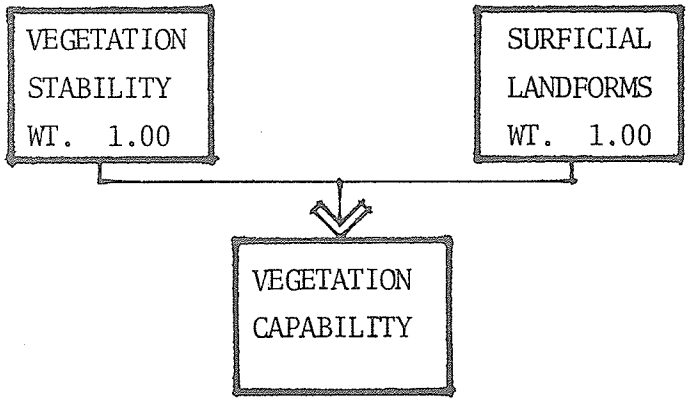
The building types of the community are anticipated to be bearing wall structures with linear spread footing foundations. The surficial material with the greatest bearing capacity and most appropriate for this type of foundation is sand or gravel (usually associated with eskers, group 5). Several other factors also make gravel eskers an excellent foundation material. Eskers provide a relatively homogeneous base which allows consistent building techniques throughout the site manifesting in construction efficiency. One can expect buildings to suffer only minor settlement with gravel or sand foundation conditions. Eskers are usually well drained and are not susceptible to capillary action by water. This fact reduces construction problems and seasonal movements of soil due to frost action. The eskers within the study area are usually permafrost free which greatly increases their desirability as a foundation material for communities. Finally, the eskers and kames have sufficient overburden which would insure ease of excavation for basements and services.

The clay - till areas (group four) would be less desirable as a foundation material due to the fact that clay is quite susceptible to frost action and seasonal movements. The bearing capacity of clay is less than sand and gravel and buildings usually suffer from settlement for long periods of time.

Given the building types and construction techniques, wherever possible permafrost, high water tables and rock outcrops should be avoided. Thus, groups one, two, and three offer major development constraints.

	0	water
LEAST	1	group one
COMPATIBLE	2	group two
	3	group three
	4	
	5	
	6	group four
	7	
MOST	8	
COMPATIBLE	9	group five

VEGETATION CAPABILITY



VEGETATION STABILITY

According to the Sherritt program for the community the single family units will require 75% of the total area of the site. Mindful of this type of input a general assumption can be made that a more stable vegetation on the site would make it less difficult to introduce substantial new development while retaining sufficient quantities of vegetation. This concept is developed further under level B analysis GENERAL GUIDELINES.

LEAST	0	water
COMPATIBLE	1	group one
	2	group two
	3	group three
	4	group four
	5	group five
	6	group six
	7	group seven
MOST	8	group eight
COMPATIBLE	9	group nine

SURFICIAL LAND FORMS

Soil type is often an influential factor in determining the ability of the vegetation to support development activities. Discussions with geomorphologists revealed that very general correlations between surficial materials and vegetation capability can be established.

Clay - till areas free from permafrost (group four) have properties which allow more stable vegetation types to develop. The mixture of soil types allows for a diverse vegetation while the commonality of esker soils leads to a less diverse vegetation type. As suggested in McHarg's model for health (p.11) diversity is a component of health and ultimately, stability. The clay content of the clay-till areas allows for slower percolation of water through the soil, less humus is lost, thus creating the opportunity for a strong soil profile to develop. Soils with clay content are less susceptible to rapid changes in water table level caused by development thus allowing more time for vegetation to adjust to the changes. Development on eskers (group five) often causes dramatic and severe water level changes in which the indigenous vegetation is not able to adjust, thus initiating retrogression within the vegetation.

Soil types associated with groups one and three are affected by permafrost which creates a tenuous existence for the vegetation and are not able to support development activities. Vegetation on rock outcroppings also leads a tenuous existence due to the lack of root anchor capacity.

SURFICIAL LAND FORMS

LEAST COMPATIBLE	0	water
	1	group one
	2	group two
	3	group three
	4	
	5	
	6	group five
	7	
MOST COMPATIBLE	8	
	9	group four

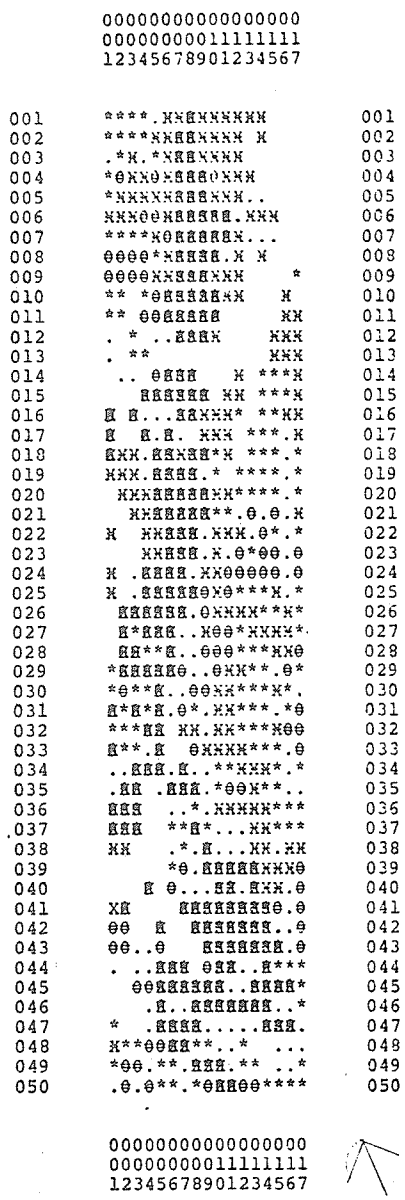
VISUAL ACCESS CAPABILITY

Perceptual diversity within the community is an established policy goal. Areas that have visual access to unique landscape features, significantly contribute to attaining this goal.

a) Visual access to unique landscapes offers an atypical visual experience which increases the perceptual diversity of the resident.

b) Novel landscape features can be used to create points of interest (focal points) which can provide sufficient interest to motivate tourists to remain or return.

LEAST COMPATIBLE	0	water
	1	no features outside normal
	2	
	3	view of marshlands
	4	
	5	view of stream (riverlets)
	6	
	7	visual access to a ravine, hill or kettle
MOST COMPATIBLE	8	
	9	visual access to water (ponds, rivers, lakes).



COMMUNITY SITING ANALYSIS
LAND USE CODE :

FOUNDATION CAPABILITY

WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEAF RAPIDS PLANNING STUDY
DAVID JOHNS M. ARCH. 1972
ONE SYMBOL EQUALS 36 ACRES

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS		.....	+++++++++	*********	XXXXXXXXX	XXXXXXXXX	XXXXXXX	0000000	0000000	XXXXXXX
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		.....	+++++++++	*********	XXXXXXXXX	XXXXXXXXX	XXXXXXX	0000000	1111111	XXXXXXX
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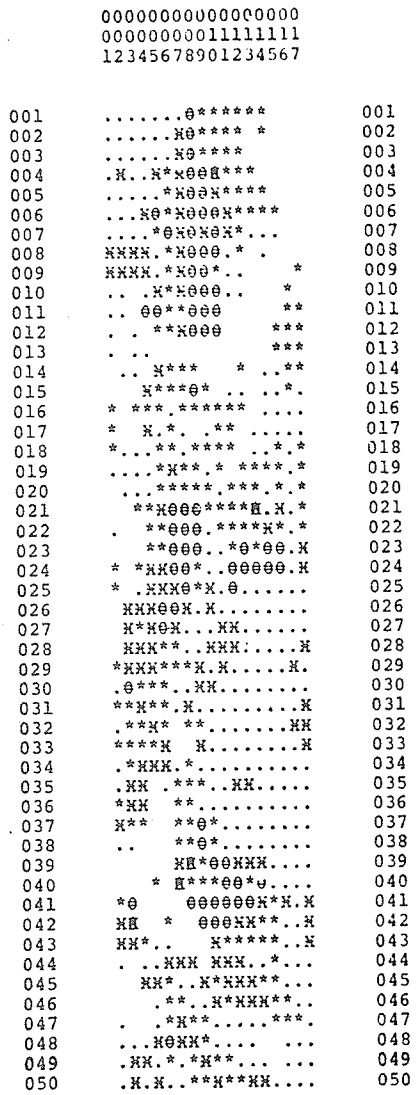


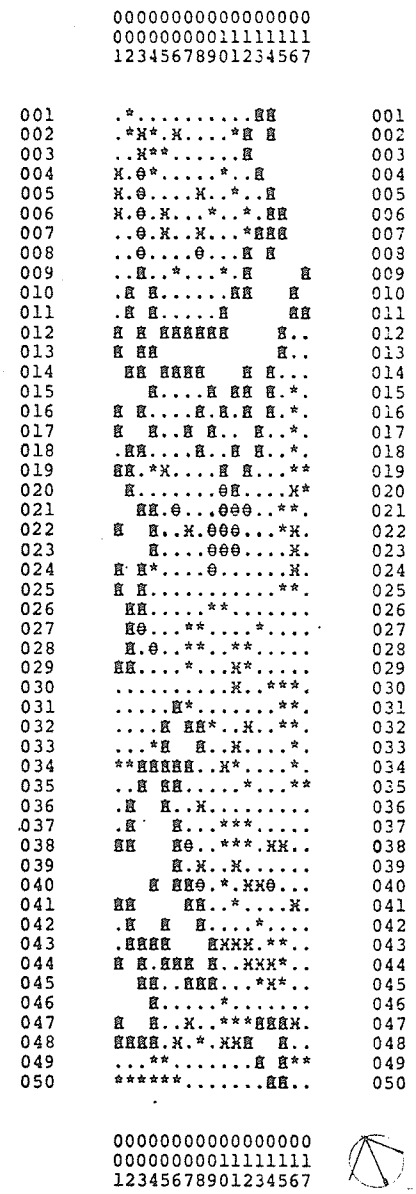
COMMUNITY SITING ANALYSIS
LAND USE CODE:

VEGETATION CAPABILITY

WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5 SCATTERED SITE MODIFICATIONS
6
7
8
9 MINOR SITE MODIFICATIONS

LEAF RAPIDS PLANNING STUDY
DAVID JOHNS M. ARCH. 1972
ONE SYMBOL EQUALS 36 ACRES

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	.	+	*	X	X	X	0	0	0



COMMUNITY SITING ANALYSIS
LAND USE CODE :

VISUAL ACCESS CAPABILITY

WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

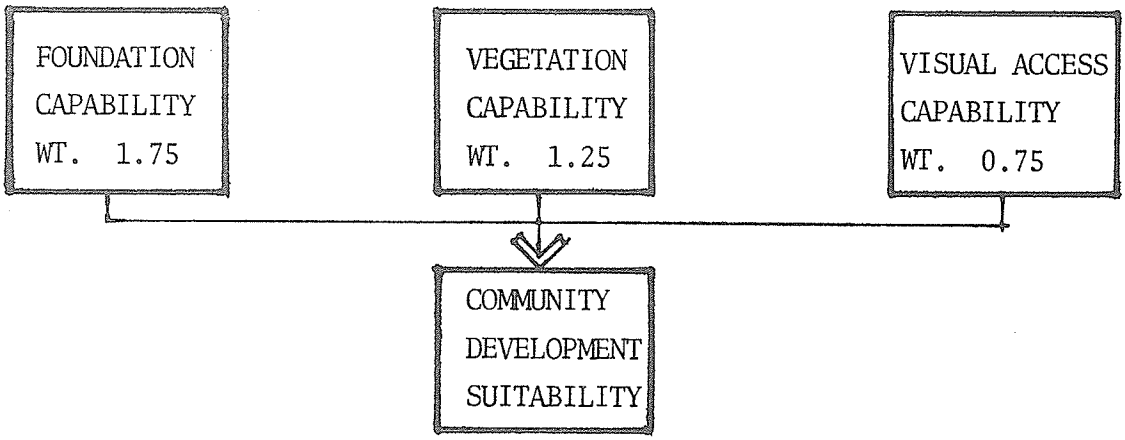
LEAF RAPIDS PLANNING STUDY
DAVID JOHNS M. ARCH. 1972
ONE SYMBOL EQUALS 36 ACRES

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.....	+++++++++	*********	XXXXXXXX	XXXXXXXX	XXXXXXXX	00000000	@@@@@@@@	#########	
	.....	+++++++++	*********	XXXXXXXX	XXXXXXXX	XXXXXXXX	00000000	@@@@@@@@	#########	
	.....	+++++++++	*********	XXXXXXXX	XXXXXXXX	XXXXXXXX	00000000	@@@@@@@@	#########	
	.....	+++++++++	*********	XXXXXXXX	XXXXXXXX	XXXXXXXX	00000000	@@@@@@@@	#########	
	.....	+++++++++	*********	XXXXXXXX	XXXXXXXX	XXXXXXXX	00000000	@@@@@@@@	#########	

SITE SUITABILITY STUDIES

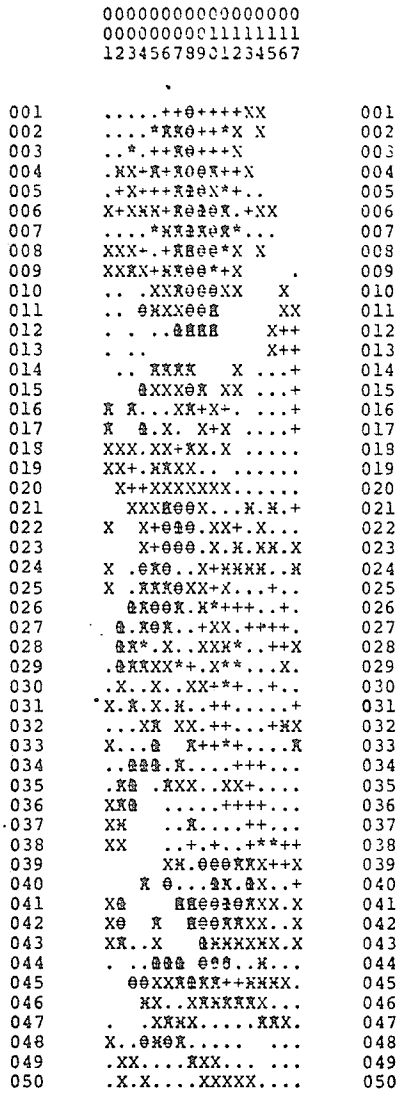
Site suitability scores at level A represent the combined capabilities of the resource base to satisfy general community demands. Each capability map is weighted commensurate with its degree of importance in satisfying these community demands. The weights of the variables (value system employed) were provided by opinions of experts with previous community planning experience and resulted in resource capability variables being allocated specific weights. Future studies could employ the use of linear regression analysis techniques to better define accurate resource variable weights.

These suitability scores are used to rate the degree of "attractiveness" of each grid cell for development of a town.



The resultant map is defined in terms of the degree of modification to the resource base necessary to achieve stated goals.

LEAST COMPATIBLE	0	water
	1	development constraint
	2	
	3	major site modifications
	4	extensive site modifications
	5	
	6	scattered site modifications
	7	
MOST COMPATIBLE	8	
	9	minor site modifications



COMMUNITY SITING ANALYSIS
LAND USE CODE:

COMMUNITY DEVELOPMENT SUITABILITY

WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEAF RAPIDS PLANNING STUDY
DAVID JOHNS M. ARCH. 1972
ONE SYMBOL EQUALS 36 ACRES

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.....	+++++++++	*********	XXXXXXXX	XXXXXXXX	XXXXXXXX	00000000	99999999	88888888	
	.....	+++++++++	*********	XXXXXXXX	XXXXXXXX	XXXXXXXX	00000000	99999999	88888888	
	.....	+++++++++	*********	XXXXXXXX	XXXXXXXX	XXXXXXXX	00000000	99999999	88888888	
	.....	+++++++++	*********	XXXXXXXX	XXXXXXXX	XXXXXXXX	00000000	99999999	88888888	
	.....	+++++++++	*********	XXXXXXXX	XXXXXXXX	XXXXXXXX	00000000	99999999	88888888	

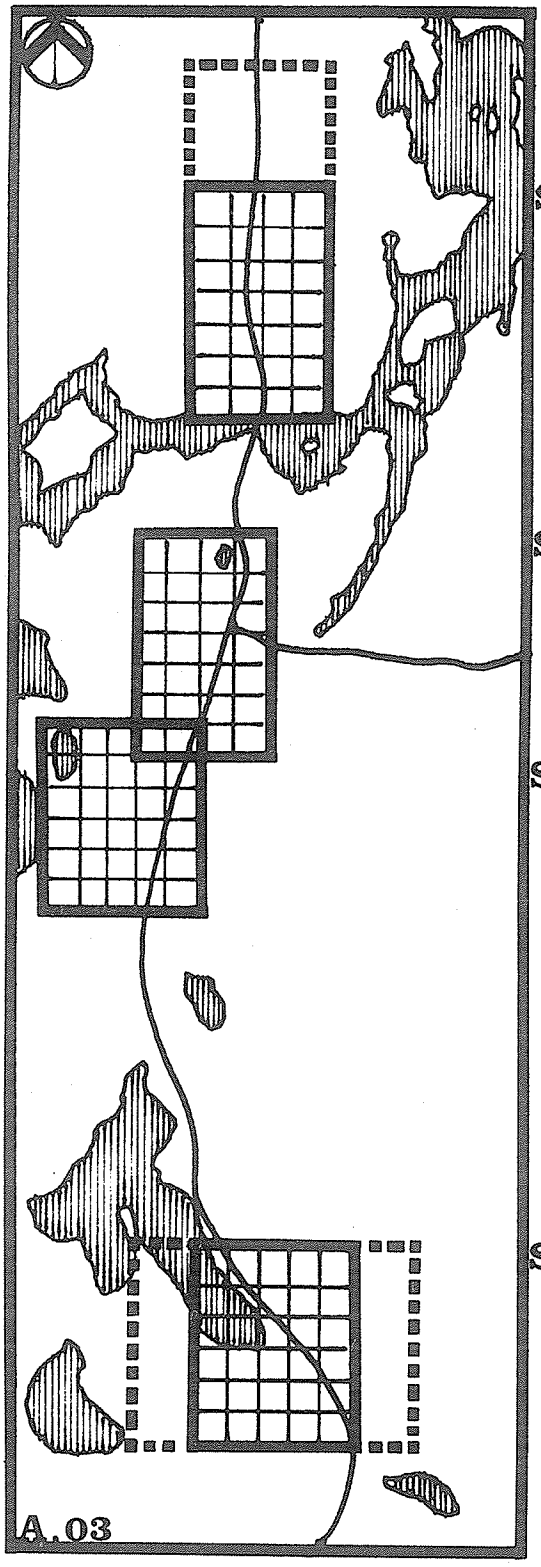
POTENTIAL TOWN SITES

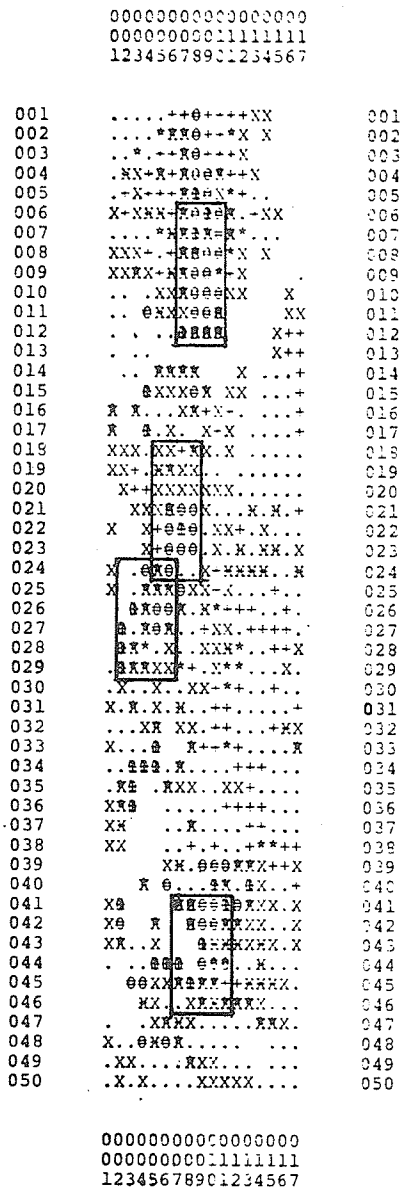
The Sherritt-Gordon program stipulates that potential townsites would require a minimum of 600 acres to allow for the complete development of the community (population 8500). In order to facilitate a greater degree of flexibility in the siting of activities, a cluster of 800 acres (25 land grid cells) was used to define potential townsites. Each site should also be able to support reasonable future expansion in such a way that would allow a viable continuity with the original site. In order to negate the possibility of sites having a configuration that would not be conducive for development (given the types of input anticipated) a restraint was imposed that potential townsites must have a minimum width of four grid cells.

An investigation of the community site suitability scores revealed four areas that were able to satisfy the area and shape requirements while exhibiting high suitability scores. (See following A.03 diagram). In delineating the boundaries of the potential sites, statistical methods were used to define areas of homogeneous characteristics that reflected accurately the site conditions. This assured that any future community boundaries within the larger boundary area could expect little or no change in the frequency distribution of suitability scores. (Refer to appendix A.1 for boundary definition techniques.)

POTENTIAL TOWNSITES

SCALE : ONE CELL EQUALS 36 ACRES





COMPUTER GRAPHIC : COMMUNITY SUITABILITY RATINGS

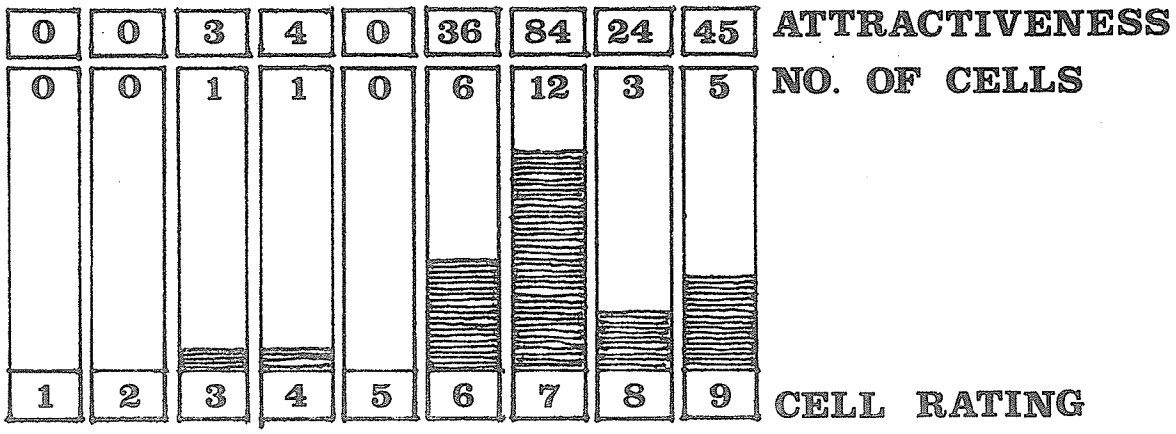
SITE EVALUATION

Each of the four proposed townsite locations were evaluated according to the degree to which each site would be able to satisfy the community requirements. This was accomplished by comparing the frequency distribution of suitability scores that existed at each site location. The results of each proposed location are represented in bar graph form and infinite "attractiveness" scores. The attractiveness scores result from the multiplication of the number of grid cells times their respective grid cell suitability rating. The author acknowledges the inherent statistical issues associated with this form of analysis but has accepted the technique evaluation for two reasons:

a) The analysis procedure has generally been accepted by those professionals involved in the application of computer graphic models.

b) At this time there are no reasonable statistically valid alternatives that would alleviate the problem.

SITE A

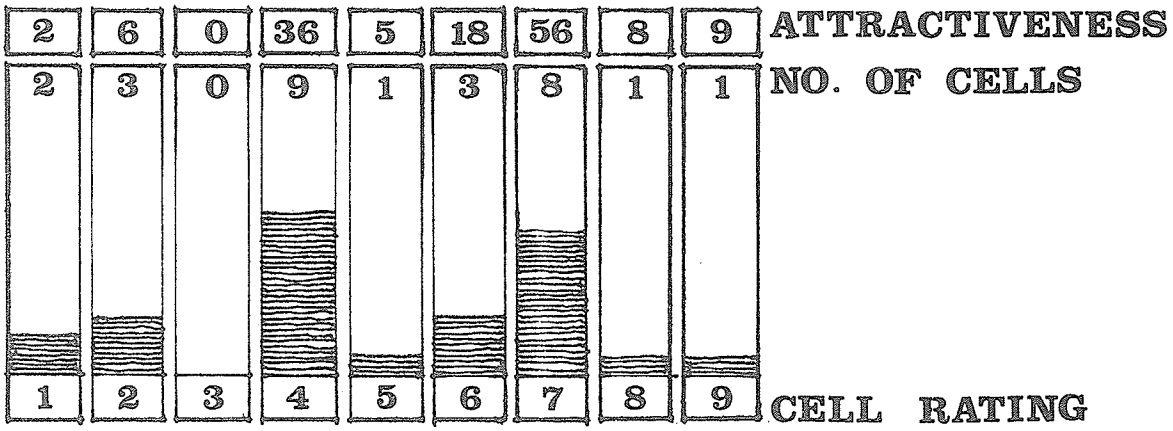


F.07

Combined attractiveness scores	=	196
Total number of land grid cells	=	28
Average grid cell score	=	7.00

Site A attractiveness score (7.00) (10^3) = **7000**

SITE B

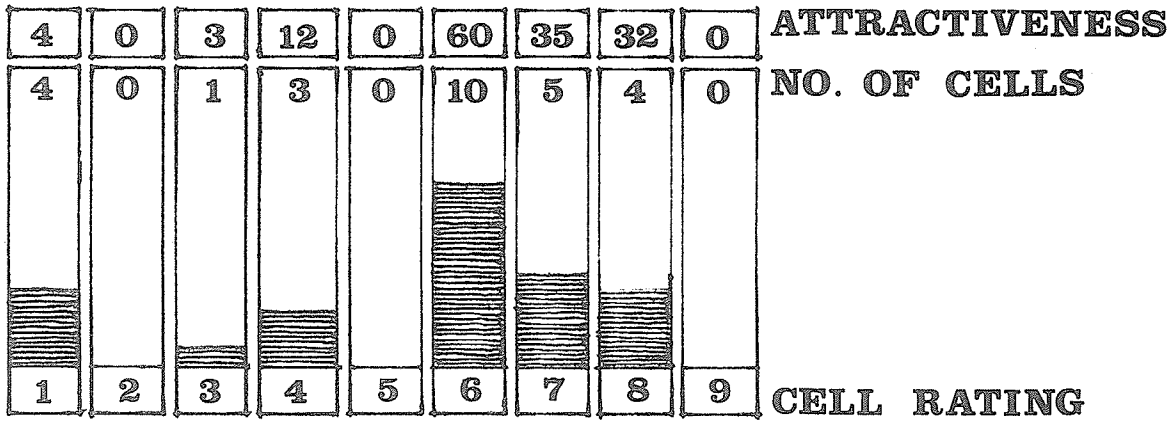


F.07

Combined attractiveness scores	=	140
Total number of land grid cells	=	28
Average grid cell score	=	5.00

Site B attractiveness score (5.00) (10^3) = 5000

SITE C

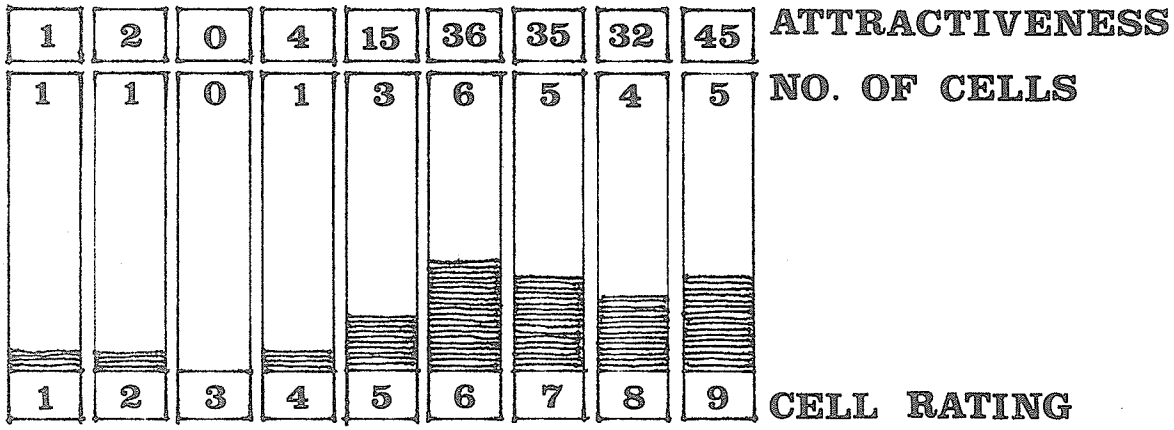


F.07

Combined attractiveness score	=	146
Total number of land grid cells	=	27
Average grid cell score	=	5.40

Site C attractiveness score (5.40) (10^3) = 5400

SITE D



F.07

Combined attractiveness score	=	170
Total number of land grid cells	=	26
Average grid cell score	=	6.54

Site D attractiveness score (6.54) (10^3) = 6540

The following value system is used to evaluate the bar graph and attractiveness score results:

a) The curve of the graph for an optimal site would indicate that all the suitability ratings would occur in the 7 - 9 range. Sites that have suitability ratings in the 1 - 3 range significantly decrease the desirability of the site.

b) The attractiveness score quantifies the total difference in suitability ratings. Thus, it very generally indicates which site has the highest proportion of suitability cells. Therefore the higher the attractiveness score the more desirable the site.

Both forms of evaluation indicate the same ordering of townsite locations according to their desirability for development. Within the context of the established value systems, site A and D indicate a low incidence of unsuitable areas and the highest attractiveness scores. Sites C and B

indicate a somewhat greater proportion of grid cells unsuitable for development and lower attractiveness scores.

SUMMARY

At this point within the study the potential sites have been delineated and their relative desirabilities evaluated. The decision as to which site was to be studied in greater detail was made by the fact that site B (the proposed Leaf Rapids townsite) already had detailed resource investigations completed and this information was readily available. The time and resources available during this thesis did not allow for any other locations to be considered at the more detailed level of analysis, but future studies employing similar techniques would not be limited by this factor. Therefore the community planning analysis was focused on site B as the environmental resource base.

RESOURCE ANALYSIS

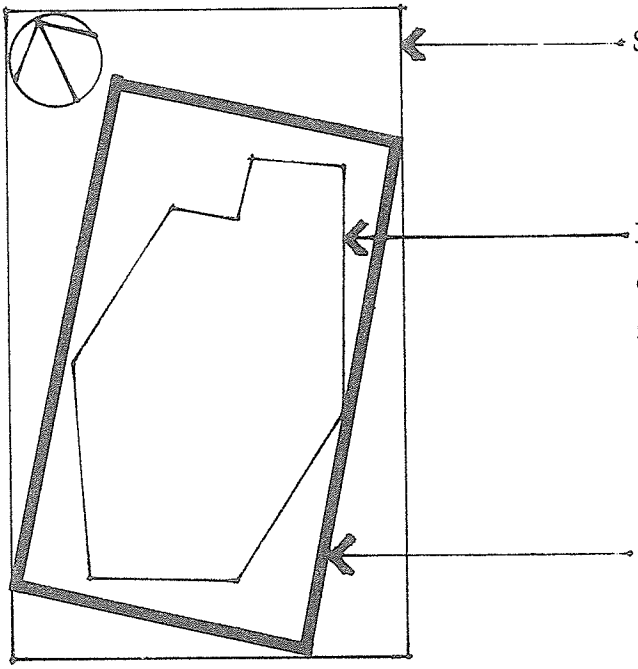
4

LEVEL B: COMMUNITY PLANNING ANALYSIS

SYNOPSIS: The analysis at level B involves a detailed investigation of the resource characteristics of one site. This reveals areas of the site that are able to support specific community inputs with the minimum of environmental damage. The analysis ultimately assists in the allocation of functions during the planning and design process and in evaluating the success of each alternative design proposal.

LEVEL B: STUDY AREA BOUNDARY

SITE B, SCHEMATIC



F.08

The boundary for the level B analysis is defined in such a way that it encompasses the boundaries of the proposed Leaf Rapids townsite, 1970. The extent of the boundary is also responsive to the limiting constraints created by the availability of detailed resource information and thus assumes the configuration delineated above.

DATA BANK

The function of the data bank at level B is similar to level A in that its purpose is to classify and store objective site information ready for combination in site capabilities, site suitabilities and impact analyses of the design proposals. The difference between the two levels is that the data at level B analysis is of a much finer and more comprehensive scale and is geared to reflect a specific site condition.

The resource information for the Leaf Rapids site (site B) has been obtained from the various studies and reports compiled for the actual development of the townsite. These include the following reports:

1) A Proposal for the Development of the Leaf Rapids townsite. 1970.

- Henderson, D.G.

2) Leaf Rapids Evaluation Report. 1970.

- Municipal Planning Branch

3) Leaf Rapids Townsite Preliminary Design Municipal Service. 1970

- W.L. Wardrop and Associates Ltd.

4) Report on Sub-soil investigation at the Proposed Townsite.

- Ripley, Klohn, and Leonoff International Ltd. 1971.

To supplement these data sources, air photo interpretation has been used as a rapid means of observing and recording natural features of the study area. Wherever possible this information has been cross checked with other sources and verified by field surveys.

The data required by the proposed analysis technique in this paper will be of a similar type and degree of detail that can be expected in any

future town developments of this kind. It is sufficient to note that no extra detailed information other than can be obtained from existing sources was required to satisfy both the general and specific goals previously established.

The site information, as before, has been broken down into distinct data categories. The data category and the internal organization of each is representative of the range and type of conditions present at the Leaf Rapids site. The scale and type of information being handled has determined the necessary size of grid cell which is able to pick up the fine detail. This level of analysis uses a grid cell size of approximately one acre.

DATA CATEGORIES

1) TOPOGRAPHIC SLOPE

0	water
1	
2	0% - 4%
3	4% - 8%
4	
5	8% - 12%
6	12% - 16%
7	
8	16% - 20%
9	> 20%

Source of data

1) TOPOGRAPHIC drawing prepared for Sherritt-Gordon
2) air photo interpretation
3) field survey

2) ORIENTATION

0	water
1	North
2	North East
3	North West
4	Flat
5	East
6	West
7	South East
8	South West
9	South

Source of data

1) topography maps
2) air photo interpretation

3) SURFACE DRAINAGE

1 water
2 poorly drained wetlands
3 swales
4
5 minor surface runoff (seasonal)
6 drainage pattern (heavy storms)
7
8
9 well drained

Source of data

1) test hole analysis
2) field survey
3) air photo interpretation

4) SUB-SURFACE DRAINAGE (Watertable)

0 water
1 0' - 2'
2
3 2' - 4'
4
5 4' - 6'
6
7 6' - 8'
8
9 > 8'

Source of data

1) test hole analysis
2) air photo interpretation

NOTE: perched water tables evaluation is not within the scale of this study

5) DEPTH TO BEDROCK

1 rock outcropping
2
3 3'
4
5 5'
6
7 10'
8
9 10' (OVER)

Source of data

1) test hole analysis
2) air photo interpretation

6) SOILS: BY COMPOSITION

0 water
1 organic peat or no soil cover
2
3 silts and clays
4
5 sand, silts, clays
6
7 poorly graded sand (gravel)
8
9 well graded sand (gravel)

Source of data

1) test hole analysis
2) air photo interpretation

NOTE

Although the Leaf Rapids site is predominantly gravel esker which has sufficient sized soil lenses of alluvial origin to warrant consideration. The soils not only occur in varying compositions but also in distinct striated layers. Thus particular soil layers may comprise similar properties as specific soil compositions and receive the same value. For example, consecutive layers of sand and clay can have foundation properties that are proportional to a sand, silt and clay composition and thus receive the same rating even though no silt exists.

7) VEGETATION STABILITY

The vegetation stability classification in level A analysis (P.50) is sufficiently detailed and representative of the Leaf Rapids site (site.B) to be used for this scale of analysis. The Leaf Rapids site is situated on an esker and thus the vegetation as a whole is less stable that vegetation on clay-till areas (Refer to P.60). Several factors hamper the development of stable esker vegetation. A rich soil increases the potential of vegetation stability. The composition of the soil and surface drainage characteristics of site B does not allow for a strong profile development. The annual contribution of humus is small and the percolation of the water through the sand is very rapid, often carrying much of the humus content through the soil and away, so that there is little or no benefit to the vegetation. Also, the gravel and sand character of eskers increases the potential of windthrow due to the lack of root anchor capacity of these soils.

Thus the following classification system was used to evaluate the stability of the vegetation on site B.

GROUP ONE: Low vegetation cover including underbrush, herbacious plants, muskeg and bog.

GROUP TWO: Underdeveloped, dwarf or stagnating coniferous trees (low number of species.)

GROUP THREE: Young coniferous trees in dense stand. (low number of species.)

GROUP FOUR: Over mature coniferous trees in dense stand (low number of species). NOTE: There is a special hazard to development due to high potential of winds causing large trees to fall on buildings.

GROUP FIVE: Open black spruce, white spruce and jackpine forest with no understory regeneration. (medium number of species.) - openness indicates a more stable root structure but lack of understory suggests poor top soil conditions and low rebound potential.

GROUP SIX: Open black spruce, white spruce and jackpine forest with good understory regeneration.

GROUP SEVEN: Open or closed deciduous stand, with or without understory regeneration. (represents small proportion of trees on site.)

GROUP EIGHT: Mixed deciduous and coniferous trees with no understory regeneration (high number of species.)

GROUP NINE: Mixed deciduous and coniferous trees with healthy understory regeneration. This would include a mix of species and ages which maximizes the chances of some trees being able to adapt to a changed environment (high number of species.)

VEGETATION STABILITY

0 water
1 group one
2 group two
3 group three
4 group four
5 group five
6 group six
7 group seven
8 group eight
9 group nine

Source of data

1) field survey
2) air photo interpretation

8) VEGETATION PREFERENCE

A sample group chose in which vegetation type they would prefer to have the various land-use inputs located. In an attempt to reduce redundancy the vegetation stability classification system will be used for preferential ratings as well, for it is representative of the vegetation that exists on the site.

Refer to Appendix A.2 for testing format.

0 water
1 group one
2 group two
3 group three
4 group four
5 group five
6 group six
7 group seven
8 group eight
9 group nine

Source of data

1) field survey
2) air photo interpretation

9) VISUAL ACCESS TO FEATURE LANDSCAPES

0 water
1 environmental visual nuisance
2
3 no features outside normal
4 view of marshland
5 view of stream (intermittent)
6 screened view of a ravine, hill or kettle
7 direct visual access to a ravine, hill or kettle
8 screened view of water
9 direct visual access to water.

NOTE

These visual features represent realistic existing environmental conditions present at the Leaf Rapids site. If two or more features occur in one grid cell the feature with the largest value takes precedence.

10) VISUAL ABSORPTION

Frequently those aspects of the landscape considered as perceptual amenities are altered so radically by the development that the potential of the amenities are unnecessarily and severely constrained. Reaction to perceived consequences, desired or not, typically have occurred after the fact.

Visual absorption measurements enable one to predict the existing capacity of the landscape to visually absorb or expose the physical development. It is a value-free perceptual measurement that predicts the visual consequences of land-use input on the landscape. As such, the measurement requires a policy statement regarding the desired visual impact of development on the landscape.

A succinct description of this visual tool would be thus: visual absorption is a function of three landscape characteristics, vegetation density, topographic closure, and visual complexity.* A particular development will be absorbed by the landscape as a function of its visual transparency (the degree of vegetation density and topographic closure), and its visual complexity (the amount of clarity of visual information which the viewer must sort and evaluate.) Thus, landscapes that are visually transparent with little visual complexity are most susceptible to visual impact. Based on research analysis by Jacobs and Way;

Visual Absorption = K + .14 VD +.27TC + .40VC

The Leaf Rapids site has been evaluated using the above analytic tool. A more detailed discussion of the measurement techniques and the evaluation of the landscape characteristics can be found in Appendix A.3, A.4.

---

* Jacobs. Way. Visual Analysis of Landscape Development. Graduate School of Design, Harvard University, 1969.

To retain the data bank at a manageable size, the combination of vegetation density, topographic closure and visual complexity will be completed first and then the resultant absorption rating will form the resource information for the data bank.

VISUAL ABSORPTION

0	water	Source of data
1	least absorptive	
2		1) field survey
3		2) air photo interpretation
4		
5		
6		
7		
8		
9	most absorptive	

11) PERCEPTUAL CARRYING CAPACITY

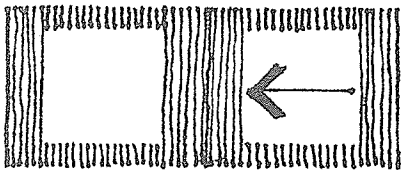
Visual absorption basically specifies areas in which land uses will be visually absorbed or exposed. The perceptual carrying capacity measurement of the vegetation defines the quantity of development that can be imposed on an absorptive area before the original absorptive and perceptual qualities begin to diminish or become totally lost. This data level is not used as a site selection criteria but functions as a checklist, during the feasibility stages, where the planner can use the information to ascertain the quantity of land use each cell can support. Conversely, perceptual impact of feasibility proposals can be evaluated with respect to the degree of over-development in each grid cell.

The degree of perceptual carrying capacity is defined by four levels of visual buffer capability. The level or levels of buffer capability desired must be established by a policy statement. A field survey of the Leaf Rapids site was conducted and all vegetation types that had reasonable buffer capability were analysed according to the distance of separation required to achieve each of the four levels. (Refer to Appendix A.5 for field survey techniques employed in obtaining and analyzing this information). The policy defining the buffer capability desired will determine the distances dwelling units must be separated in each vegetat-

ion type in order to achieve the specified buffer levels. This specification is reflected in the number of dwelling units/grid cell.

The four levels of buffer capability are defined as:

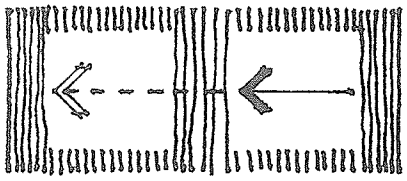
MAJOR BUFFER POTENTIAL:



F.09

The vegetation creates total visual separation, thus completely defining the space. Residential uses would include separating non-compatible land uses or creating a perceptual extreme of being totally absorbed in the landscape.

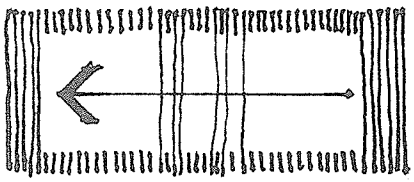
MODERATE BUFFER POTENTIAL:



F.09

The vegetation allows visual penetration from one space to another but establishes an edge condition which segregates the two spaces. The residential use would be to separate compatible land uses creating visual privacy, but maintaining moderate visual contact with other dwellings.

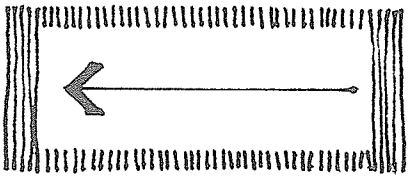
MINOR BUFFER POTENTIAL:



F.09

Vegetation qualities that would create minor visual interferences but still allows for continuity of the whole space. This would have primarily residential application in which the vegetation would create psychological fences, without destroying visual contact with other dwellings. Vegetation adds to the visual complexity of the vista.

NO BUFFER POTENTIAL:



F.09

Vegetation types that either through sparce growth, lack of foliage, lack of understory or dwarfness do not obstruct visual penetration to any degree that would be perceptually useful as a buffer. (low potential as scalar or spatial tools).

All the vegetation types measured have been subdivided into groups using the different distances required to achieve the four levels of buffer potential. Five distinct groups were delineated by a natural clustering of the measured distances.

VEGETATION BUFFER GROUPS

GROUP ONE:	no possibility of major, moderate or minor buffers.	
GROUP TWO:	major buffer distance	90 - 150 yds.
	moderate buffer distance	25 - 40 yds.
	minor buffer distance	15 - 20 yds.
	buffer capability lost	< 15 yds.
GROUP THREE:	major buffer distance	70 - 80 yds.
	moderate buffer distance	15 - 25 yds.
	minor buffer distance	5 - 10 yds.
	buffer capability lost	< 10 yds.
GROUP FOUR:	major buffer distance	45 - 60 yds.
	moderate buffer distance	10 - 20 yds.
	minor buffer distance	5 yds.
	buffer capability lost	< 5 yds.
GROUP FIVE:	major buffer distance	30 - 35 yds.
	moderate buffer distance	5 - 10 yds.
	minor buffer distance	5 yds.
	buffer capability lost	< 5 yds.

These measurements only reflect perceptual benefits of the vegetation and no other considerations have been made.

PERCEPTUAL CARRYING CAPACITY

0 water
1 Group one
2
3 Group two
4
5 Group three
6
7 Group four
8
9 Group five

Source of data

1) field survey
2) air photo interpretation
3) computer analysis of absorption levels.)

CONCLUSION

All relevant site information has been fed into the data categories previously presented and forms the complete data bank for the analysis of the study area. (refer to next section for computer graphics of resource information at site B.)

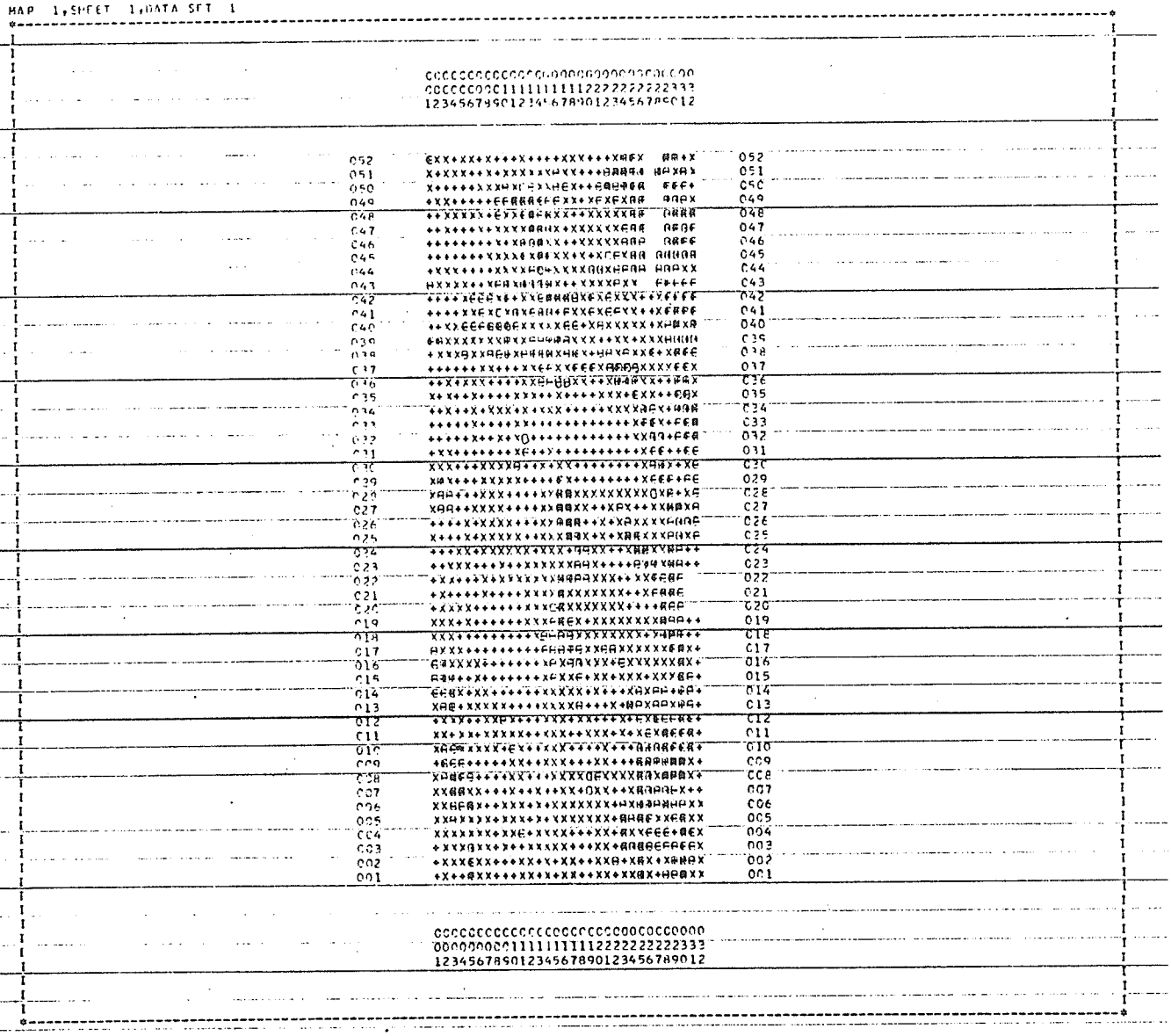
RESOURCE ANALYSIS

COMPUTER GRAPHIC DISPLAY OF RESOURCE INFORMATION :

(DATA BANK : LEVEL B)

4

MAP 1,SHEET 1,DATA SET 1



1300

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

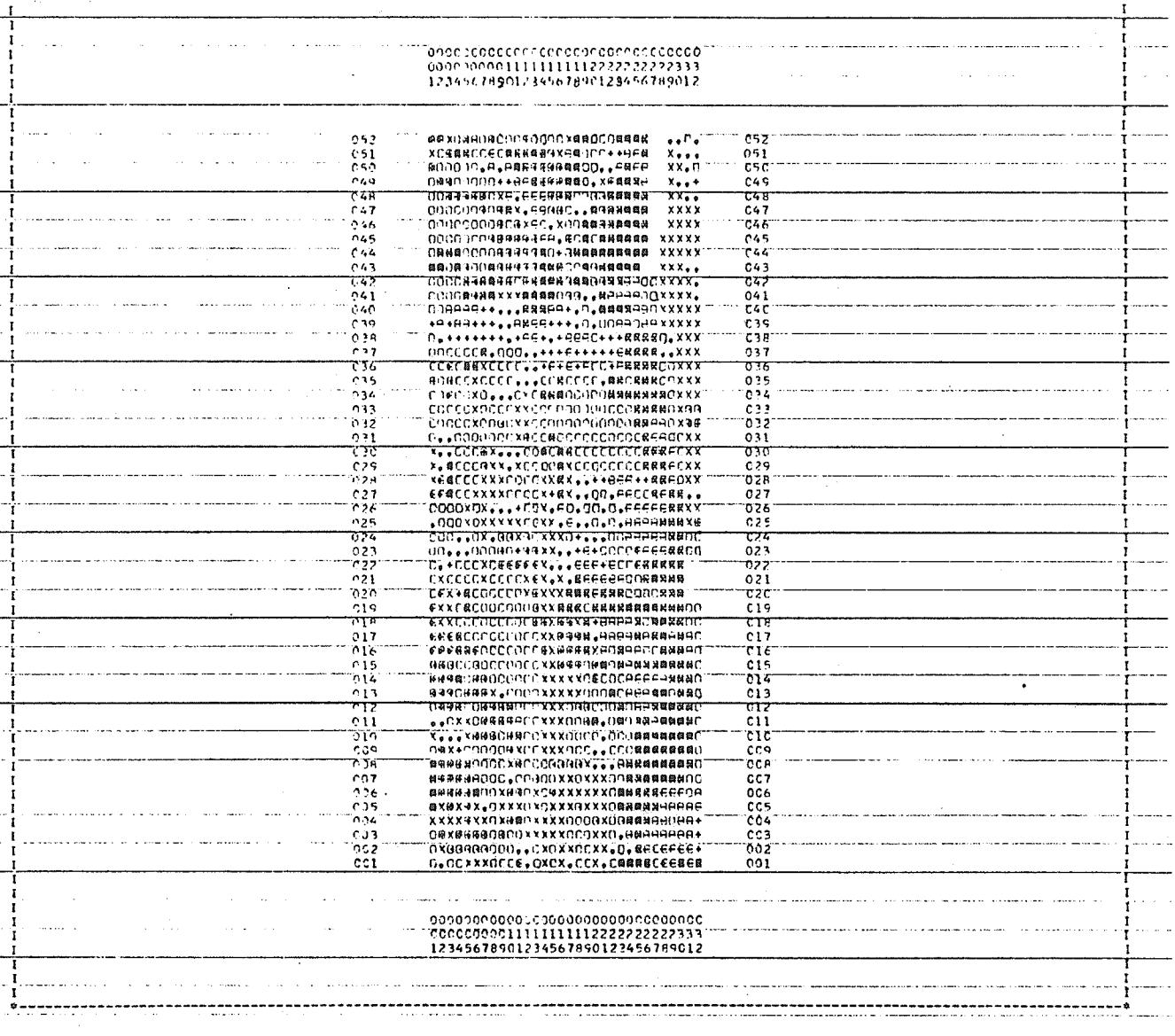
ACTIVITY ALLOCTION DATA BANK
LAND USE CODE

LITOPOGRAPHIC SLOPE

0 WATER
1
2 0%-4%
3 4%-8%
4
5 8%-12%
6 12%-16%
7
8 16%-20%
9 OVER 20%

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	,	+	X	O	E	S	R	A	@
FREQUENCY	23	0	524	670	2	195	160	1	66	23

MAP 2,SHEET 1,DATA SET 1



1301

LEAF RAPIDS PLANNING STUDY

CAVIQ JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

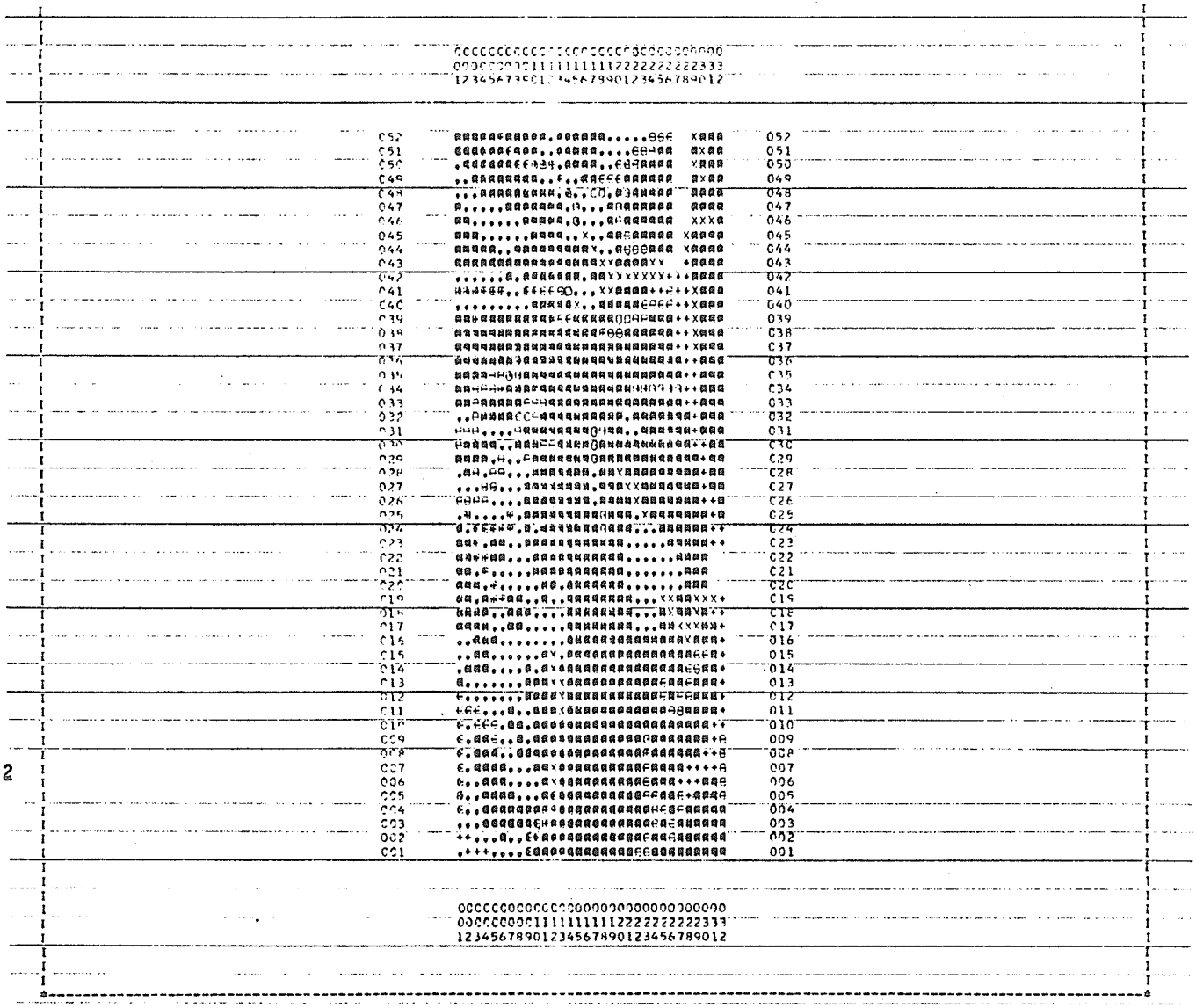
ACTIVITY ALLOCTION DATA BANK
LAND USE CODE

2) ORIENTATION

0 WATER
1 NORTH
2 NORTH-EAST
3 NORTH-WEST
4 FLAT
5 EAST
6 WEST
7 SOUTH-EAST
8 SOUTH-WEST
9 SOUTH

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	,	+	X	C	8	#	@	&	A
FREQUENCY	24	126	60	249	524	164	195	155	36	131

MAP 3,SHEET 1,DATA SET 1



1302

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

ACTIVITY ALLOCTION DATA BANK
LAND USE CODE

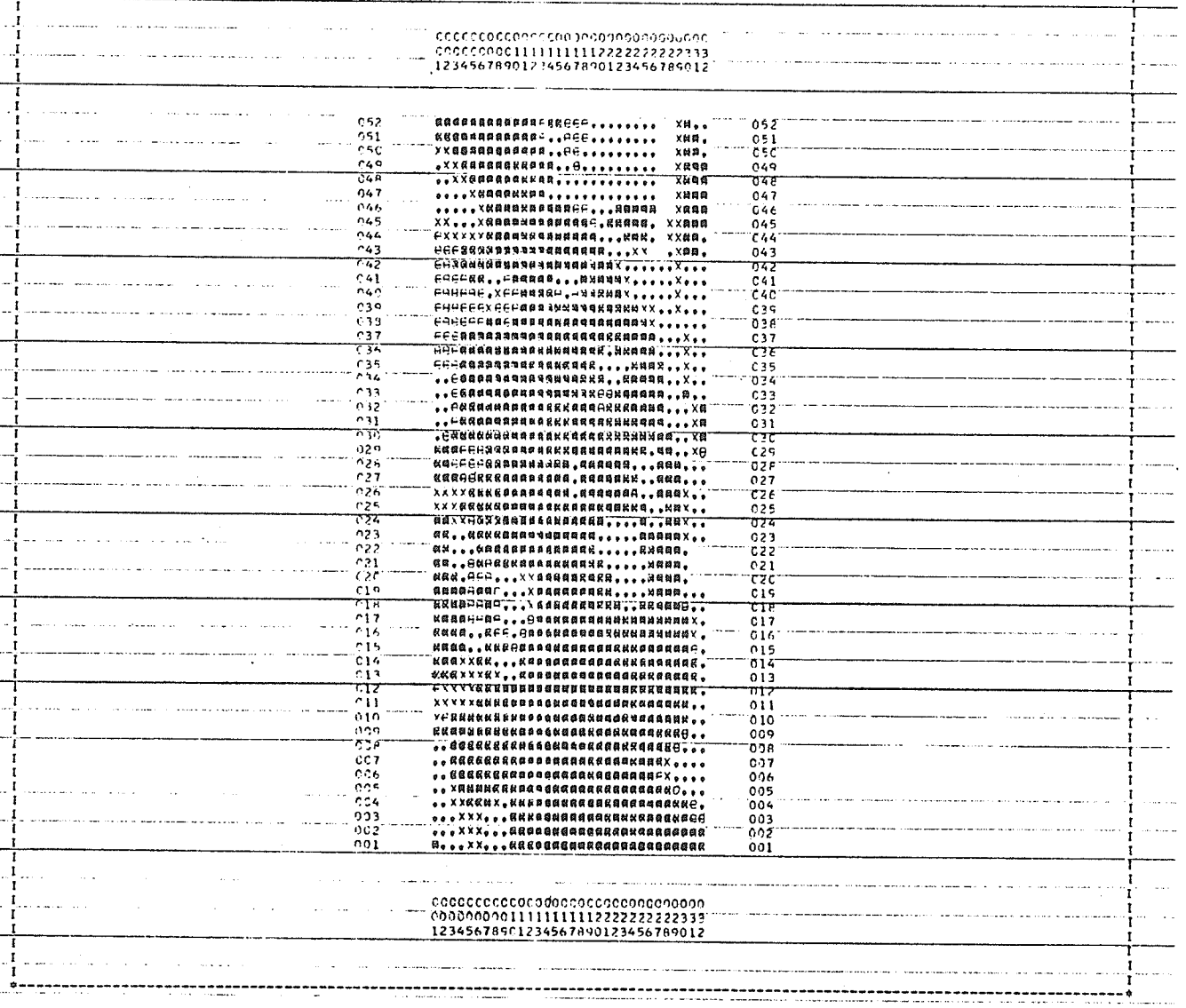
3) SURFACE DRAINAGE

0 WATER
1 POORLY DRAINED WETLANDS
2 INTERMITTENT CREEK
3 SWALES
4
5 MINOR SURFACE WATER RUNOFF (SEASONAL)
6 DRAINAGE PATTERN (HEAVY STORMS)
7
8
9 WELL DRAINED

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	286	66	54	0	105	70	0	0	1059

90.

MAP 4,SHEET 1,DATA SET 1



1303

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

ACTIVITY ALLOCTION DATA BANK
LAND USE CODE

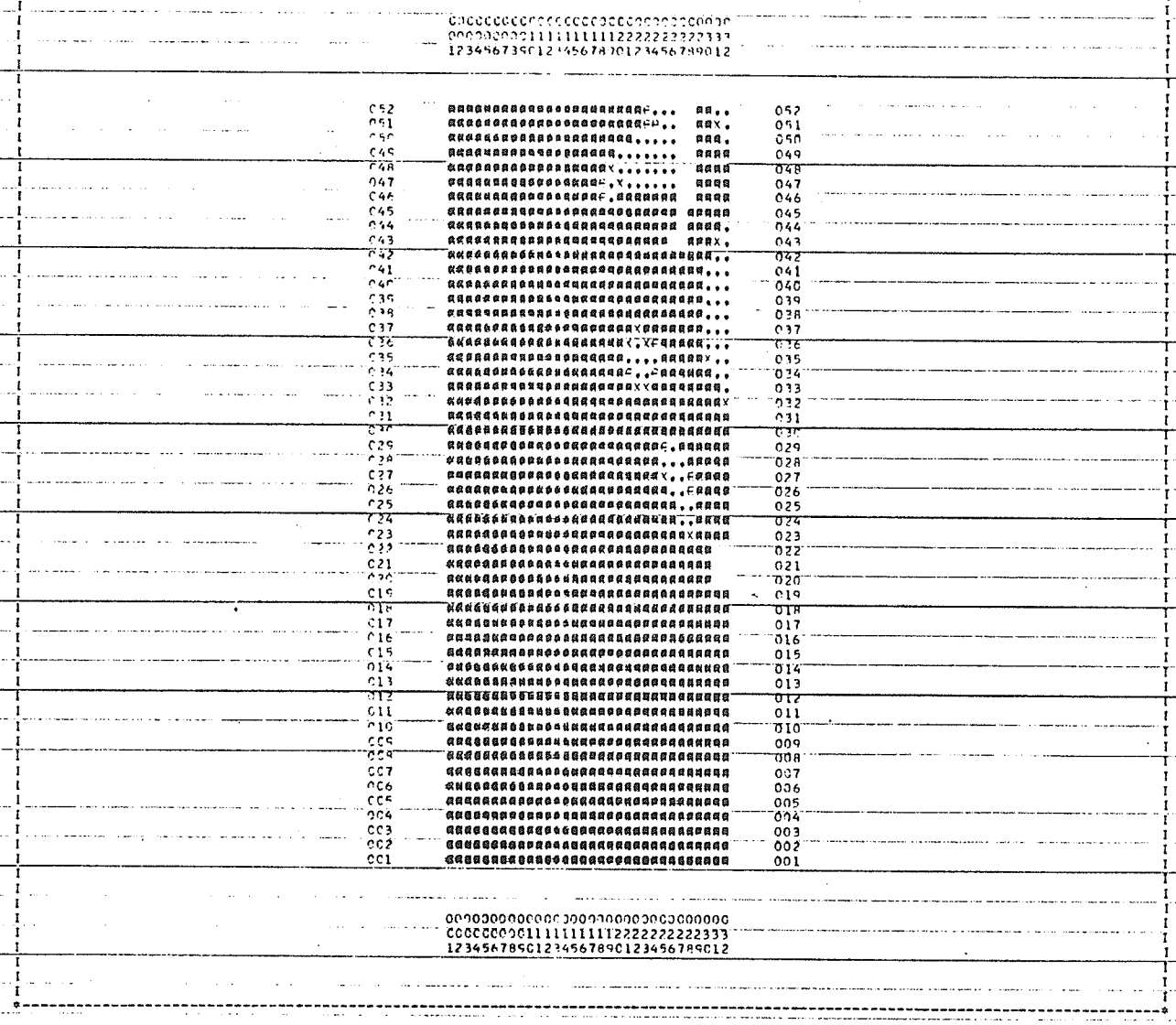
4) SUB-SURFACE DRAINAGE

0 WATER
1 0'-2'
2
3 2'-4'
4
5 4'-6'
6
7 6'-8'
8
9 OVER 8'

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	A	@	#	=	-	*
FREQUENCY	24	342	0	99	0	109	0	328	0	762

MB.04

MAP 5, SHEET 1, DATA SET 1



LEAF RAPIDS PLANNING STUDY

CAVIC JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

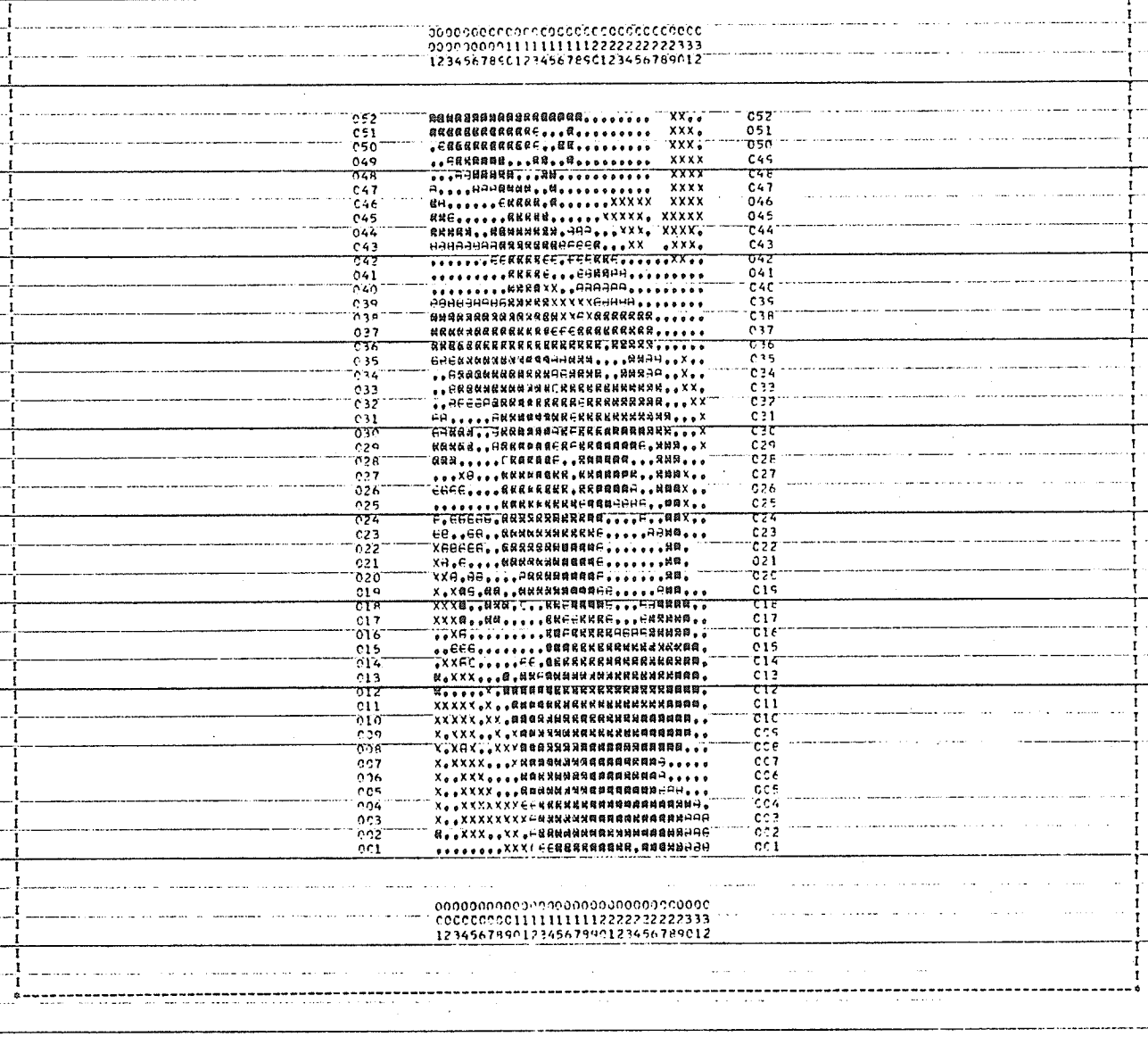
ACTIVITY ALLOCTION DATA BANK
LAND USE CODE

5) DEPTH TO BEDROCK

0 WATER
1 ROCK OUTCROPPING
2
3 3'
4
5 5'
6
7 10'
8
9 OVER 10'

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	82	0	13	0	11	0	1	0	1533

MAP 6,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

CAVIC JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

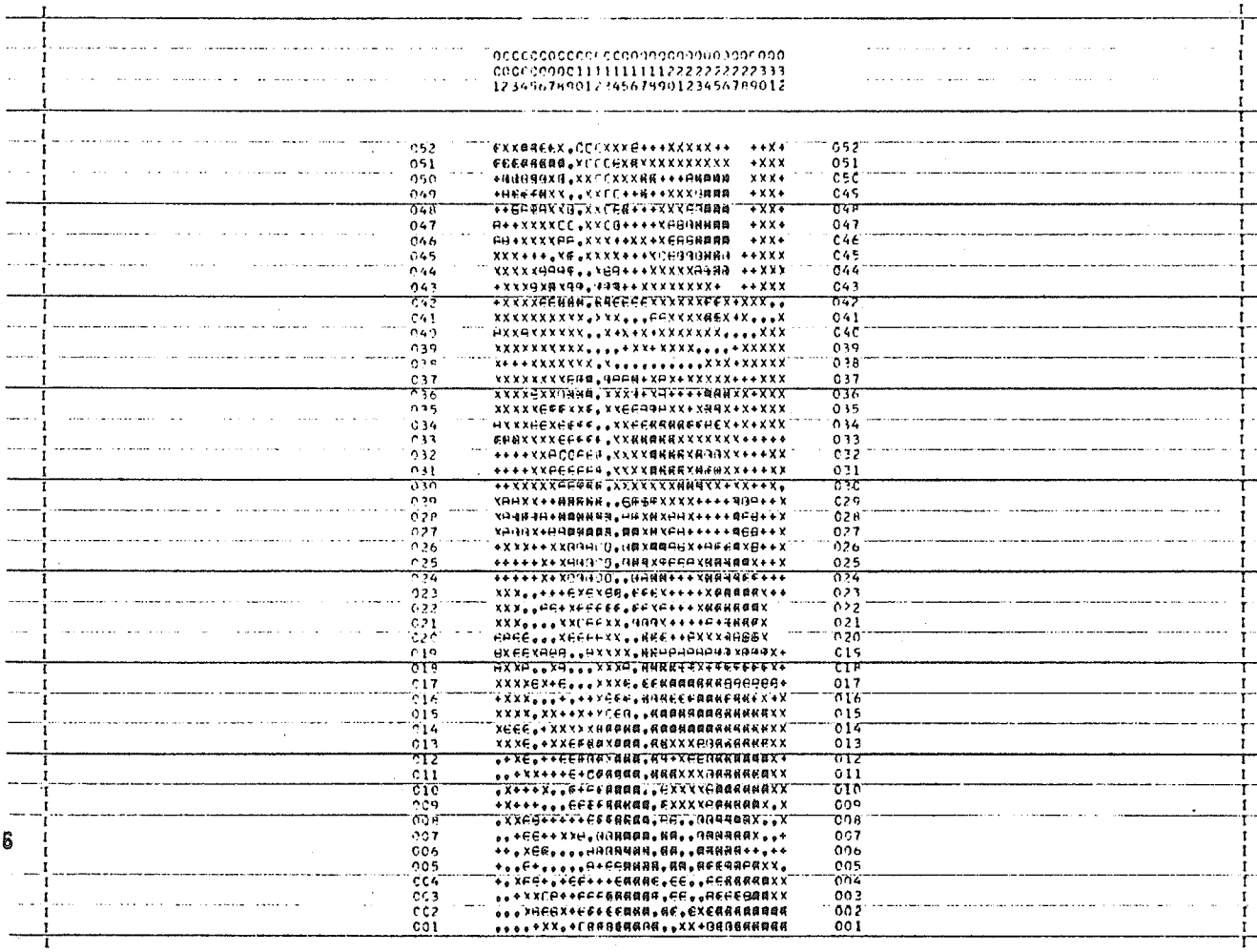
ACTIVITY ALLOCTION DATA BANK
LAND USE CODE

6) SOILS: BY COMPOSITION

0 WATER
1 ORGANIC PEAT
2
3 SILTS AND CLAYS
4
5 SANDS, SILTS, AND CLAYS
6
7 POORLY GRADED SAND (GRAVEL)
8
9 WELL GRADED SAND (GRAVEL)

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	502	0	161	0	189	0	569	0	219

MAP 7,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

CAVIC JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

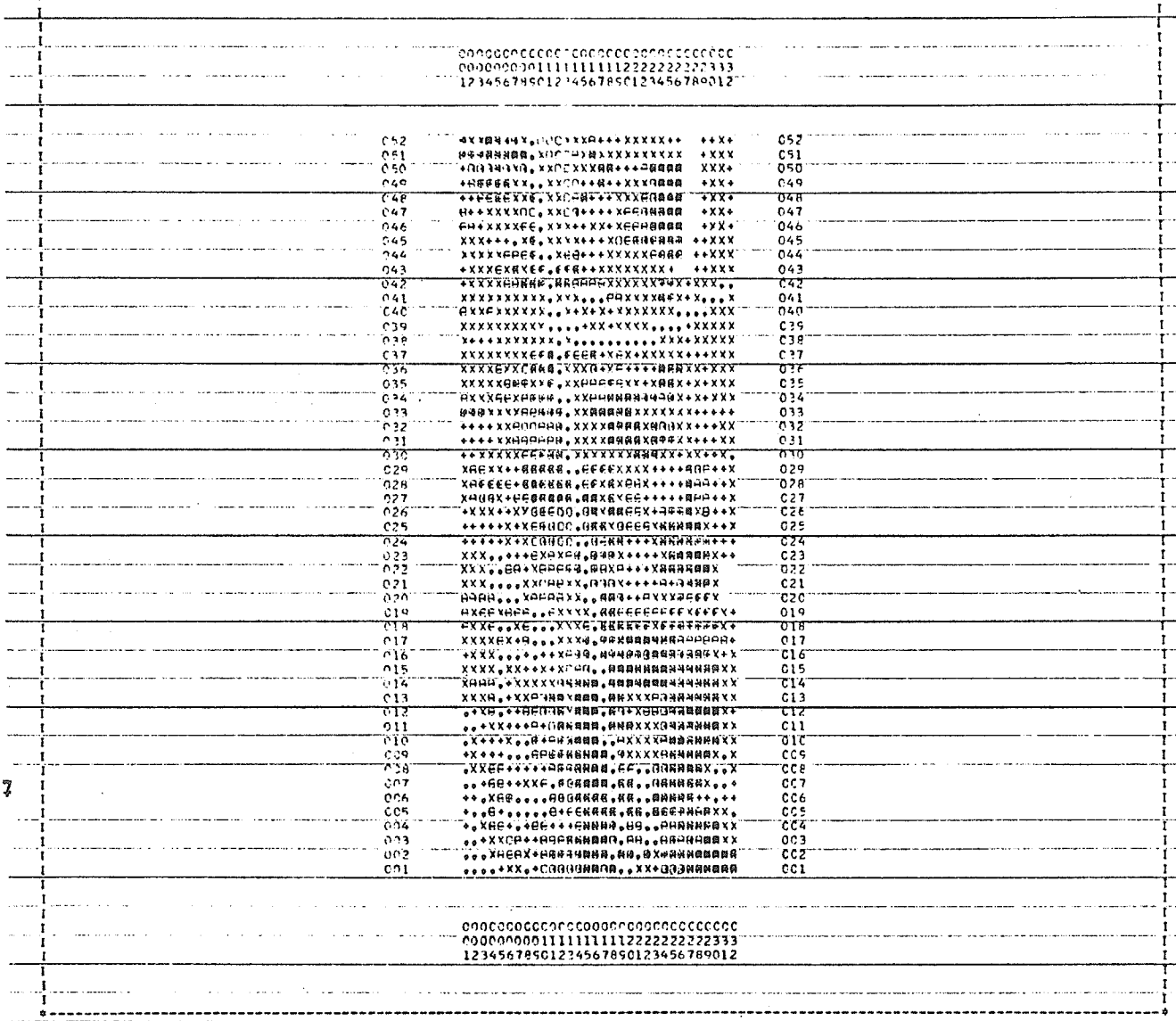
ACTIVITY ALLOCTION DATA BANK
LAND USE CODE

7) VEGETATION STABILITY

0 WATER
1 GROUP ONE
2 GROUP TWO
3 GROUP THREE
4 GROUP FOUR
5 GROUP FIVE
6 GROUP SIX
7 GROUP SEVEN
8 GROUP EIGHT
9 GROUP NINE

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	178	248	499	19	211	171	3	216	97

MAP 8,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS B. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

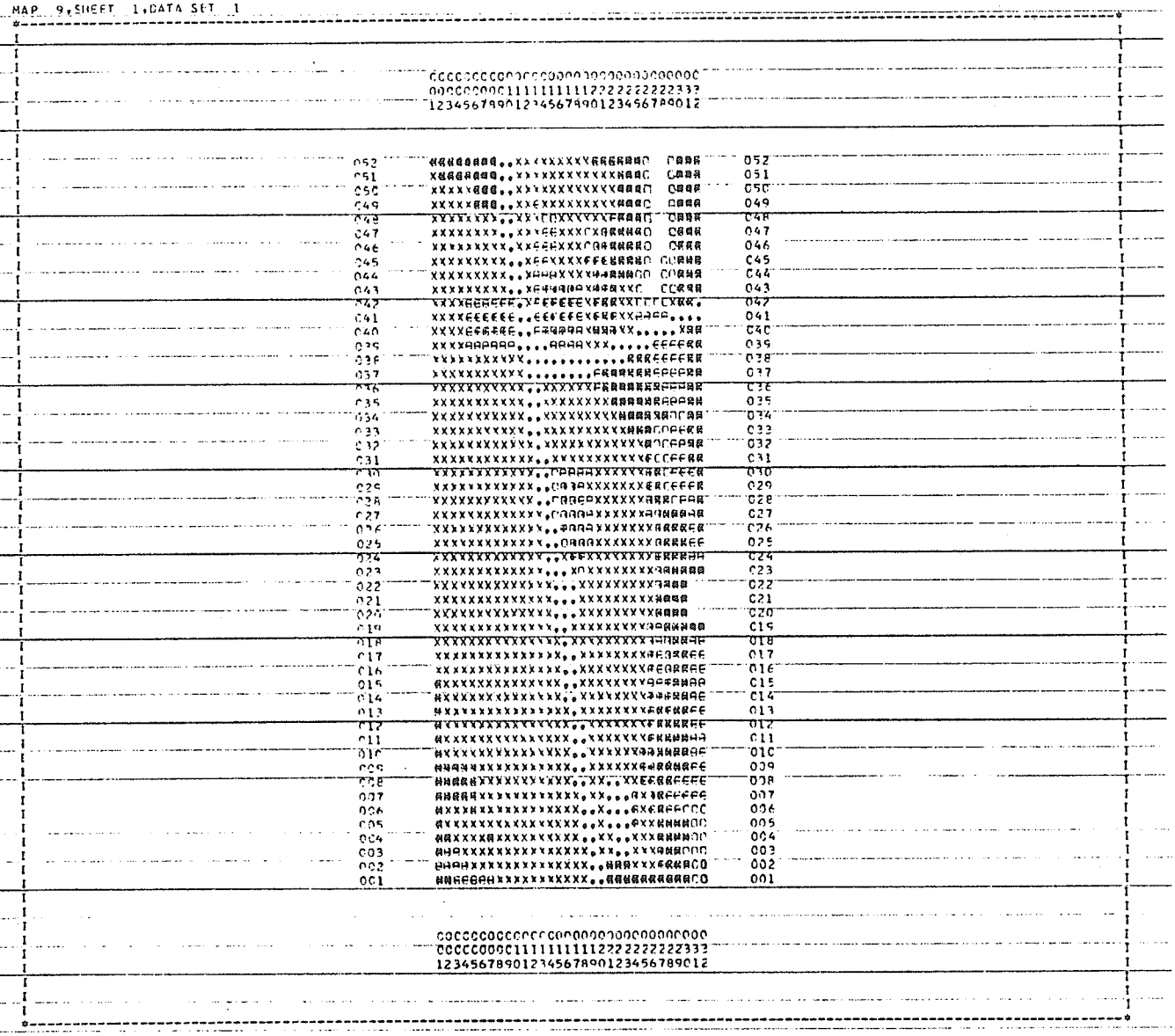
ACTIVITY ALLOCATION DATA BANK
LAND USE CODE

81 VEGETATION PREFERENCE

0 WATER
1 GROUP ONE
2 GROUP TWO
3 GROUP THREE
4 GROUP FOUR
5 GROUP FIVE
6 GROUP SIX
7 GROUP SEVEN
8 GROUP EIGHT
9 GROUP NINE

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	.	+	X	C	E	A	R	8	@
FREQUENCY	24	178	246	499	19	211	171	2	216	97

MAP 9,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

CAVIC JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

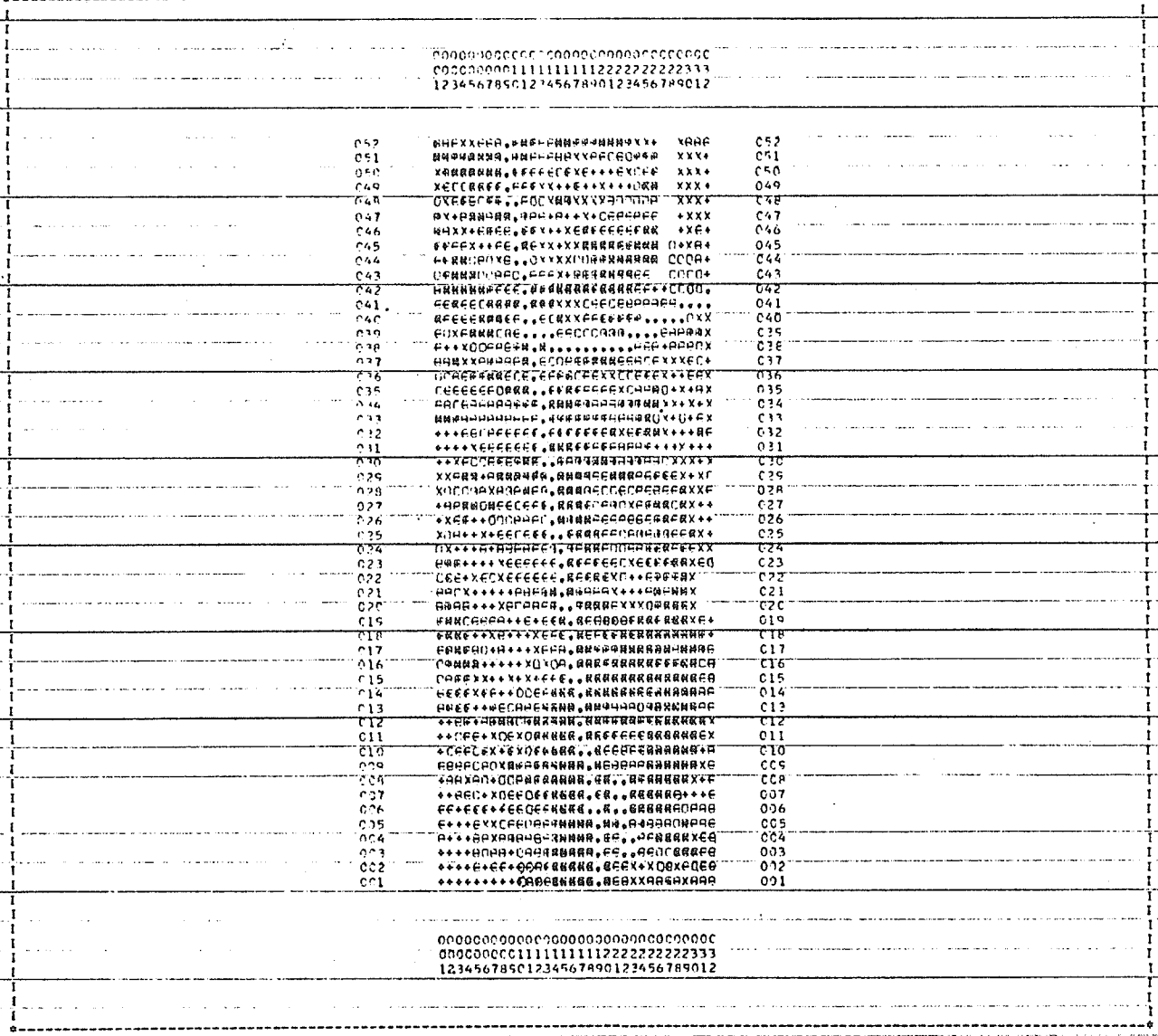
ACTIVITY ALLOCTION DATA BANK
LAND USE CODE

91 VISUAL ACCESS TO UNIQUE LANDSCAPE FEATURES

0 WATER
1 ENVIRONMENTAL VISUAL NUISANCES
2
3 NO FEATURES OUTSIDE FORMAL VEGETATION
4 VIEW OF MARSHLAND
5 VIEW OF STREAM (INTERMITTENT)
6 SCREENED VIEW OF RAVINE, HILLS, AND KETTLES
7 DIRECT VISUAL ACCESS TO RAVINES, HILLS, AND KETTLES
8 SCREENED VISUAL ACCESS TO WATER
9 DIRECT VISUAL ACCESS TO WATER

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	.	+	X	O	E	R	A	H	C
FREQUENCY	24	148	0	921	51	154	91	131	82	62

MAP 10,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

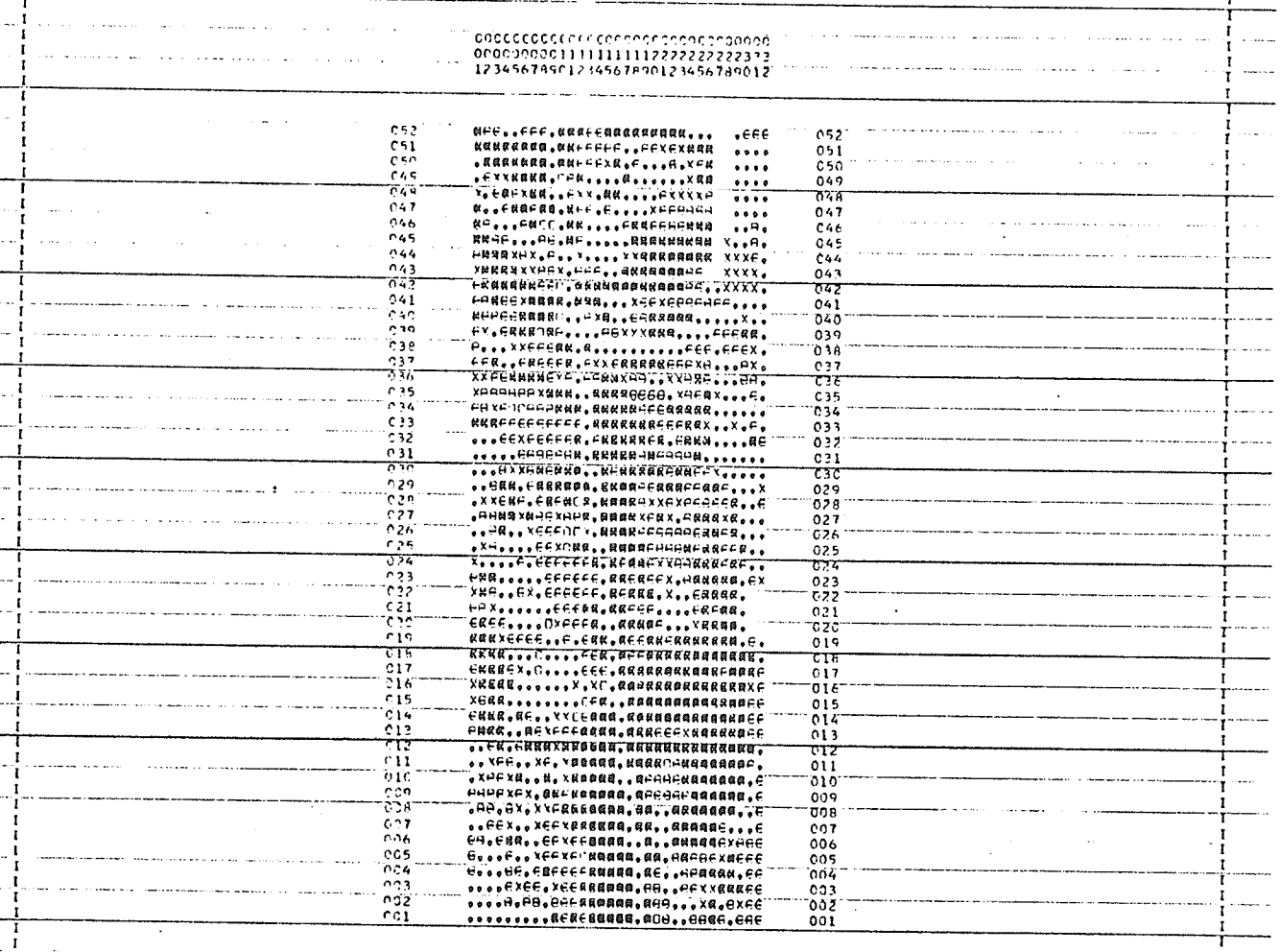
ACTIVITY ALLOCATION DATA BANK
LAND USE CODE

101 VISUAL ABSORPTION

0 WATER
1 LEAST ABSORPTIVE
2
3
4
5
6
7
8
9 MOST ABSORPTIVE

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	.	+	X	C	E	@	#	=	A
FREQUENCY	24	100	178	157	133	466	226	190	182	8

MAP 11,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

ACTIVITY ALLOCTION DATA BANK
LAND USE CODE

111 PERCEPTUAL CARRYING CAPACITY

0 WATER
1 GROUP ONE
2
3 GROUP TWO
4
5 GROUP THREE
6
7 GROUP FOUR
8
9 GROUP FIVE

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	*	X	C	@	E	#	%	A	B
FREQUENCY	24	435	0	133	0	466	0	416	0	190

SITE CAPABILITY

5

GENERAL GUIDELINES

RESIDENTIAL
RECREATION
ROAD & UTILITY
INDUSTRIAL
COMMERCIAL

SITE CAPABILITY

Site capability is the potential of the natural resources of an area to satisfy the requirements, with acceptable ecological consequences, of specified types and intensities of 'institutional' and 'welfare' requirements. The physical components of the community requirements have been subdivided into general land-use types. The delineation of distinct land-use types was arrived at by considering both their characteristics which made them unique from the other inputs and the number of types that could be handled by a study at this scale. The land-use types being considered in this study are single family residences, cluster or multi-family developments, active and passive recreation, roads and utilities, industrial complexes, and commercial requirements. Each land use has special requirements of the resource base and accordingly the resource capabilities will be discussed within the context of each specific land-use type. Before beginning the individual capability studies it is necessary to establish general guidelines which are applicable to all land-use types.

GENERAL GUIDELINES

1) Resource Impact Technique

Within the context of the Leaf Rapids area the land-use types can be distinguished by their scale of impact on the environment.

A) The most numerous input, the single family unit, has a small point impact. This is a result of the scale of physical input and also constructural techniques that can be employed which results in a minimal loss of vegetation cover.

B) The remaining development inputs consist of strip or cluster impacts requiring relatively large amounts of vegetation loss with gross and expedient construction techniques which usually compound environmental damage.

The esker vegetation can be delineated along the lines of stability. In discussions with experts from fields related to the problem, it was found

that no accurate eco-support indexes for land-use inputs could be established although some generalizations could be made.*

It was generally conceded after some study that even the most stable vegetation on the site probably could not withstand a typical suburban land use without suffering considerable environmental damage. A less demanding land use would be necessary to reduce the large scale of negative impacts. On the other extreme the least stable vegetation was found to be so sensitive that no matter what precautions were taken the environmental situation was so tenuous that even the mere proximity to development would initiate retrogressive reactions in the vegetation.

The solution that optimized the particular characteristic of each extreme seemed to be the most reasonable approach to activity allocation in such a sensitive eco-system. By locating large 'strip and cluster impacts' on the most unstable vegetation the sum total impact would be concentrated in one area. By applying this approach to all strip and cluster inputs this would maximize the negative impact over less total area.

Conversely it was felt that the stable vegetation had the greatest opportunity to survive development and this potential could be increased by siting only small 'point' impacts in these areas. A critical aspect of this concept rests upon the ability to establish some indication of the carrying capacity of the land so that the impacts from these small inputs would not overlap and cause a large impact over a wide area.

Overlapping of impacts is an issue that must be considered carefully within such a sensitive condition. One should not only consider the direct impact created by the land-use input but also the associated sphere of impacts around the input that cause secondary ecological consequences.

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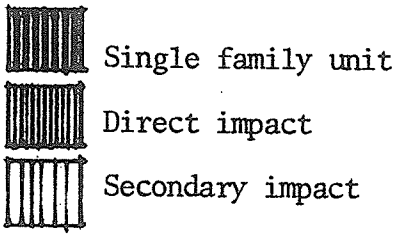
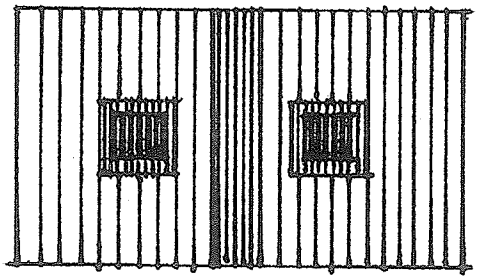
* Conclusions drawn from discussions with Parks Branch Planners, landscape architects, and professors of forestry.

As the environment becomes more sensitive the sphere increases in radius. For example:



WINNIPEG
(wooded suburb)

F.10



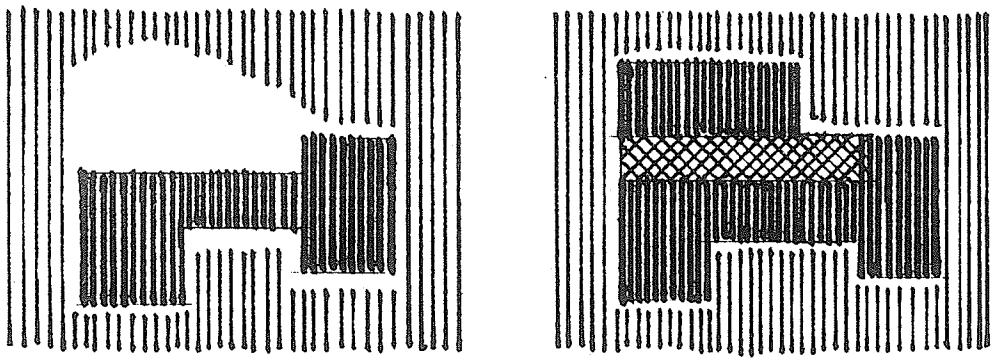
LEAF RAPIDS

F.10

The dwellings are spaced the same distance apart but the amount of area that remains unaffected varies greatly. The Winnipeg suburb spacing leaves sufficient area to support a healthy vegetation while the Leaf Rapids area would suffer from an overlap of affected areas compounding impact and initiating retrogressive activity. When this overlapping proliferates over a whole suburban area the result is maximization of impact over a large area. This is one of the major reasons why typical suburban layouts in subarctic regions have proven to be so disastrous to the environic health. If vegetation is to function within the community as a useful component, the spacing of the single family units must be in accordance with the land carrying capacity which will assuredly spread the single family units

further apart than a normal subdivision. The concept of standard lot sizes, suburban planning layouts, and vehicular and utility servicing must be carefully scrutinized for its appropriateness to the context.

The efficient use of unstable land by concentrating strip and cluster impacts on the area depends on the total development of that area. Using only 1/2 or 3/4 of the area reduces the efficiency of the land and defeats the purpose behind the whole approach. The defeat would occur because the development would be juxtaposed to a devastated natural environment lacking all the perceptual amenities.



F.11

Thus locating strip and cluster activities is directly related to the size of the area that is suitable. This should not be viewed as a restriction but as an opportunity for unique solutions. If some areas are too large for a specific land use, one alternative would be to initiate new and innovative activity combinations. The varying sizes and shapes of areas will create diversity in the dimensions and forms of development packages which would add to the scalar and spatial diversity of the community as a whole.

SUMMARY

The typical suburban approach to the Leaf Rapids area can only destroy the natural environment creating a mono-spatial and scalar impact profile, mediocre efficiency in servicing and utility economies, and a bland and depressing unhealthy community.

The approach, suggested within these guidelines, which spreads the smaller impacts over a larger area while concentrating the large impacts, should result in the retention of as much vegetation as is possible considering the type of development input. This should substantially contribute to the attainment of the specified policy goals. The increased distance between single family units should increase initial servicing costs while the concentration of strip and cluster inputs should reduce costs. The major and most important gain will be the overall institutional, environmental and human welfare health.

2) Visual Guidelines

The visual guidelines have been established by a general consensus of professional opinion and respect both policy goals and the land-use visual impact ratings. (see visual impact ratings, Appendix A.4). The premise underlying these guidelines is that visual absorption is the converse of input. Thus as the degree of visual impact increases, correspondingly the more difficult it is to absorb.

The following chart is a graphic representation of a low impact profile community which respects the natural visual rhythms of the vegetation, provides visual continuity, and establishes absorptive qualities allowing individual spatial events to be established. As a general rule, the land uses will be absorbed by the vegetation, but two exceptions occur:

1) The circulation infrastructure connects these sequential spatial events which are already absorbed and is thus not subject to absorptive guidelines.

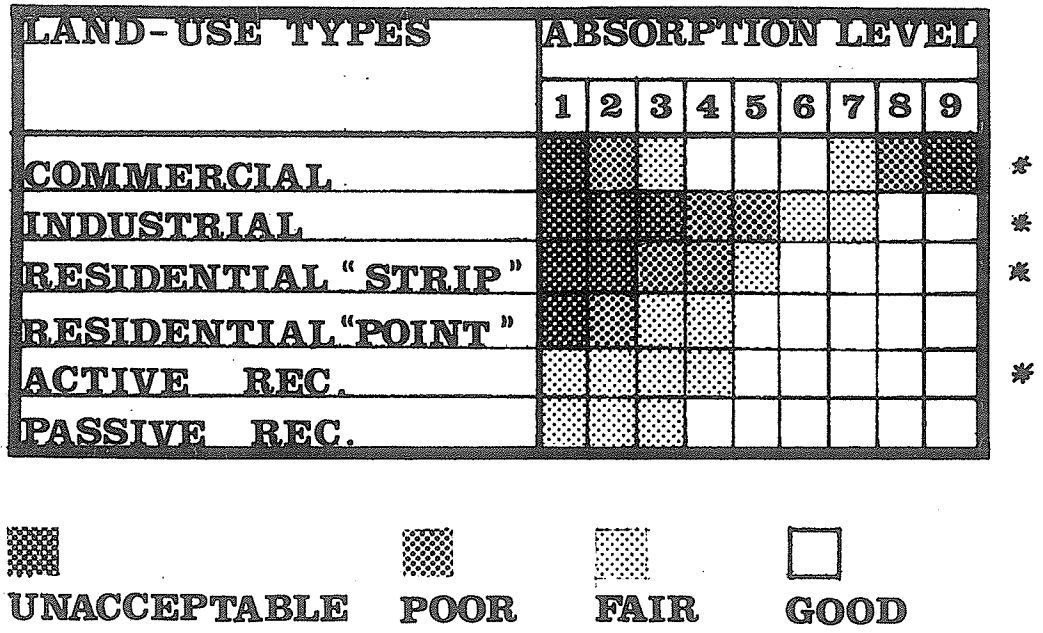
2) Commercial facilities require a strong visual impact to

attract customers, both resident and tourist. The visual impact rating of commercial facilities is extremely strong and harsh. In order to facilitate continuity with the rest of the community which will have a very low visual impact and attract attention, siting in a transparent vegetation (minor buffer) would be the optimal solution. This would soften the hard visual impact without losing its visual attractiveness.

Visual Guidelines

The visual health of the community is directly related to the specified absorptive levels of vegetation in which the activity is located.

COMMUNITY IMAGE

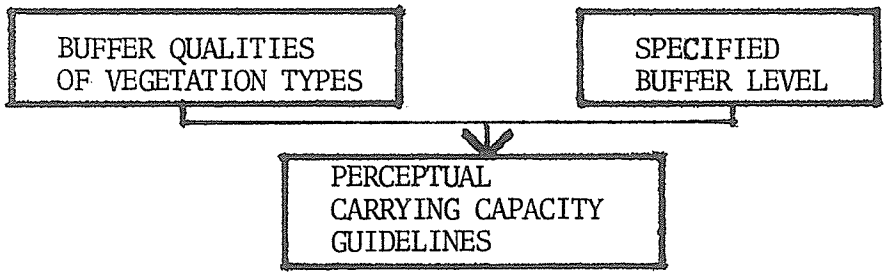


F.12

* The absorption levels refer to the vegetation (landscape) on the periphery of the development activity due to the resource impact techniques.

PERCEPTUAL CARRYING CAPACITY GUIDELINES

The perceptual carrying capacity of an area specifies the quantity of a land-use type that can be located in an absorptive area without destroying the desired perceptual benefits. The carrying capacity of a site is a function of the inherent buffer qualities, of the vegetation type and of the specified buffer level. (major, moderate, minor, and none).



The vegetation types have already been analysed according to the four buffer levels. Of the four levels it is found that only the 'moderate' and 'major' buffer levels would satisfy the previously established perceptual goals. Also, apprehension was expressed by ecologists who felt that the distances involved in 'no buffer' and 'minor buffer' levels would not leave sufficient quantity of vegetation to support a normal eco-system and that retrogression was a real possibility. Therefore the 'specified buffer level' for this study will be the moderate and major buffer levels.

By knowing the distances required to achieve those buffer levels for each vegetation group and by knowing the size of the grid cell, the perceptual carrying capacity of that cell can be established.

For point inputs (single family units) which will require the largest area (75%), the following guidelines have been instituted. (Refer to Appendix A.51 for an explanation concerning the technique employed in which buffers will be used to define the distances between inputs). (Chart is a result of a consensus of professional opinions).

PERCEPTUAL CARRYING CAPACITY GUIDELINES (S.F.U.)

LANDSCAPE CAPACITY	NO. OF S.F.U.'S / CELL						
	>4.5	4.5	4.0	3.0	2.0	1.0	<1.0
GROUP ONE							
GROUP TWO							
GROUP THREE							
GROUP FOUR							
GROUP FIVE							

UNACCEPTABLE POOR FAIR COMPATIBLE

NOTE: Calculations allow for 30% of each grid cell to be used for circulation and servicing infra-structure contingencies.

F.13

Strip and cluster inputs will have a periphery vegetation that will separate large developments to the extent that loss of perceptual amenities of the vegetation is avoided. But, due to the nature of the input technique the site itself can suffer from the perceptual problem of underdevelopment. Therefore the perceptual carrying capacity concerning strip and cluster inputs is related to the degree of unstable vegetation that is developed.

1) Strip and cluster inputs that do not totally develop the unstable vegetation area will be juxtaposed to a destroyed eco-system with no perceptual benefits. This will be considered 'unacceptable'.

2) Strip and cluster inputs that develop the whole of the unstable area will receive a 'good rating because the maximum perceptual potential of the site will be realized.

NOTE: The edge condition delineating the vegetation to be displaced and that vegetation to function as a buffer is expounded upon in appendix B.2.

The perceptual carrying capacity is a function of the site capability but it is not a component in locating activities. Rather, the guidelines will operate as a check list for feasibility proposals concerning the quantity of inputs that a vegetation type can support. These guidelines also act in an evaluative role by measuring the impact of the feasibility proposals on the perceptual benefits of the vegetation. For example, if an activity is located in an appropriate absorption zone but the quantity destroys the absorptive & perceptual qualities of the vegetation this will be rated as a 'threshold impact'.

SITE CAPABILITY

RESIDENTIAL POINT INPUT

SINGLE FAMILY UNIT

5

RESIDENTIAL POINT INPUT

(single family units, S.F.U.)

The unique characteristic about single family units is that their individual scale and impact characteristics allow great flexibility in site selection. They are much less sensitive to slopes than larger strip or cluster inputs, thus the beneficial micro-climate conditions that exist on certain slopes can be capitalized upon.

1) Studies of subarctic conditions suggest that generally the southern oriented slopes support the most stable vegetation due to the effects of solar radiation. The increased stability of vegetation increases the carrying capacity of the land without damaging the environment.

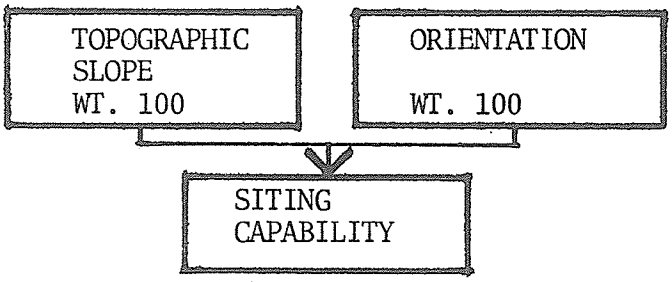
2) The extra heat loads obtained by southerly slopes can have significant ramifications over time concerning the heating costs of individual homes.

3) The accrued benefits also include the psychological lift one can receive by the direct sunlight and the milder micro-climate created around the house during bitterly cold days. This becomes especially important during the winter when on December 21st at Leaf Rapids the sun only reaches an altitude of 10° above the horizon and there are only about 6 1/2 daylight hours. Flat areas and northerly slopes receive little or no direct sunlight because the low sunlight is blocked by the hill or the surrounding trees.

4) A slope oriented away from the prevailing winds can reduce the heat loss by the dwellings and reduce the wind chill factor of the area.

Along with the normal site requirements, micro-climate conditions should form an integral component of the measure to establish the ability of the site to support human habitation.

1) SITING CAPABILITY (S.F.U.)

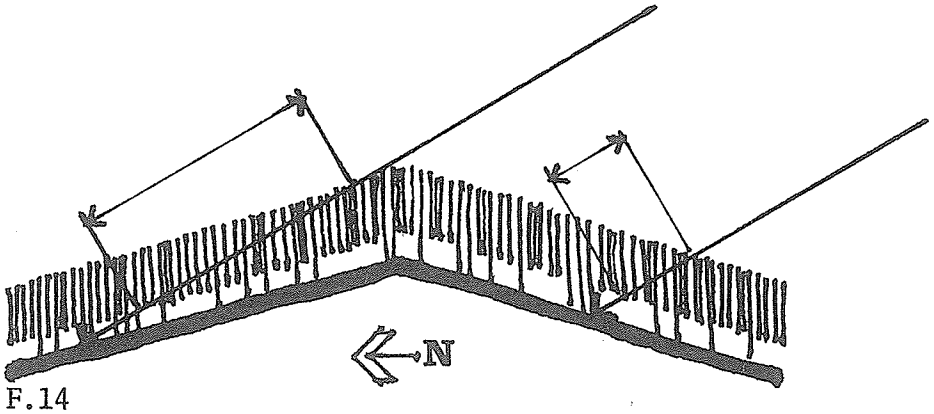


TOPOGRAPHIC SLOPE

Slopes influence direct solar radiation in two ways:

1) The intensity of direct radiation on a surface is directly proportional to the angle between the solar beam and the surface. The more perpendicularly the solar radiation hits the slope the more heat is gained through absorption and the less heat is lost through reflection.

2) Penetration of direct solar radiation depends upon the amount of tree vegetation encountered by the beam.

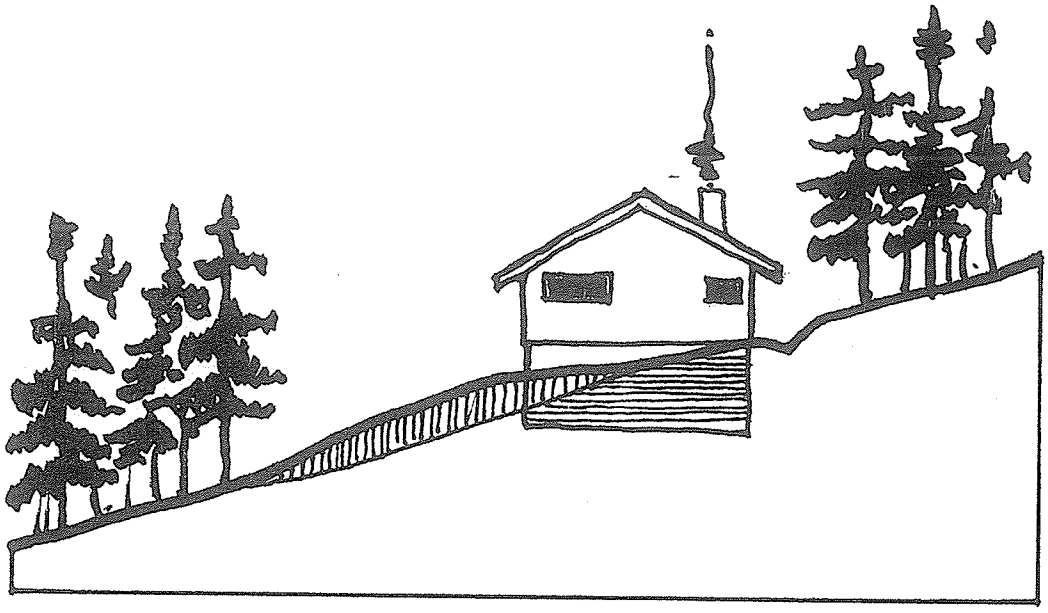


F.14

Therefore the slopes facing the sun's rays have less vegetation to screen the solar energy.

Since the sun's angle is so low in subarctic regions the steeper slopes would receive the greatest heat load. This consideration must be balanced with the realities of existing site conditions and construction capabilities. An investigation of current site criteria used by developers to

determine residential development capability revealed that slopes of 15% - 20% are considered marginal for a typical suburban development. It was found that excavation equipment required by the type of input can work on slopes of 25% without any operational difficulties. Roads and utilities are being considered as a separate component and their restrictions do not influence site capability as yet. An economic advantage through construction on slopes occurs when the quantity of cut material equals the fill material. Thus excavated materials from basements on slopes is used to level the slope and does not have to be trucked away and disposed of in an ecologically sensitive manner.



F.15

Considering both the minimal amount of vegetation being removed and the sandy soil conditions it has been estimated that erosion will become a serious problem on slopes over 20% - 25%. Also in reviewing the solar heat load ranges, slopes around 20% begin to capitalize substantially upon the sun's radiations. A preliminary analysis of solar heat loads on slopes has been completed for the Leaf Rapids site.[13] The following brief

---

[13] Dakin, A. - Some Micro-climatic Effects Through Siting in Northern Environments, Masters Thesis, U. of M. 1972.

summary represents some interpolated facts from this thesis. These figures represent a comparison of direct solar heat loads between southerly oriented slopes of 20% and level or 0% slope at 12:00 pm. on the 21st of each month. Northerly oriented slopes receive little or no direct solar heat loads and form the opposite extreme.

DECEMBER	0% =	30 BTU / hr. / sq. ft.
	20% =	66 BTU / hr. / sq. ft.
JANUARY	0% =	49 BTU / hr. / sq. ft.
	20% =	91 BTU / hr. / sq. ft.
FEBRUARY	0% =	102 BTU / hr. / sq. ft.
	20% =	152 BTU / hr. / sq. ft.
MARCH	0% =	156 BTU / hr. / sq. ft.
	20% =	201 BTU / hr. / sq. ft.
APRIL	0% =	198 BTU / hr. / sq. ft.
	20% =	234 BTU / hr. / sq. ft.
MAY	0% =	220 BTU / hr. / sq. ft.
	20% =	240 BTU / hr. / sq. ft.
JUNE	0% =	226 BTU / hr. / sq. ft.
	20% =	252 BTU / hr. / sq. ft.
JULY	0% =	216 BTU / hr. / sq. ft.
	20% =	244 BTU / hr. / sq. ft.
AUGUST	0% =	190 BTU / hr. / sq. ft.
	20% =	224 BTU / hr. / sq. ft.
SEPTEMBER	0% =	146 BTU / hr. / sq. ft.
	20% =	186 BTU / hr. / sq. ft.
OCTOBER	0% =	98 BTU / hr. / sq. ft.
	20% =	144 BTU / hr. / sq. ft.
NOVEMBER	0% =	49 BTU / hr. / sq. ft.
	20% =	89 BTU / hr. / sq. ft.

It is important to note that solar heat load on a 20% slope in February equals the heat load of the 0% slope of March roughly advancing the solar heat load of an area by a month. Also the solar heat load of a 20% slope in November is roughly equal to that heat load on a 0% slope in October thus retarding by a month the loss of direct solar heat. Thus by siting

single family units in areas that have the best attributes of slope and orientation the inherent micro-climate created will act as an environmental flywheel - extending the heat loads of autumn and spring which are extremely short seasons in the area and moderating the sub-zero winter temperatures.

Considering all the above positive and negative factors a slope of between 16% - 20% was found to optimize the positive attributes while minimizing the negative ones and as such will be viewed as the optimal slope.

TOPOGRAPHIC SLOPE		(S.F.U.)
LEAST	0	water
COMPATIBLE	1	over 20%
	2	0% - 4%
	3	
	4	4% - 8%
	5	8% - 12%
	6	
	7	12% - 16%
MOST	8	
COMPATIBLE	9	16% - 20%

ORIENTATION

The optimal orientation in this study is a function of the direction of the slope in regards to direct solar radiation and the prevailing winds. The extremes of heat loads between any two surfaces occur between north and south slopes. The south slopes of the subarctic regions receive the greatest amount of direct solar radiation. The prevailing winds in the Leaf Rapids area are from the North thus the northern slopes receiving the brunt of the wind while the southern slopes are buffered.

ORIENTATION		(S.F.U.)
LEAST	0	water
COMPATIBLE	1	North
	2	North east
	3	North west
	4	flat
	5	East
	6	West
	7	South east
MOST	8	South west
COMPATIBLE	9	South

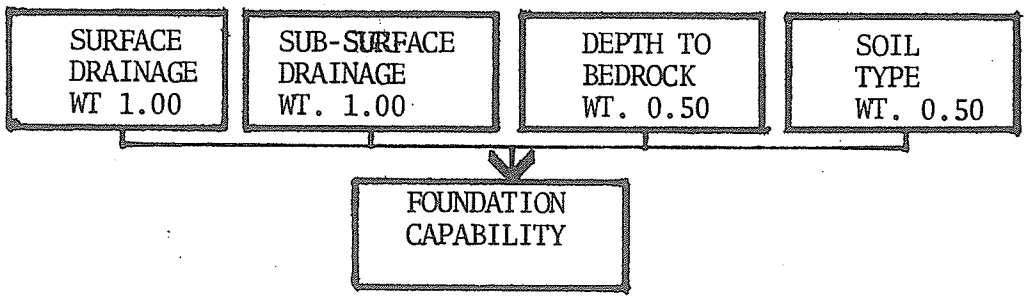
In order to explain the process which leads up to computer manipulation of the preceeding information, this one example will be completed to that level. Since the process for all capability variables is similar, it need not be repeated for the rest of the variables.

SITING CAPABILITY (S.F.U.)

1) Adjustment process

Checks must be made so that the results of combinations lead to accurate reflections of site conditions. Some of the combinations of slope and orientation do not result in true values. For example. The combinations of a north orientation and a 16% - 20% slope would receive a greater value (1 + 9) than a West orientation of 0% - 4% slope (5 + 1), which is not an accurate reflection of potential micro-climate conditions. In reality the north-oriented slopes receive no solar radiations and negates the original reason for siting on a slope. Thus an adjustment is made that whenever a northerly orientation combines with any slope it will receive a value of (1). The adjustment process solves the problem of inequities in the final capability values. (Refer to Appendix B.1 for Mapping Process.)

2) FOUNDATION CAPABILITY (S.F.U.)



The variables with the greater weight reflect both ecological and constructional implications.

SURFACE DRAINAGE (S.F.U.)

The hydrologic system of the watershed (surface drainage) is in equilibrium with present distribution of natural landuse. Whenever possible perturbation of this system should be avoided thus lowering the potential of any

imbalance within the system which would cause both primary and secondary ecological consequences. Involvement with surface runoff can also create difficult constructural and maintenance problems.

LEAST	0	water
COMPATIBLE	1	poorly drained wetlands
	2	intermittent creek
	3	swales
	4	
	5	minor surface runoff (seasonal)
	6	drainage pattern (heavy storms)
	7	
MOST	8	
COMPATIBLE	9	well drained

SUB-SURFACE DRAINAGE (S.F.U.)

Interaction with the watertable during excavations for Basements and footings results in an increase in development and ecological cost.

1) Excavations most often are sheeted and pumped out. This causes problems in that slopes may begin to slough, and a loss of ground in neighbouring sites is not unusual. Also if the bottom of the excavation becomes 'quick' water appears in forms of springs and constructional techniques or repairs become onerous.

2) Utilities and Basements must be water proofed.

3) Depending on the soil composition and the level of undifferentiation of the particles one of the following could occur.

A) In clay soils the water table will not change rapidly and thus creates problems of keeping basements dry.

B) A drop in water table can result in a reduction of the cohesive force in some soils created by moisture content and thus cause weaker foundation material. A drop in water table normally causes settlement in the ground surface roughly proportional to the descent of the

water table.

4) Water table elevations of less than 8 feet in sandy soils are susceptible to large and rapid decreases due to excavations. Surrounding root structures of the vegetation will not be able to adapt to the change and a retrogressive condition in the ecology will be initiated resulting in the loss of the vegetation over time.

LEAST	0	water
COMPATIBLE	1	0 ft. - 2 ft.
	2	2 ft. - 4 ft.
	3	
	4	
	5	4 ft. - 6 ft.
	6	6 ft. - 8 ft.
	7	
MOST	8	
COMPATIBLE	9	over 8 ft.

DEPTH TO BEDROCK (S.F.U.)

Basement excavations usually require a depth of between 5 feet and 7 feet below grade. The program calls for developer type houses which include typical basement requirements. The undulating characteristics of the bedrock in the area would make a depth greater than 10 feet of overburden the most optimal condition. Whenever possible rock should be avoided because excavation costs jump dramatically when rock is encountered (1966 figures indicate excavation costs of $25.00 to $30.00 per cubic yard[14]).

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[14] Municipal Planning Branch - Manitoba Services in New Townsites and Subdivisions, 1966. Page 4

LEAST	0	water
COMPATIBLE	1	rock outcropping
	2	
	3	3 ft. to bedrock
	4	
	5	5 ft. to bedrock
	6	
	7	10 ft. to bedrock
MOST	8	
COMPATIBLE	9	over 10 ft. to bedrock

SOIL TYPE (S.F.U.)

Single family units have supporting walls with linear spread footings which means the load is distributed over a larger area rather than a columnar type point load. Therefore considering the type of foundation within the Leaf Rapids site conditions, a well graded undifferentiated gravel is the best foundation material.

1) well graded sand or gravel has good permeability and is thus very well drained. All the settlement will occur during construction and it is not susceptible to seasonal movement. One can expect it to have the highest bearing capacity (4 - 6 tons/sq. ft.) when compared to the other soils on the site.

2) The second best foundation material on the site is poorly graded gravel or sand. Because this material gains its strength through friction the lack of different sizes reduces its bearing capacity (1-4 tons/sq. ft. depending upon compactness). If the gravel is fine it is also susceptible to capillary action of water which could create seasonal movements.

3) As the soils increase in clay and silt content, they are more susceptible to large settlements over time, seasonal movements, and frost action which render them less capable of supporting foundations.

LEAST	0	water
COMPATIBLE	1	organic peat (no overburden)
	2	
	3	silts and clays
	4	
	5	sand, silts and clays
	6	
	7	poorly graded gravel (sand)
MOST	8	
COMPATIBLE	9	well graded gravel (sand)

The conversion table has been adjusted so that any area with major development constraints such as a rock outcropping, will receive an unacceptable rating (1) even though the other resource variables are ideal.

VEGETATION CAPABILITY (S.F.U.)

As previously discussed within the general guidelines, the most 'stable' vegetation is the optimal location for point impacts such as single family units and thus the most capable.

LEAST	0	water
COMPATIBLE	1	Group one
	2	Group two
	3	Group three
	4	Group four
	5	Group five
	6	Group six
	7	Group seven
MOST	8	Group eight
COMPATIBLE	9	Group nine

VEGETATION PREFERENCE CAPABILITY (S.F.U.)

Using the same vegetation classification as vegetation stability the sample group chose the vegetation type in which they would prefer to have their dwellings located. This choice was qualified with the assumption that the original qualities of the vegetation would not be altered significantly by the development of the area. The relative scores received

are reflected in the preferential scale.

LEAST	0	water
PREFERRED	1	Groups one, two, three
	2	
	3	Group four
	4	Group six, nine
	5	
	6	Group five
	7	Group seven
MOST	8	
PREFERRED	9	Group eight

VISUAL ACCESS CAPABILITY (S.F.U.)

Policy stresses the importance of perceptual diversity and complexity and thus visual access to feature landscapes will be considered as an important attribute of site capability.

LEAST	0	water
PREFERRED	1	environmental visual nuisances
	2	
	3	no features outside normal vegetation
	4	view of marshland
	5	view of stream (intermittent)
	6	screened view of ravine, hills, kettles.
	7	direct visual access to ravines, hills, kettles.
MOST	8	screened visual access to water
PREFERRED	9	direct visual access to water.

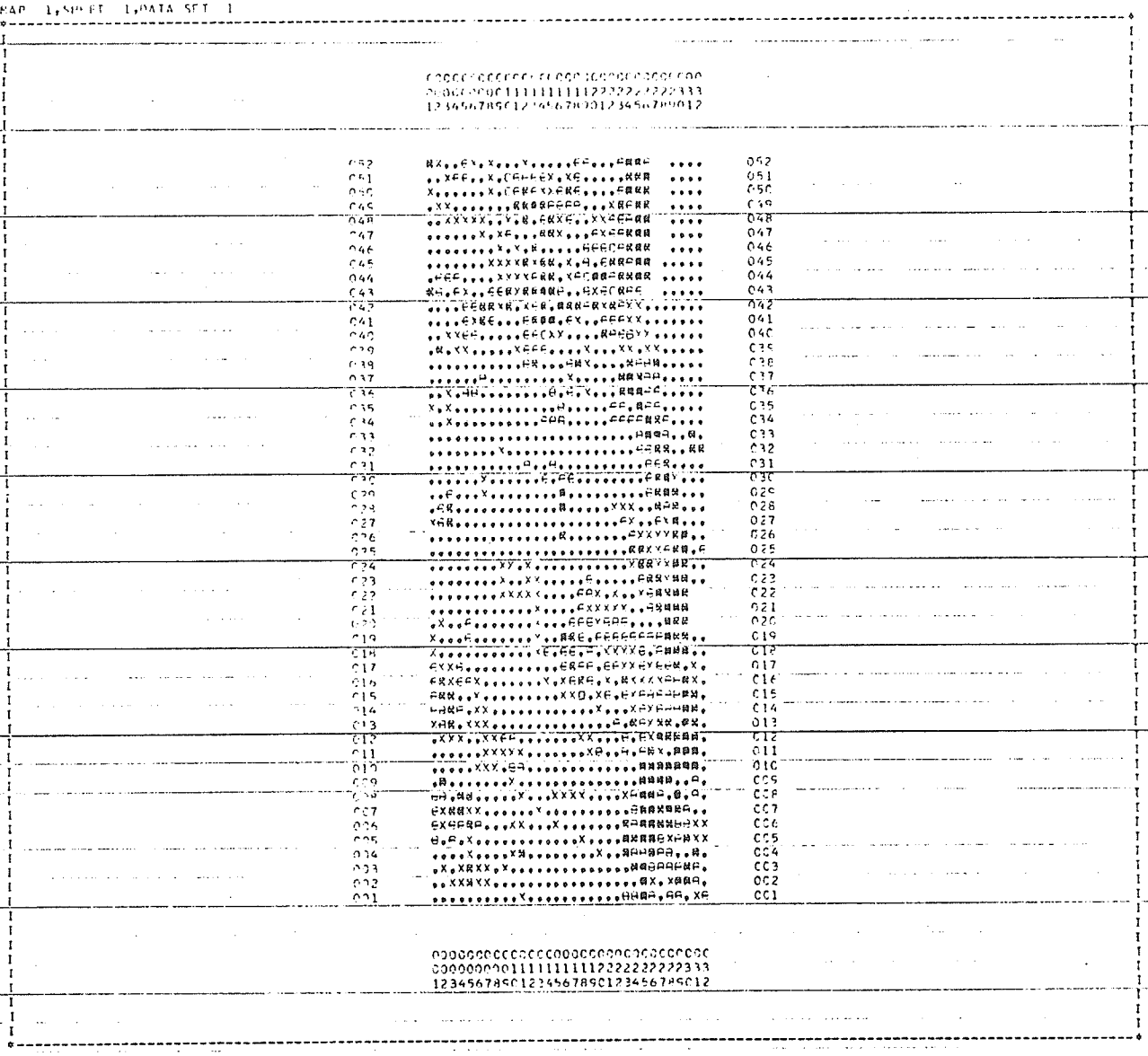
VISUAL ABSORPTION CAPABILITY (S.F.U.)

Consistent with the guidelines established for attaining the total visual health of the community, the ability of the site to absorb the single family units to the desired level is represented by the following values.

LEAST COMPATIBLE	0	water
	1	Group one
	2	
	3	Group two
	4	
	5	
	6	Group three, four
	7	
MOST COMPATIBLE	8	
	9	Group five, six, seven, eight, nine

NOTE: Groups defined by absorption rating of vegetation types.

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

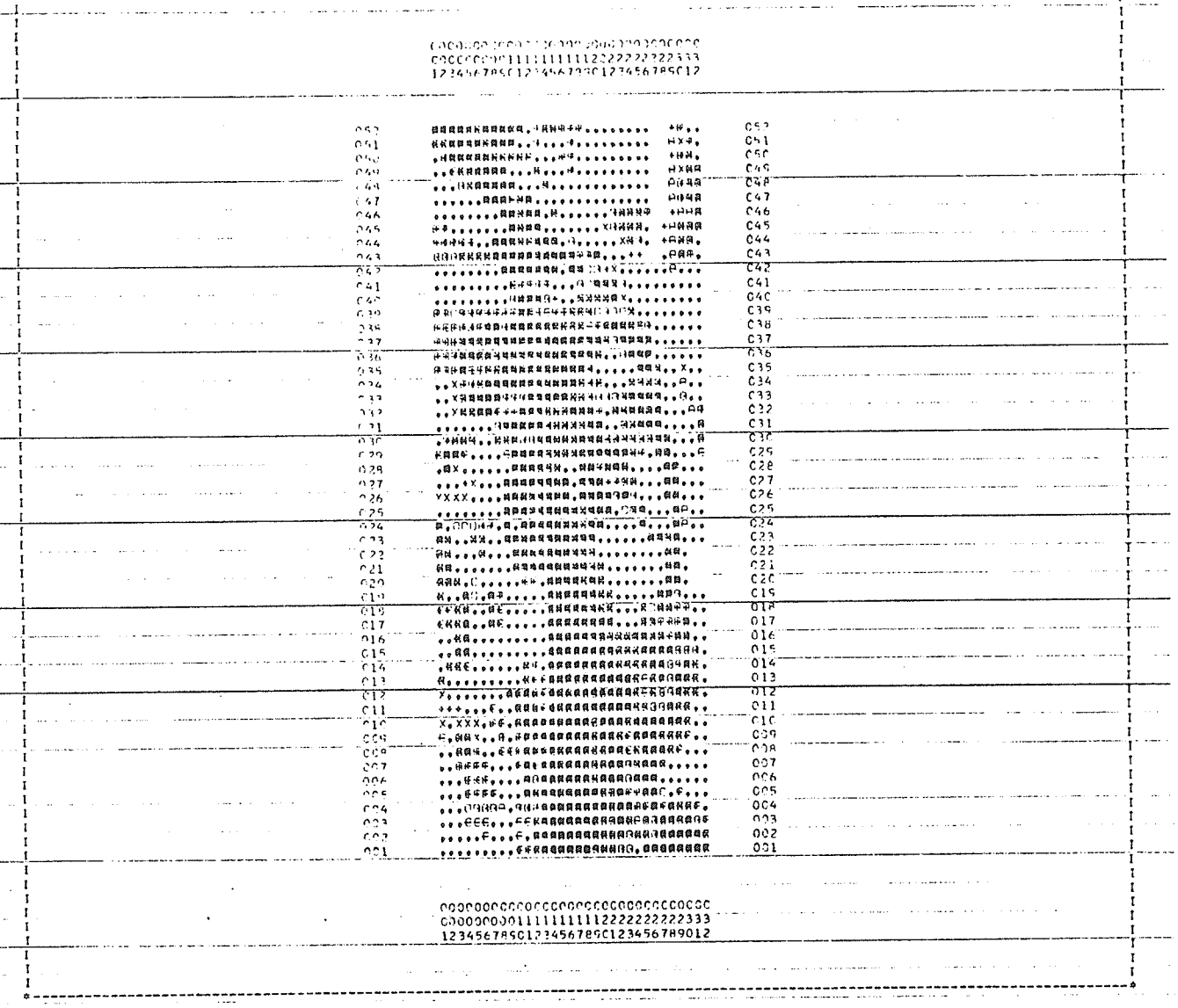
SINGLE FAMILY UNIT ALLOCATION ANALYSIS
LAND USE CODE

11 SITING CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	977	0	212	0	240	0	128	0	83

MAP 2,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

CAVIN JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

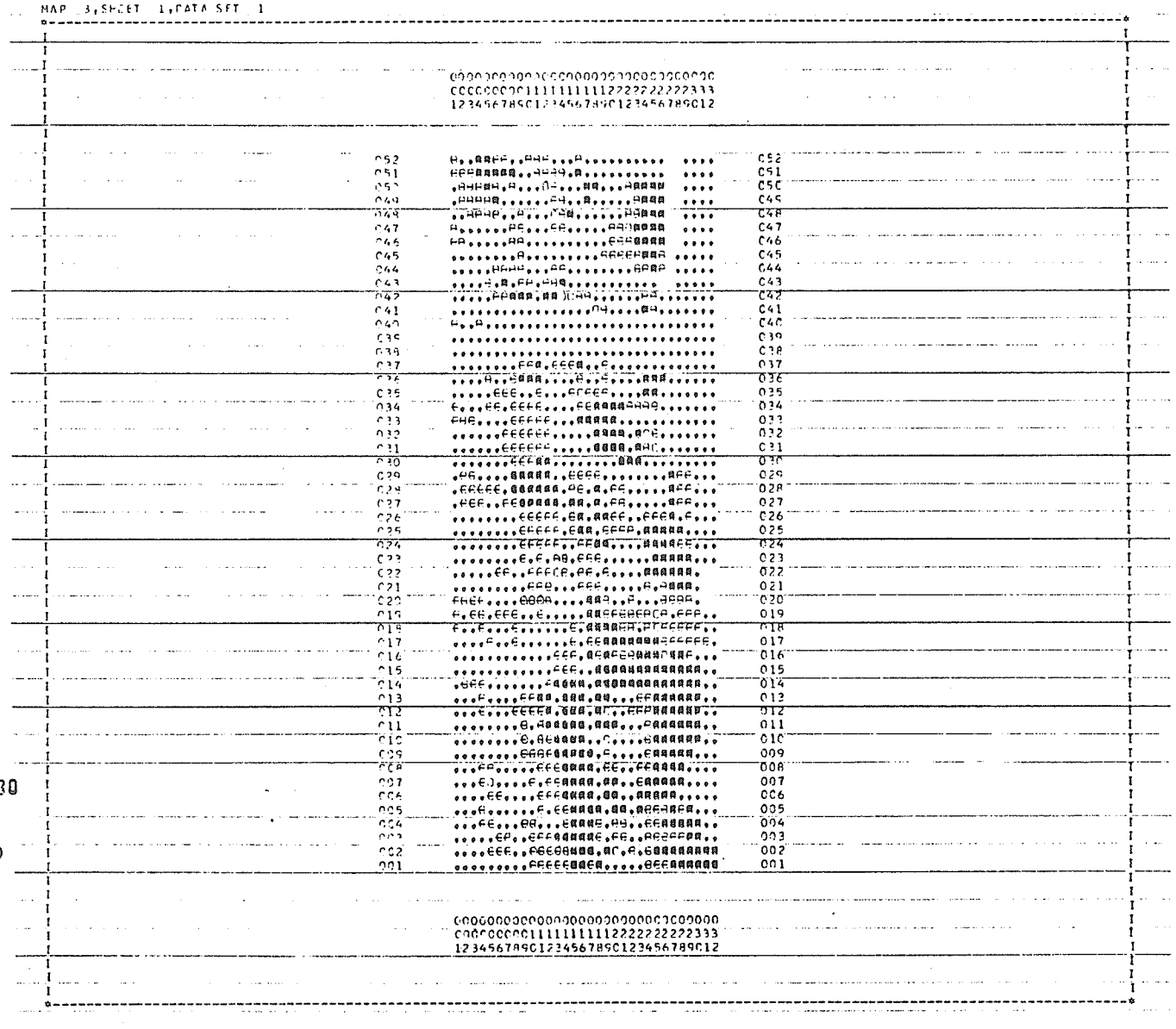
SINGLE FAMILY UNIT ALLOCATION ANALYSIS
LAND USE CODE

21 FOUNDATION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	C	E	#	@	A	B
FREQUENCY	24	588	12	22	14	31	189	47	176	561

MAP 3,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

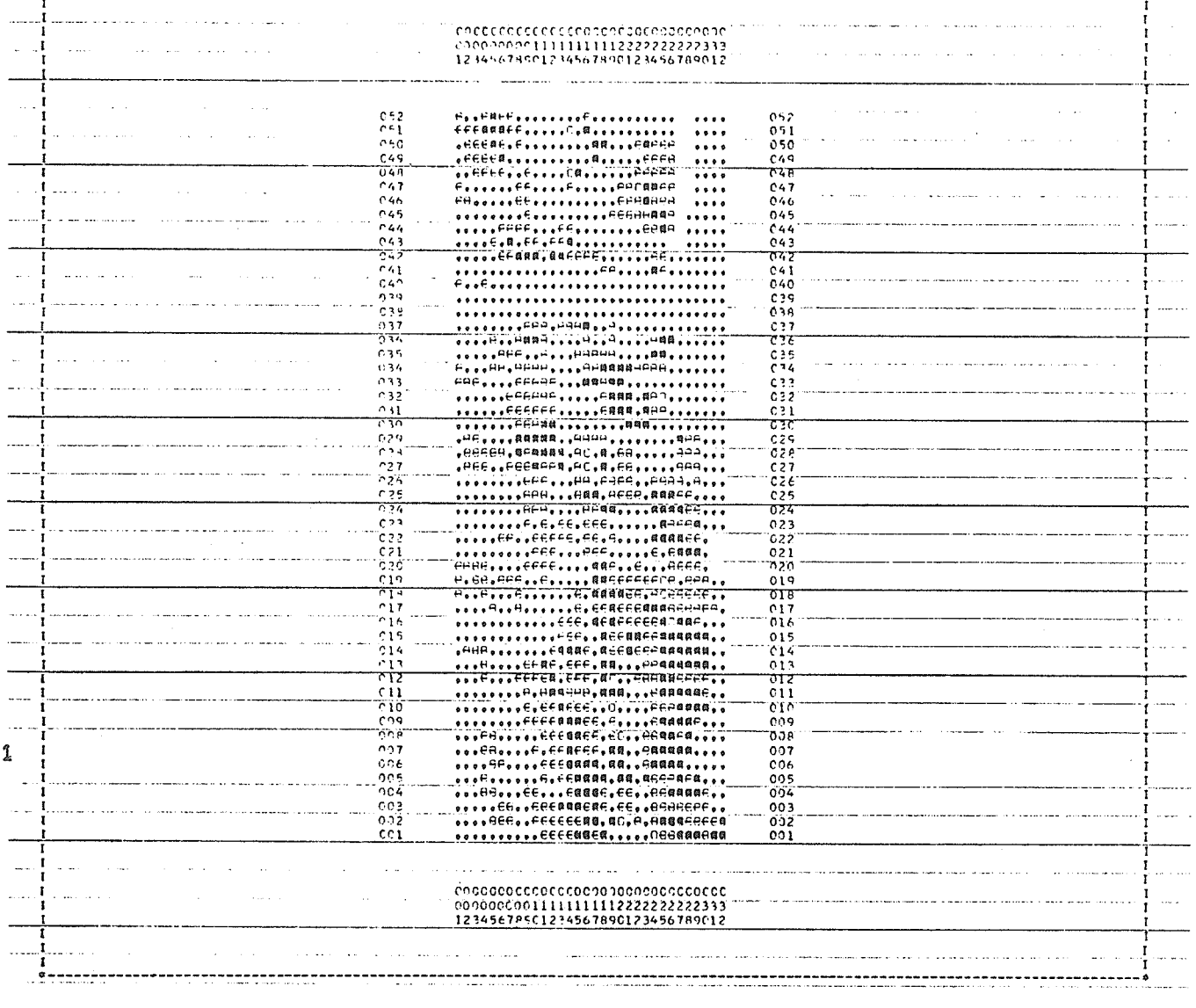
SINGLE FAMILY UNIT ALLOCATION ANALYSIS
LAND USE CODE

31 VEGETATION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	@	#	=	-	:	*
FREQUENCY	24	973	0	0	0	401	0	0	0	316

MAP 4,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JUHLS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

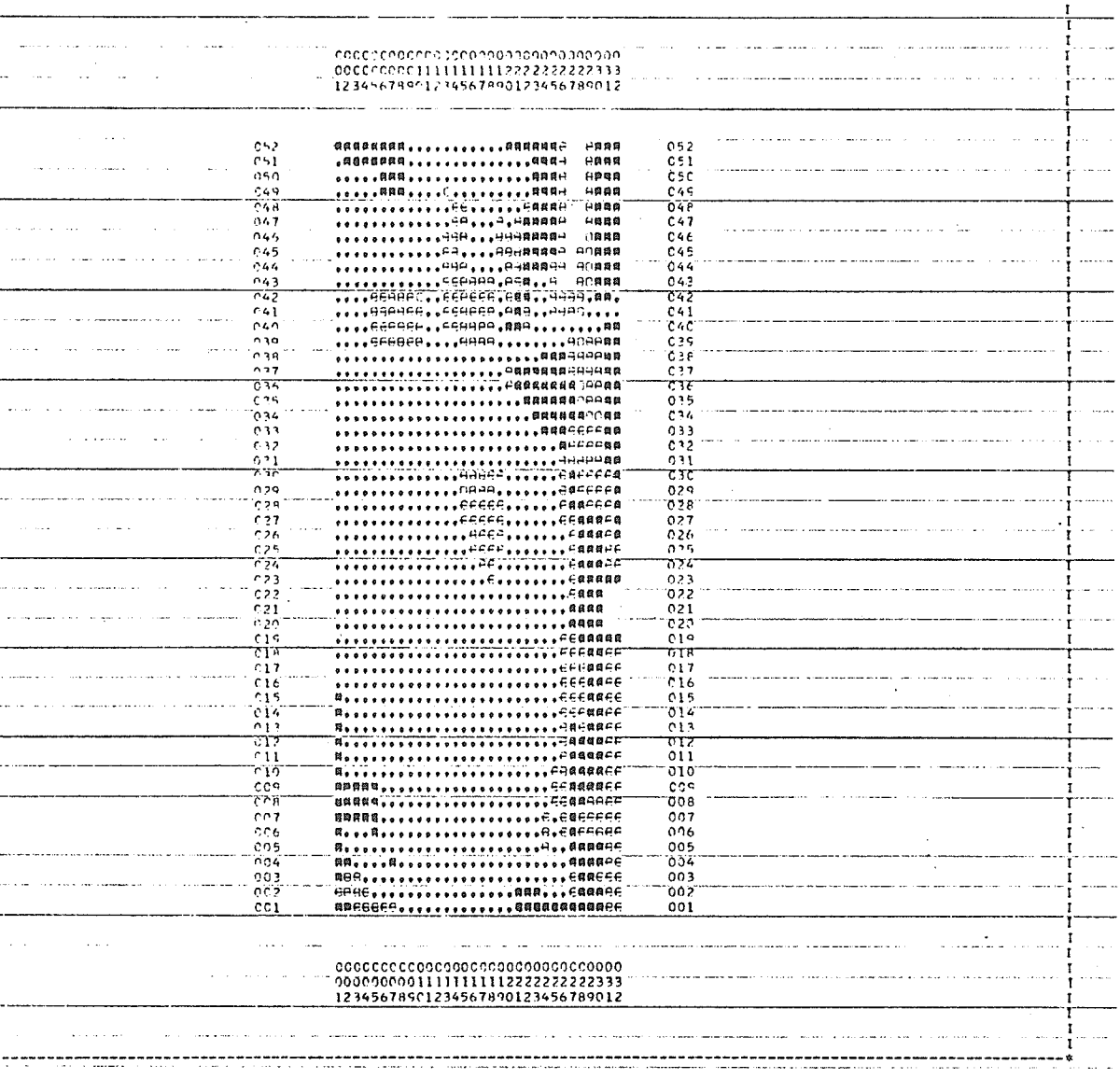
SINGLE FAMILY UNIT ALLOCATION ANALYSIS
LAND USE CODE

41 VEGETATION PREFERENCE CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	*	X	O	#	@				
FREQUENCY	24	942	0	0	0	479	0	0	0	219

MAP 5,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

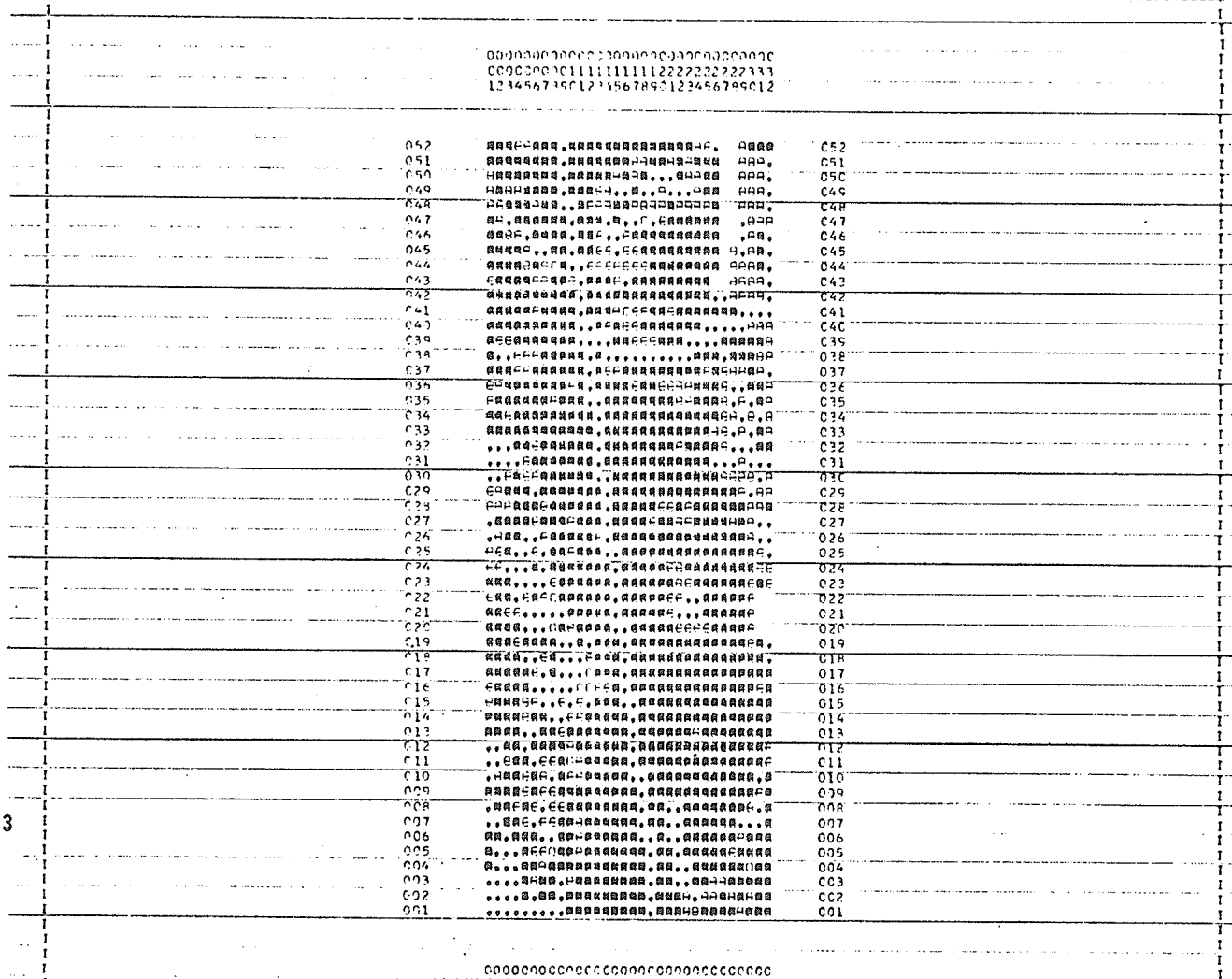
SINGLE FAMILY UNIT ALLOCATION ANALYSIS
LAND USE CODE

5) VISUAL ACCESS CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	#	E	A	@	B	C
FREQUENCY	24	1069	0	0	0	296	0	0	0	275

MAP 6,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

SINGLE FAMILY UNIT ALLOCATION ANALYSIS
LAND USE CODE

41 VISUAL ABSORPTION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	#	@	&	=	-	A
FREQUENCY	24	278	0	0	0	290	0	0	0	1072

SITE CAPABILITY

RESIDENTIAL STRIP OR CLUSTER INPUT

MULTI-FAMILY UNIT

5

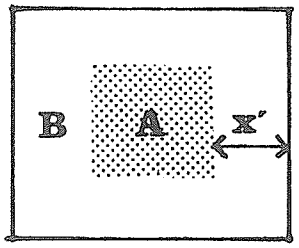
RESIDENTIAL STRIP OR CLUSTER INPUT

(multi-family units, M.F.U.)

The scale of multi-family inputs dictates much less flexibility in site selection. The relative energy required to provide multi-family developments on slopes greatly increases compared to flat slopes. This means that the advantages gained on slopes become out-weighed by the unreasonable increases in effort and cost. Strip and cluster-construction techniques combined with the size and type of vegetational areas being considered would also make slope development ecologically undesirable.

The loss of perceptual advantages of slope habitation can be regained by optimizing the perceptual benefits of the flat site and, although not within the scope of this study, by architectural solutions to the monolithic forms of the development.

A two level capability analysis must be introduced for all the strip and cluster developments in order to avoid cancelling out of relevant criteria. This type of input totally displaces the vegetation that made the site capable which differs from point inputs which fit into the surrounding environment. Thus the vegetation on the periphery of the area totally displaced must also function as an integral component of the whole site capability rating. The result is that the capability rating for multi-family input will be staged.



STAGE 'A' - will consider the area which will be totally replaced by the development.

1) SITING CAPABILITY
2) FOUNDATION CAPABILITY
3) VEGETATION CAPABILITY
4) VISUAL ACCESS CAPABILITY

STAGE 'B' - will consider the area on the periphery of the development.

1) VEGETATION PREFERENCE CAPABILITY
2) VEGETATION CAPABILITY
3) VISUAL ABSORPTION CAPABILITY

The resultant suitability scores will be procured by combining the ratings of both stages A and B. The resultant area of the suitability rating will encompass that area of the two combined. (The method of combining the two capability stages into a suitability rating is explained in appendix B.2).

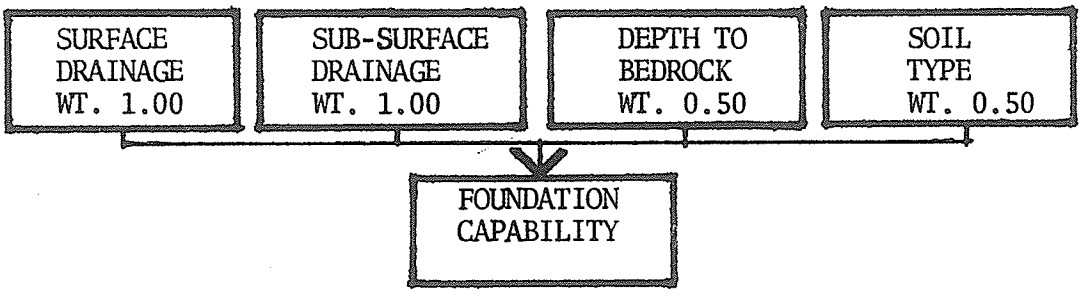
STAGE 'A'

SITING CAPABILITY (M.F.U.)

Siting requirements of multi-family units consist only of topographic criteria. Since the slopes being considered for locating these inputs are minimal (0% - 4%) orientation does not play a significant factor and is thus not included within the criteria.

LEAST COMPATIBLE	0	water
	1	over 20%
	2	16% - 20%
	3	12% - 16%
	4	8% - 12%
	5	
	6	4% - 8%
	7	
MOST COMPATIBLE	8	
	9	0% - 4%

FOUNDATION CAPABILITY (M.F.U.)



Since the multi-family unit types are anticipated to not exceed four stories it is most likely they will be bearing wall structures and as a result require the same foundation capabilities as the single family units.

SURFACE DRAINAGE (M.F.U.)

LEAST COMPATIBLE	0	water
	1	poorly drained wetlands
	2	intermittent creek
	3	swales
	4	minor surface run off (seasonal)
	5	drainage pattern (heavy storms)
	6	
	7	
MOST COMPATIBLE	8	
	9	well drained

SUB-SURFACE DRAINAGE (M.F.U.)

LEAST COMPATIBLE	0	water
	1	0 ft. - 2 ft.
	2	2 ft. - 4 ft.
	3	
	4	
	5	4 ft. - 6 ft.
	6	6 ft. - 8 ft.
	7	
MOST COMPATIBLE	8	
	9	over 8 ft.

DEPTH TO BEDROCK (M.F.U.)

LEAST COMPATIBLE	0	water
	1	rock outcropping
	2	
	3	3 ft. to bedrock
	4	
	5	5 ft. to bedrock
	6	
	7	10 ft. to bedrock
MOST COMPATIBLE	8	
	9	over 10 ft. to bedrock

SOIL TYPE (M.F.U.)

LEAST COMPATIBLE	0	water
	1	organic peat
	2	
	3	silts and clays
	4	
	5	sand, silts and clays
	6	
	7	poorly graded gravel (sand)
MOST COMPATIBLE	8	
	9	well graded gravel (sand)

VEGETATION CAPABILITY (M.F.U.)

In accordance with the 'resource impact technique' established for strip and cluster inputs the most capable vegetation type is the least stable.

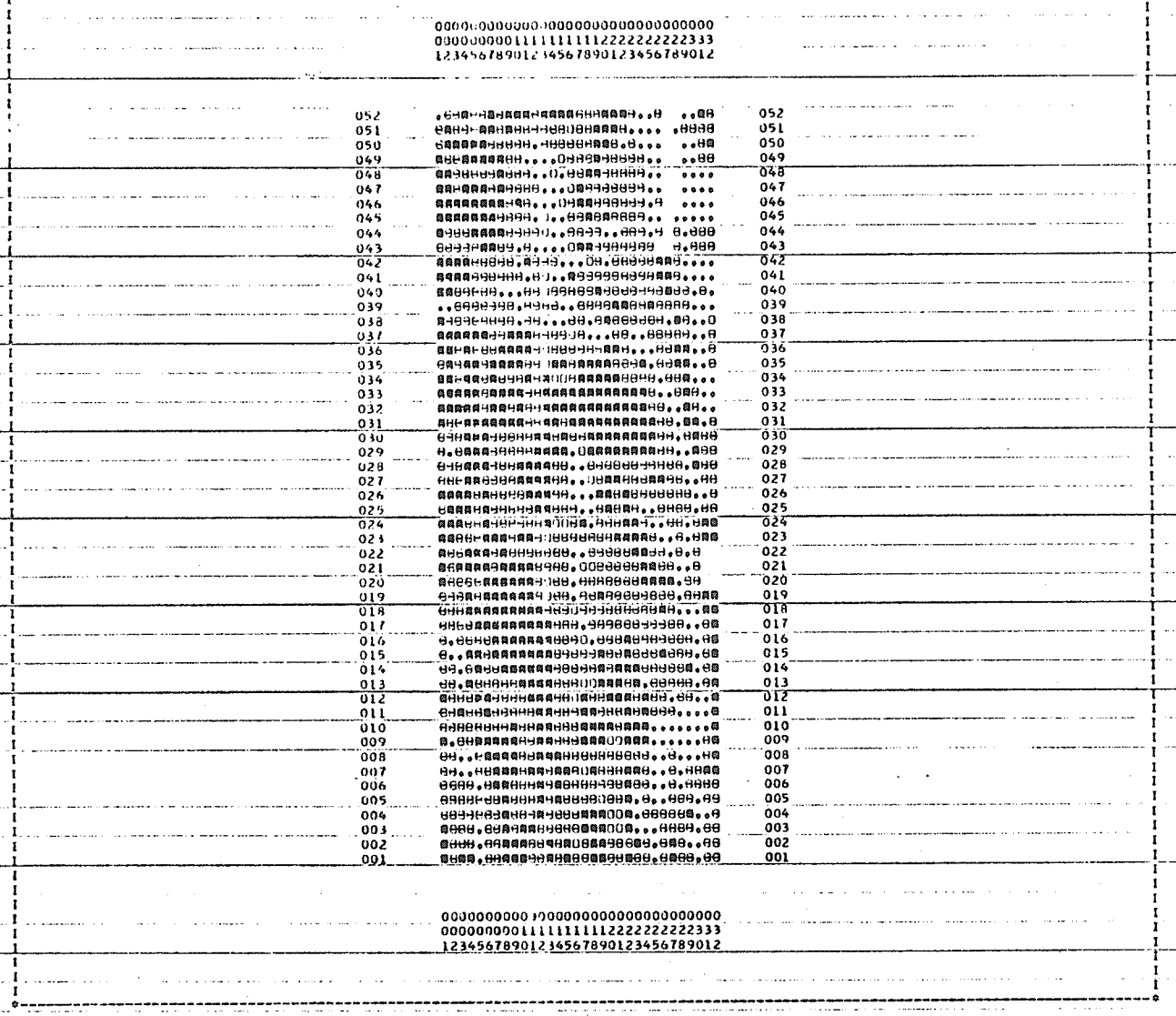
LEAST	0	water
COMPATIBLE	1	Groups nine, eight
	2	Group seven
	3	Group six
	4	Group five
	5	Group four
	6	
	7	Group three
MOST	8	Group two
COMPATIBLE	9	Group one

VISUAL ACCESS CAPABILITY (M.F.U.)

Visual access to unique perceptual experiences is just as important for multi-family units as it is for single family units and thus is included as a function of site capability.

LEAST	0	water
PREFERRED	1	environmental visual nuisances
	2	
	3	no features outside normal vegetation
	4	view of marshland
	5	view of stream (intermittent)
	6	screened view of ravine, hills, kettles
	7	direct visual access to ravine, hills, kettles
MOST	8	screen visual access to water
PREFERRED	9	direct visual access to water

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

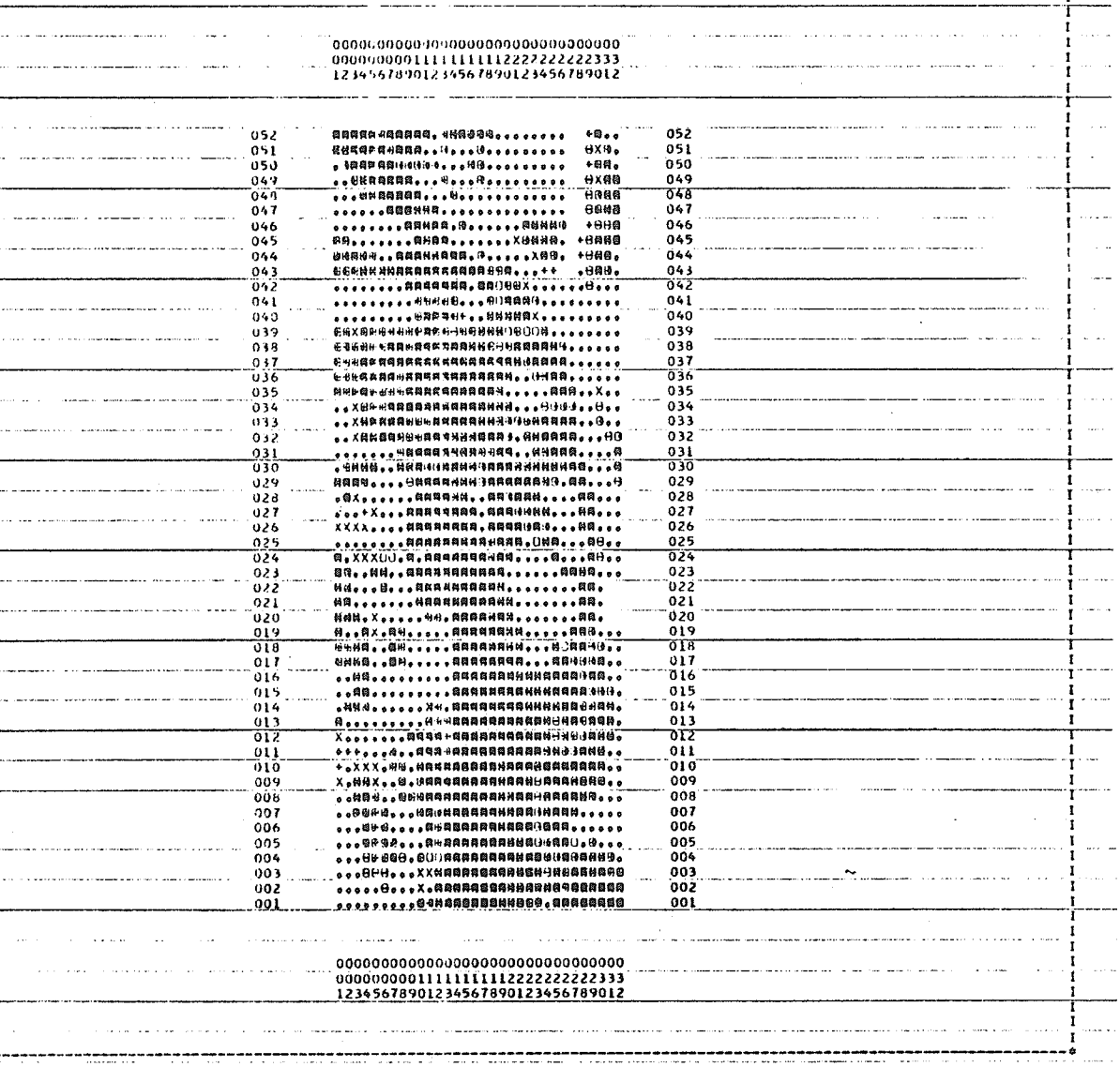
MULTI-FAMILY UNIT ALLOCATION ANALYSIS (STAGE A)
LAND USE CODE

11 SITING CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	#	@	=	-		
FREQUENCY	23	252	0	0	0	865	0	0	0	524

MAP 2, SHEET 1, DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

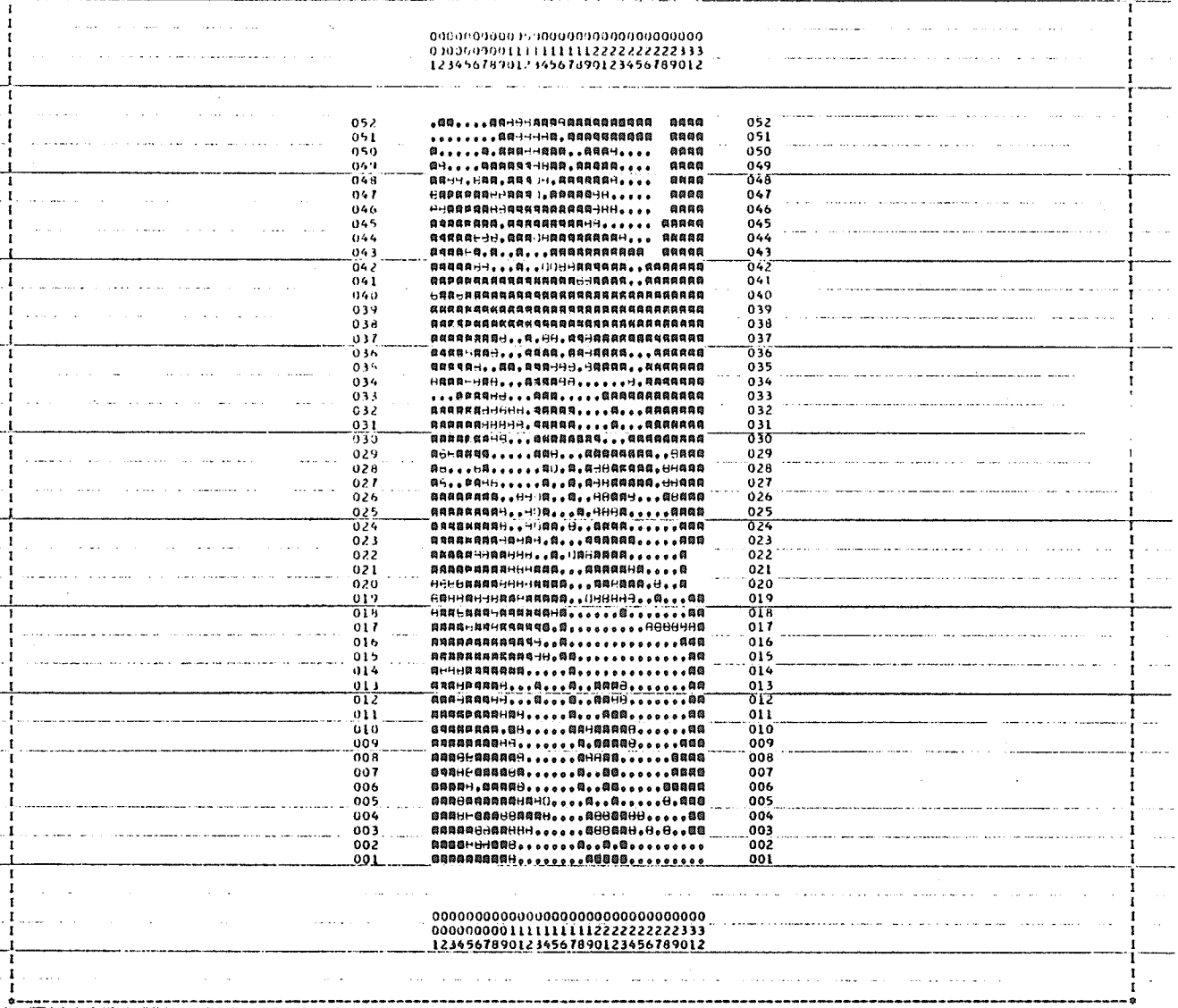
MULTI-FAMILY UNIT ALLOCATION ANALYSIS (STAGE A)
LAND USE CODE

2) FOUNDATION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	H	@	#	$	%	&
FREQUENCY	24	588	13	31	12	30	209	39	160	558

MAP 3,SHEET 1,DATA SET 1



1141

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

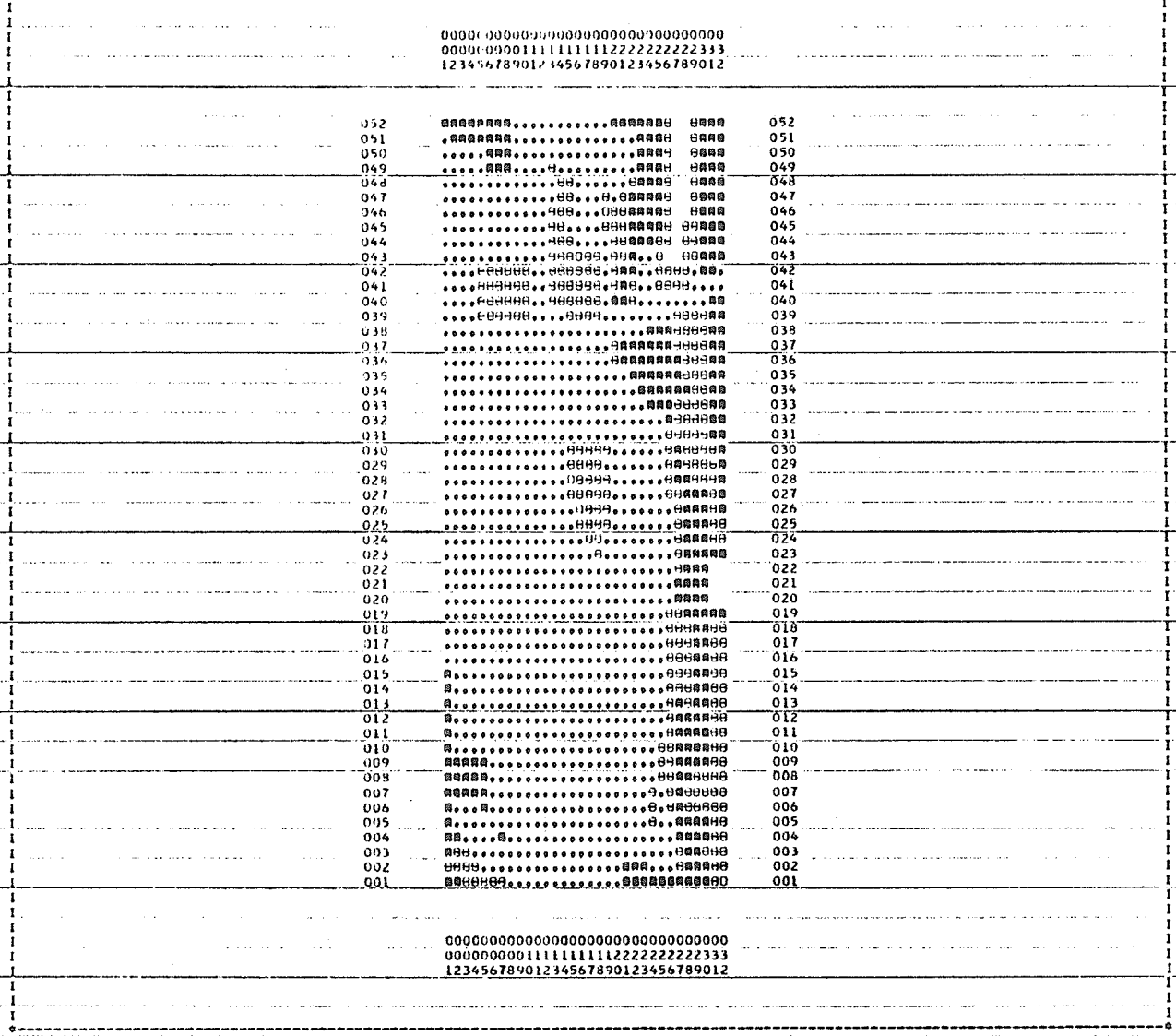
MULTI-FAMILY UNIT ALLOCATION ANALYSIS (STAGE A)
LAND USE CODE

3) VEGETATION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	687	0	0	0	230	0	0	0	923

MAP 4,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

MULTI-FAMILY UNIT ALLOCATION ANALYSIS (STAGE A)
LAND USE CODE

41 VISUAL ACCESS CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	#	@	~	=	%	*
FREQUENCY	24	1069	0	0	0	296	0	0	0	275

STAGE 'B'

VEGETATION CAPABILITY (M.F.U.)

The vegetation will be required to be sufficiently stable to withstand the activities associated with close proximity to and public use of by such a dense population. Vegetation types with no understory will suffer the least damage.

LEAST COMPATIBLE	0	water
	1	Group one
	2	Group two
	3	
	4	Group three
	5	
	6	Group nine
	7	
MOST COMPATIBLE	8	
	9	Groups eight, seven, six, five, four

VEGETATION PREFERENCE CAPABILITY M.F.U.)

The immediate site will be devoid of any significant amounts of vegetation. The vegetation around the development is to play an integral role in creating a healthy environment and thus it is important that it satisfy the preferential needs of the future residents.

LEAST PREFERRED	0	water
	1	Groups one, two, three
	2	
	3	Group four
	4	Groups six, nine
	5	
	6	Group five
	7	Group seven
MOST PREFERRED	8	
	9	Group eight

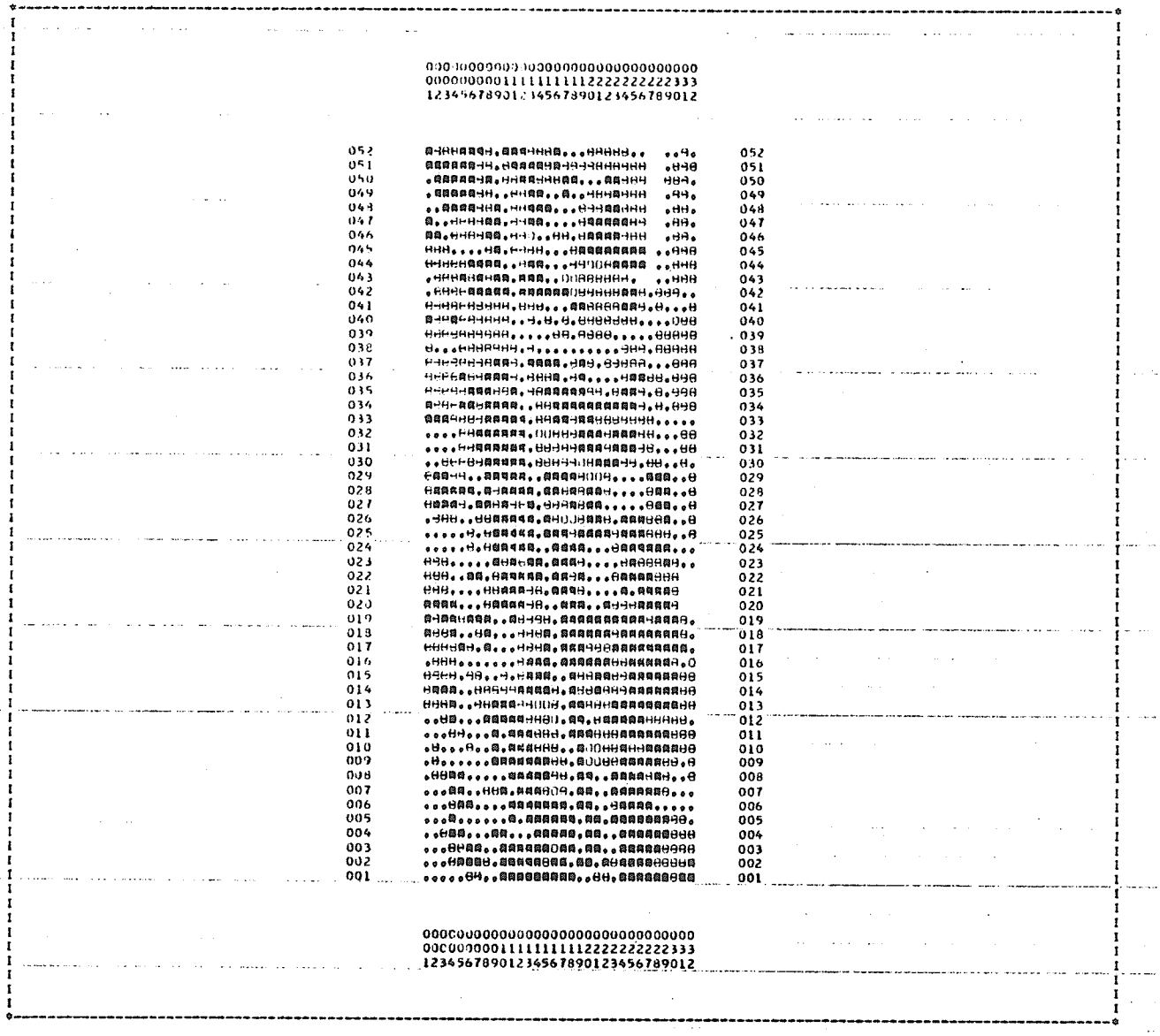
VISUAL ABSORPTION CAPABILITY (M.F.U.)

The following values have been established by the visual guidelines, to facilitate the total visual health of the community.

LEAST	0	water
CAPABLE	1	Groups one, two
	2	
	3	Group three
	4	Group four
	5	
	6	Group five
	7	
MOST	8	
CAPABLE	9	Groups nine, eight, seven, six

NOTE: Groups defined by absorption ratings of vegetation types.

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

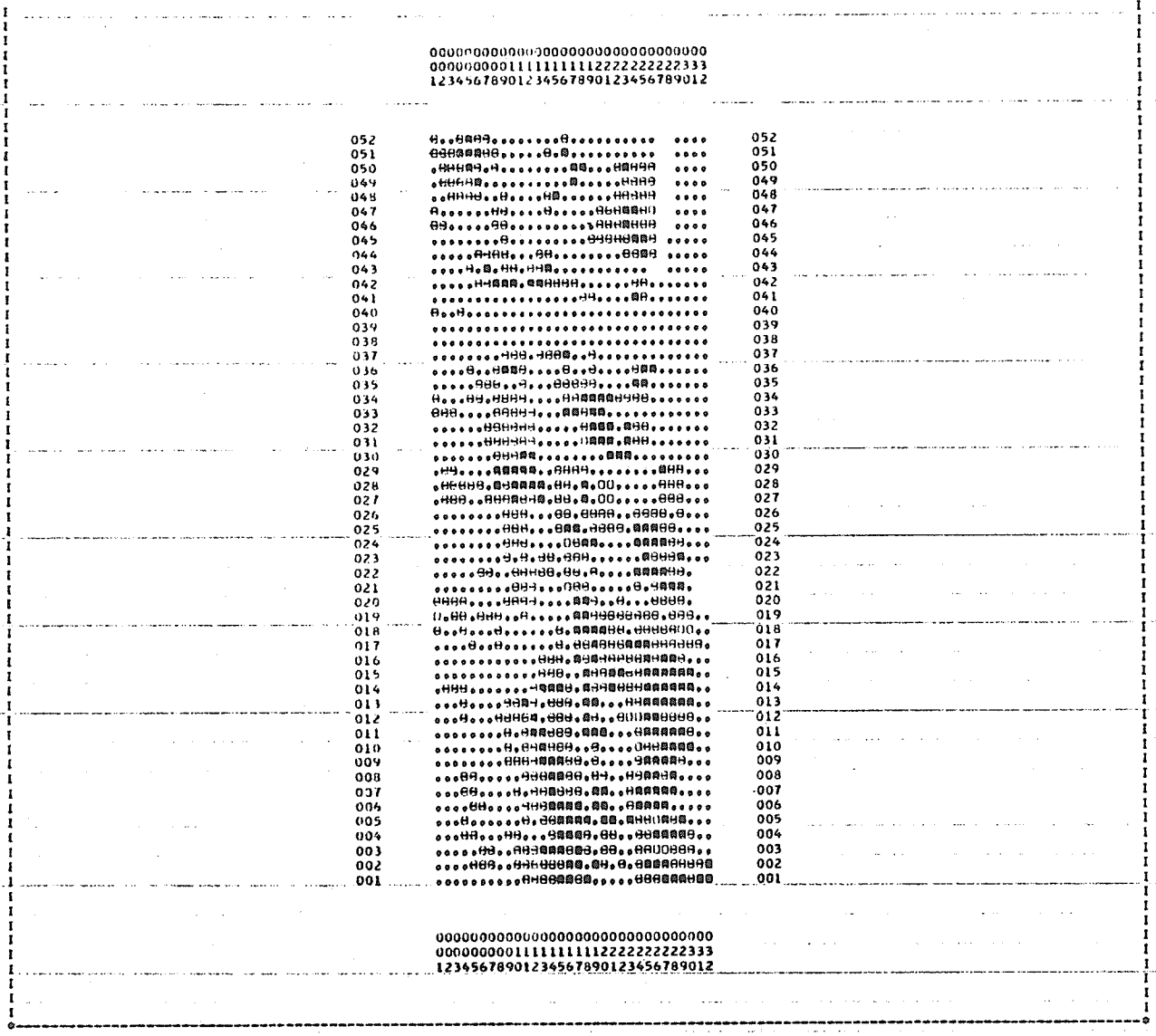
MULTI-FAMILY UNIT ALLOCATION ANALYSIS (STAGE 8)
LAND USE CODE

1) VEGETATION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	424	0	0	0	596	0	0	0	620

MAP 2,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

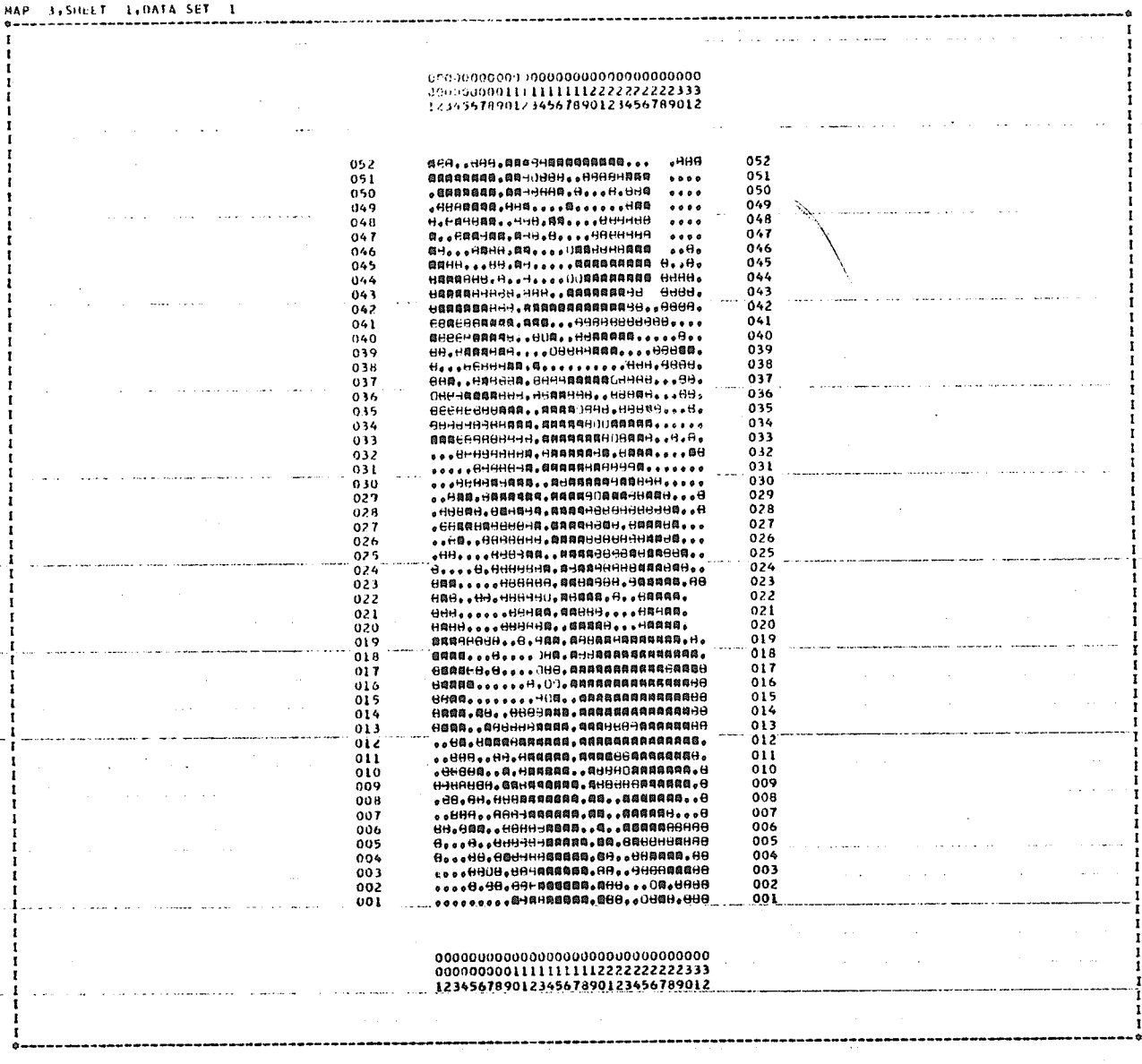
MULTI-FAMILY UNIT ALLOCATION ANALYSIS (STAGE B)
LAND USE CODE

21 VEGETATION PREFERENCE CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	#	@	;	;	;	;
FREQUENCY	24	942	0	0	0	479	0	0	0	219

MAP 3,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

MULTI-FAMILY UNIT ALLOCATION ANALYSIS (STAGE B)
LAND USE CODE

3) VISUAL ABSORPTION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	435	0	0	0	599	0	0	0	606

SITE CAPABILITY

RECREATIONAL INPUT

5

PASSIVE
ACTIVE

RECREATIONAL INPUT

Recreational areas can very generally be defined in areas of land that provide for maximum revitalization of body and mind. Within a report, prepared by Angus Hills, which discussed the meaning of recreation he pointed out that:

> "Recreation is both recreative and creative. In restoring the individual to physical and mental health or by renewing a lost zeal for performing the routine tasks of life, recreation is recreative. In operating as a potent teaching force in enrichening, broadening and developing individual capabilities and in gratifying man's natural desire for new and more satisfying ways of life, recreation is creative." [15]

Within this concept of recreation, the lands allocated for recreational use should have a significant contribution to make concerning physical and mental health of the inhabitants. Often planning policies treat recreational areas within the community as the crumbs of left over land that have no other land-use capabilities. The result usually is an unsuccessful interface between the communities and recreational lands with little or no benefit to the inhabitants. The President's Council on Recreation and Natural Beauty suggested in their report that an open space system for metropolitan areas should be selected and reserved in advance of development on the basis of an ecological inventory. This approach to the development of a community have several meaningful advantages over existing practices.

1) The ecological inventory allows for unique natural features to be protected and saved, minimizing the loss of valuable assets to the community which could have both perceptual and economic ramifications.

---

[15] HILLS, G.A. - The Ecoligical Basis for Land-use Planning, Ontario Ontario Department of Lands and Forests, Research Report Number 46, Dec. 1961. P. 117.

2) The 'natural' infra-structure within the community allows for coherent and consistent planning by optimizing the interface with land uses which would take advantage of benefits and by eliminating undesirable interfaces with land uses which would destroy their recreational function.

3) These areas can function as pedestrian circulation routes and assist in structuring the perceptual experience along these routes (control of community image).

4) The recreational benefits will form an integral part of the residents' daily experience rather than an area required to escape to from one's normal environment. (Since the residents' life experiences are primarily community oriented, this increases the importance of such a factor when considering human welfare.)

5) The natural infra-structure running through the town will aid in achieving the visual 'fit' between new developments and mature vegetation. By giving this vegetation these definite functions it will increase the dependency of the community on the vegetation which satisfies a necessary evolutionary (health) prerequisite.

While it is essential to maintain a reasonably consistent attitude towards recreation, a distinction is made between open space used in a passive manner and those used in an active manner for participatory recreation. Both have qualities of recreation and creation but are achieved through different modes.

PASSIVE RECREATION

One of the major objectives of establishing a passive recreation area is the preservation of a permanent reserve of various types of indigenous flora and fauna of the region. When major development such as a town moves into an area most of this indigenous vegetation disappears. The

ecological reserve preserves the diversity of the original vegetation of the area. Hence, on the Leaf Rapids site by preserving the flora and fauna such as reindeer moss, sphagnum moss, labrador tea, moss and bear berries, small animals and birds would flourish and be part of the daily community experience.

Associated activities of passive recreation are related to landscape experiencing such as the following:

1) Enrichening and teaching process - experiencing the dynamics of nature and seasonal changes.

2) The receiving of inspirational enjoyment through auditory, visual, tactile and olfactory stimulations.

3) The gathering of domestic materials such as berries, flowers and stones for decoration.

4) The viewing of wildlife that usually frequents these indigenous natural areas.

5) The opportunity of going picnicing in a close, natural environment.

ACTIVE RECREATION

This land-use activity uses the area much more intensively than passive recreation areas. Active recreation involves more organized leisure time activities such as those field activities associated with schools and community facilities:

1) baseball diamonds
2) football fields
3) hockey rinks
4) general play areas.

The demanding requirements of these field activities will be an influential force in determining the location of schools and community centers. Due to the necessity of having large open spaces absorbed by periphery

vegetation, a two stage capability analysis will be required. Active recreation will be considered a strip or cluster input and thus will be required to follow the 'resource impact technique' established for that type of input.

PASSIVE RECREATION CAPABILITY

SITING CAPABILITY (P. REC.)

Passive recreation areas have the most flexible site requirements of all the land-use inputs and can function in areas where other inputs cannot. In order to create a diverse perceptual quality different from any other in the community and to facilitate land-use efficiency, slopes of greater than 20% will be considered optimal. Since the impact of this activity is negligible, increasing slope does not increase the potential of environmental damage. The orientation of this land use does not play an important beneficial role and as such does not function as part of the resource capability.

TOPOGRAPHIC SLOPE (P. REC.)

LEAST	0	water
COMPATIBLE	1	0% - 4%
	2	4% - 8%
	3	8% - 12%
	4	
	5	12% - 16%
	6	16% - 20%
	7	
MOST	8	
COMPATIBLE	9	over 20%

VEGETATION CAPABILITY (P. REC.)

It is anticipated that areas of passive recreation will sustain low intensity small impacts. Most vegetation types are sufficiently 'stable' to withstand the land use without suffering any deleterious effects.

LEAST COMPATIBLE	0	water
	1	Groups one, two
	2	
	3	
	4	
	5	Group three
	6	
	7	
MOST COMPATIBLE	8	
	9	Groups four, five, six, seven, eight, nine.

VEGETATION PREFERENCE CAPABILITY (P. REC.)

The sample group of people were asked to rate the vegetation types according to which one would be most desirable for passive recreation activities as defined. The scores are reflected in the preferential scale below.

LEAST PREFERRED	0	water
	1	Groups one, two
	2	Group three
	3	
	4	Group nine
	5	Group six
	6	
	7	Group seven, eight
MOST PREFERRED	8	Group four
	9	Group five

VISUAL ACCESS CAPABILITY (P. REC.)

A passive recreation area would be greatly enhanced by the preception of a unique landscape feature.

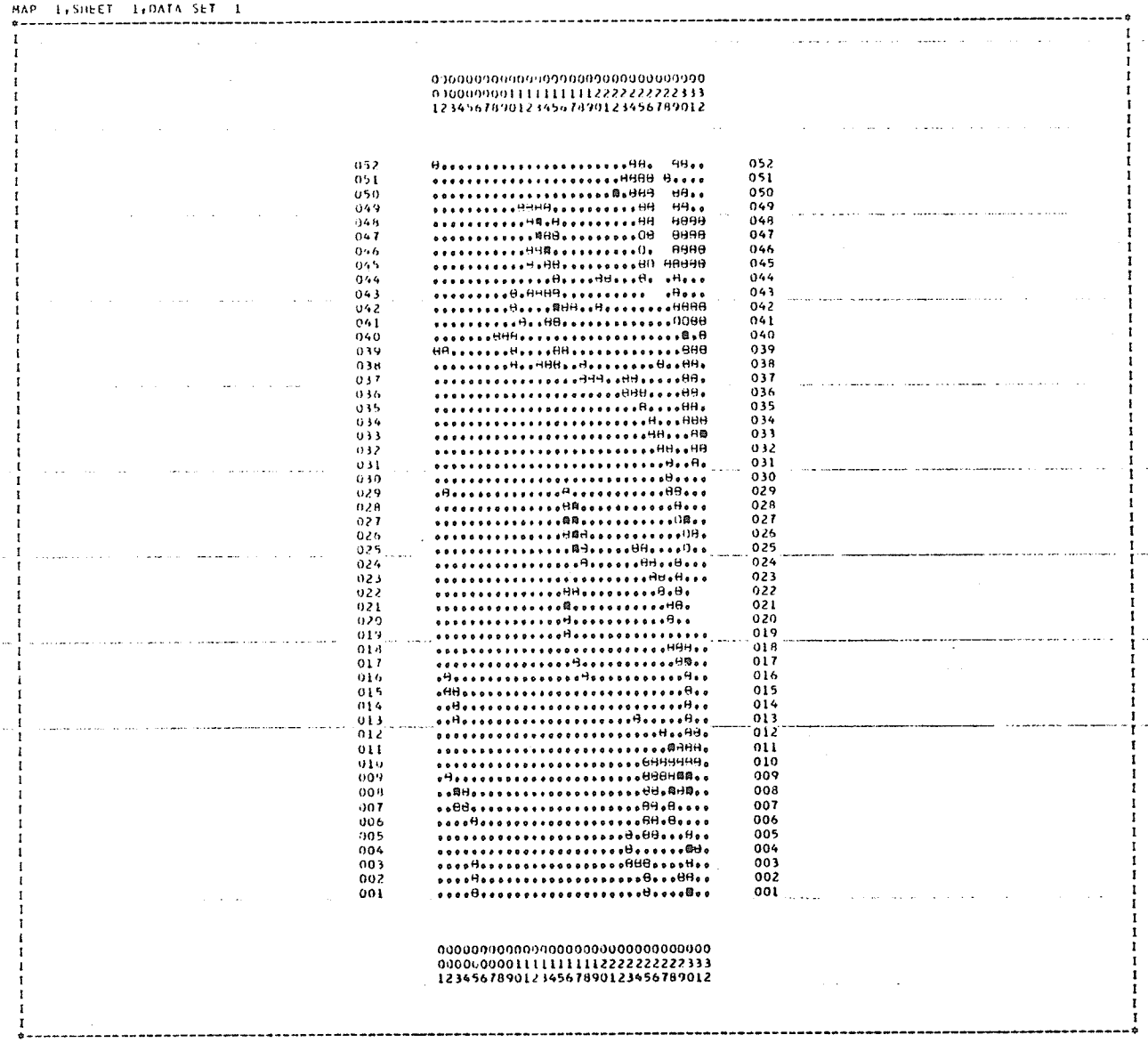
LEAST PREFERRED	0	water
	1	environmental visual nuisance
	2	
	3	no features outside normal vegetation
	4	view of marshland
	5	view of stream (intermittent)
	6	screened view of ravine, hills, kettles
	7	direct visual access to ravine, hills, kettles
MOST PREFERRED	8	screen visual access to water
	9	direct visual access to water

VISUAL ABSORPTION CAPABILITY (P. REC.)

(as per guidelines)

LEAST COMPATIBLE	0	water
	1	Group one
	2	
	3	
	4	Group two
	5	Group three
	6	
	7	
MOST COMPATIBLE	8	
	9	Groups four, five, six, seven, eight, nine

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

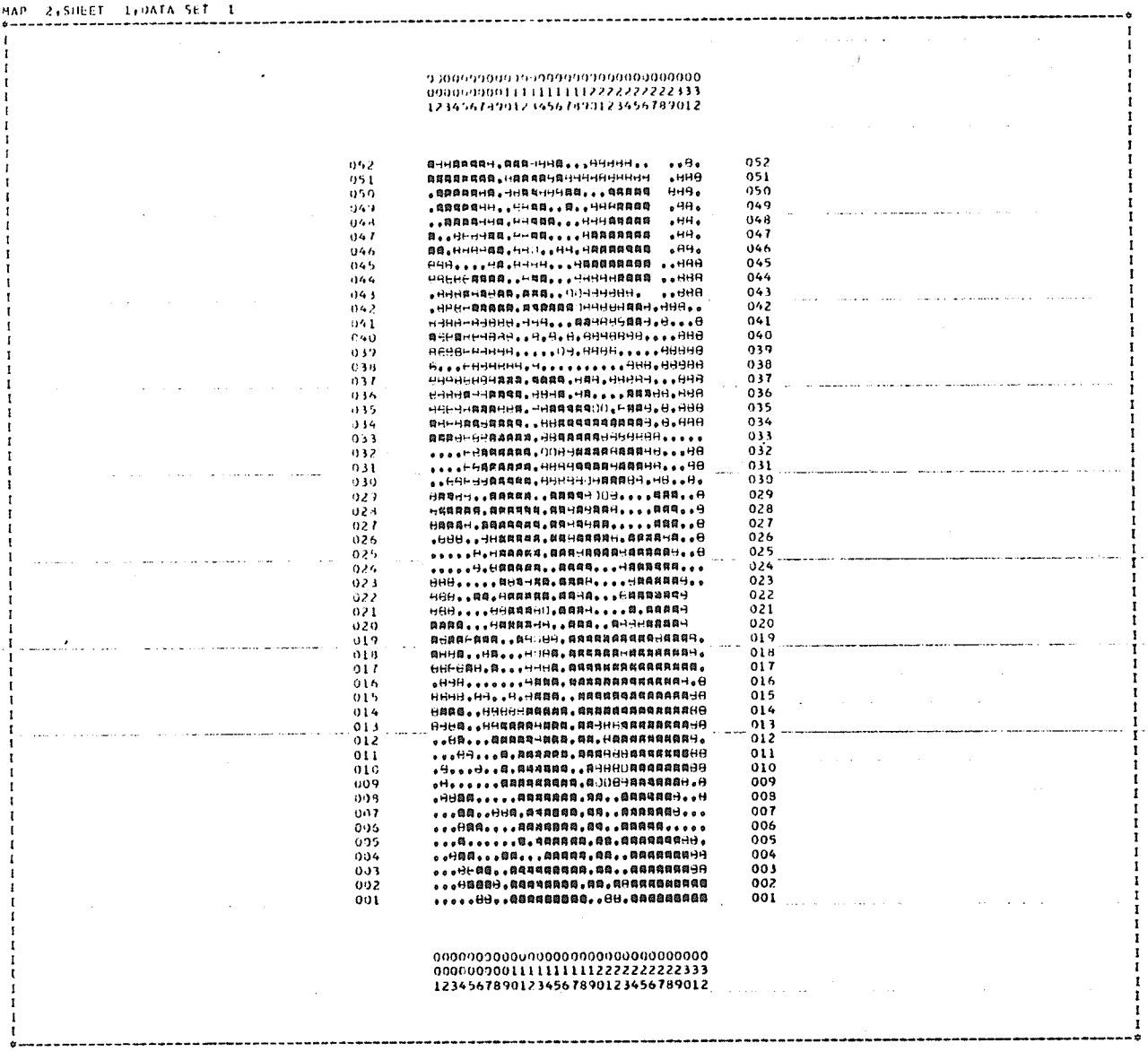
PASSIVE RECREATION ALLOCATION ANALYSIS
LAND USE CODE

1) SITING CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	23	1392	0	0	0	226	0	0	0	23

MAP 2,SHEET 1,DATA SET 1



5534

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

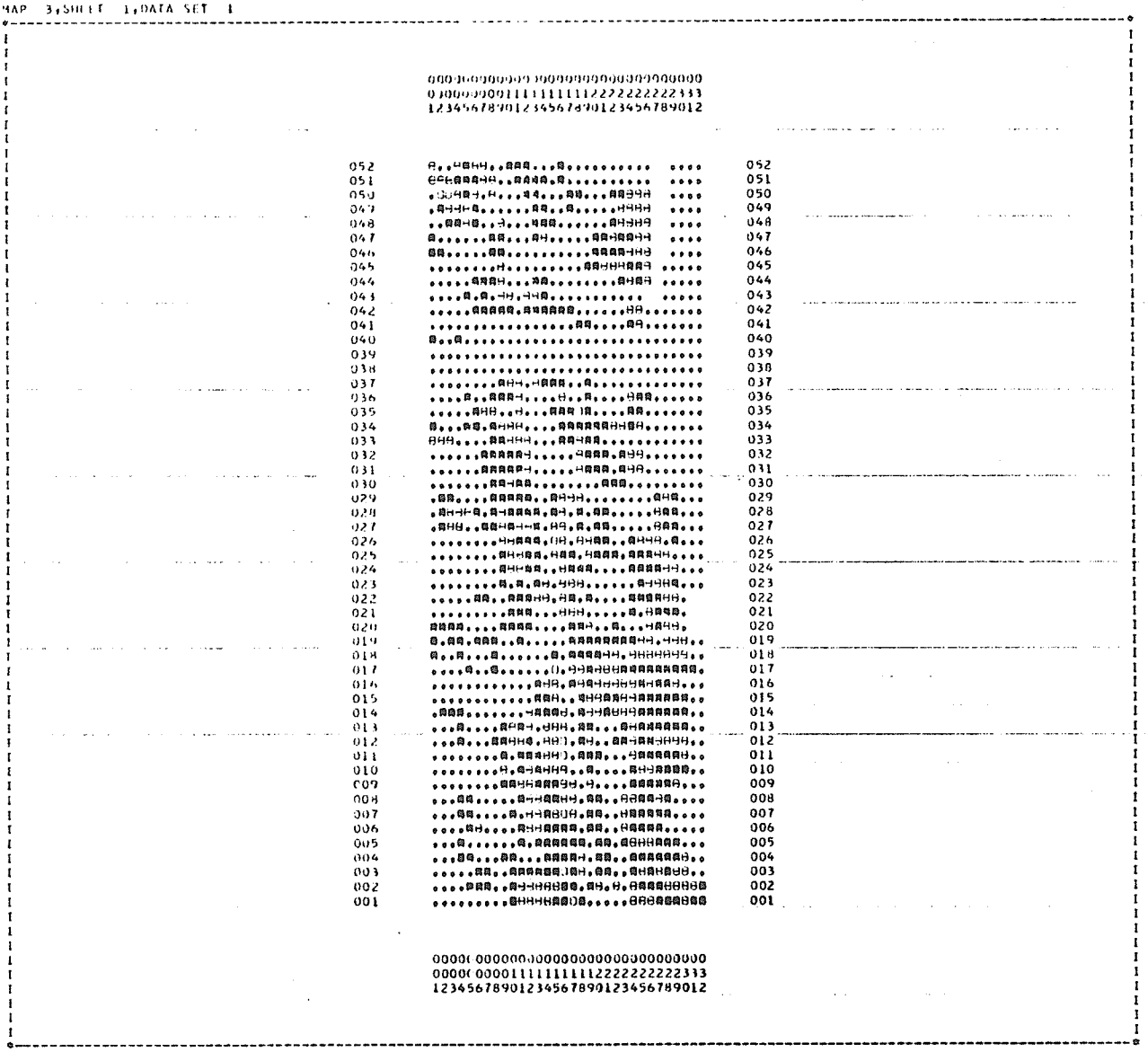
PASSIVE RECREATION ALLOCATION ANALYSIS
LAND USE CODE

2) VEGETATION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	424	0	0	0	499	0	0	0	717

MAP 3,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

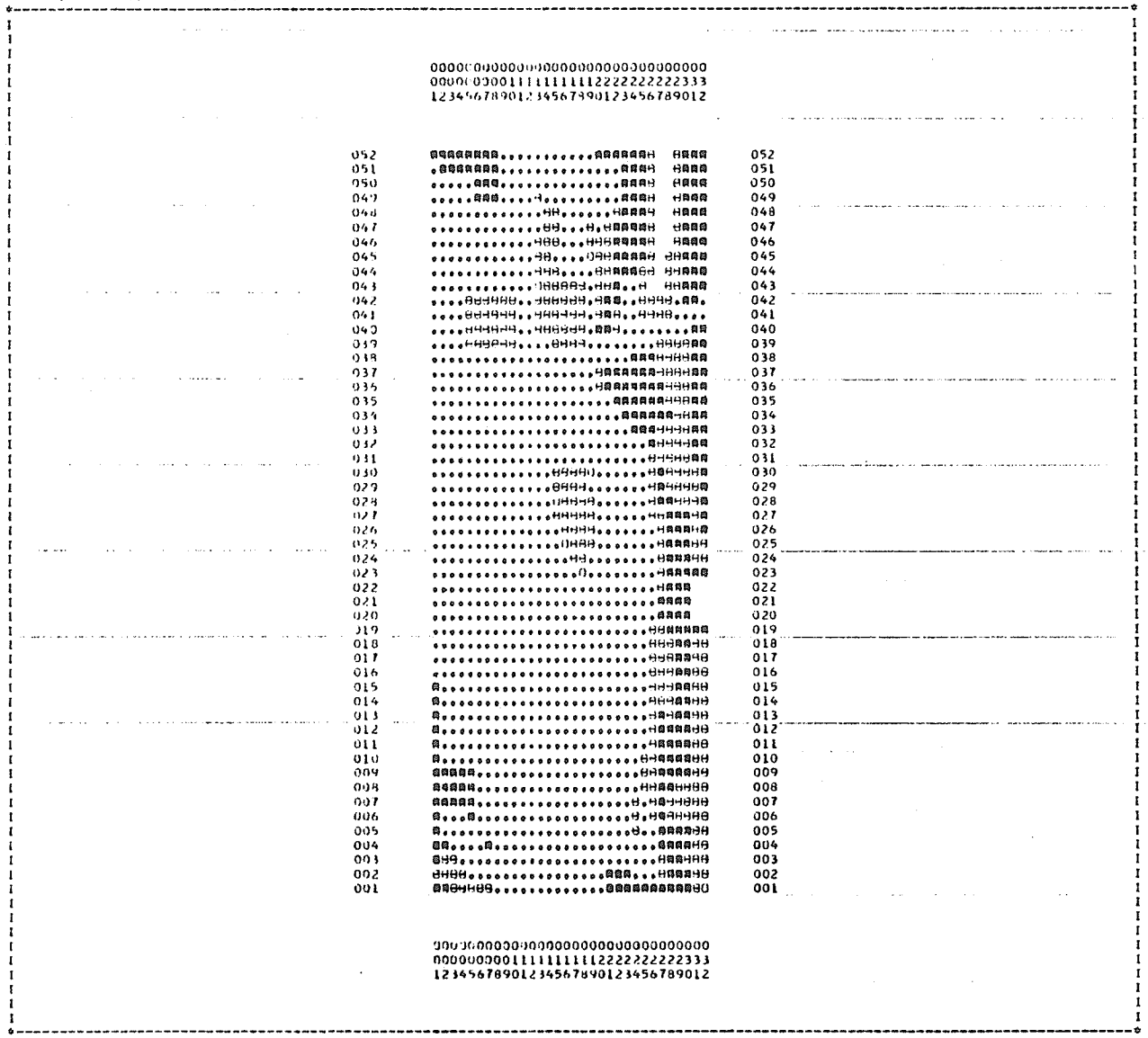
PASSIVE RECREATION ALLOCATION ANALYSIS
LAND USE CODE

3) VEGETATION PREFERENCE CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	H	@	#	=	A	B
FREQUENCY	24	923	0	0	0	268	0	0	0	449

MAP 4,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

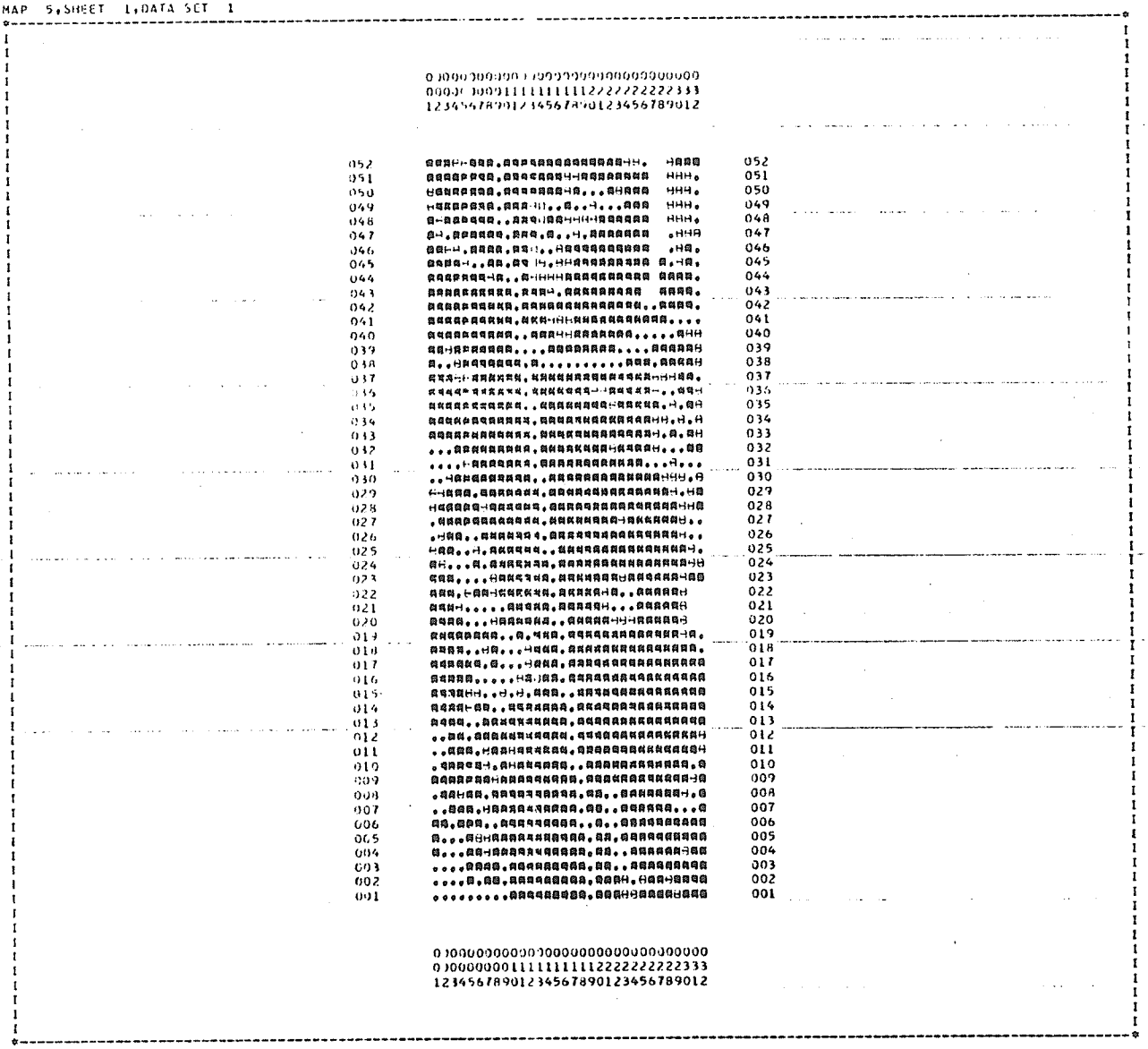
PASSIVE RECREATION ALLOCATION ANALYSIS
LAND USE CODE

41 VISUAL ACCESS CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	1069	0	0	0	296	0	0	0	275

MAP 5,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

PASSIVE RECREATION ALLOCATION ANALYSIS
LAND USE CODE

5) VISUAL ABSORPTION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	#	@	-			
FREQUENCY	24	278	0	0	0	157	0	0	0	1205

ACTIVE RECREATION CAPABILITY

STAGE 'A'

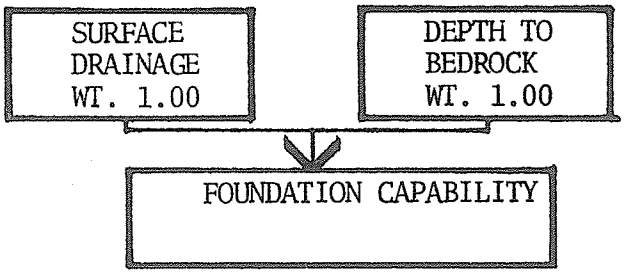
SITING CAPABILITY (A. REC.)

The field sports associated with this type of recreation require large areas of level playing surface. Cut and fill operations required to level sites of the scale required would be both economically and environmentally very costly. Thus the optimum condition would be a site with a 0% slope.

TOPOGRAPHIC SLOPE

LEAST	0	water	
COMPATIBLE	1	over 20%,	16% - 20%
	2	12% - 16%	
	3	8% - 12%	
	4		
	5		
	6	4% - 8%	
	7		
MOST	8		
COMPATIBLE	9	0% - 4%	

FOUNDATION CAPABILITY (A. REC.)



SURFACE DRAINAGE (A. REC.)

A well drained site is the most preferable condition, for this would eliminate the necessity of draining or filling which over such a large field could affect drastically the water table of the surrounding area.

LEAST	0	water
COMPATIBLE	1	poorly drained wetlands
	2	intermittent creek
	3	swales
	4	
	5	minor surface run off (seasonal)
	6	drainage pattern (heavy storms)
	7	
MOST	8	
COMPATIBLE	9	well drained

DEPTH TO BEDROCK (A. REC.)

A small amount of overburden is required for minor alterations in levelling or cambering the surface for drainage. A depth of five feet to bedrock would allow this flexibility in site manipulation.

LEAST	0	water
COMPATIBLE	1	rock outcropping
	2	
	3	3 ft. to bedrock
	4	
	5	
	6	
	7	5 ft.
MOST	8	
COMPATIBLE	9	10 ft., over 10 ft. to bedrock

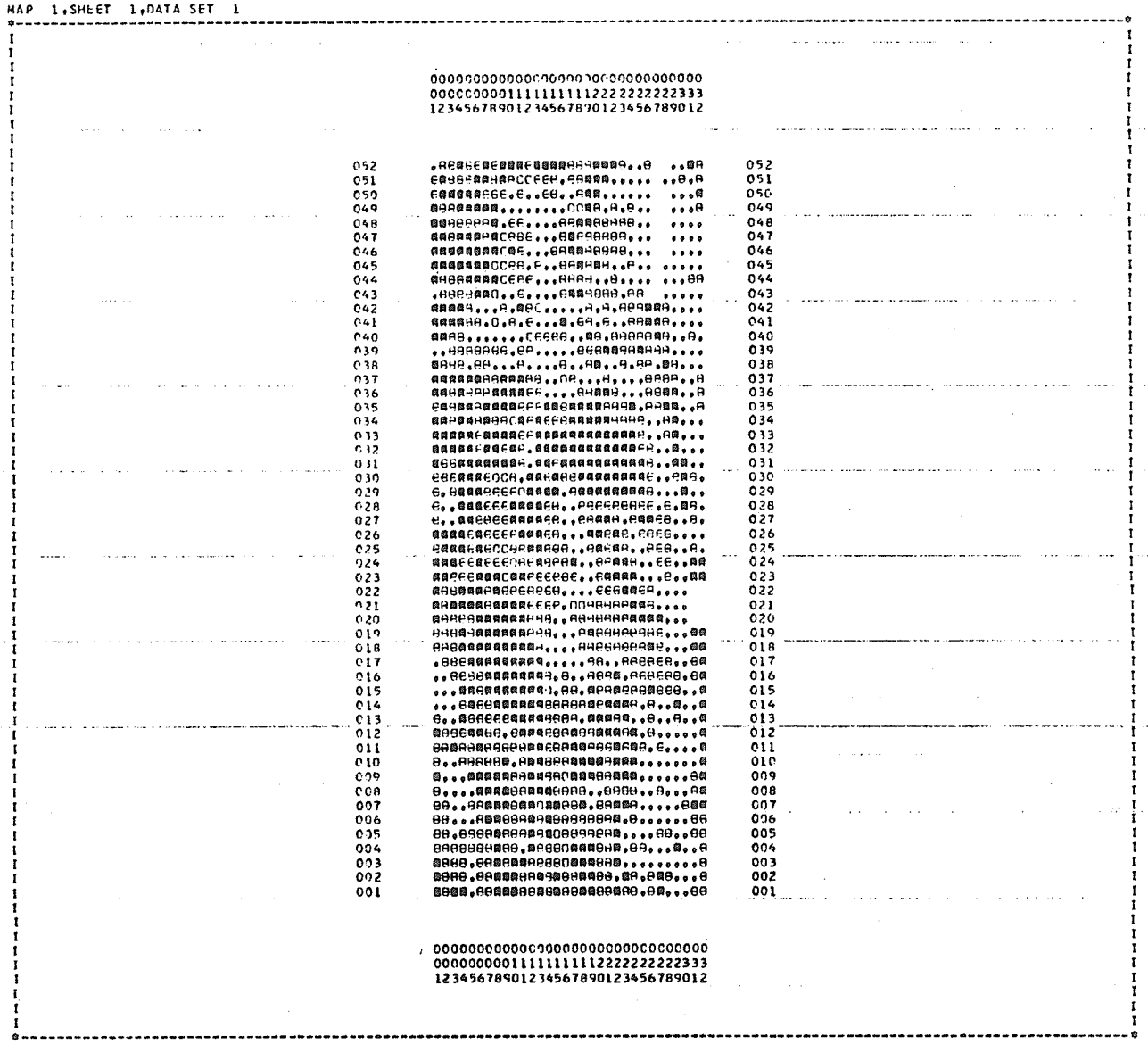
The conversion table has been adjusted so that any area with a major development constraint receives an unacceptable rating.

VEGETATION CAPABILITY (A. REC.)

This area will be subjected to the removal of all the vegetation cover and thus a sparse 'unstable' vegetation would be the most capable of supporting this land-use requirement.

LEAST	0	water
COMPATIBLE	1	Groups eight, nine
	2	Group seven
	3	Group six
	4	Group five
	5	Group four
	6	
	7	Group three
MOST	8	Group two
COMPATIBLE	9	Group one

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

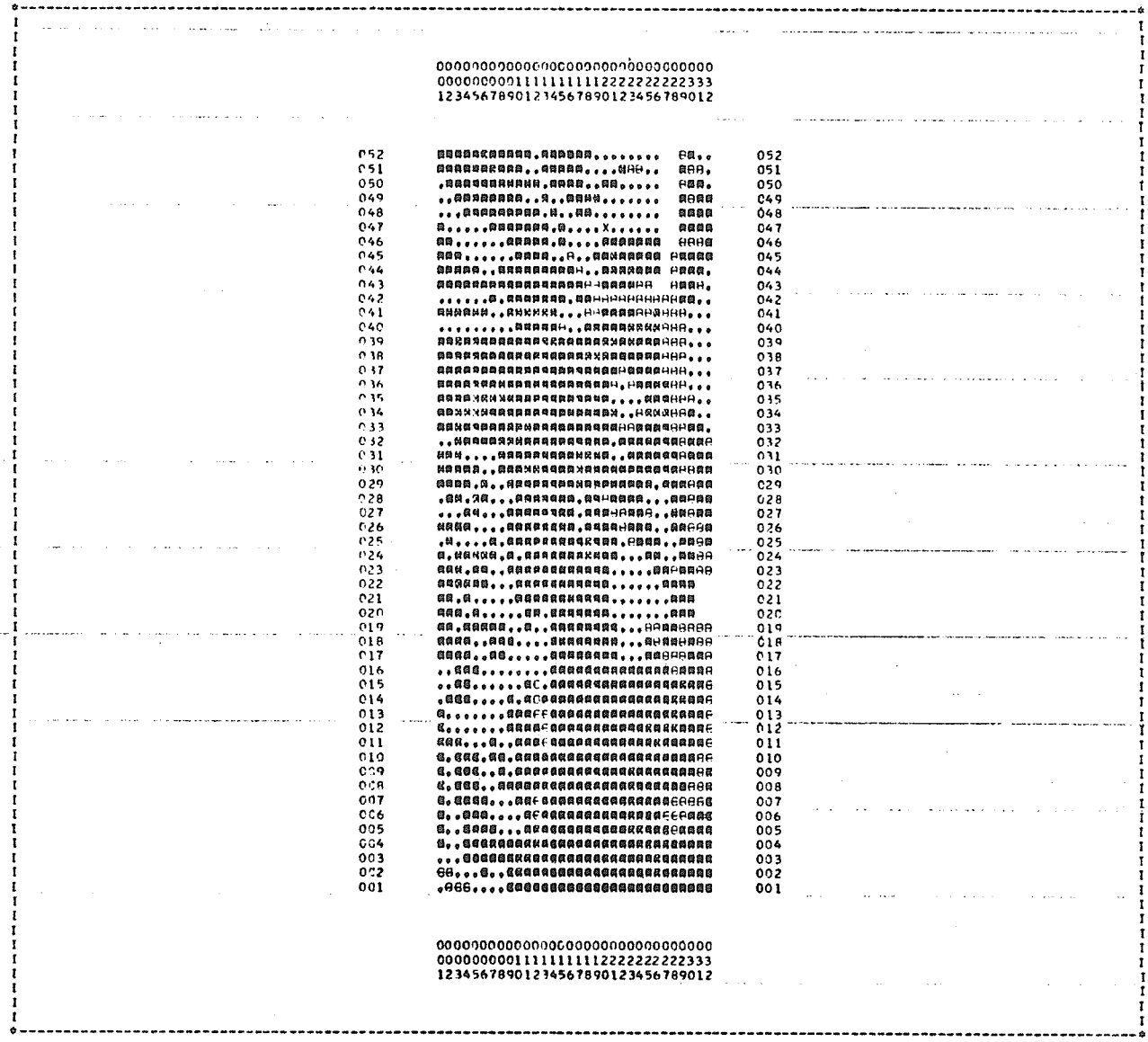
ACTIVE RECREATION ALLOCATION ANALYSIS (STAGE A)
LAND USE CODE

1) SITING CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	23	447	0	0	0	670	0	0	0	524

MAP 2,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

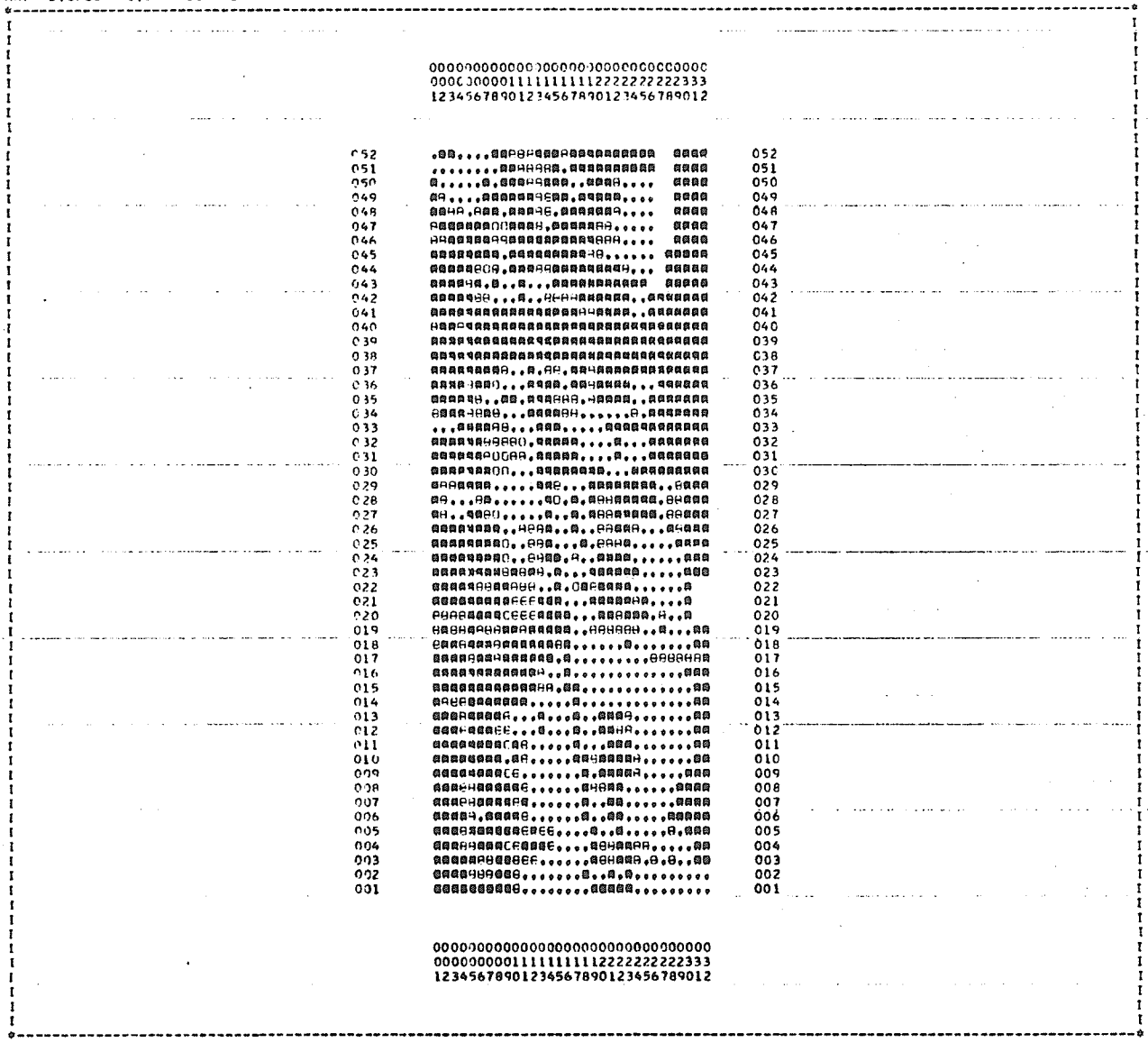
ACTIVE RECREATION ALLOCATION ANALYSIS (STAGE A)
LAND USE CODE

2) FOUNDATION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	*	X	0	A	@	E	#	%	$
FREQUENCY	24	368	0	1	0	134	0	168	0	969

MAP 3,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

ACTIVE RECREATION ALLOCATION ANALYSIS (STAGE A)
LAND USE CODE

3) VEGETATION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	.	+	X	0	8	@	#	&	A
FREQUENCY	24	487	0	0	0	230	0	0	0	923

STAGE 'B'

VEGETATION CAPABILITY (A. REC.)

The vegetation surrounding the open field activities will receive intensive usage by children and thus should be stable enough not to succumb to these pressures. A vegetation with little or no understory that could be destroyed by play activities, snow mobiles, or that would impede pedestrians would be the best type.

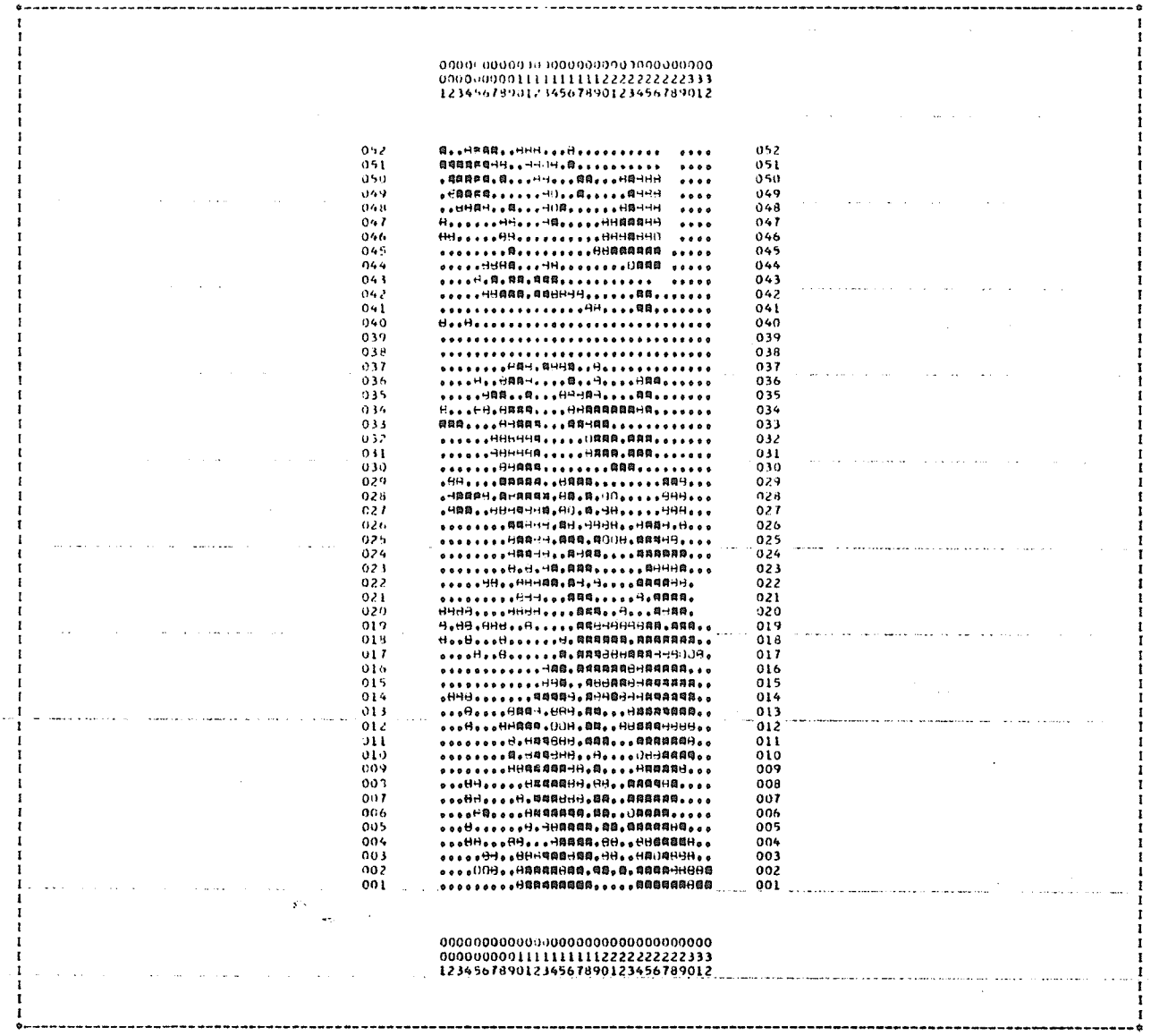
MOST COMPATIBLE	0	water
	1	Group one
	2	Group two
	3	Group three
	4	Group nine
	5	Group five
	6	Group four
	7	Group six
LEAST COMPATIBLE	8	Group seven
	9	Group eight

VISUAL ABSORPTION CAPABILITY (A. REC.)

(as per guidelines)

LEAST COMPATIBLE	0	water
	1	Group one
	2	
	3	Group two
	4	Group three
	5	Group four
	6	
	7	
MOST COMPATIBLE	8	
	9	Group five, six, seven, eight, nine

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

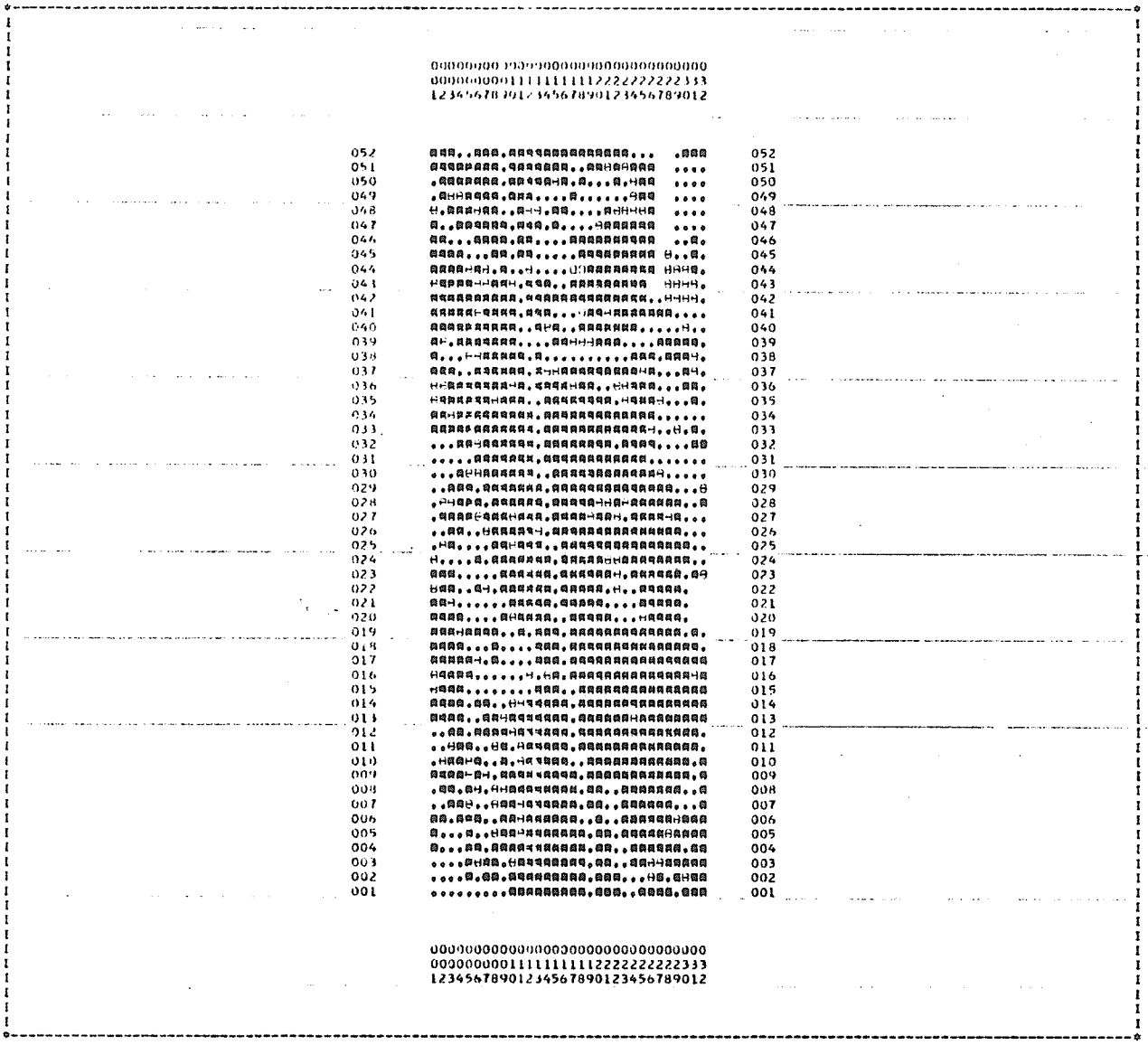
ACTIVE RECREATION ALLOCATION ANALYSIS (STAGE B)
LAND USE CODE

1) VEGETATION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	923	0	0	0	327	0	0	0	390

MAP 2,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

ACTIVE RECREATION ALLOCATION ANALYSIS (STAGE B)
LAND USE CODE

21 VISUAL ABSORPTION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	435	0	0	0	133	0	0	0	1072

SITE CAPABILITY

ROAD AND UTILITY INFRA-STRUCTURE

5

ROAD & UTILITY INFRA-STRUCTURE

An assumption is made that the major vehicular and utility systems will be considered as one infra-structure. This is a generally accepted planning practice which not only facilitates a combination of easement rights but also reduces economic cost and environmental damage. The systems involved in the infra-structure are:

1) major and minor street systems
2) storm sewers
3) sanitary sewers
4) underground utilities
5) Depending upon how the services are laid, small hydro distribution lines, sub-transmission lines and telephone lines can also be included.

The most extreme functional requirements and negative environmental impacts of the above systems must be considered as the functional requirements and negative impact for the whole system. Accepting normal functional characteristics and construction techniques, road and utility land use can be described as 'strip' inputs. Consequently the guidelines established for strip or cluster inputs must be considered as the approach to resource capability for roads and utilities. Due to the inherent characteristics of this input type, a two stage analysis is beyond the scale of detail of this study although future capability does exist.

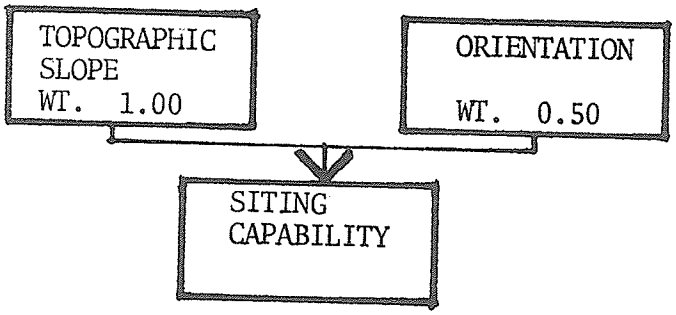
The goal concerning the diversity of the perceptual experience suggests that the images and sensual stimulations of a community is in a large part contingent upon the stimulations received along the circulation routes. Special consideration is placed on the visual access to unique environmental features while unwanted visual nuisances will be avoided. Such aspects as type of feature and distance from the landscape element will play important roles in the overall visual effect and the resultant capability of the area.

Future proposals for Leaf Rapids suggest that highway 391 which runs through the site will eventually circumvent the community. It will be the

objective of this analysis to let the resource constraints suggest varying possible locations for the potential relocation thus allowing greater flexibility within the feasibility studies.

An important characteristic of the road and utility infrastructure that should be actively considered is that it is the life line of all the other community components and, as such, is a major determining factor in the structure and controlled future growth of the community.

SITING CAPABILITY (R. and U.)



TOPOGRAPHIC SLOPE (R. and U.)

Slopes of 0% - 4% represent areas of greatest horizontal flexibility with minimum requirements for cut and fill. These areas are the most desirable for roads and utilities, because they require the least cost for design, construction, and maintenance. By minimizing the cut and fill operations, potential sub-surface water level changes are reduced. Areas with slopes of between 4% - 8% can still have roads aligned vertically to the gradient and retain flexibility in all directions. The upper limits allowable for residential street systems are 8% - 12% slopes. It is usually at 10% that major cut and fill operations begin to take place when the road is running parallel to the gradient, thus forcing the roads to run parallel to the gradient. It is also suggested that a 10% slope should not be exceeded when considering winter driving conditions in Manitoba. A 10% slope represents an upper limit for sewer systems. Since sewers depend on gravity flow an increase in slope results in an increase in sewage flow and a corresponding increase in sewer size. Major sewer costs tend to rapidly increase as the slopes increase over 10%. Construction of road

and utility infra-structure on inclines greater than 12% increases the economic and environmental costs to unacceptable proportions. Exposed areas flanking either side of the road due to cut and fill gradients, tend to develop excessive sheet erosion which causes puddling in swales and silting in minor surface drainage which leads to streams. Even when running the roads parallel to the gradients the sandy soil conditions of the esker makes the removal of large strips of vegetation very susceptible to large scale erosion damage on inclines of 12% and over.

TOPOGRAPHIC SLOPE

LEAST	0	water	
COMPATIBLE	1	16% - 20%	over 20%
	2	12% - 16%	
	3		
	4	8% - 12%	
	5		
	6	4% - 8%	
	7		
MOST	8		
COMPATIBLE	9	0% - 4%	

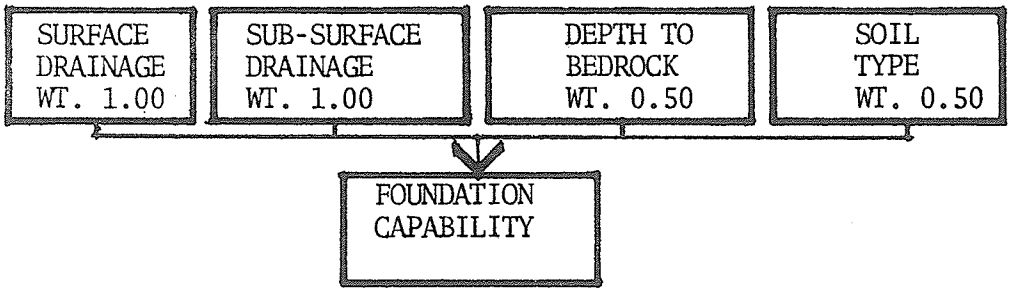
ORIENTATION (R. and U.)

Excessive freeze-thaw action on warmer slopes during winter causes a break-up and slumping of cut and filled areas in the road. The solar radiation on slopes causes melt water which freezes in the evening, creating safety and ice maintenance problems. Therefore, topographic areas that have minimal exposure time to the sun in winter become more preferable sites.

LEAST	0	water
COMPATIBLE	1	South
	2	South west
	3	South east
	4	West
	5	East
	6	Flat
	7	North west
MOST	8	North east
COMPATIBLE	9	North

An adjustment has been made so that any orientation combining with slopes of over 12% receives an unacceptable rating.

FOUNDATION CAPABILITY (R. and U.)



SURFACE DRAINAGE (R. and U.)

Poorly drained areas are normally not capable of adequately supporting roads and excessive water generates construction and maintenance problems. Natural drainage swales or surface runoff channels should also be avoided because fill operations impound water behind the road, thus directly affecting surface runoff in quantity and direction. This would negatively affect the vegetation and wildlife in the area. Excessive surface water flow during storms can cause road washouts. By avoiding cutting across drainage patterns this would reduce the need for culverts. Experience in similar northern situations has shown that culvert installations are often ineffective. Construction practices leave the areas without vegetation and they become unsightly environmental nuisances.

LEAST COMPATIBLE	0	water
	1	poorly drained wetlands
	2	intermittent creek
	3	swales
	4	
	5	minor surface runoff (seasonal)
	6	drainage pattern (heavy storms)
	7	
MOST COMPATIBLE	8	
	9	well drained

SUB-SURFACE DRAINAGE (R. and U.)

The deeper the water table below grade, the less fill will be needed and the less likely is the occurence of standing water on either side in cut areas, side ditches or swales. This softens the fill materials often causing serious maintenance problems. The chances of intercepting a major ground water movement, which would result in springs or weeping along areas of cut, would be greatly reduced if a water table depth of greater than 6 ft. was sought. Those areas with shallower depth to subsurface water could intercept the ground water, drain it off into culverts, and reduce the water supply on the other side of the road. The road and its drainage ditches act as interceptor pipes accepting ground water and carrying it away thus reducing water table depth which greatly affects the vegetation of that area. The installations of utilities requires excavation of a minimum of 8 feet below grade allowing for protection against freezing and allowing adequate slope for sewer from houses to the collector sewer. Encountering water creates construction difficulties and increases the cost. Sewer lines should be above the water table, to prevent the possibility of ground water contamination. Therefore considering all the infra-structure components a site capable of supporting this land use should have a water table depth of greater than 8 feet.

LEAST	0	water
	1	0 ft. - 2 ft.
	2	2 ft. - 4 ft.
	3	4 ft. - 6 ft.
	4	
	5	
	6	6 ft. - 8 ft.
	7	
MOST	8	
COMPATIBLE	9	over 8 ft.

DEPTH TO BEDROCK (R. and U.)

An overburden depth greater than 10 feet to bedrock is preferred for the greater depth adds greater flexibility to normal cut operations without requiring any blasting or ripping of bedrock structure. Bedrock that has a 5 ft. to 10 ft. overburden is still acceptable due to the initial

minimum gradients accepted under the slope catagories. Utility installations again form a determining factor in that they must have a minimum of 8 ft. of overburden. Wherever possible bedrock must be avoided due to the exorbitant excavation costs.

LEAST	0	water
	1	rock outcropping
	2	3 feet to bedrock
	3	5 feet to bedrock
	4	
	5	
	6	10 feet to bedrock
	7	
MOST	8	
COMPATIBLE	9	over 10 feet to bedrock

SOIL TYPE (R. and U.)

Frost action is most common in very fine silts and clays and some fine sands. This is due to their capability to draw water up through capillary action which can form frost lenses. When the lenses melt this causes loss of bearing capacity of the soil and often causes road damage. The areas with this type of soil should be avoided because this overburden will have to be removed and replaced with more suitable non frost heaving materials which increases cost substantially. Coarse sands and coarse gravels are generally acceptable for most road construction as sub-base and back-fill. They are generally well drained soils.

LEAST	0	water
COMPATIBLE	1	organic peat
	2	
	3	silts and clays
	4	
	5	sand, silts and clays
	6	
	7	poorly graded gravel (sand)
MOST	8	
COMPATIBLE	9	well graded gravel (sand)

The conversion table has been adjusted so that any major development constraint will annul the site capability and it will receive an unacceptable rating.

VEGETATION CAPABILITY (R. and U.)

A total absence of trees would not only reduce the total impact of the land use but also lower the cost of construction. A total absence of trees would require the least amount of grubbing and clearing trees. As one exceeds 50% of the area covered with trees, there are more clearing costs and greater potential of secondary ecological consequences caused by the severe changes in environmental balance. Shorter dwarf or stagnating trees are preferred because they are easily removed by chain grubbing or mechanical chipping as opposed to sawing and removal of logs in unsightly piles at both edges of the road. In general, younger stands are preferred to mature stands for clearing.

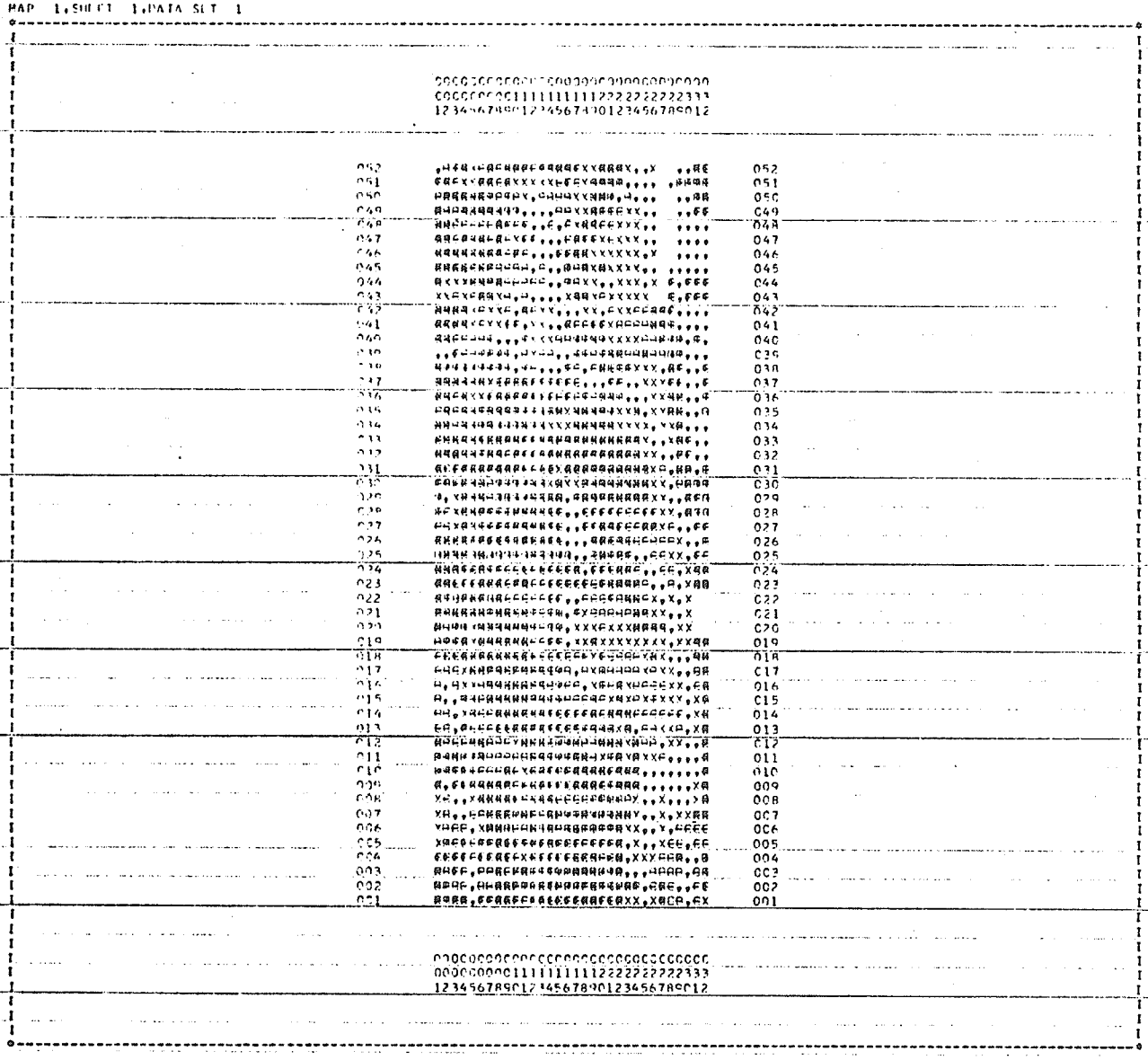
Dense stands of large coniferous trees should be avoided due to the possibility of the wind blowing the large trees on the road creating traffic hazards. Very open stands of deciduous or coniferous trees with underdeveloped branching systems do not act as barriers which throw snow into drifts. This vegetation type is preferred because it lowers the opportunities for snow drifting and inundating right of way cuts for circulation.

LEAST	0	water
COMAPTIBLE	1	Groups four, seven, nine
	2	Group five
	3	
	4	Group eight
	5	Group six
	6	
	7	
MOST	8	Group three
COMPATIBLE	9	Groups one, two

VISUAL ACCESS CAPABILITY (R. and U.)

LEAST	0	water
PREFERRED	1	environmental visual nuisances
	2	
	3	no features outside normal vegetation
	4	view of marshland
	5	view of stream (intermittent)
	6	screen view of ravine, hills, kettles
	7	direct visual access to ravine, hills, kettles
MOST	8	screen visual access to water
PREFERRED	9	direct visual access to water

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

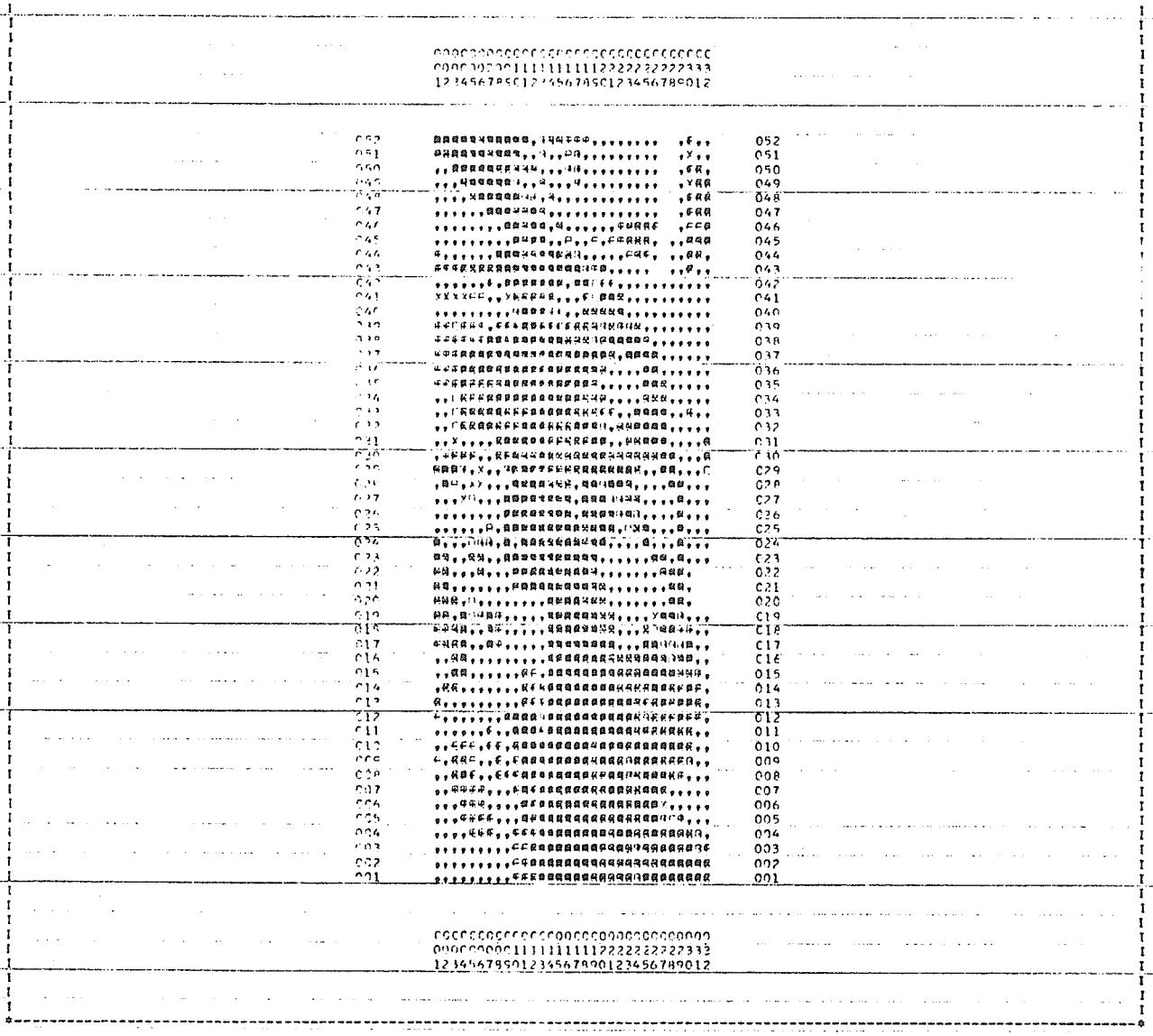
ROAD AND UTILITY ALLOCATION ANALYSIS
LAND USE CODE

SITING CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	23	252	0	225	0	287	355	0	520	2

MAP 2,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

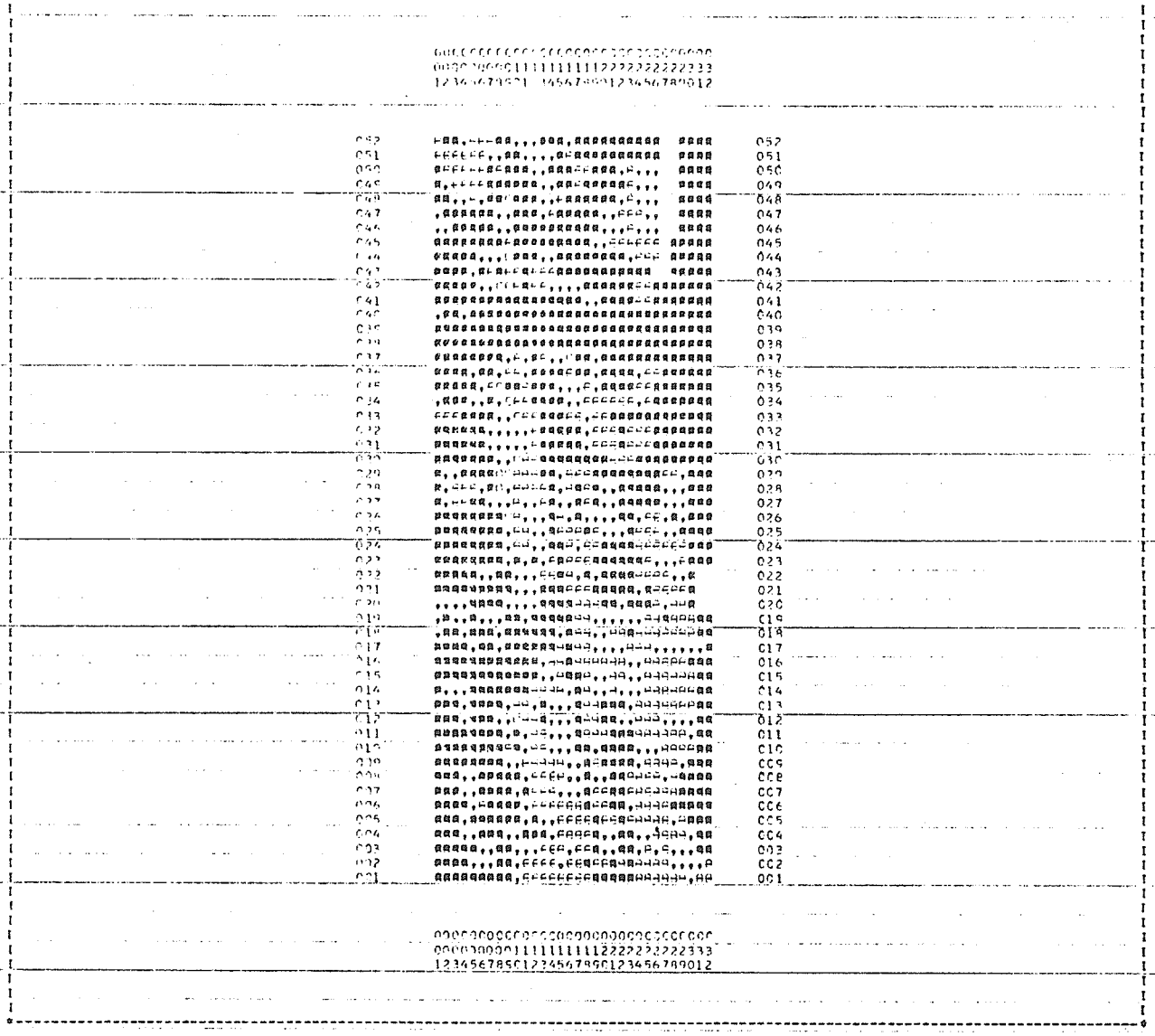
ROADS AND UTILITIES ALLOCATION ANALYSIS
LAND USE CODE

?) FOUNDATION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	,	*	X	C	F	R	@	#	&	$
FREQUENCY	24	621	1	14	13	22	143	49	219	558

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

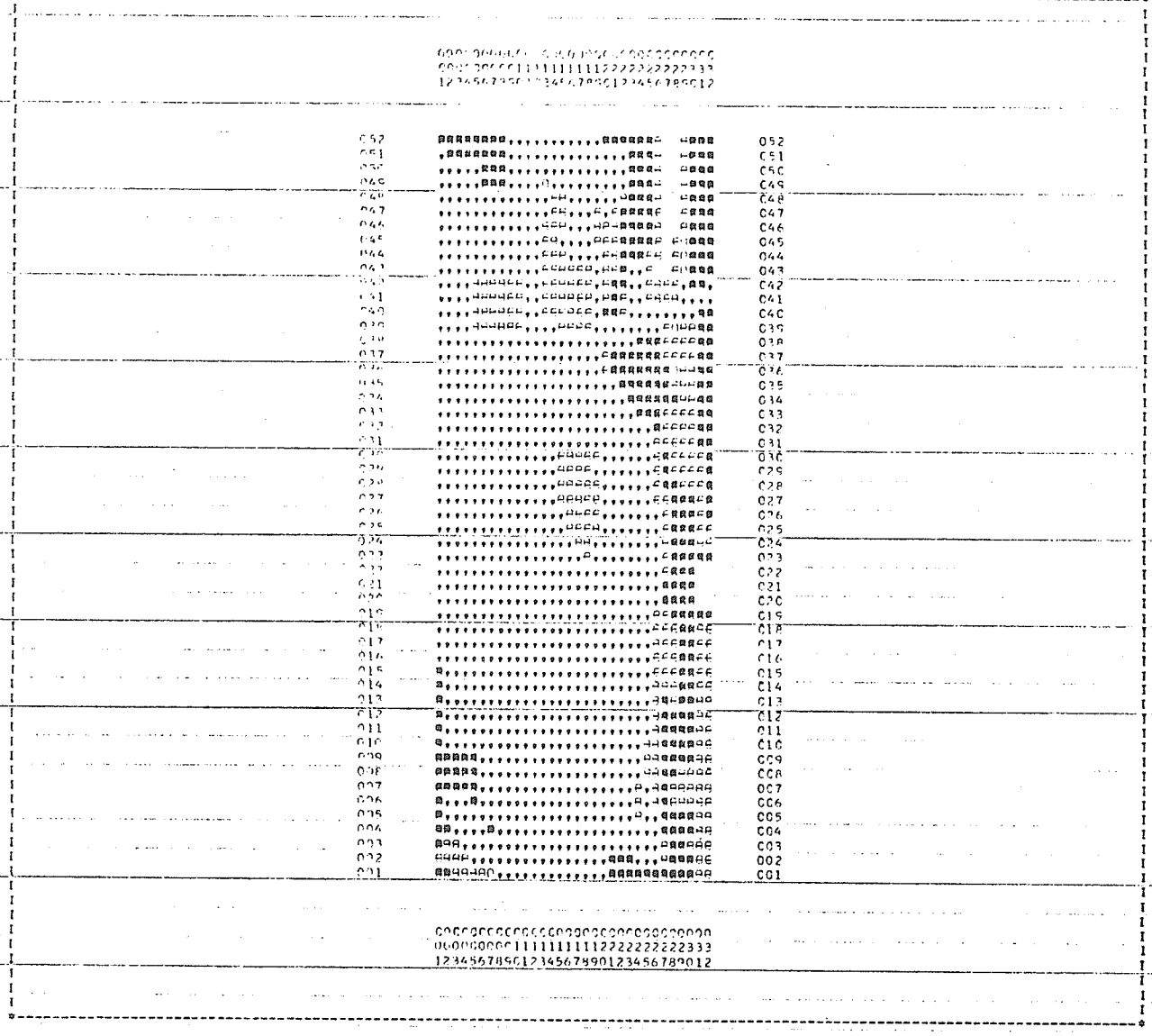
ROADS AND UTILITIES ALLOCATION ANALYSIS
LAND USE CODE

31 VEGETATION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	•	•	X	C	F	#	@	A	B	E
FREQUENCY	24	330	0	0	0	387	0	0	0	923

MAP 4,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

ROADS AND UTILITIES ALLOCATION ANALYSIS
LAND USE CODE

4) VISUAL ACCESS CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	1069	0	0	0	296	0	0	0	275

SITE CAPABILITY

INDUSTRIAL INPUT

5

INDUSTRIAL INPUT

The industrial types expected to locate in or around the townsite are:

1) car body shop
2) trucking business
3) lumber yard
4) miscellaneous warehousing
5) oil companies
6) construction camps and storage yards.

The scale and type of land use associated with these industrial types suggest that they be considered as strip or cluster inputs. The resultant approach to resource use will be to concentrate these impacts on an area of unstable vegetation thus maximizing the impact over a smaller area. Consistent with the established guidelines this will be viewed as a two stage analysis.

It is to the advantage of the community as a whole to be able to spread its economic base in order to reduce the potential of high economic entropy. Since much of the industry will be privately owned it is to the advantage of the community as a whole to create as appealing and functional a climate as possible. This would assist in attracting alternate industries which would aid in lowering the economic entropy of the town if one of the industries failed. Besides adequate foundation capability, the single most important resource attribute of a functional climate is immediate access to vehicular and utility infra-structure. Therefore the site itself must be capable of supporting the resource requirements of the road and utility input and these requirements will play an integral part of the site capability rating.

A reasonable case for exposing industries to obtain visual diversity could be forwarded, for they do provide uniqueness and complexity of forms and scales. But experience to date has not provided sufficient evidence to the fact that this could be accomplished in a manner that would make a positive contribution to the perceptual health of the community. A positive contribution could be made if sufficient visual guidelines were established which would control and order these visual inputs within the

context of the natural environment.

Exorbitant visual constraints can have a detrimental effect on the ability of a community to entice private industry whose major concern is cost/benefit ratio. If there are no stringent visual constraints it is best to let the vegetation visually absorb these land uses, for their economic motives often leave them as environmental visual nuisances. Therefore a major criteria within the siting of industrial areas will be the ability of the location to absorb the land-use input to the extent where no visual information can be perceived.

STAGE 'A'

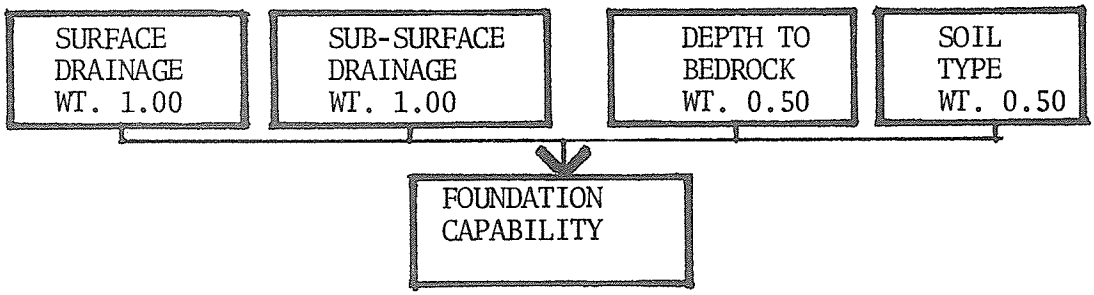
SITING CAPABILITY (IND.)

TOPOGRAPHIC SLOPE

Large-scale removal of vegetation cover would suggest that ecologically a 0% slope would generate the least erosion potential. Since industry is cost / benefit oriented a 0% slope would provide the easiest,most economical site on which to construct. Finally, transportation on the site such as large trucks and rail lines (marshalling yards) require 0% slope, if major cut and fill is to be avoided.

LEAST	0	water	
COMPATIBLE	1	16% - 20%	over 20%
	2	12% - 16%	
	3		
	4	8% - 12%	
	5		
	6	4% - 8%	
	7		
MOST	8		
COMPATIBLE	9	0% - 4%	

FOUNDATION CAPABILITY (IND.)



SURFACE DRAINAGE (IND.)

Poorly drained areas and surface drainage patterns should be avoided if construction and maintenance costs are to be kept low and if ecological damage is to be minimized.

LEAST COMPATIBLE	0	water
	1	poorly drained wetlands
	2	intermittent creek
	3	swales
	4	
	5	minor surface runoff (seasonal)
	6	drainage pattern (heavy storms)
	7	
MOST COMPATIBLE	8	
	9	well drained

SUB-SURFACE DRAINAGE (IND.)

Most anticipated industrial types are surface oriented requiring little or no excavation. In order to facilitate the necessary servicing of the area, water table depths must be considered as an important site criteria. The effluent from industrial areas increases the potential of ground water contamination therefore sewer lines above the water table is a necessary resource capability.

LEAST COMPATIBLE	0	water
	1	0 ft. - 2 ft.
	2	2 ft. - 4 ft.
	3	4 ft. - 6 ft.
	4	
	5	
	6	6 ft. - 8 ft.
	7	
MOST COMPATIBLE	8	
	9	over 8 ft.

DEPTH TO BEDROCK (IND.)

The utility infra-structure on the site defines the overburden requirements.

LEAST COMPATIBLE	0	water
	1	rock outcropping
	2	3 feet to bedrock
	3	5 feet to bedrock
	4	
	5	
	6	10 feet to bedrock
	7	
MOST COMPATIBLE	8	
	9	over 10 feet to bedrock

SOIL TYPE (IND.)

A well graded sand is the optimal foundation material for the circulation infra-structure and the type of industrial buildings expected (bearing wall less than four stories).

LEAST	0	water
COMPATIBLE	1	organic peat
	2	
	3	silts and clays
	4	
	5	sand, silts and clays
	6	
	7	poorly graded gravel (sand)
MOST	8	
COMPATIBLE	9	well graded gravel (sand)

The conversion table rates 'unacceptable' a site with any major development constraint.

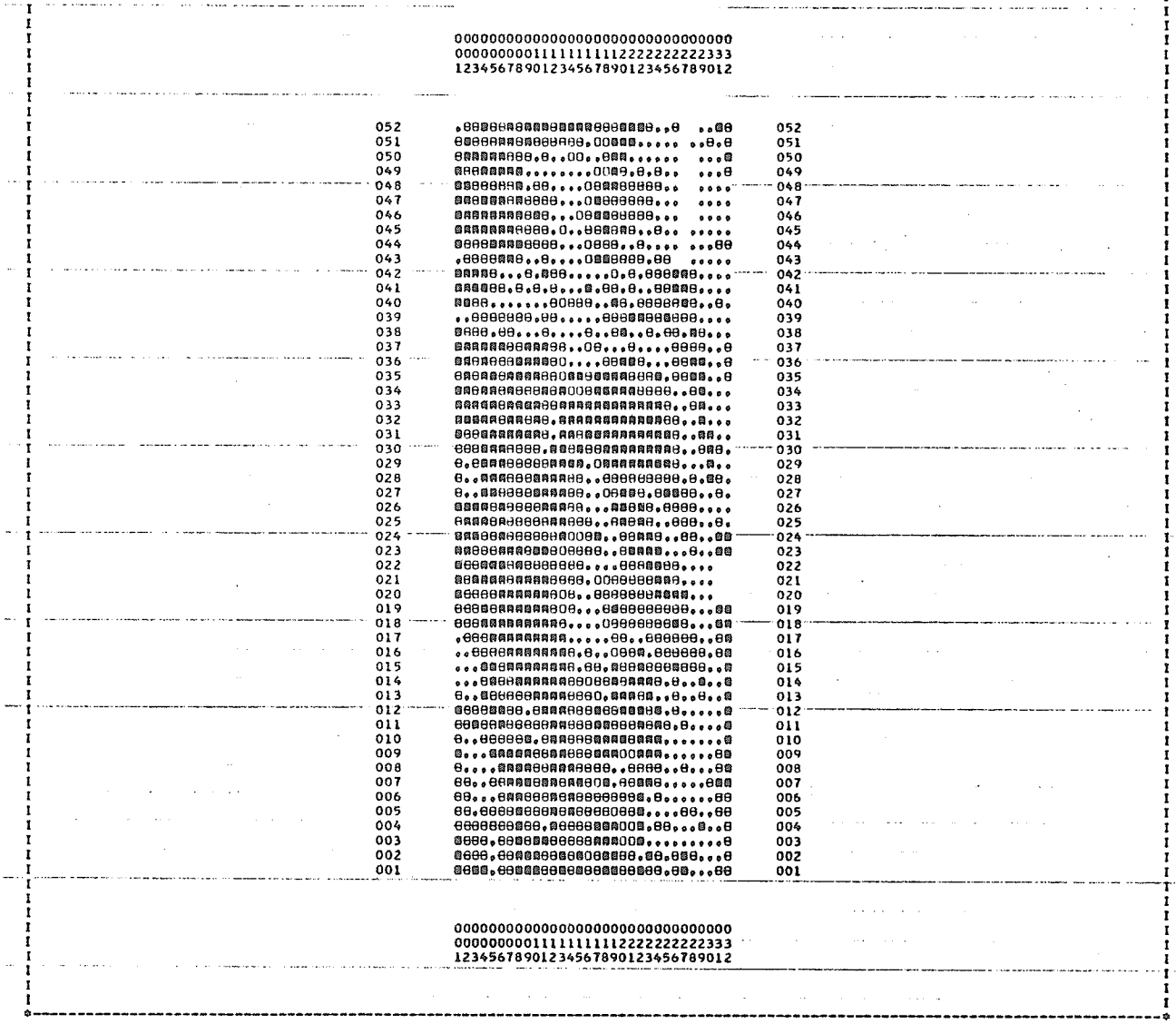
VEGETATION CAPABILITY (IND.)

(strip and cluster resource input technique).

LEAST	0	water
COMPATIBLE	1	Group nine
	2	Group eight
	3	Group seven
	4	Group six
	5	Group five
	6	Group four
	7	Group three
MOST	8	Group two
COMPATIBLE	9	Group one

(Groups defined by potential stability of the vegetation type).

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

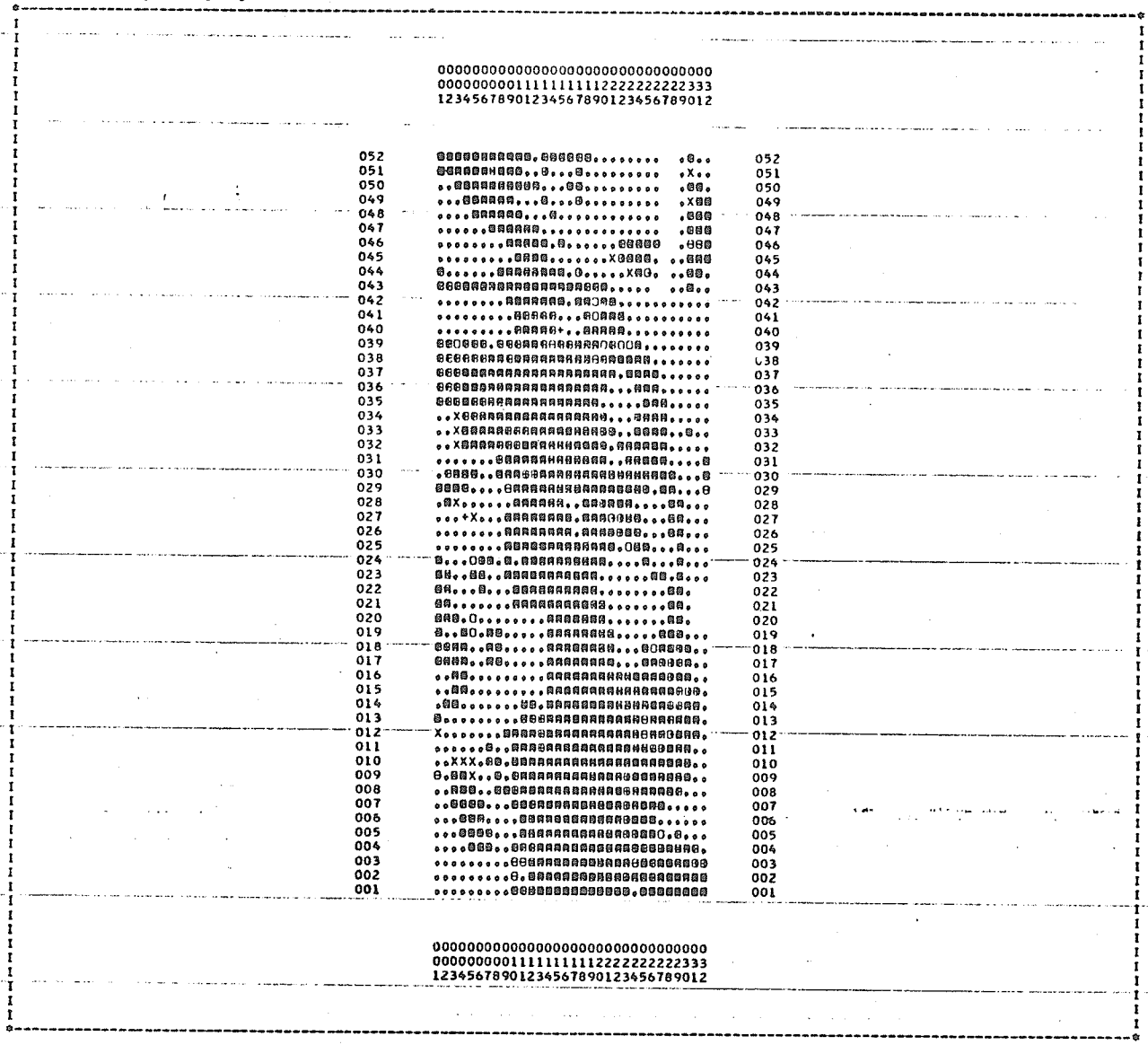
INDUSTRIAL ALLOCATION ANALYSIS (STAGE A)
LAND USE CODE

1) SITING CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	8	8	8	8	8	8
FREQUENCY	23	447	0	0	0	670	0	0	0	524

MAP 2,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

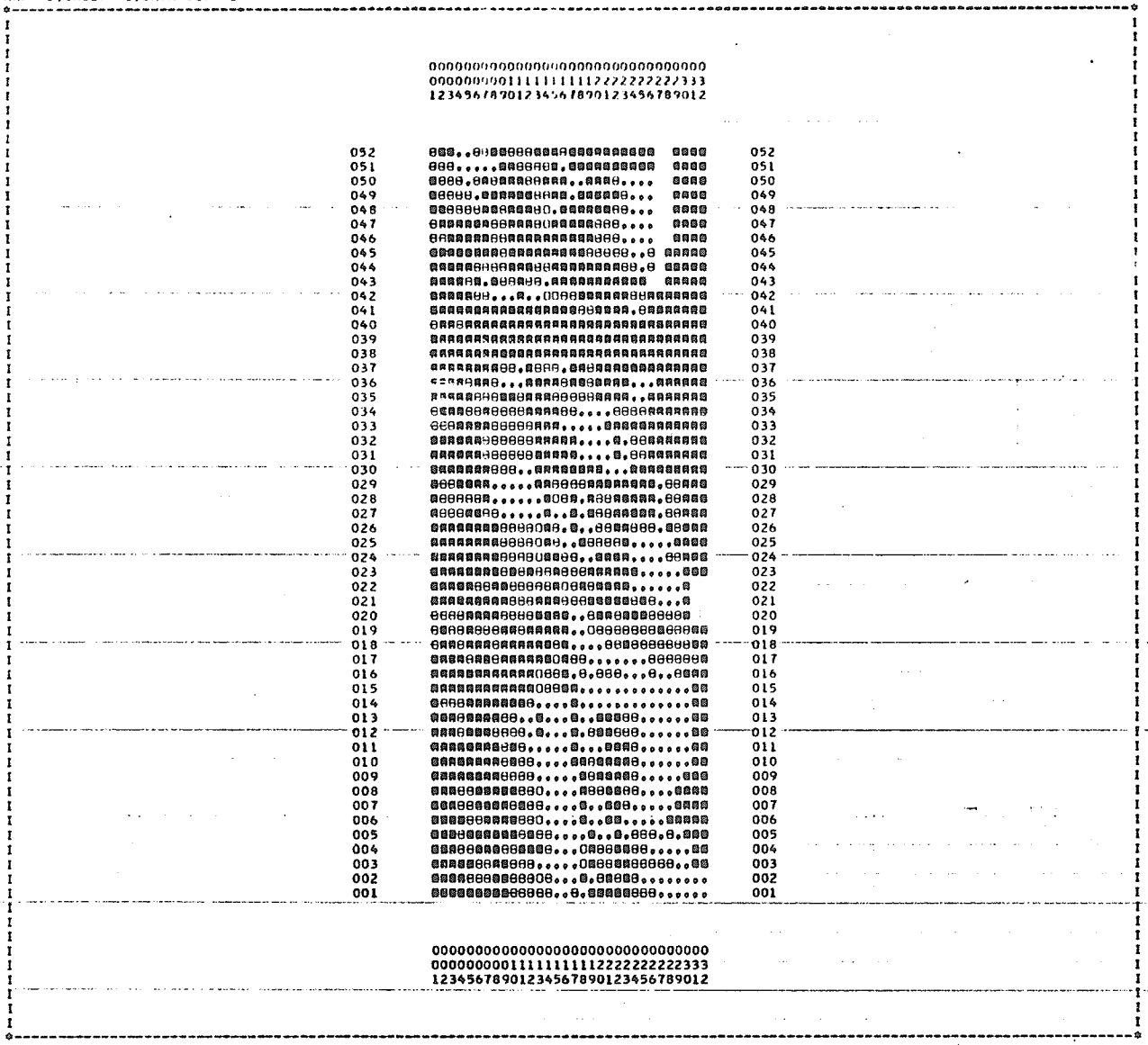
INDUSTRIAL ALLOCATION ANALYSIS (STAGE A)
LAND USE CODE

21 FOUNDATION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	@	@	@	@	@	@
FREQUENCY	24	649	2	14	12	13	169	46	177	558

MAP 3,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

INDUSTRIAL ALLOCATION ANALYSIS (STAGE A)
LAND USE CODE

3) VEGETATION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	8	@	#	=	A	R
FREQUENCY	24	316	0	0	0	401	0	0	0	923

STAGE 'B'

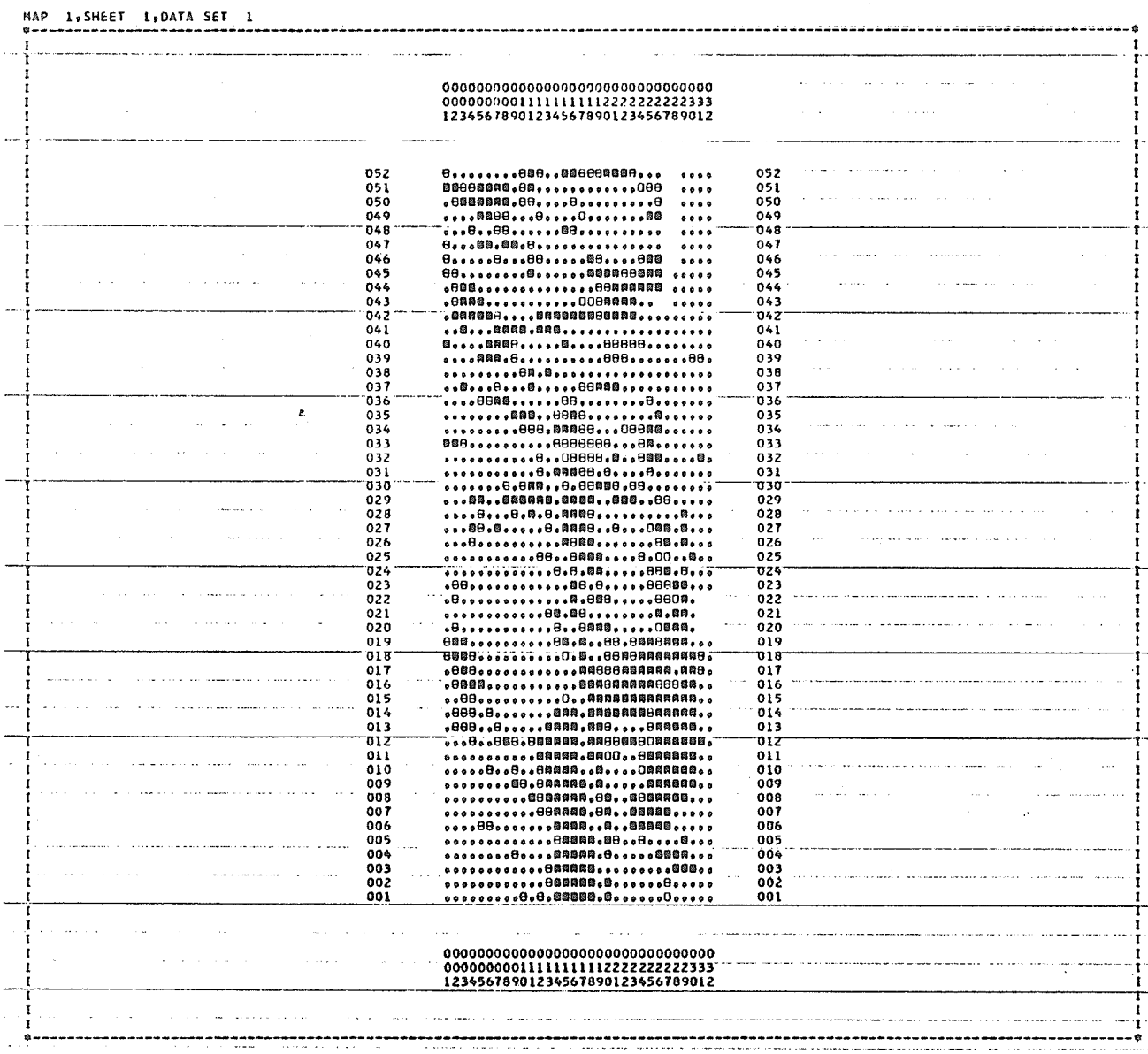
VISUAL ABSORPTION CAPABILITY (IND.)

(refer to established visual guidelines).

LEAST	0	water
COMPATIBLE	1	Group one, two, three
	2	
	3	Group four, five
	4	
	5	
	6	Group six
	7	Group seven
MOST	8	
COMPATIBLE	9	Group eight, nine

(Groups defined by the ability of the vegetation types to visually absorb industrial land-use input).

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

INDUSTRIAL ALLOCATION ANALYSIS (STAGE B)
LAND USE CODE

LT VISUAL ABSORPTION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	1034	0	0	0	226	0	0	0	380

SITE CAPABILITY

COMMERCIAL INPUT

5

COMMERCIAL INPUT

The commercial input can be roughly subdivided into a hotel facility, municipal buildings, miscellaneous commercial outlets and parking facilities. The characteristics of these inputs, combined with the accepted need for close proxemic relationships to each other would suggest that they be considered as a strip or cluster impact. Vehicular access to the commercial area is important and the ability of the site to support a road and utility infra-structure forms an integral part of commercial site capability rating.

Within small communities the commercial center usually functions as the focal point for the residents and tourists. Accordingly, the commercial area should not only have a strong visual impact but also a definite visual image, one that will emphasize the special role of this input within the community. In environmental terms this can be accomplished by locating the commercial establishments in areas that have direct visual access to a unique feature landscape. This would aid in creating a visual image which the residents could identify with as being unique to their town and an image by which tourists would be able to differentiate Leaf Rapids from other northern communities.

STAGE 'A'

SITING CAPABILITY (COM.)

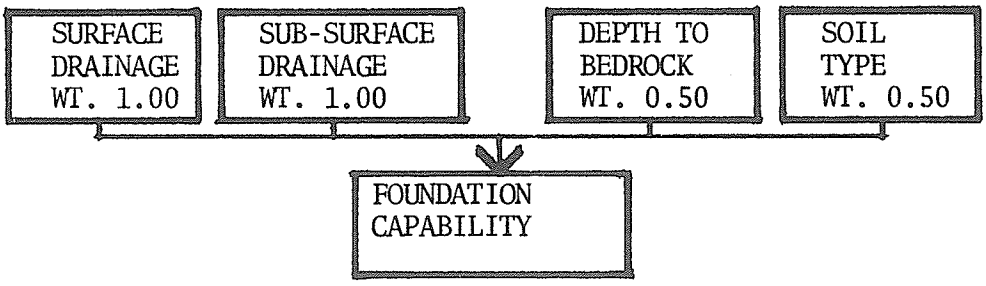
TOPOGRAPHIC SLOPE

A flat site is the most conducive slope for construction, maintenance, and servicing (utility and produce transportation).

LEAST	0	water	
COMPATIBLE	1	16% - 18%	over 20%
	2	12% - 16%	
	3		
	4	8% - 12%	
	5		
	6	4% - 8%	
	7		
MOST	8		
COMPATIBLE	9	0% - 4%	

FOUNDATION CAPABILITY (COM.)

Commercial establishments will most likely be bearing wall structures having similar vehicular and utility servicing requirements as industrial inputs and thus their foundation requirements will be the same.



SURFACE DRAINAGE (COM.)

LEAST	0	water
COMPATIBLE	1	poorly drained wetlands
	2	intermittent creek
	3	swales
	4	
	5	minor surface runoff (seasonal)
	6	drainage pattern (heavy storm)
	7	
MOST	8	
COMPATIBLE	9	well drained

SUB-SURFACE DRAINAGE (COM.)

LEAST COMPATIBLE	0	water
	1	0 ft. - 2 ft.
	2	2 ft. - 4 ft.
	3	4 ft. - 6 ft.
	4	
	5	
	6	6 ft. - 8 ft.
	7	
MOST	8	
COMPATIBLE	9	over 8 ft.

DEPTH TO BEDROCK (COM.)

LEAST COMPATIBLE	0	water
	1	rock outcropping
	2	3 feet to bedrock
	3	5 feet to bedrock
	4	
	5	
	6	10 feet to bedrock
	7	
MOST	8	
COMPATIBLE	9	over 10 feet to bedrock

SOIL TYPE (COM.)

LEAST COMPATIBLE	0	water
	1	organic peat
	2	
	3	silts and clays
	4	
	5	sands, silts, and clays
	6	
	7	poorly graded gravel (sand)
MOST	8	
COMPATIBLE	9	well graded gravel (sand)

Again the conversion table has been adjusted so that any major development constraint will receive an 'unacceptable' rating.

VEGETATION CAPABILITY (COM.)

(strip and cluster resource input technique)

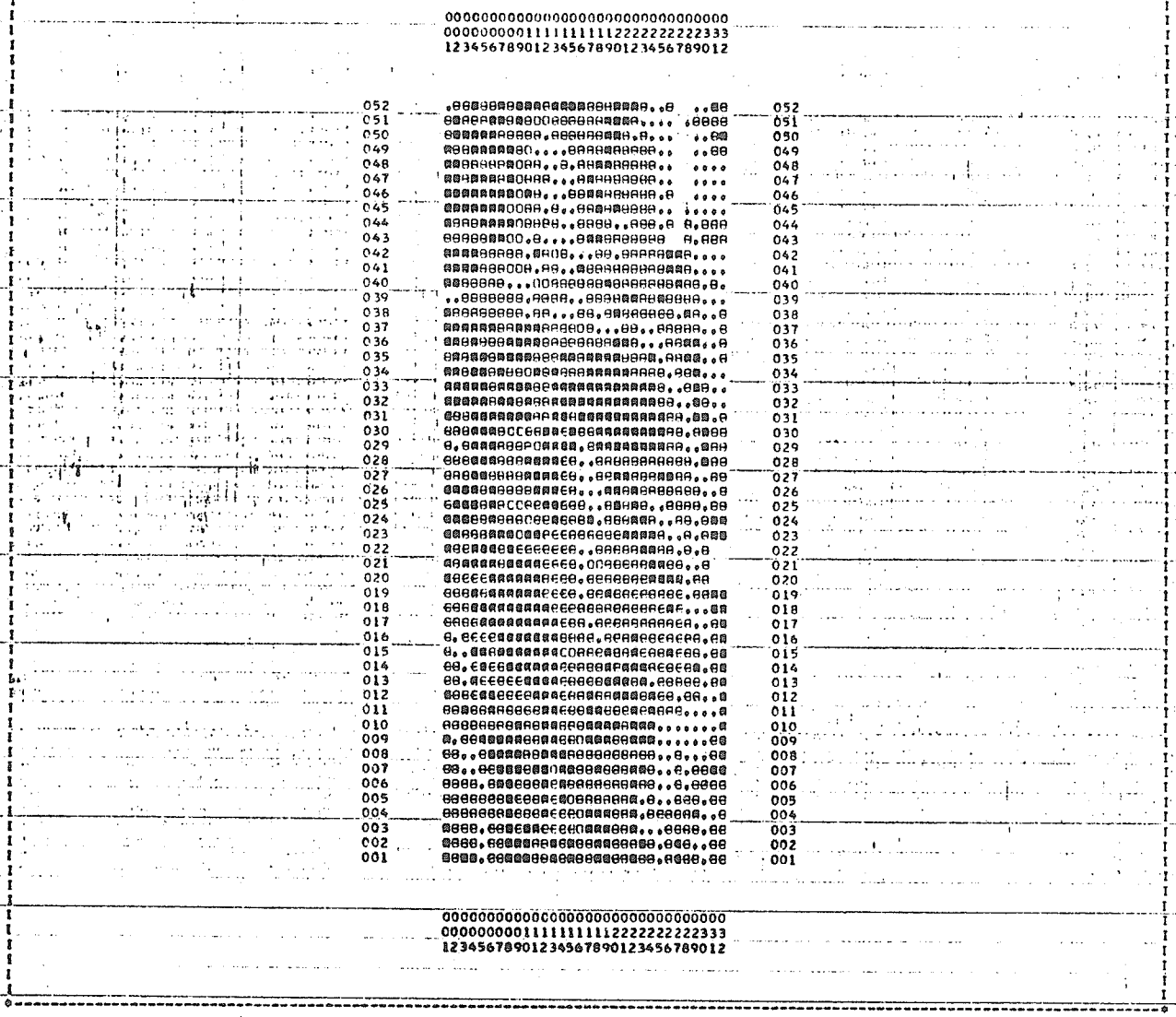
LEAST S	0	water
COMPATIBLE	1	Group nine
	2	Group eight
	3	Group seven
	4	Group six
	5	Group five
	6	Group four
	7	Group three
MOST	8	Group two
COMPATIBLE	9	Group one

(Groups defined by potential stability of vegetation type.)

VISUAL ACCESS CAPABILITY (COM.)

LEAST	0	water
PREFERRED	1	environmental nuisance
	2	
	3	no features outside normal vegetation
	4	view of marshland
	5	view of intermittent creek
	6	screened view of ravine, hills, kettles
	7	direct visual access to ravine, hills, kettles
MOST	8	screened view of water
PREFERRED	9	direct visual access to water.

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

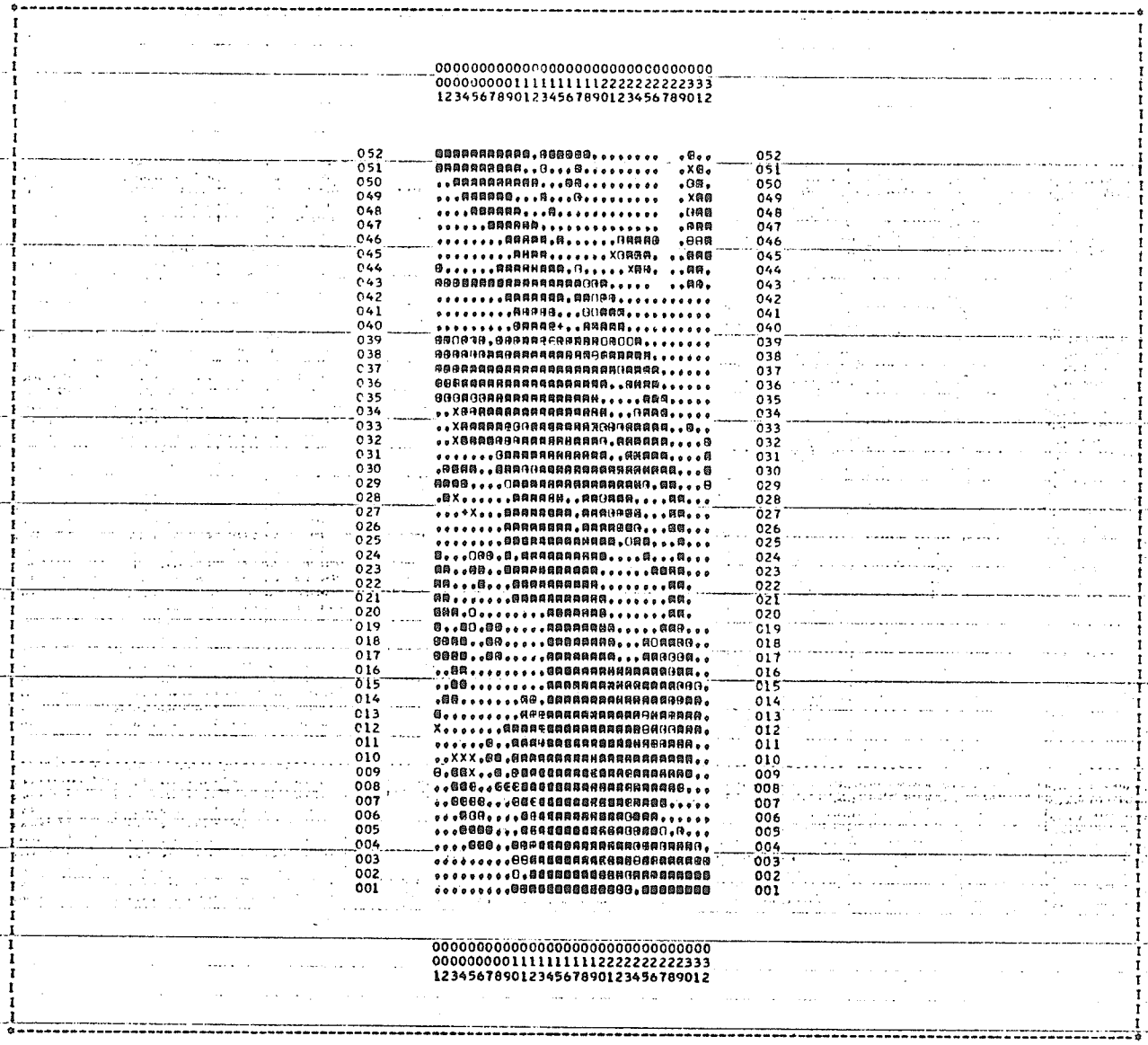
COMMERCIAL ALLOCATION ANALYSIS (STAGE A)
LAND USE CODE

1) SITING CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	23	252	0	0	0	865	0	0	0	524

MAP 2,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

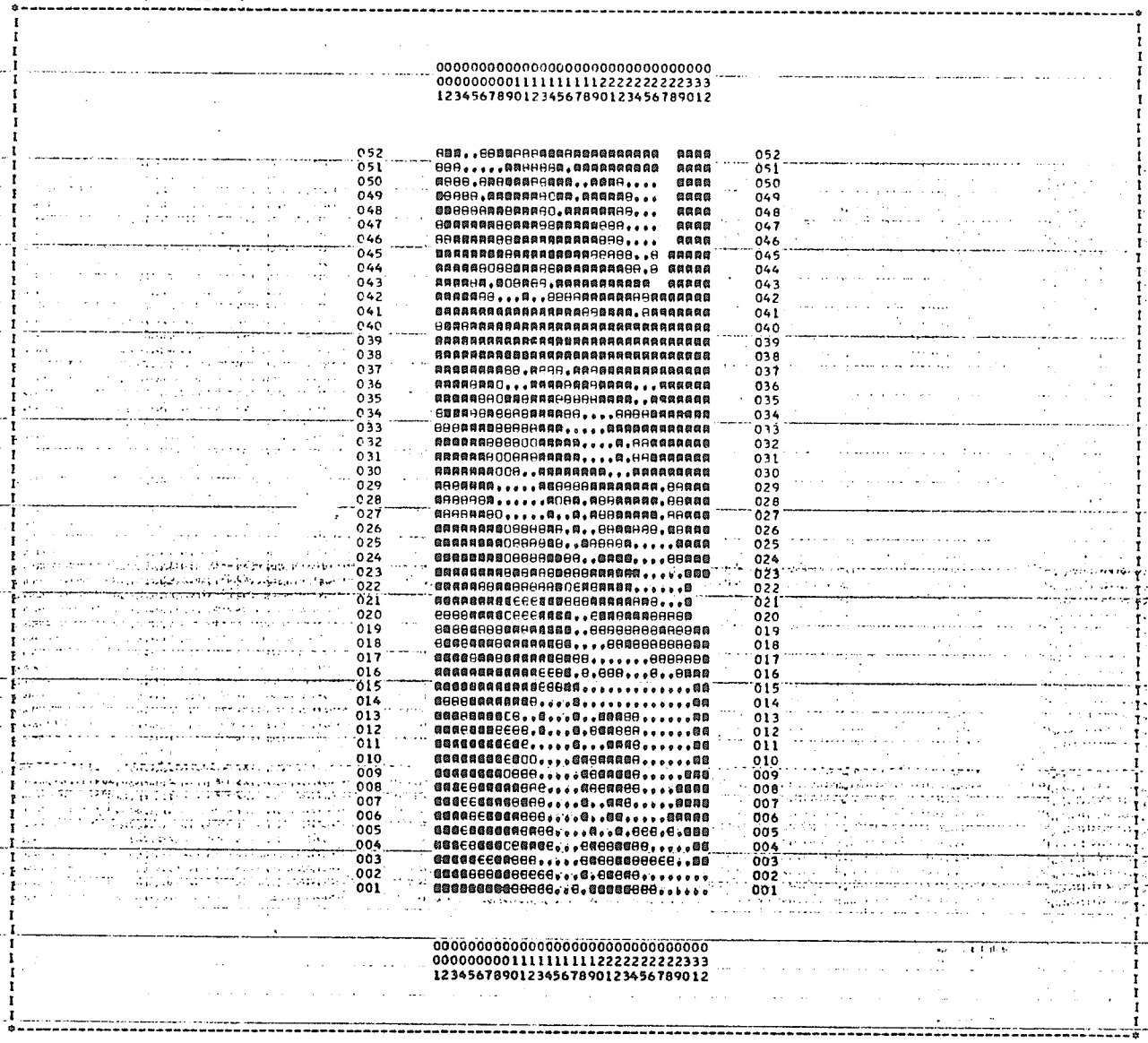
COMMERCIAL ALLOCATION ANALYSIS (STAGE A)
LAND USE CODE

2) FOUNDATION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	641	2	14	12	13	175	46	179	558

MAP 3,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

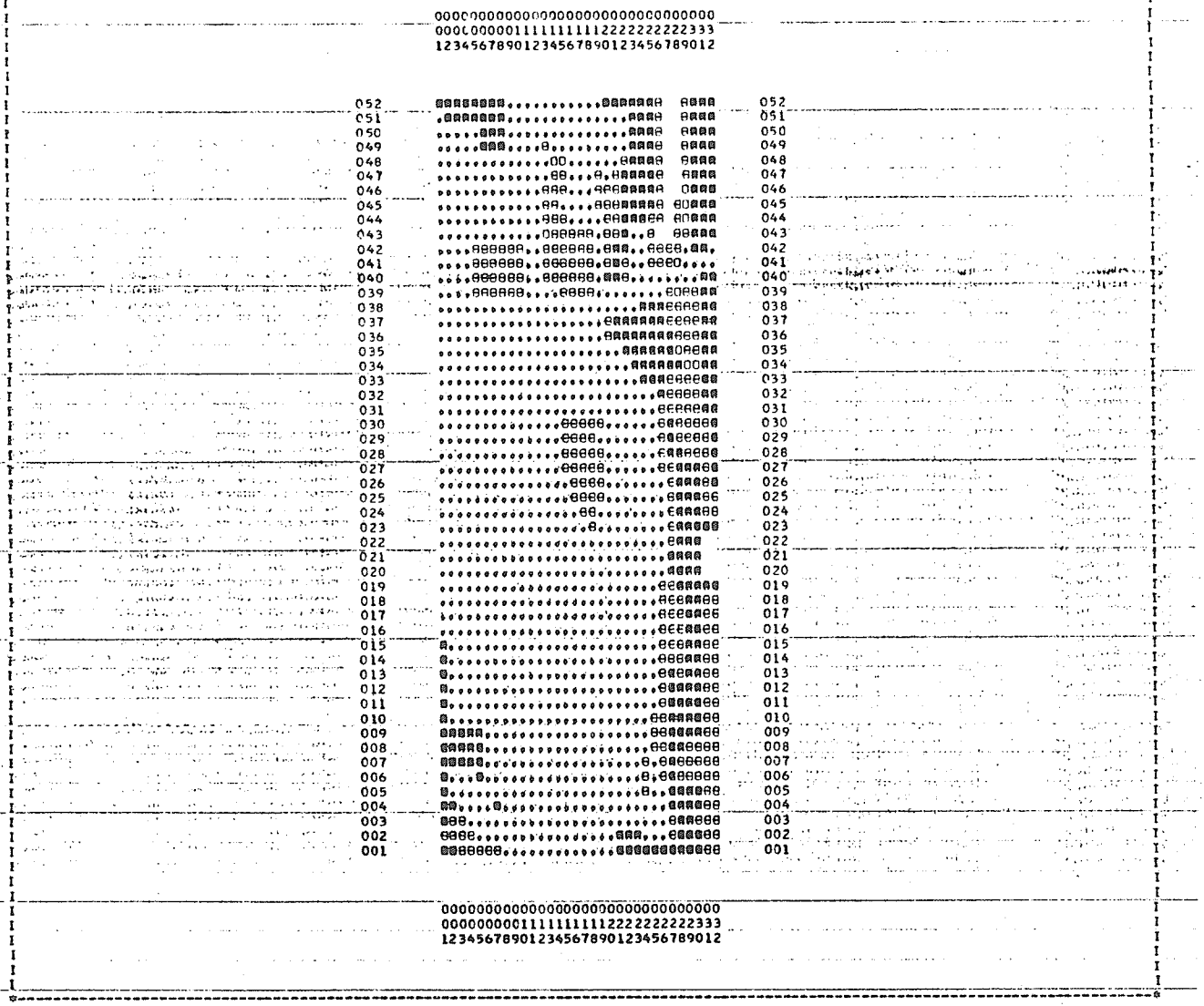
COMMERCIAL ALLOCATION ANALYSIS (STAGE A)
LAND USE CODE

3) VEGETATION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	316	0	0	0	401	0	0	0	923

MAP 4,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

COMMERCIAL ALLOCATION ANALYSIS (STAGE A)
LAND USE CODE

4) VISUAL ACCESS CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	#	@	A	E	B	C
FREQUENCY	24	1069	0	0	0	296	0	0	0	275

STAGE 'B'

VEGETATION CAPABILITY (COM.)

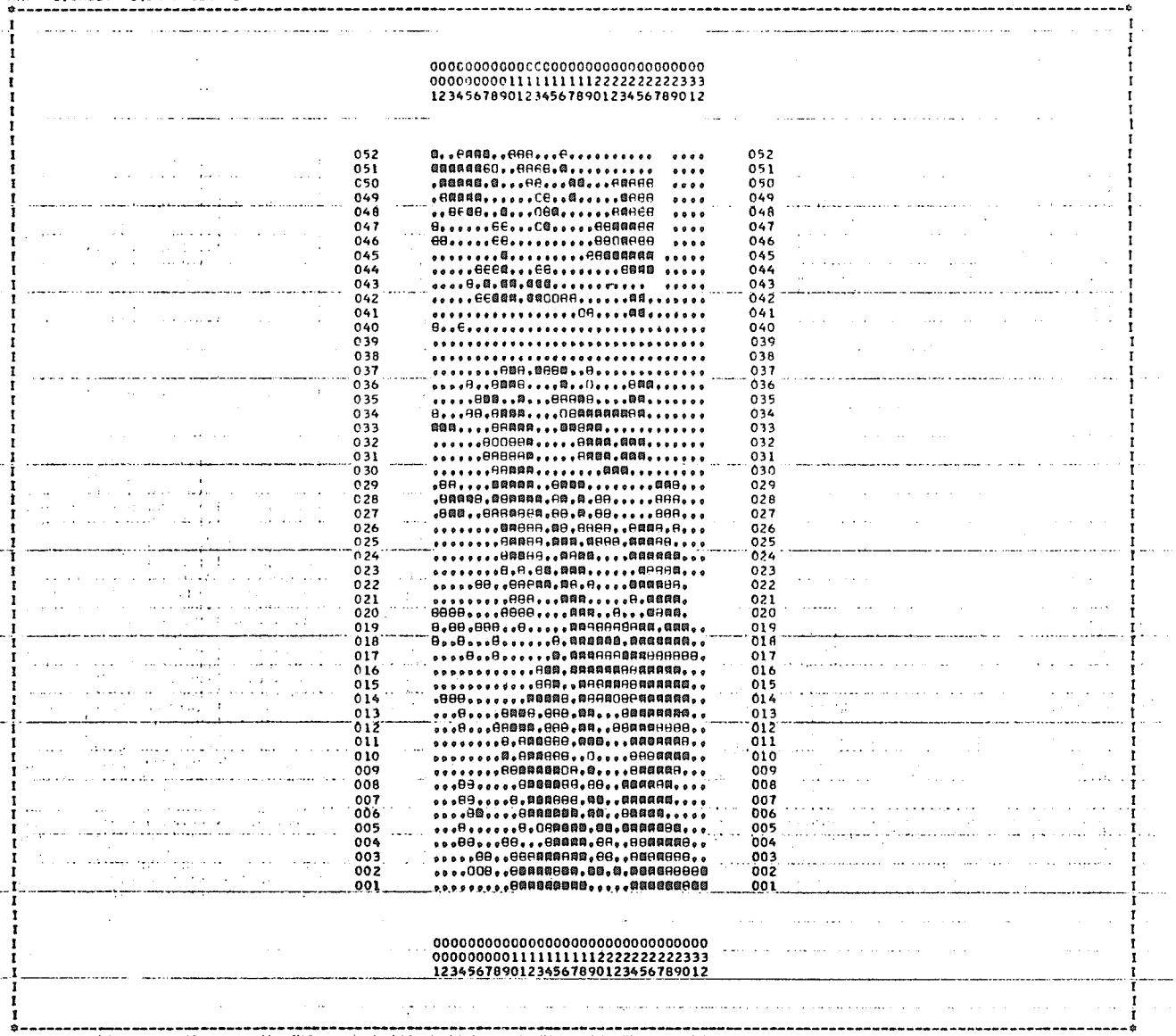
The vegetation surrounding the commercial development should be able to withstand intensive use by both pedestrians and off the road vehicles. Thus a sturdy open vegetation with no understory that would impede and be destroyed by pedestrians is the optimal condition.

LEAST	0	water
COMPATIBLE	1	Group one, two
	2	Group three
	3	Group nine
	4	
	5	Group five
	6	Group four
	7	Group six
MOST	8	Group seven
COMPATIBLE	9	Group eight

VISUAL ABSORPTION CAPABILITY (COM.)
(refer to established visual guidelines)

LEAST	0	water
COMPATIBLE	1	Groups one, nine
	2	
	3	Groups two, eight
	4	
	5	
	6	Groups three, seven
	7	
MOST	8	
COMPATIBLE	9	Groups four, five, six

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

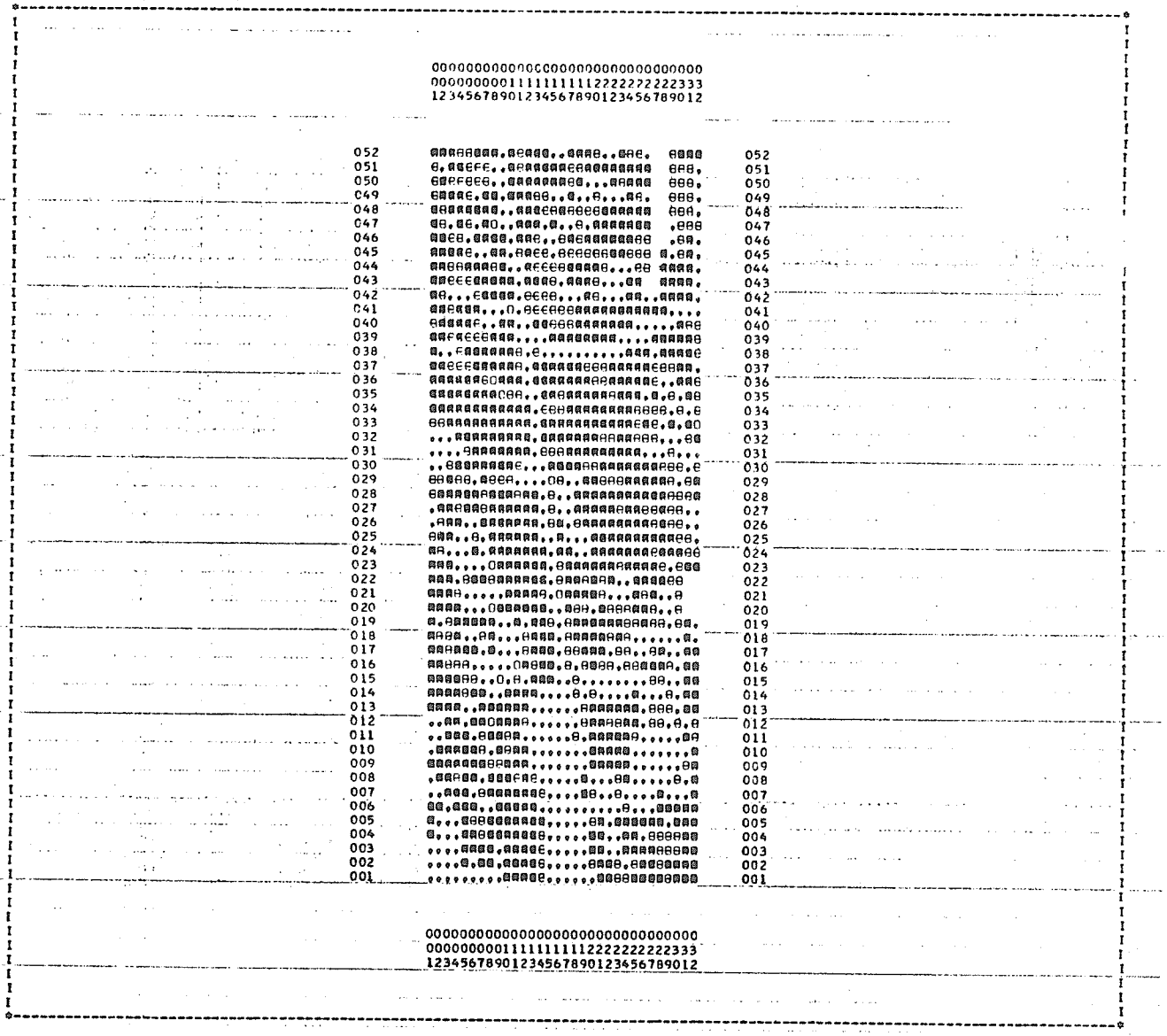
COMMERCIAL ALLOCATION ANALYSIS (STAGE B)
LAND USE CODE

1) VEGETATION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	923	0	0	0	327	0	0	0	390

MAP 2,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

COMMERCIAL ALLOCATION ANALYSIS (STAGE B)
LAND USE CODE

2) VISUAL ABSORPTION CAPABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	•	+	X	O	@	#	A	E	,
FREQUENCY	24	468	0	0	0	347	0	0	0	825

SITE SUITABILITY

6

SUITABILITY MODELS

COMPUTER GRAPHIC DISPLAY OF SUITABILITY RATINGS

SITE SUITABILITY

Site suitability represents the relative amount of energy necessary to realize a proposed development activity considering the capability of the natural resources to satisfy the specified requirements.

Each grid cell of the study area is rated in terms of how well the natural resources of that cell are able to support the specified capability requirements of each land use. This will be measured in terms of the degree of site modification required to convert a specific site in its present condition to that needed to obtain the desired level of use. The most suitable site requires the least modification and results in the minimum perturbation to the natural resources.

WEIGHTING

Consistent with the established goals and guidelines each resource capability variable is weighted commensurate with its importance to the specific land use and to the community as a whole. The weights have been established as a result of a concensus of professional and lay opinions.

The following documentation represents how the resource capability scores will be weighted when combined to form the ultimate land-use suitability scores.

RESIDENTIAL POINT INPUT SUITABILITY

			WT.
1)	SITING CAPABILITY	(S.F.U.)	1.50
2)	FOUNDATION CAPABILITY	(S.F.U.)	1.25
3)	VEGETATION CAPABILITY	(S.F.U.)	1.75
4)	VEGETATION PREFERENCE CAPABILITY	(S.F.U.)	1.00
5)	VISUAL ACCESS CAPABILITY	(S.F.U.)	1.25
6)	VISUAL ABSORPTION CAPABILITY	(S.F.U.)	1.00

RESIDENTIAL STRIP AND CLUSTER INPUT SUITABILITY

STAGE 'A'		WT.
1) SITING CAPABILITY	(M.F.U.)	1.50
2) FOUNDATION CAPABILITY	(M.F.U.)	1.25
3) VEGETATION CAPABILITY	(M.F.U.)	1.75
4) VISUAL ACCESS CAPABILITY	(M.F.U.)	1.25

STAGE 'B'		
1) VEGETATION CAPABILITY	(M.F.U.)	1.75
2) VEGETATION PREFERENCE CAPABILITY	(M.F.U.)	1.00
3) VISUAL ABSORPTION CAPABILITY	(M.F.U.)	1.00

PASSIVE RECREATION INPUT SUITABILITY

		WT.
1) SITING CAPABILITY	(P. REC.)	1.75
2) VEGETATION CAPABILITY	(P. REC.)	.75
3) VEGETATION PREFERENCE CAPABILITY	(P. REC.)	1.25
4) VISUAL ACCESS CAPABILITY	(P. REC.)	1.50
5) VISUAL ABSORPTION CAPABILITY	(P. REC.)	0.50

ACTIVE RECREATION INPUT SUITABILITY

STAGE 'A'		WT.
1) SITING CAPABILITY	(A. REC.)	1.50
2) FOUNDATION CAPABILITY	(A. REC.)	0.50
3) VEGETATION CAPABILITY	(A. REC.)	1.75

STAGE 'B'		WT.
1) VEGETATION CAPABILITY	(A. REC.)	1.25
2) VISUAL ABSORPTION CAPABILITY	(A. REC.)	.75

ROAD AND UTILITY INFRA-STRUCTURE SUITABILITY

		WT.
1) SITING CAPABILITY	(R. and U.)	0.75
2) FOUNDATION CAPABILITY	(R. and U.)	1.00
3) VEGETATION CAPABILITY	(R. and U.)	1.25
4) VISUAL ACCESS CAPABILITY	(R. and U.)	1.75

INDUSTRIAL INPUT SUITABILITY

STAGE 'A'		WT.
1) SITING CAPABILITY	(IND.)	1.00
2) FOUNDATION CAPABILITY	(IND.)	1.00
3) VEGETATION CAPABILITY	(IND.)	1.75

STAGE 'B'

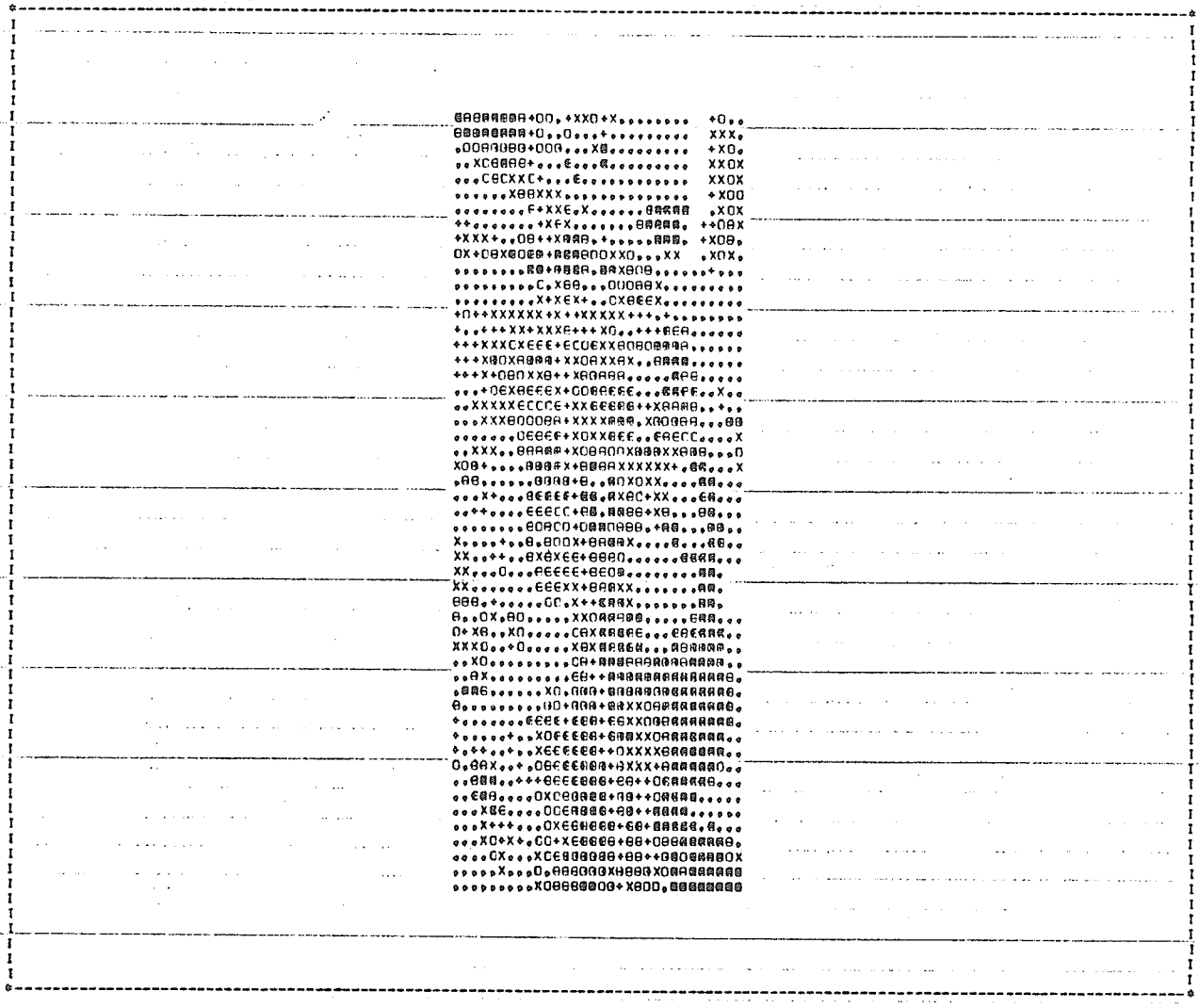
1) VISUAL ABSORPTION CAPABILITY	(IND.)	1.75

COMMERCIAL INPUT SUITABILITY

SITE 'A'		WT.
1) SITING CAPABILITY	(COM.)	1.25
2) FOUNDATION CAPABILITY	(COM.)	1.25
3) VEGETATION CAPABILITY	(COM.)	1.50
4) VISUAL ACCESS CAPABILITY	(COM.)	1.75

STAGE 'B'		
1) VEGETATION CAPABILITY	(COM.)	1.00
2) VISUAL ABSORPTION CAPABILITY	(COM.)	1.75

MAP 1, SHEET 1, DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

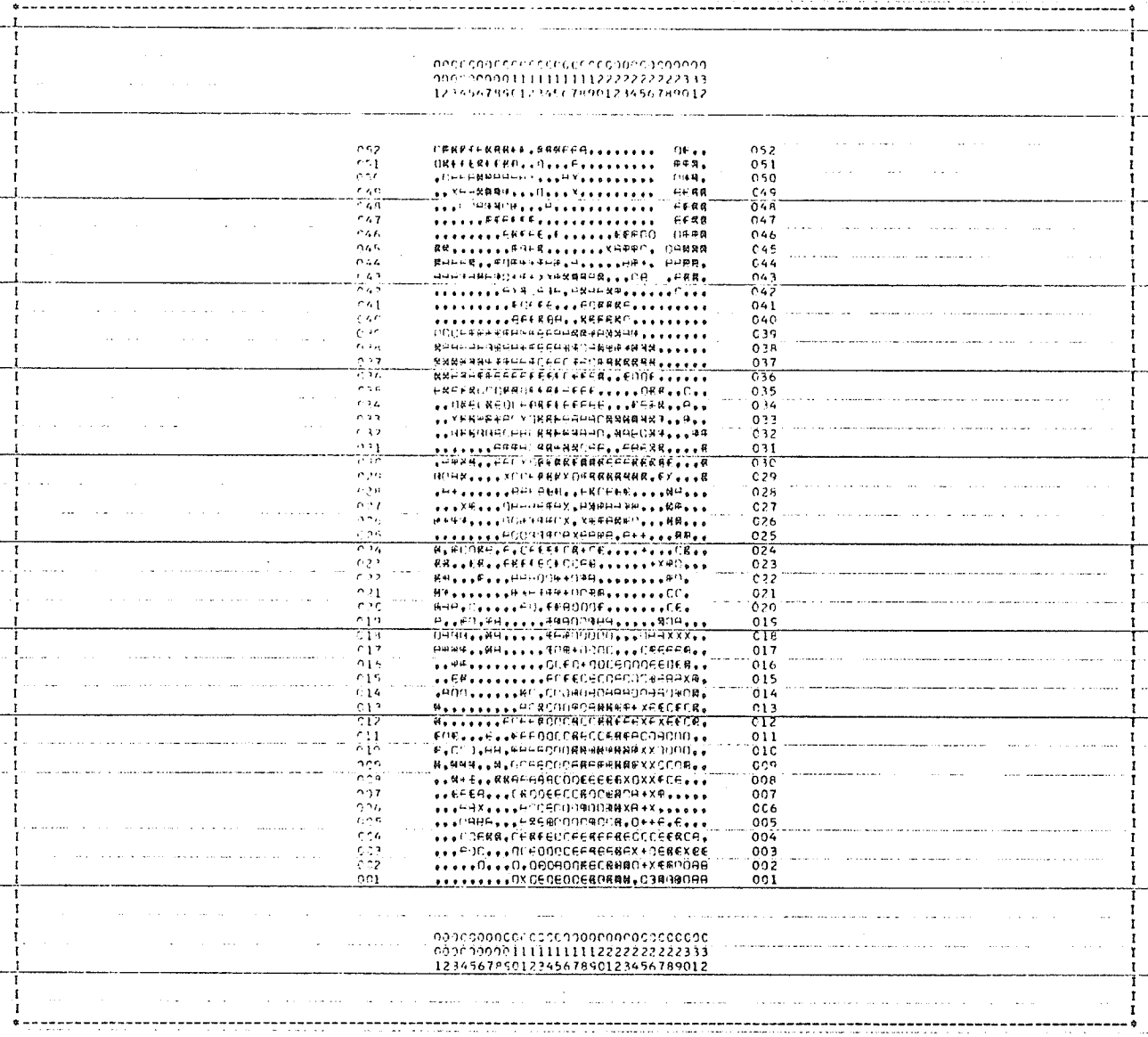
ONE SYMBOL EQUALS ONE ACRE

SINGLE FAMILY UNIT DEVELOPMENT SUITABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	. ...	....	XXXX XXXX	0000 0000	@@@@ @@@@	@@@@ @@@@	#### ####	#### ####	#### ####	#### ####
FREQUENCY	24	611	145	195	117	206	183	84	56	43

MAP 5,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

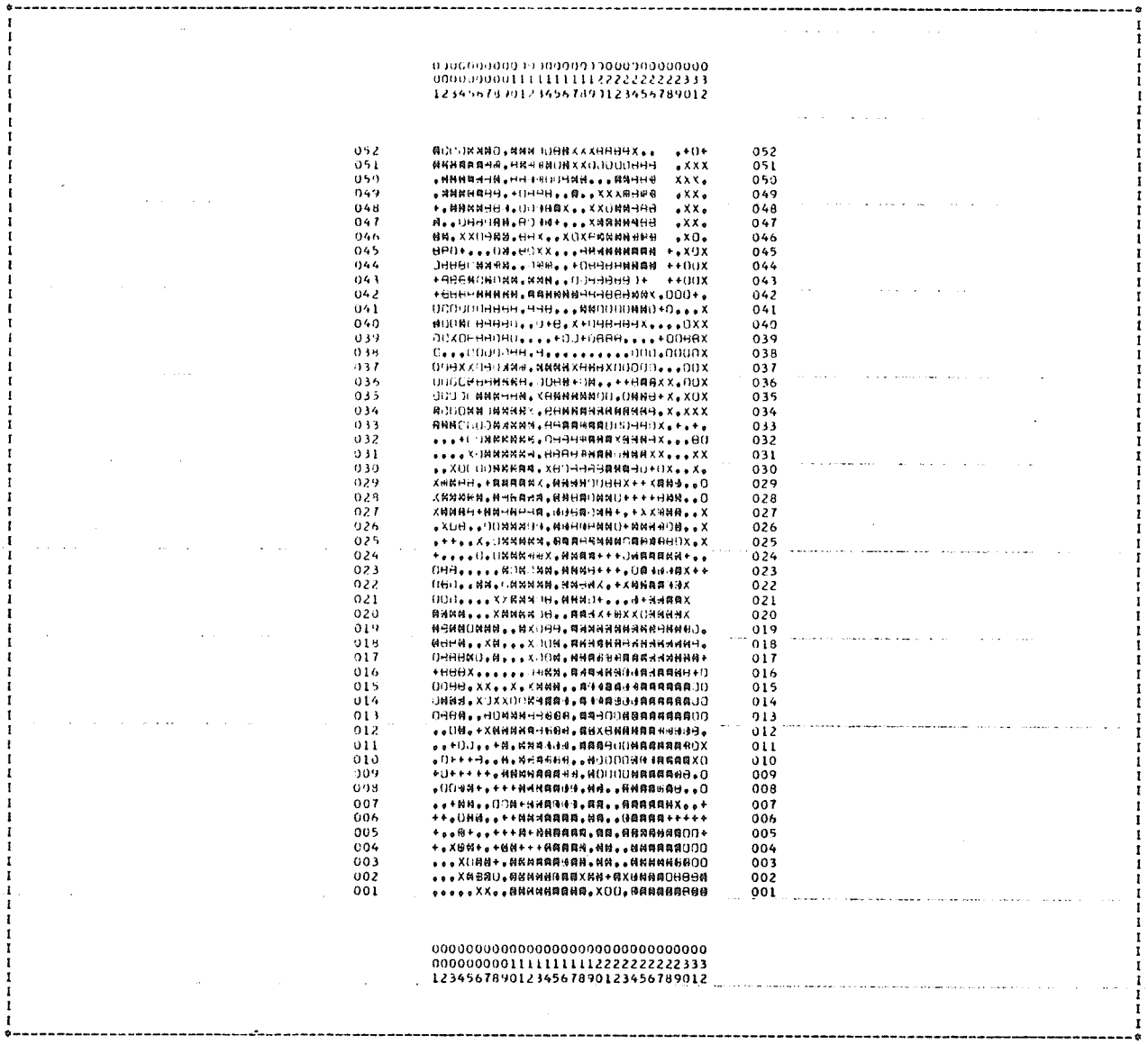
MULTI-FAMILY UNIT DEVELOPMENT (STAGE A)

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	589	20	42	243	276	247	90	123	10

8194

MAP 4,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

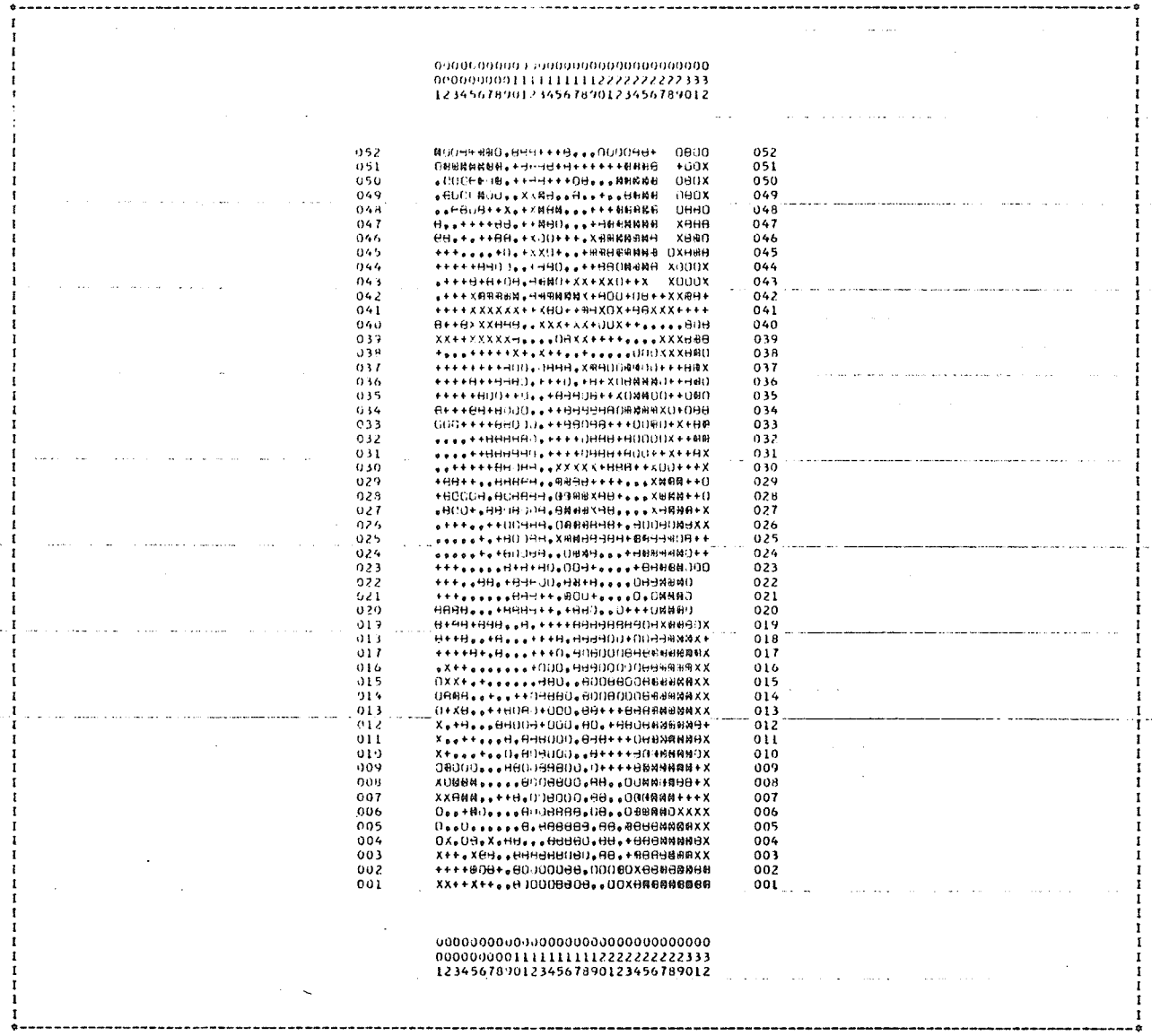
ONE SYMBOL EQUALS ONE ACRE

MULTI-FAMILY UNIT DEVELOPMENT (STAGE 8)

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	H	@	#	&	$	A
FREQUENCY	24	298	103	127	232	189	103	204	220	164

MAP 6,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

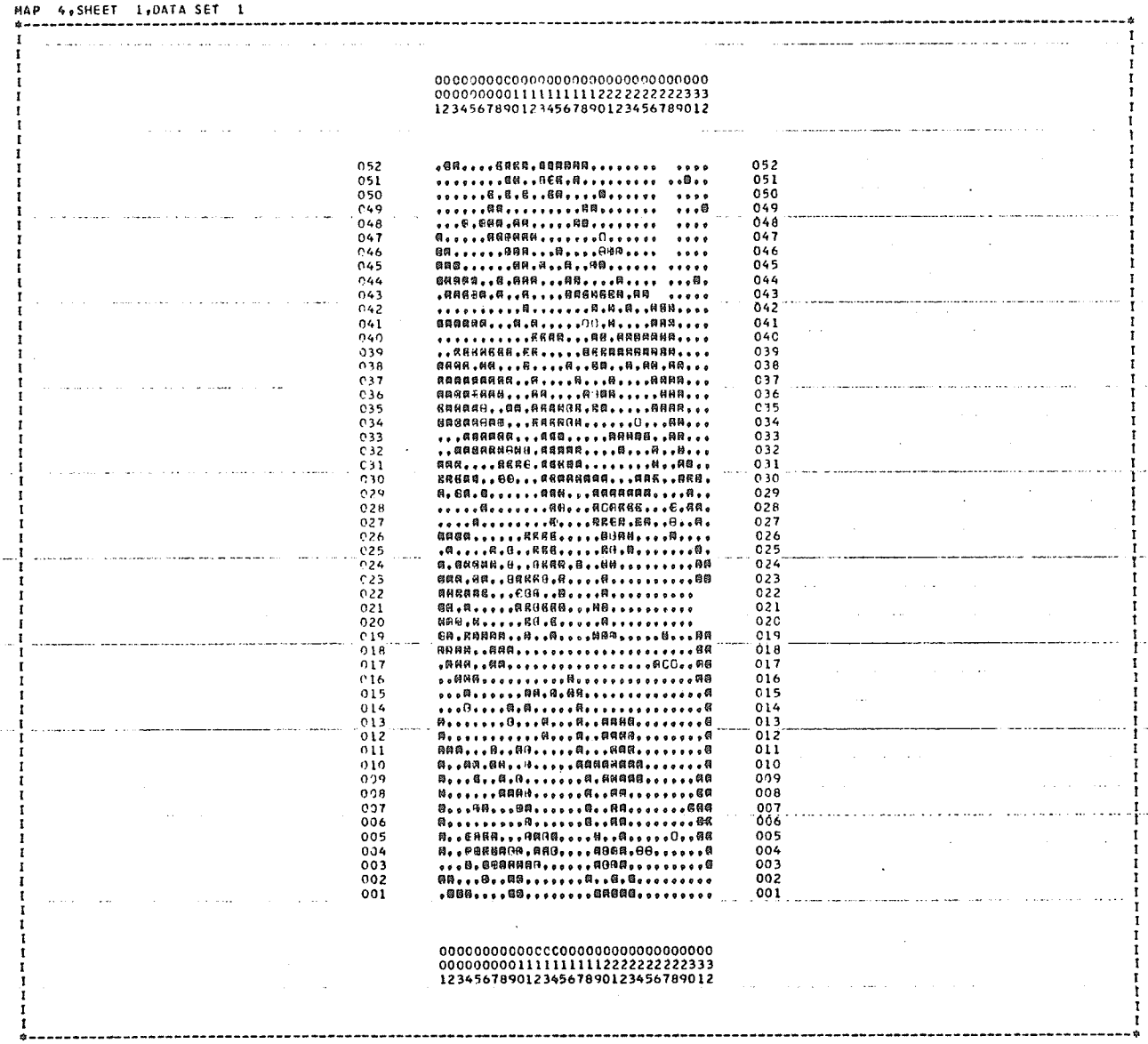
ONE SYMBOL EQUALS ONE ACRE

PASSIVE RECREATION DEVELOPMENT SUITABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	295	324	135	265	380	132	80	24	5

MAP 4,SHEET 1,DATA SET 1



1413

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

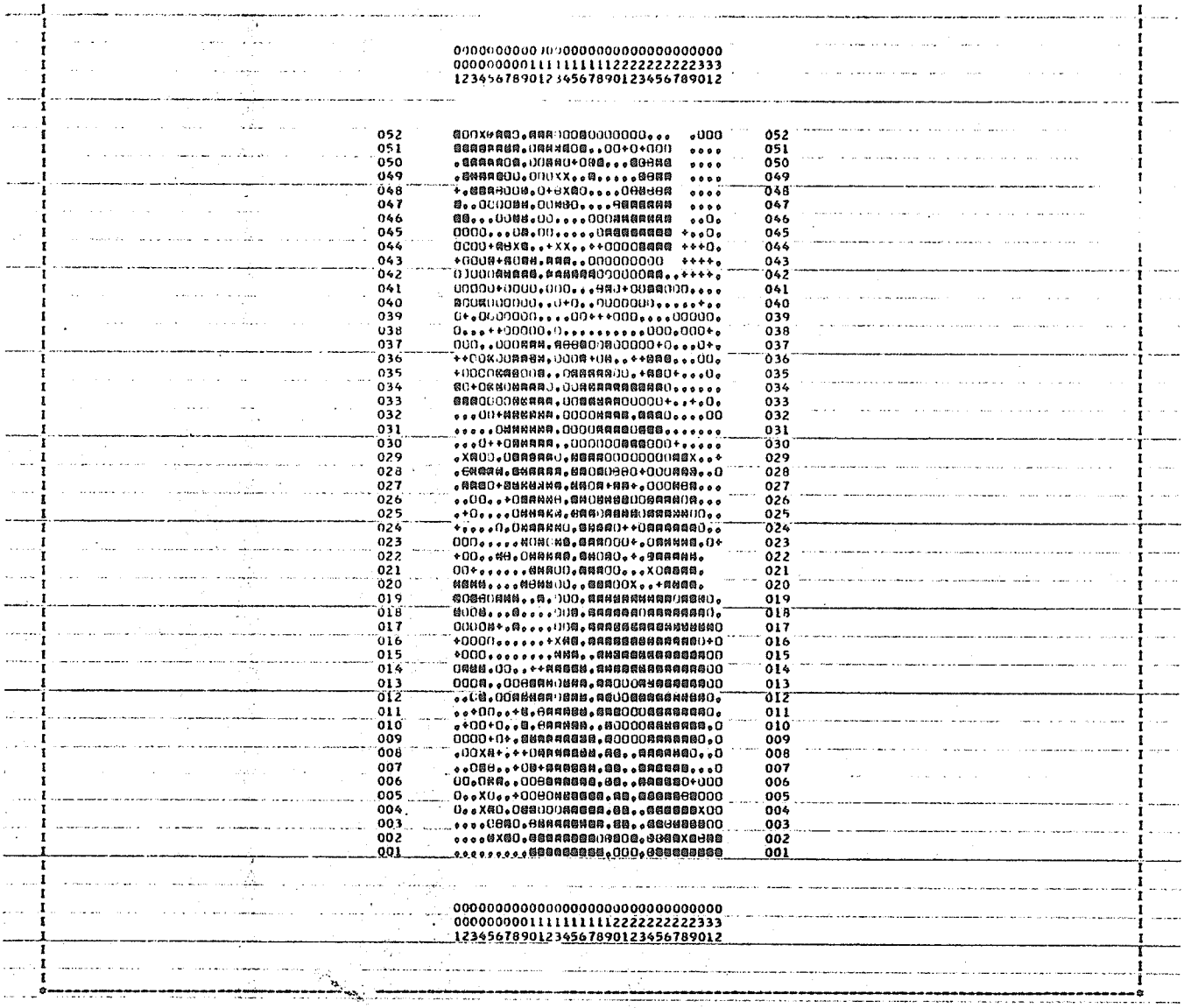
ONE SYMBOL EQUALS ONE ACRE

ACTIVE RECREATION DEVELOPMENT SUITABILITY (STAGE A)

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	A	E	@	#	*	,
FREQUENCY	23	1022	0	0	8	7	71	137	232	164

MAP 3, SHEET 1, DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

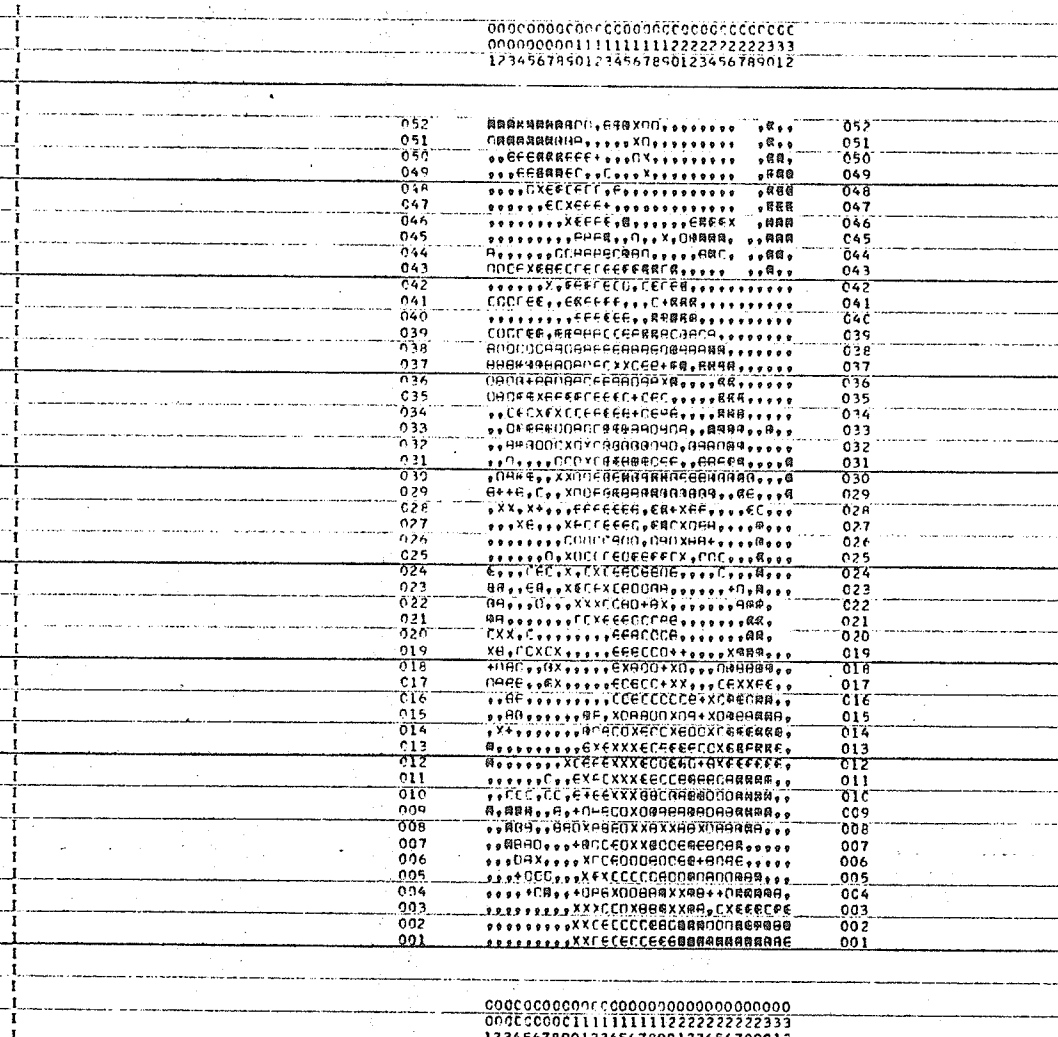
ACTIVE RECREATION DEVELOPMENT SUITABILITY (STAGE 8)

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

5647

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	#	@	=	-	:	*
FREQUENCY	24	402	87	18	434	31	15	278	15	360

MAP 5,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

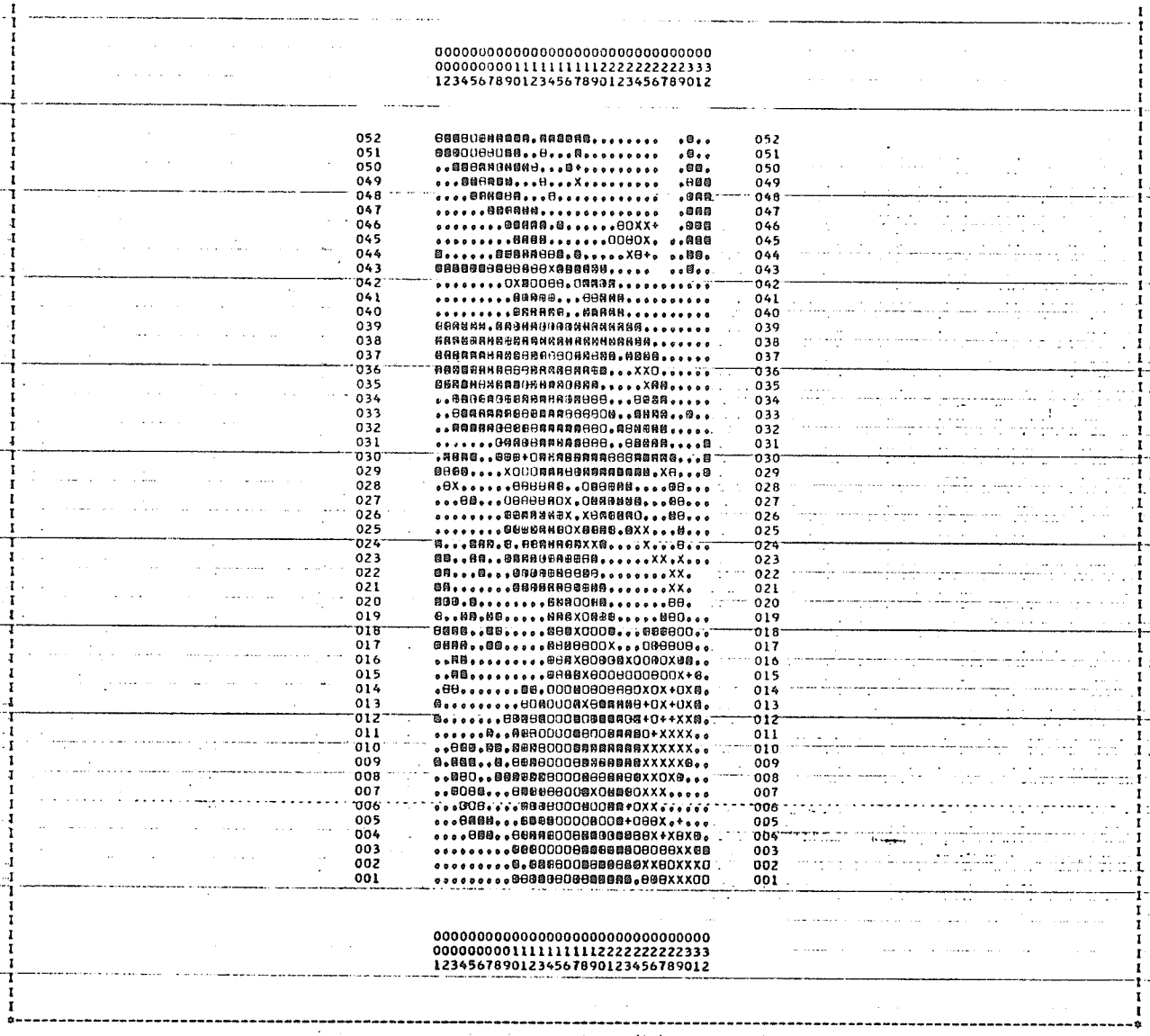
ONE SYMBOL EQUALS ONE ACRE

ROAD AND UTILITY DEVELOPMENT SUITABILITY

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS		. + X C A @ #								
FREQUENCY	24	523	32	108	268	289	173	77	46	24

MAP 4,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

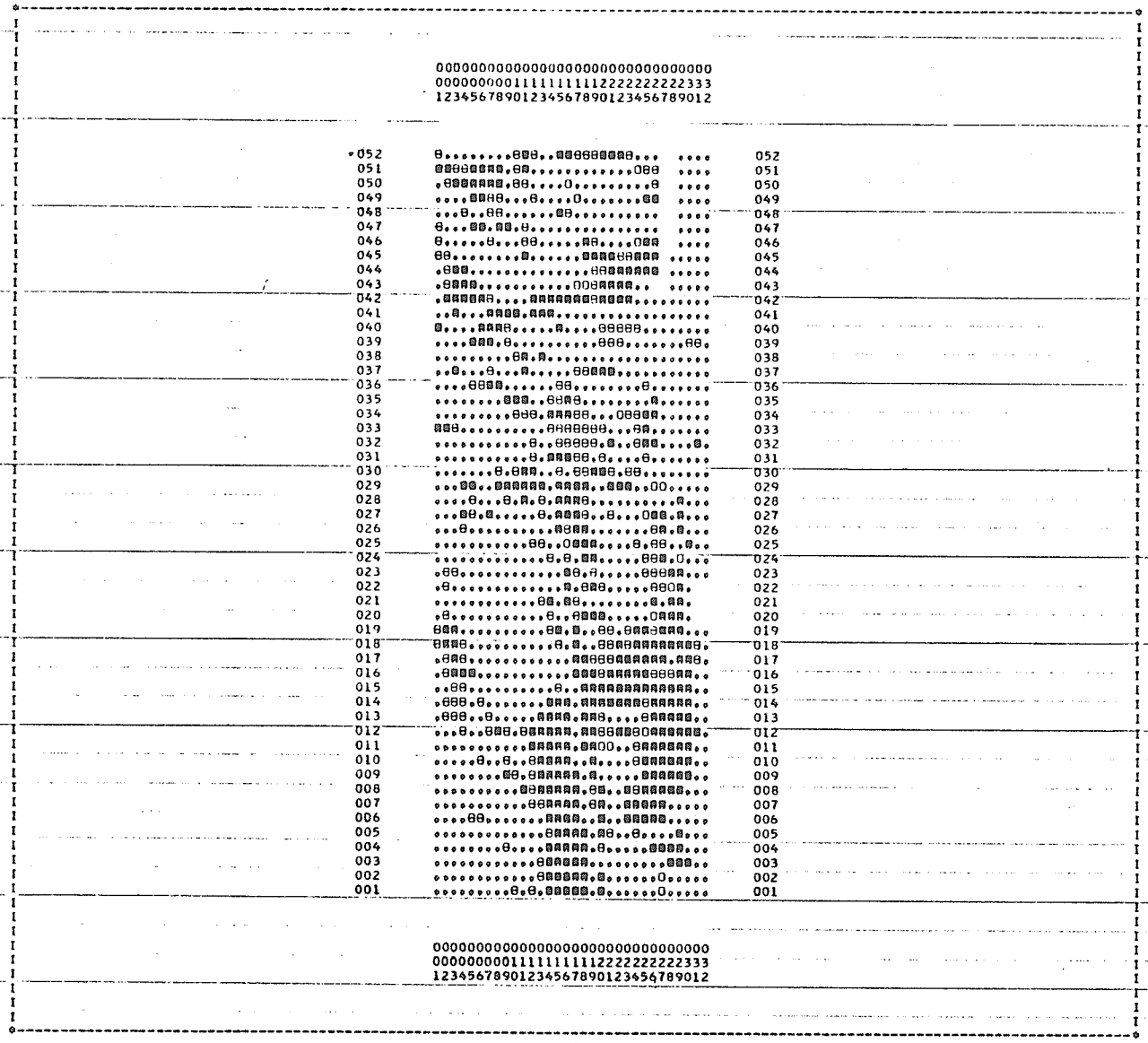
ONE SYMBOL EQUALS ONE ACRE

INDUSTRIAL DEVELOPMENT SUITABILITY (STAGE A)

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	,	+	X	0	8	@	#	&	$
FREQUENCY	24	649	16	83	119	193	182	199	165	96

MAP 2,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

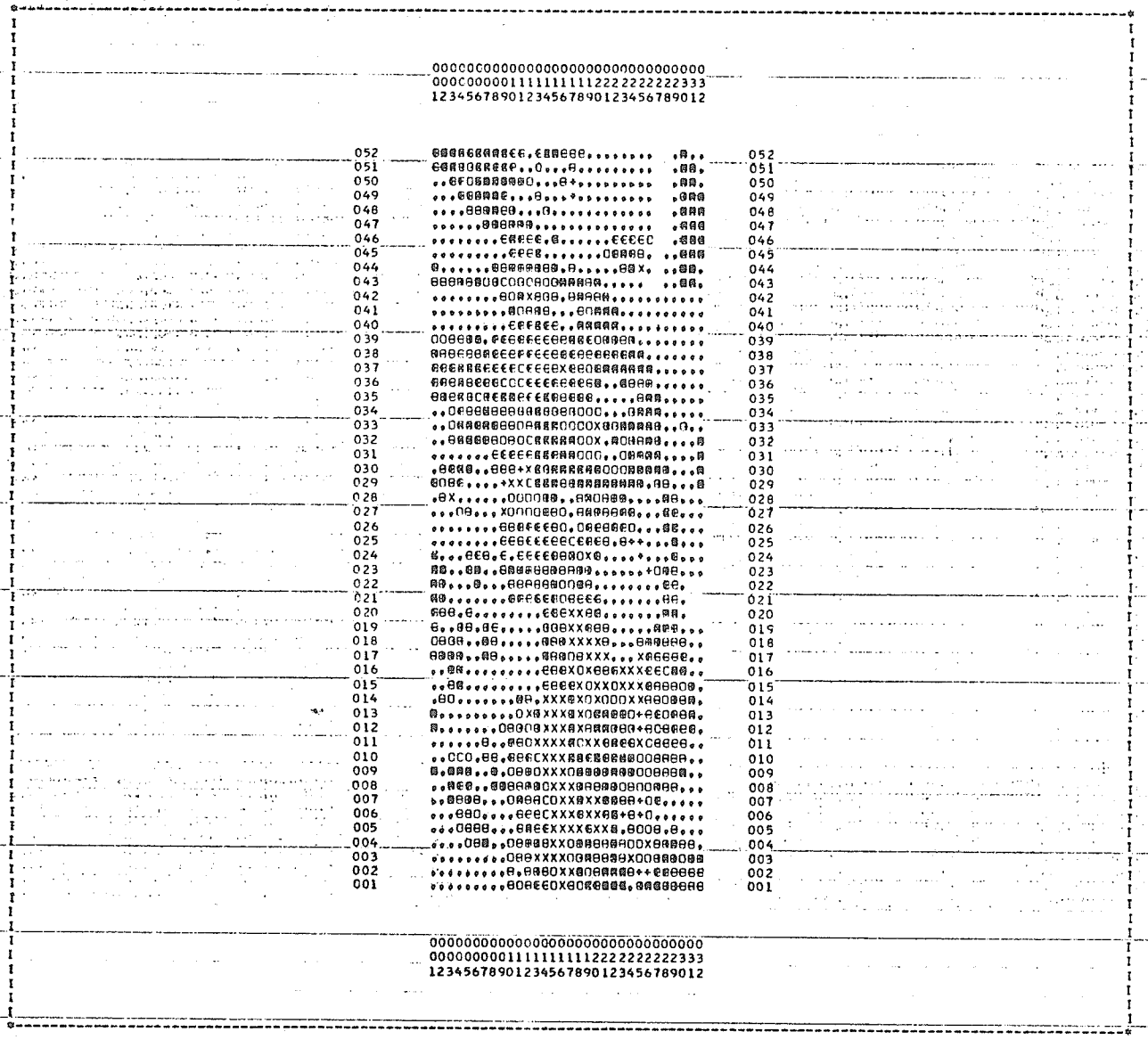
ONE SYMBOL EQUALS ONE ACRE

INDUSTRIAL DEVELOPMENT SUITABILITY (STAGE B)

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	8	@	#	=	A	R
FREQUENCY	24	1034	0	0	0	226	0	0	0	380

MAP 5, SHEET 1, DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

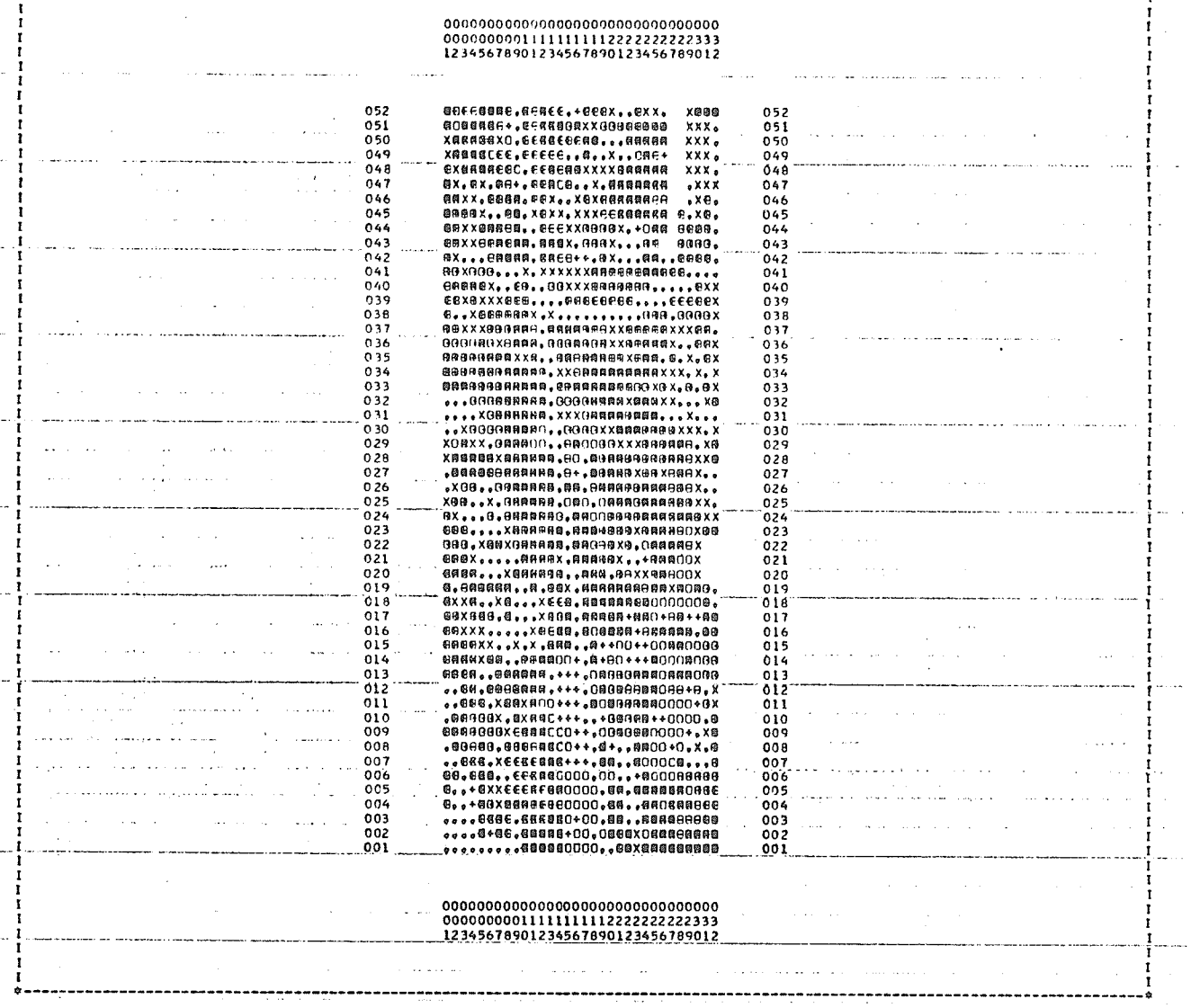
ONE SYMBOL EQUALS ONE ACRE

COMMERCIAL DEVELOPMENT SUITABILITY (STAGE A)

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	.	X	0	8	8	8	8	8	8
FREQUENCY	24	642	15	92	124	269	281	147	31	39

MAP 3, SHEET 1, DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

COMMERCIAL DEVELOPMENT SUITABILITY (STAGE B)

0 WATER
1 DEVELOPMENT CONSTRAINT
2
3 MAJOR SITE MODIFICATIONS
4 EXTENSIVE SITE MODIFICATIONS
5
6 SCATTERED SITE MODIFICATIONS
7
8
9 MINOR SITE MODIFICATIONS

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS		. + X O @								
FREQUENCY	24	302	56	195	110	64	426	88	207	192

SITE FEASIBILITY

7

TOWN PLAN PROPOSALS :

7.01 CONTROL DESIGN
7.02 ENVIRONMENT MOTIVATED DESIGN

7.01 CONTROL DESIGN

The control design is very similar to the Leaf Rapids town plan prepared for Sherritt-Gordon Mines Ltd.[1] This proposed plan is typical of many northern community designs and as such represents a realistic control. The purpose of presenting and testing a control design is to provide a yardstick from which comparative analysis can be established. The value system previously developed in this study is used to evaluate the relative environment/benefit and impact ratings of the control design 7.01 and the environment motivated design 7.02.

The following program represents the projected land use requirements for the final stage of Leaf Rapids with an estimated population of 3500. These requirements formed basic planning criteria for both 7.01 and 7.02 designs.

LAND-USE TYPE	REQUIREMENT
Single family units	1000 units
Multi-family units	800 units
Passive Recreation	
Active Recreation	50 acres
Roads and Utilities	
Industrial	40 acres
Commercial	40 acres

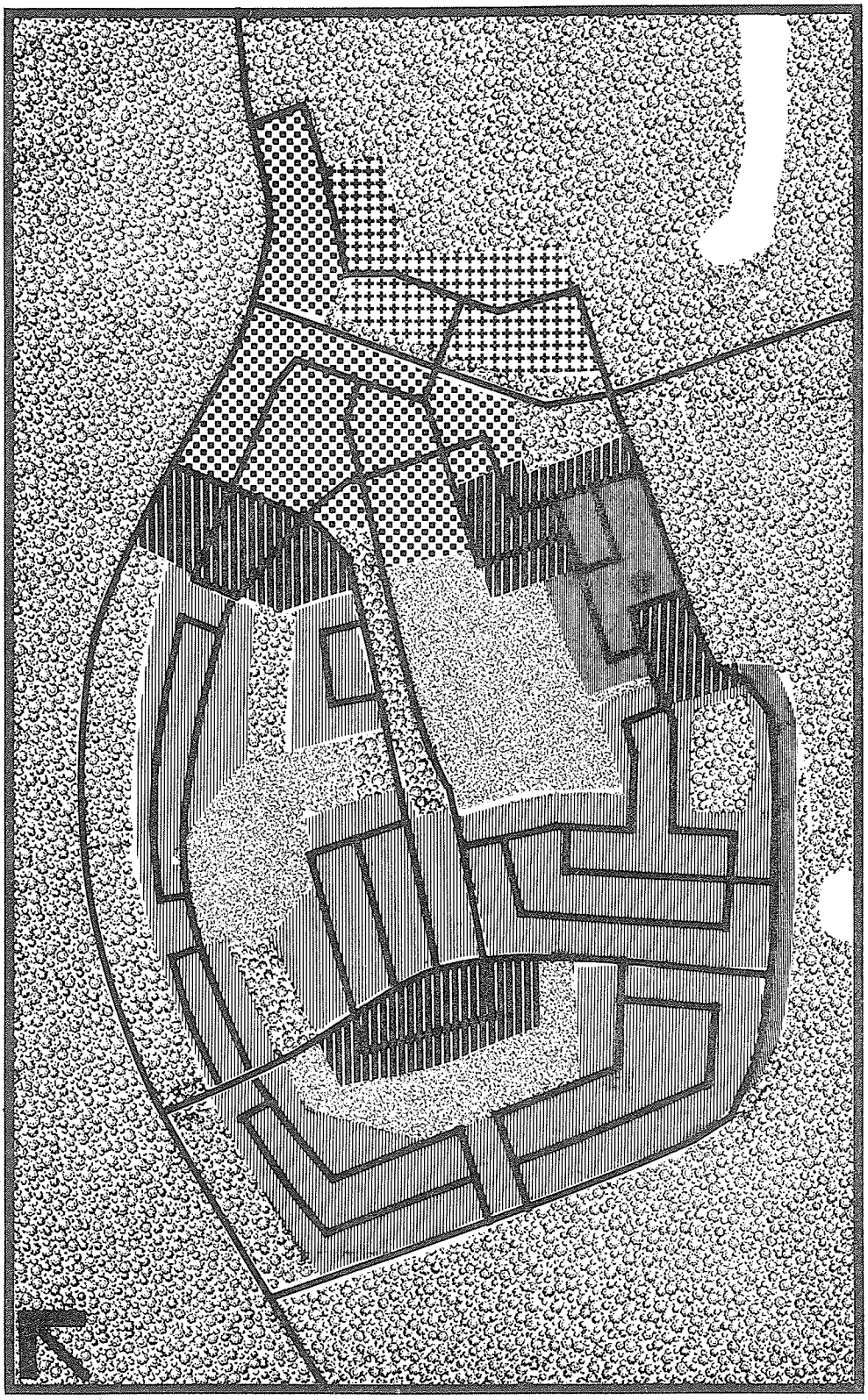
NOTE: All acreages include the necessary area for vehicular circulation and buffer zones.

---

[1] Henderson, D.G. - A Proposal for the Development of Leaf Rapids Townsite, 1970.

7.01 CONTROL DESIGN

SCALE : 0 400 800 1200 IN FEET



SINGLE FAMILY UNITS

OVER 4.5/ CELL

4.5/ CELL

4.0/ CELL

3.0/ CELL

2.0/ CELL

1.0/ CELL

LESS THAN 1.0/ CELL

MULTI-FAMILY

PASSIVE REC.

ACTIVE REC.

ROAD & UTILITY INFRA-STRUCT.

INDUSTRIAL

COMMERCIAL

7.02 ENVIRONMENT MOTIVATED DESIGN

Community design 7.02 is an alternative town plan proposed by the author of this study. The plan is a synthesis of information derived from the computer-aided resource analysis of the site, the program requirements, and the established planning policies.

The primary design consideration, in addition to satisfying area requirements of the land uses, was to comply with the planning guidelines which emphasized a healthy interface between man-made and natural environments. This entailed the locating of each land-use type in an area which optimized the positive attributes of the site while minimizing the undesired negative impacts on the environment. The fundamental design concern therefore evolved into an attempt to achieve a more symbiotic relationship between the built and natural environments.

Several secondary considerations also influenced the final form of the plan.

1) A natural infra-structure within the town was desirable for the following reasons. It was felt that such an infra-structure could:

A) Allow for pedestrian and snowmobile routes with minimal interaction with vehicular traffic.

B) Assist in achieving a visual 'fit' between substantial new development and the mature vegetation of the site.

C) Provide recreational benefits which would be an integral part of the residents' daily experiences. This would also create an opportunity to expose the unique landscape features to public view.

D) Allow for the establishment of ecological preserves which would protect the sensitive indigenous flora and fauna which is usually lost in developments of this kind. These preserves within the community provide the resident with the potential

for perceptual diversity and empathy with his sub-arctic context.

Refer to Recreation policies for a greater elaboration on these design concepts.

2) Since Leaf Rapids was planned after highway 391 was constructed, it was necessary to consider this road as an integral part of the resource base of the town. By utilizing this road as much as possible a reduction in both economic and environmental costs could be facilitated.

3) Existing planning practices and building types have been accepted as planning constraints. These were accepted for two reasons:

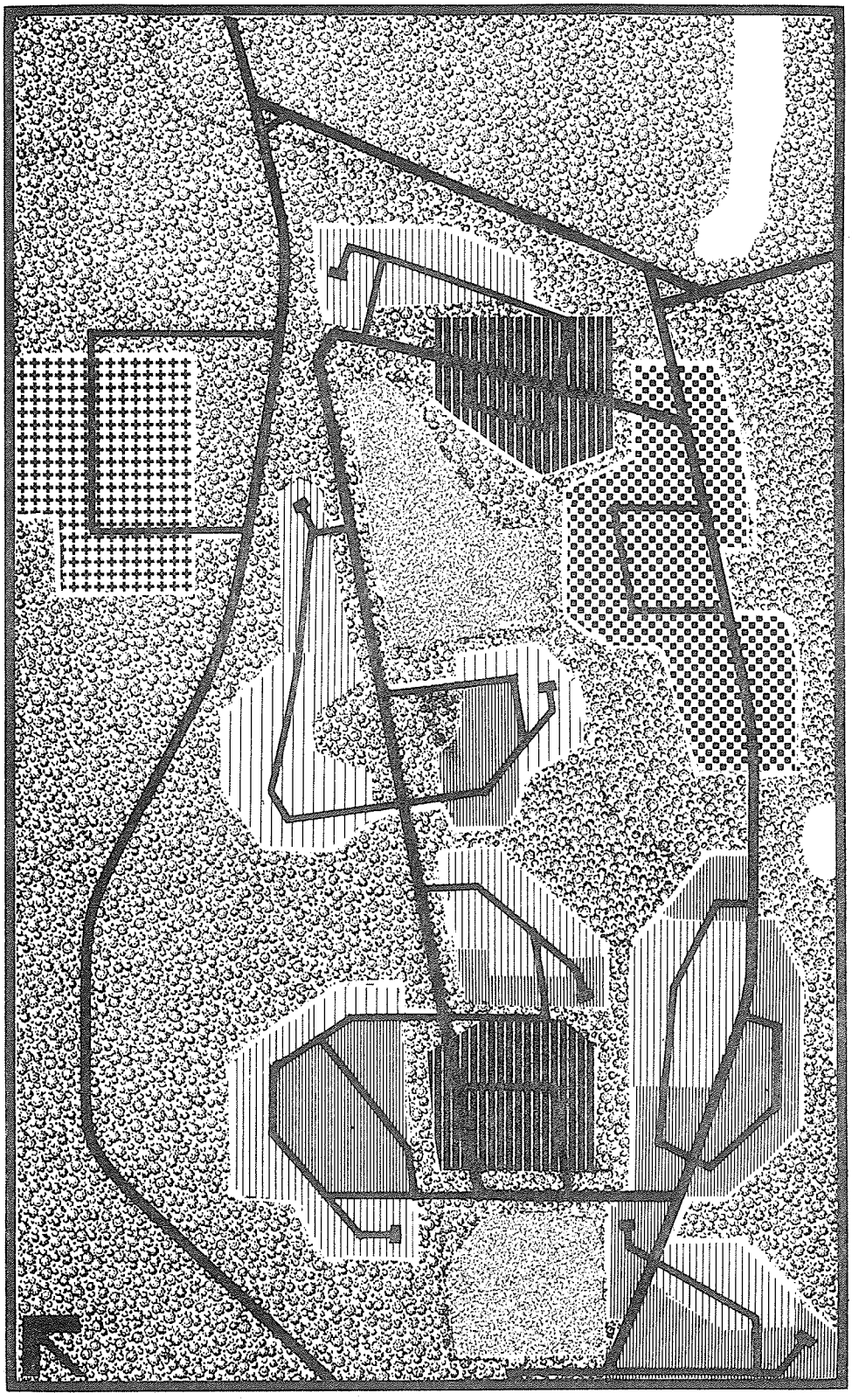
1) Innovative building type and planning techniques would require many considerations that are beyond the scope of this study.

2) By employing similar planning practices as design 7.01 this allows for a greater number of comparative ratings between the two plans.

In this study design innovation occurs when land uses are sensitively sited and their perceptual attributes are capitalized upon to satisfy the visual policies.

7.02 ENVIRONMENT MOTIVATED DESIGN

SCALE : 0 400 800 1200 IN FEET



SINGLE FAMILY UNITS

OVER 4.5/ CELL

4.5/ CELL

4.0/ CELL

3.0/ CELL

2.0/ CELL

1.0/ CELL

LESS THAN 1.0/ CELL

MULTI – FAMILY

PASSIVE REC.

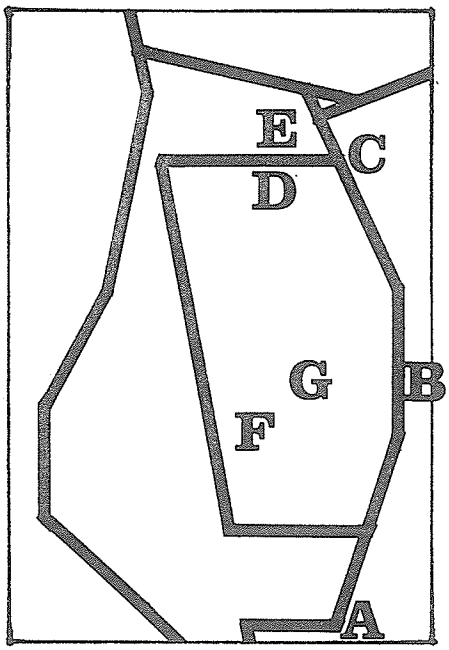
ACTIVE REC.

ROAD & UTILITY INFRA - STRUCT.

INDUSTRIAL

COMMERCIAL

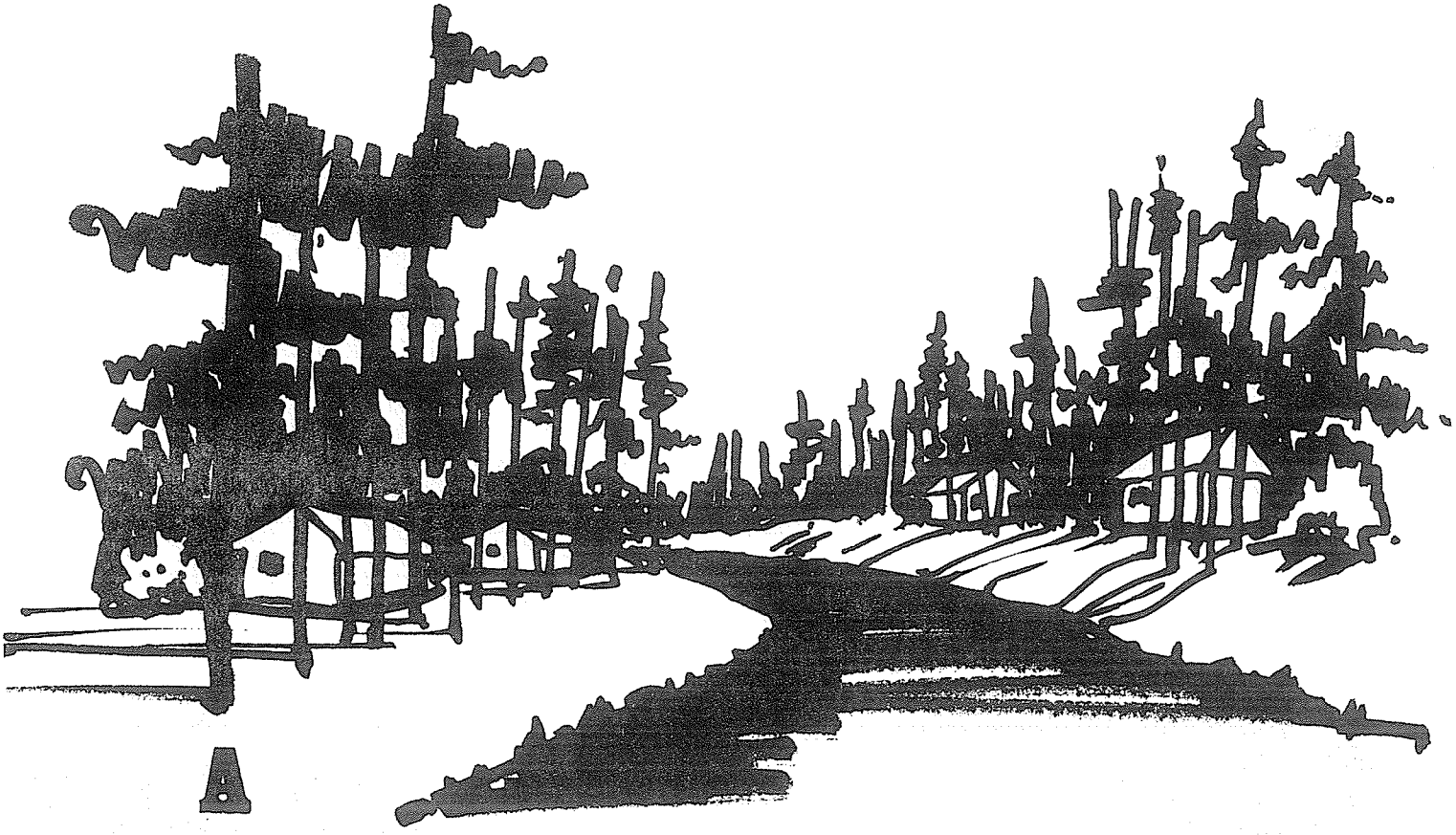
PERCEPTUAL IMAGES OF COMMUNITY DESIGN 7.02

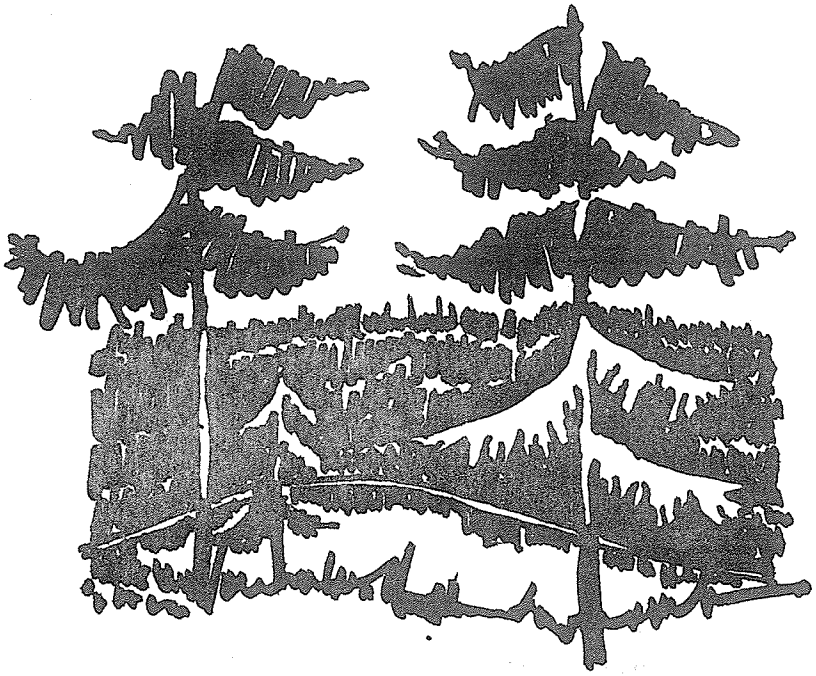


F.17

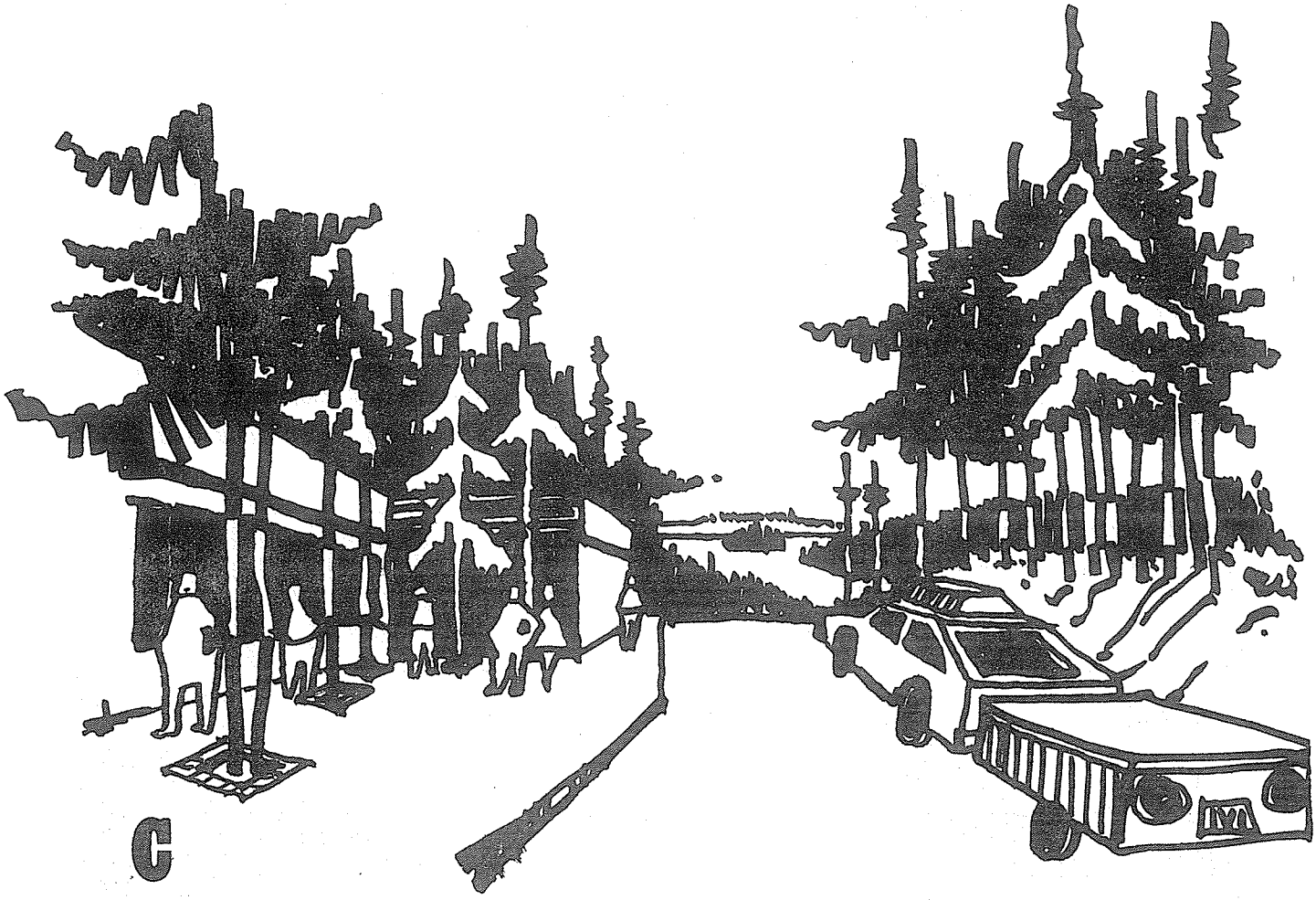
PERCEPTUAL EXPERIENCES :

A-C RESIDENT & TOURIST
D-G RESIDENT





B



C

D

E

F

G

As stipulated within the program the community was designed to allow for development in three stages (see schematic on following page).

STAGE A (population 1900)

This stage includes all the essential functioning community. A concentric circulation system permits the introduction of a natural infra-structure. The loop road is located in the area of greatest suitability thus taking advantage of the most desired foundation conditions and scenic vistas. This establishes the basic structure for the perceptual image of the community. Highway 391 functions as part of the residential circulation system as it is expected that only very light traffic will exist during the first few years.

STAGE B (population 2500)

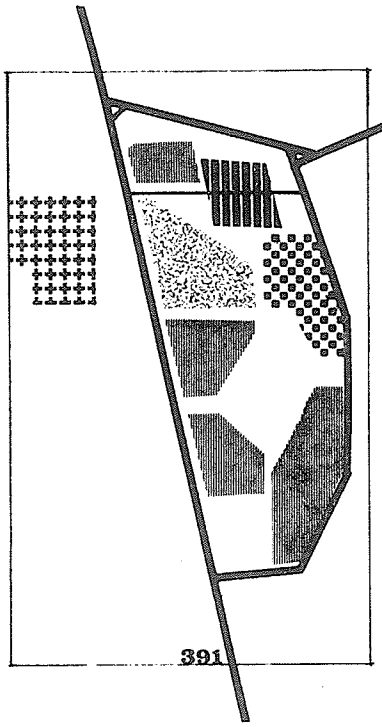
Stage B increases existing residential, commercial and recreational facilities and completes the development on the east side of the highway. To complete development to this point no alterations to highway 391 have been necessary and only minimal extra roads and utilities have been required.

STAGE C (population 3500)

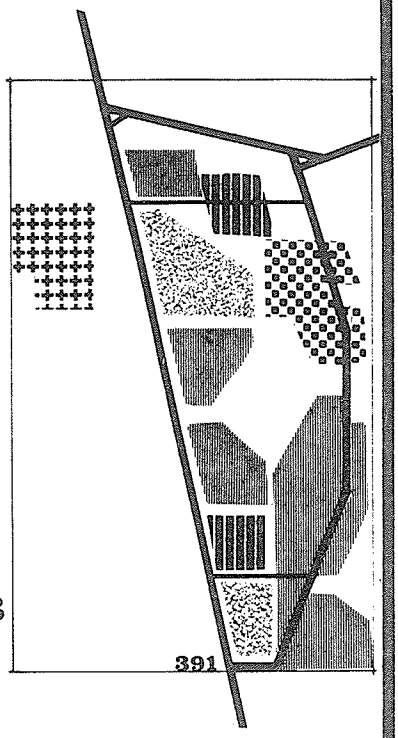
By 1976-78 large increases in traffic along the highway are expected, thus necessitating the separation of residential circulation from highway - oriented traffic. Motorists travelling along highway 391 or the mine road are given the option of circulating through the town or circumventing it via the by-pass. This final stage completes the area requirements for all land uses and develops site B to the upper limits of its carrying capacity.

STAGING OF COMMUNITY DESIGN 7.02

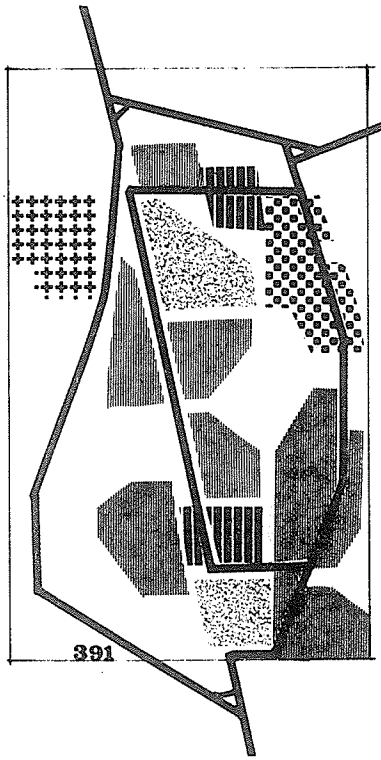
SCHEMATIC



STAGE A
POP. 1900
1971 - 73



STAGE B
POP. 2500
1974 - 75



STAGE C
POP. 3500
1976 - 78

SINGLE FAMILY UNITS

MULTI-FAMILY UNITS

PASSIVE RECREATION

ACTIVE RECREATION

MAJOR ROADS

INDUSTRIAL

COMMERCIAL

IMPACT ANALYSIS

8

IMPACT MEASUREMENTS

RESOURCE VULNERABILITY
PERCEPTUAL VULNERABILITY
ENVIRONMENT / BENEFIT

IMPACT : 7.01 CONTROL DESIGN

IMPACT : 7.02 ENVIRONMENT MOTIVATED DESIGN

RESOURCE VULNERABILITY

This area of study is primarily concerned with the negative undesired ecological and perceptual impacts on the environment. An environment impact scale originated by Carl Steinitz* has been adjusted to suit the environmental context of Leaf Rapids and the established guidelines. The four level scale establishes the degree of undesired environmental impact generated by development activities. (The criteria for the differentiation of the four levels has resulted from consultation with professionals experienced in subarctic ecology.)

1) COMPATIBLE IMPACT - The natural environment is not affected by development activities or the accepted level of impact is not exceeded.

2) MODERATE IMPACT - The land-use inputs create undesired secondary ecological consequences that causes an imbalance in the eco-system. It is expected that the system should be able to adjust without major damage.

3) SEVERE IMPACT - The environment is disturbed in such a way that an undesirable retrogressive ecological state is innitiated. This results in major damage which destroys many of the environmental attributes.

4) THRESHOLD IMPACT - The land use activities initiate undesired perturbation of the natural environment resulting in a total breakdown of the eco-system.

IMPACT EVALUATION TECHNIQUE

Resource capability for strip and cluster inputs is subdivided into two stages of analysis: the area displaced by the development and the area

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* Department of Landscape Architecture, Harvard-Honey Hill: A Systems Analysis for Planning the Multiple use of Controlled Water Areas. 1969

around the periphery of the development. For these input types a two stage impact analysis is employed.

STAGE 'A'

This level of measurement concerns itself with the scale of secondary ecological consequences created by the displacement of the vegetation. For example; areas that are able to support the development without changes to the surrounding ecological balances will receive a 'compatible' impact rating. The opposite extremes are those areas in which displacement of the vegetation causes a major ecological breakdown of the surrounding area. This will be rated as a 'threshold' impact.

STAGE 'B'

The second level of impact deals with the area immediately around the development. These impact ratings will result from the ability or inability of the environment to support the activities associated with the development. For example; if the area can support the activities without being negatively affected this will be rated as a 'compatible' impact. (Refer to Appendix B.1 for evaluating technique for the two stages.)

VISUAL IMPACT GUIDELINES

The visual guidelines (refer to SITE CAPABILITY) establish the levels of vegetation absorption required to visually absorb the land-use inputs to a specified degree. Activities located in areas not able to visually absorb them to the degree specified negatively affect the visual health of the community. Unwanted visual information will be considered as having a negative impact on the perceptual environment and will be subject to the same environmental impact scale.

COMMUNITY IMAGE -
VISUAL IMPACT GUIDELINES

LAND-USE INPUT	ABSORPTION LEVEL								
	1	2	3	4	5	6	7	8	9
COMMERCIAL									
INDUSTRIAL									
STRIP & CLUSTER RES.									
POINT RESIDENCE									
ACTIVE RECREATION									
PASSIVE RECREATION									

(CONSENSUS OF PROFESSIONAL OPINION)

THRESHOLD

SEVERE

MODERATE

COMPATIBLE

F.18

The ecological and perceptual implications of land-use inputs on the natural resource system have been discussed as an integral component of SITE CAPABILITY. Therefore the judgements regarding the level of ecological impact are in part based on those discussions and need not be repeated.

RESIDENTIAL POINT INPUT (S.F.U.)

The following value systems represent resource vulnerability (environmental impact potential) that would be created by the construction of single family units at the Leaf Rapids site.

SOIL VULNERABILITY (EROSION)

A) TOPOGRAPHIC SLOPE

	0	water
	1	0%-4%, 4%-8%, 8%-12%, 12%-16%, 16%-20%
COMPATIBLE	2	
	3	
MODERATE	4	
	5	
SEVERE	6	
	7	
	8	
THRESHOLD	9	over 20%

B) SOILS: BY COMPOSITION

	0	water
	1	
COMPATIBLE	2	well graded sand (gravel)
	3	
MODERATE	4	poorly graded sand (gravel)
	5	
SEVERE	6	sand, silt, clay
	7	
	8	
THRESHOLD	9	silts, clay and organic peat.

WATER REGIME VULNERABILITY (S.F.U.)

A) SURFACE DRAINAGE

	0	water
	1	
COMPATIBLE	2	well drained
	3	
MODERATE	4	drainage pattern (heavy storms)
	5	
SEVERE	6	minor surface runoff (seasonal)
	7	
	8	
THRESHOLD	9	poorly drained wetlands, intermittent creek, swales.

B) SUB-SURFACE DRAINAGE (DEPTH TO WATERTABLE)

	0	water
	1	
COMPATIBLE	2	over 8 feet
	3	
MODERATE	4	
	5	
SEVERE	6	6 feet - 8 feet
	7	
	8	
THRESHOLD	9	0 feet - 2 feet, 2 feet - 4 feet, 4 feet - 6 feet.

VEGETATION VULNERABILITY (S.F.U.)

	0	water
	1	
COMPATIBLE	2	Groups seven, eight, nine
	3	
MODERATE	4	Groups five, six
	5	
SEVERE	6	Group four
	7	
	8	
THRESHOLD	9	Groups one, two, three

(Groups defined by the stability of vegetation types)

PERCEPTUAL RESOURCE VULNERABILITY (S.F.U.)

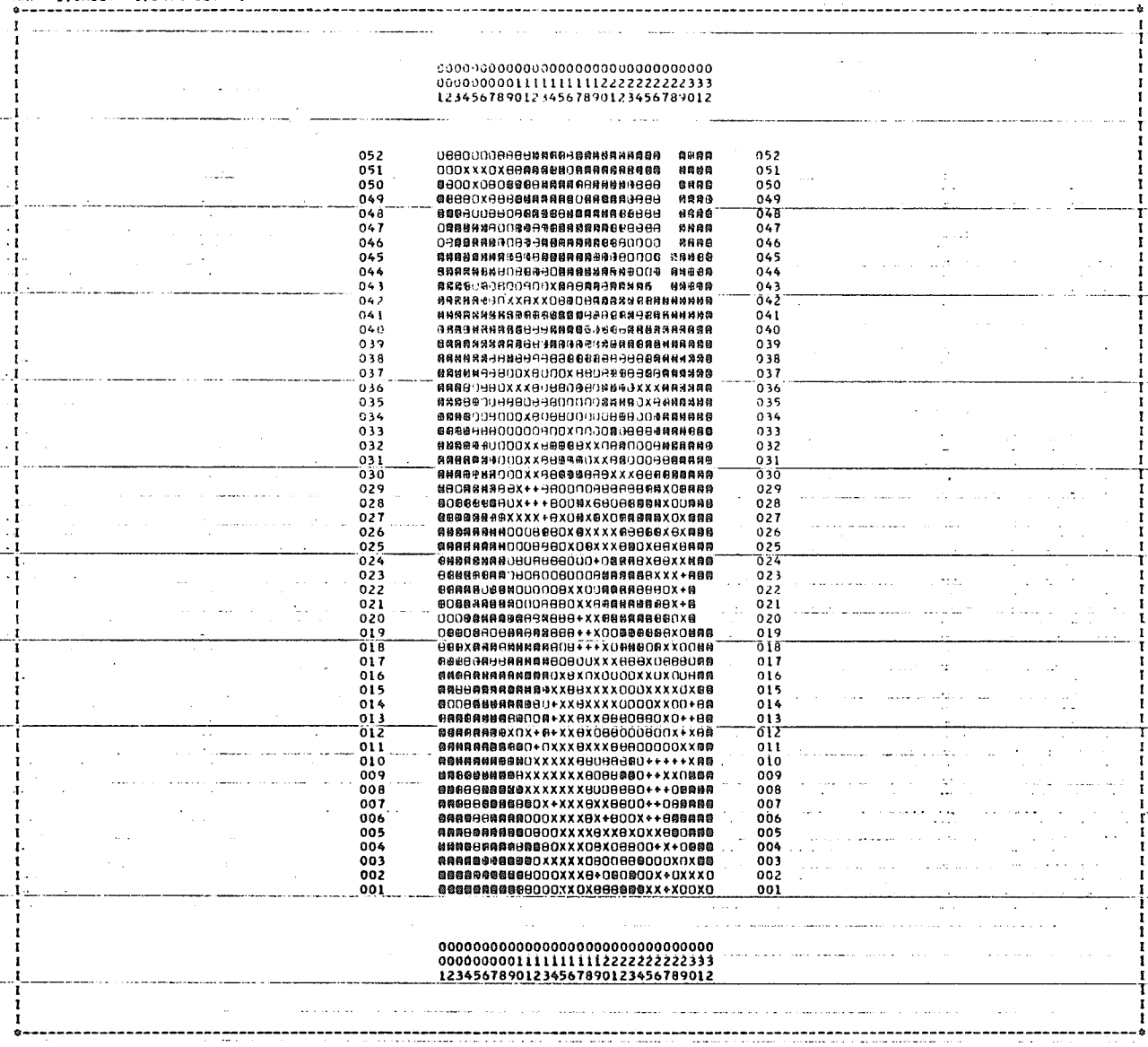
	0	water
	1	
COMPATIBLE	2	Groups five, six, seven, eight, nine
	3	
MODERATE	4	Group four
	5	
SEVERE	6	Group three
	7	
	8	
THRESHOLD	9	Groups one, two

(Groups defined by the ability of the vegetation to visually absorb land-use input.)

COMBINED RESOURCE SYSTEM VULNERABILITY (S.F.U.)	WT.
SOIL VULNERABILITY (EROSION)	1.25
WATER REGIME VULNERABILITY	1.50
VEGETATION VULNERABILITY	1.75
PERCEPTUAL RESOURCE VULNERABILITY	1.00

The map on the subsequent page defines the areas in terms of their potential vulnerability to residential impact.

MAP 1, SHEET 1, DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

UNIVERSITY OF MANITOBA

SINGLE FAMILY UNIT IMPACT ANALYSIS
LAND USE CODE

0 WATER
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	:	X	0	8	@	#	A	M	W
FREQUENCY	24	0	46	201	263	297	220	248	305	60

5889

RESIDENTIAL STRIP AND CLUSTER INPUT (M.F.U.)

Resource vulnerability and impact potential created by the construction of multi-family units in the following circumstances.

STAGE 'A'

SOIL VULNERABILITY (EROSION)

A) TOPOGRAPHIC SLOPE

	0	water
	1	
COMPATIBLE	2	0% - 4%
	3	
MODERATE	4	4% - 8%
	5	
SEVERE	6	8% -12%
	7	
	8	
THRESHOLD	9	12% - 16%, 16% - 20%, over 20%

B) SOILS: BY COMPOSITION

	0	water
	1	
COMPATIBLE	2	well graded sand
	3	
MODERATE	4	poorly graded sand
	5	
SEVERE	6	sand, silt, clay
	7	
	8	
THRESHOLD	9	silt, clay, and organic peat

WATER REGIME VULNERABILITY (M.F.U.)

A) SURFACE DRAINAGE

	0	water
	1	
COMPATIBLE	2	well drained
	3	
MODERATE	4	drainage pattern (heavy storms)
	5	
SEVERE	6	minor surface runoff (seasonal)
	7	
	8	
THRESHOLD	9	poorly drained wetlands, intermittent creek, swales.

B) SUB-SURFACE DRAINAGE (DEPTH TO WATERTABLE)

	0	water
	1	
COMPATIBLE	2	over 8 feet
	3	
MODERATE	4	
	5	
SEVERE	6	6 feet - 8 feet
	7	
	8	
THRESHOLD	9	0 feet - 2 feet, 2 feet - 4 feet, 4 feet - 6 feet.

VEGETATION VULNERABILITY (M.F.U.)

	0	water
	1	
COMPATIBLE	2	Groups one, two, three
	3	
MODERATE	4	Groups four, five
	5	
SEVERE	6	Group six
	7	
	8	
THRESHOLD	9	Groups seven, eight, nine

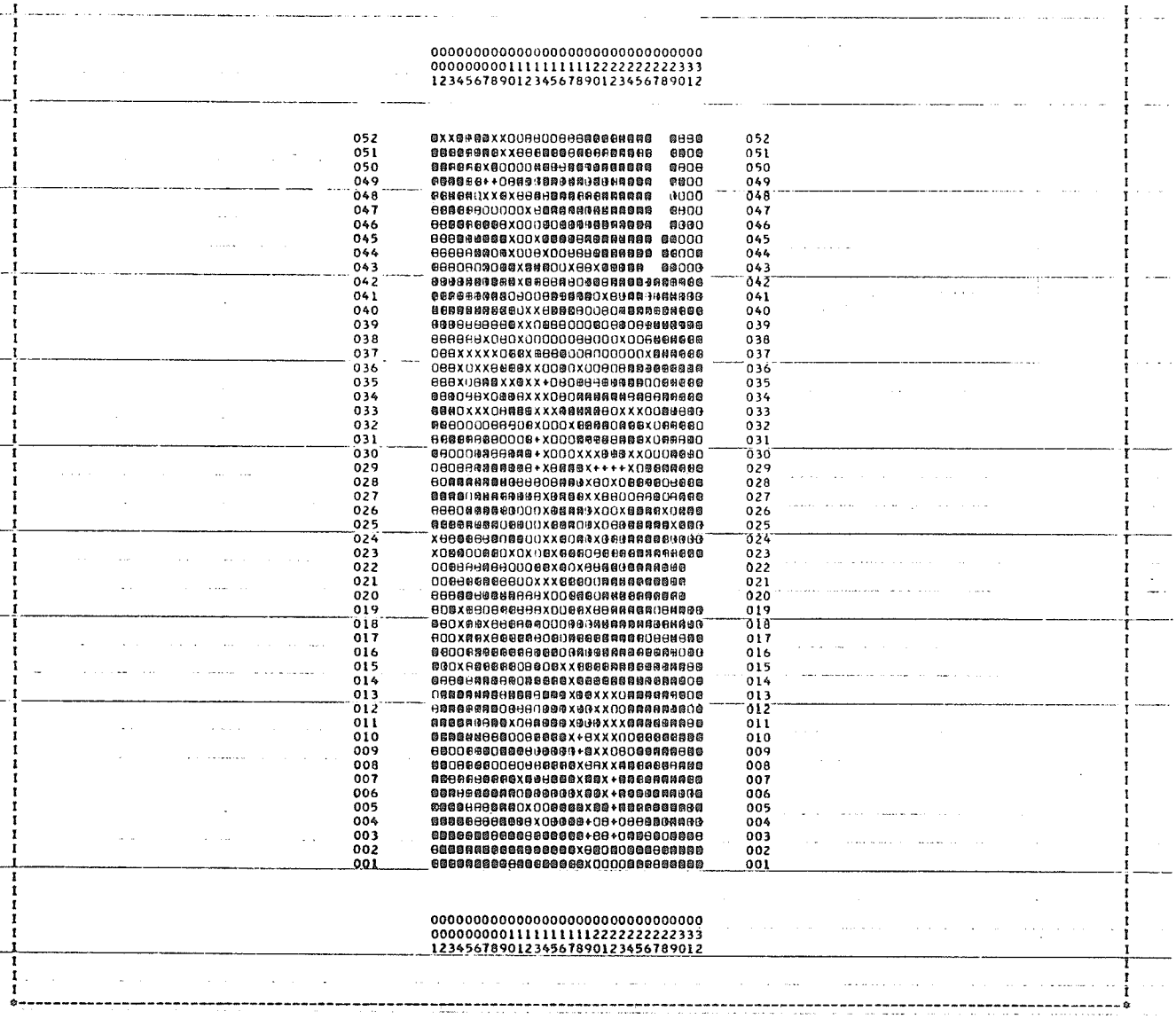
NOTE: As one exceeds 50% of the area covered by trees, clearing and grubbing increases the potential of severe soil erosion. The destruction of vegetation types that are most suitable for other activities is considered one of the components of environmental impact.

COMBINED RESOURCE SYSTEM VULNERABILITY (M.F.U.)

STAGE 'A'

	WT.
SOIL VULNERABILITY (EROSION)	1.25
WATER REGIME VULNERABILITY	1.50
VEGETATION VULNERABILITY	1.75

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

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MULTI-FAMILY UNIT IMPACT ANALYSIS (STAGE A)
LAND USE CODE

0 WATER
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	#	@	&	$	A	%
FREQUENCY	24	0	19	141	238	240	550	335	50	67

RESIDENTIAL STRIP AND CLUSTER INPUT (M.F.U.)

STAGE 'B'

VEGETATION VULNERABILITY (M.F.U.)

	0	water
	1	
COMPATIBLE	2	Groups four, six, seven, eight
	3	
MODERATE	4	Groups nine, five
	5	
SEVERE	6	
	7	
	8	
THRESHOLD	9	Groups one, two, three

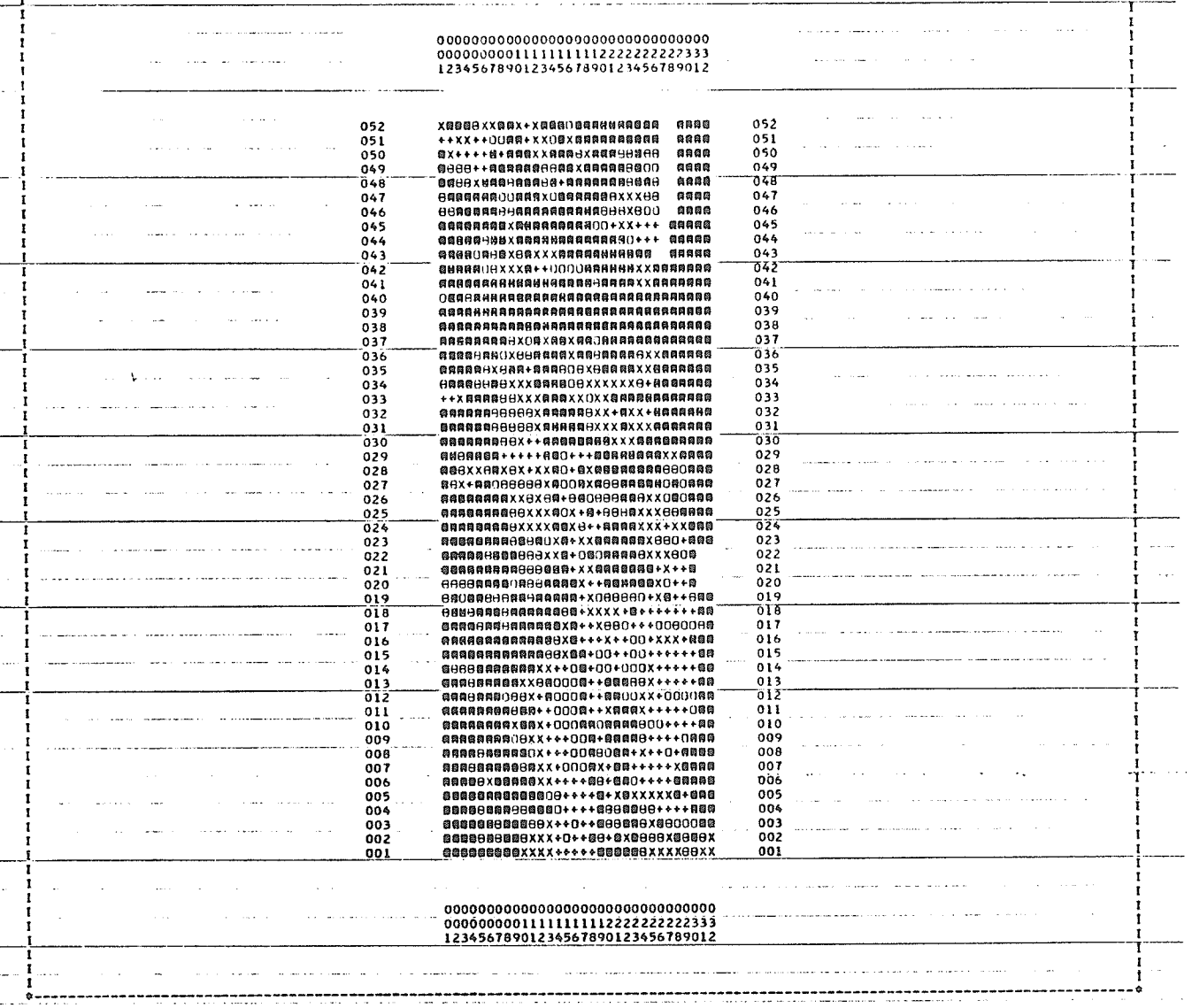
PERCEPTUAL RESOURCE VULNERABILITY (M.F.U.)

	0	water
	1	
COMPATIBLE	2	Groups seven, eight, nine
	3	
MODERATE	4	Groups five, six
	5	
SEVERE	6	Groups three, four
	7	
	8	
THRESHOLD	9	Groups one, two

COMBINED RESOURCE SYSTEM VULNERABILITY (M.F.U.)

STAGE'B'	WT.
VEGETATION VULNERABILITY	1.75
PERCEPTUAL RESOURCE VULNERABILITY	1.00

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

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MULTI-FAMILY UNIT IMPACT ANALYSIS (STAGE B)
LAND USE CODE

0 WATER
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	@	A	H	X	0	@
FREQUENCY	24	0	185	190	100	197	0	45	95	828

PASSIVE RECREATION INPUT (P. REC.)

Resource vulnerability and impact potential is created by the location of passive recreation areas in the following circumstances.

VEGETATION VULNERABILITY (P. REC.)

	0	water
	1	
COMPATIBLE	2	Groups four, five,six, seven, eight, nine
	3	
MODERATE	4	Group three
	5	
SEVERE	6	Groups one, two
	7	
	8	
THRESHOLD	9	

(Groups defined by vegetation stability)

PERCEPTUAL RESOURCE VULNERABILITY (P. REC.)

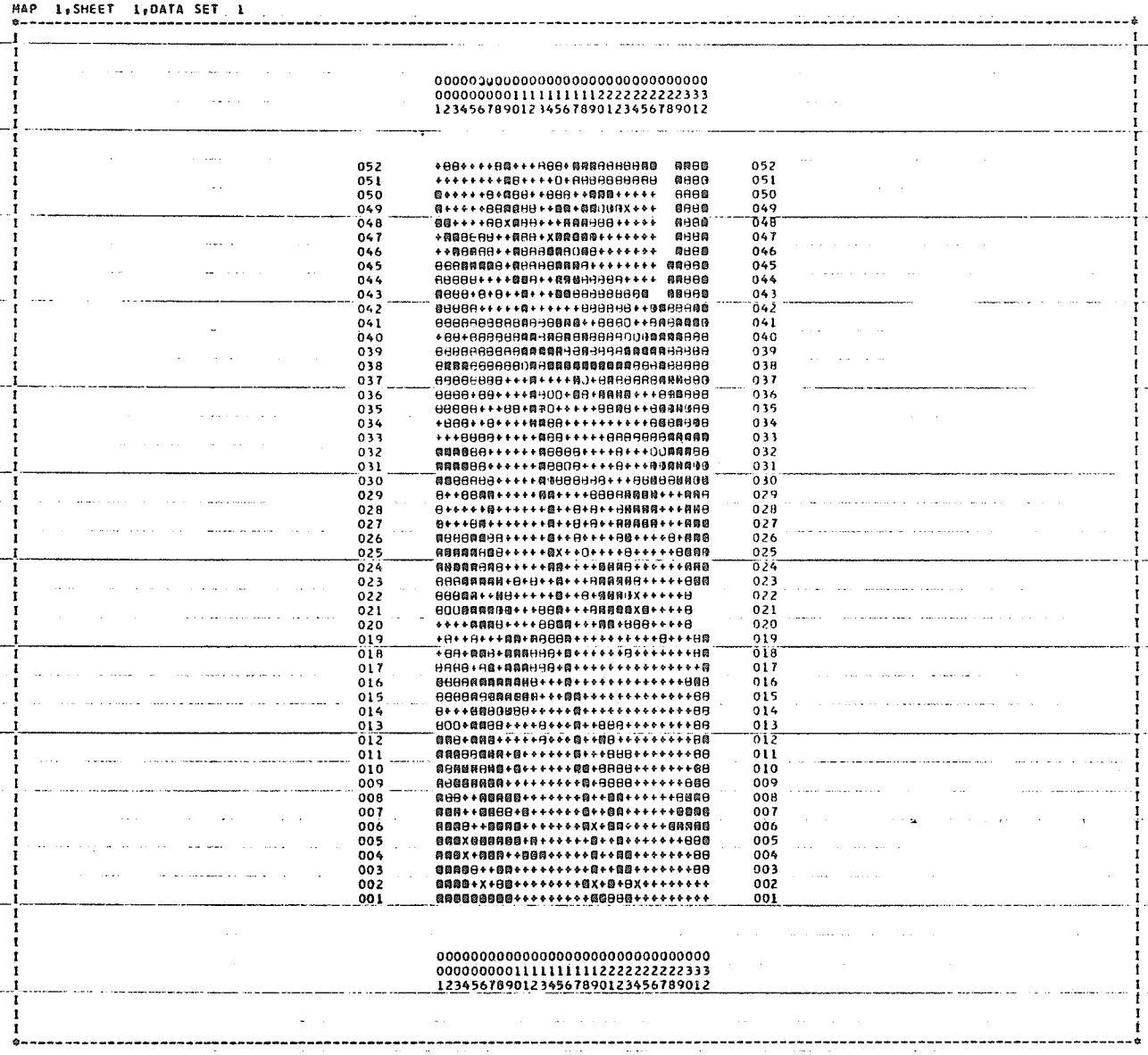
	0	water
	1	
COMPATIBLE	2	Groups three, four, five, six, seven, eight, nine
	3	
MODERATE	4	Groups one, two
	5	
SEVERE	6	
	7	
	8	
THRESHOLD	9	

(Groups defined by ability to absorb land-use input)

COMBINED RESOURCE SYSTEM VULNERABILITY (P. REC.)

	WT.
VEGETATION VULNERABILITY	1.75
PERCEPTUAL RESOURCE VULNERABILITY	1.00

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

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PASSIVE RECREATION IMPACT ANALYSIS
LAND USE CODE

0 WATER
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	.	X	0	0	0	0	#	#	#
FREQUENCY	24	0	705	12	0	456	43	0	201	223

ACTIVE RECREATION INPUT (A. REC.)

Resource vulnerability and impact potential is created by the location and construction of active recreation areas in the following circumstances.

STAGE 'A'

SOIL VULNERABILITY (EROSION)

A) TOPOGRAPHIC SLOPE

	0	water
	1	
COMPATIBLE	2	0% - 4%
	3	
MODERATE	4	4% - 8%
	5	
SEVERE	6	8% -12%
	7	
	8	
THRESHOLD	9	12% - 16%, 16% - 20%, over 20%

NOTE: Since active recreation cannot function on slopes the potential impact created by cut and fill practices needed to level off a site would severely damage the water regime with a commensurate loss of surrounding vegetation.

B) SOILS: BY COMPOSITION

	0	water
	1	
COMPATIBLE	2	well graded sand (gravel)
	3	
MODERATE	4	poorly graded sand (gravel)
	5	
SEVERE	6	sand, silt, clay
	7	
	8	
THRESHOLD	9	silt, clay, and organic peat.

WATER REGIME VULNERABILITY (A. REC.)

	0	water
	1	
COMPATIBLE	2	well drained
	3	
MODERATE	4	drainage pattern (heavy storm)
	5	
SEVERE	6	minor surface runoff (seasonal)
	7	
	8	
THRESHOLD	9	poorly drained wetlands, intermittent creek, and swales.

(Levels defined by surface drainage types)

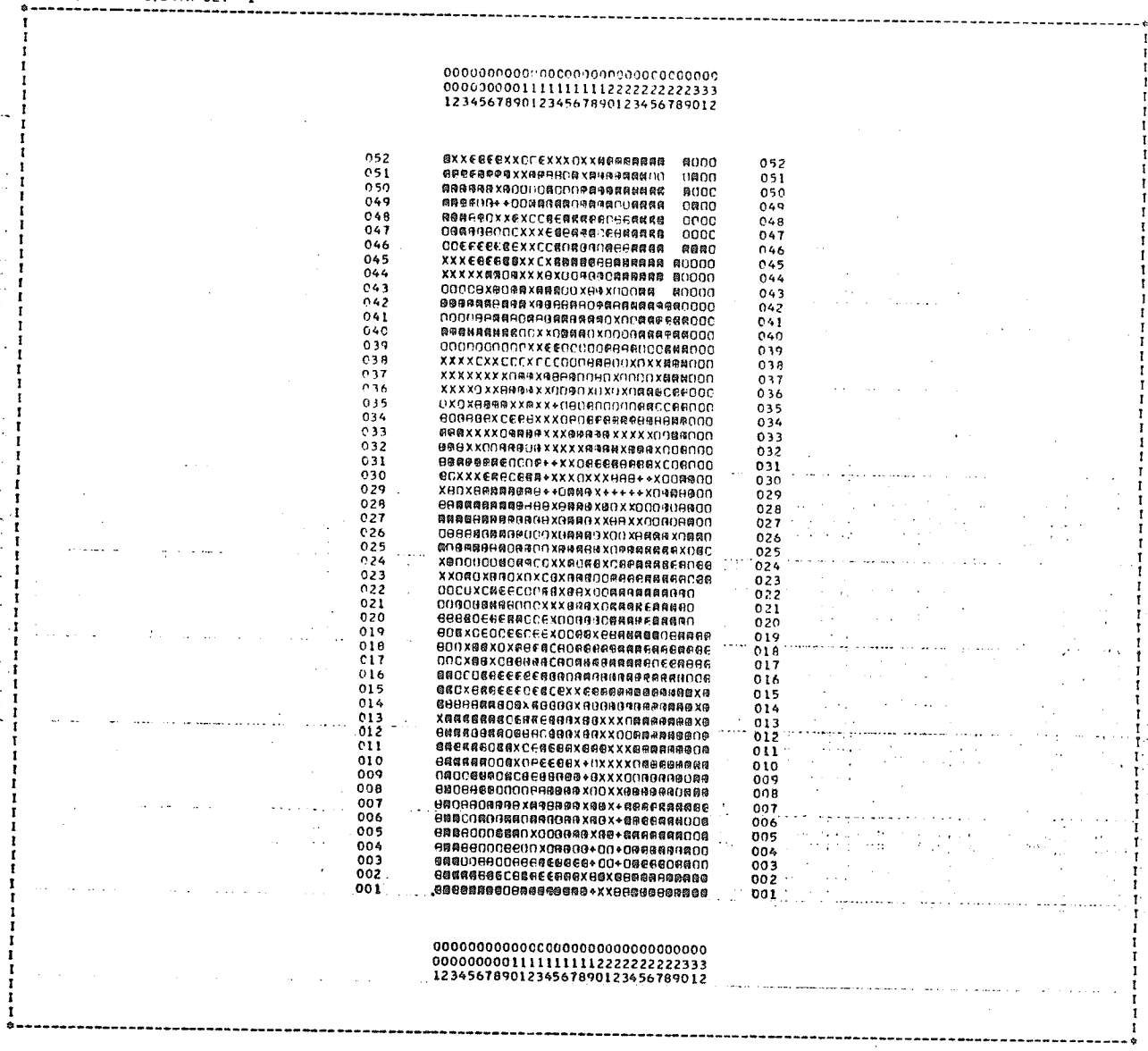
VEGETATION VULNERABILITY (A. REC.)

	0	water
	1	
COMPATIBLE	2	Groups one, two, three
	3	
MODERATE	4	Groups four, five
	5	
SEVERE	6	Group six
	7	
	8	
THRESHOLD	9	Groups seven, eight, nine

COMBINED RESOURCE SYSTEM VULNERABILITY (A. REC.)

STAGE 'A'	WT.
SOIL VULNERABILITY	1.50
WATER REGIME VULNERABILITY	1.50
VEGETATION VULNERABILITY	1.75

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

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ACTIVE RECREATION IMPACT ANALYSIS (STAGE A)
LAND USE CODE

0 WATER
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	24	0	29	214	388	149	497	272	51	48

ACTIVE RECREATION INPUT (A. REC.)

STAGE 'B'

VEGETATION VULNERABILITY (A. REC.)

	0	water
	1	
COMPATIBLE	2	Groups four, six, seven, eight
	3	
MODERATE	4	Groups five, nine
	5	
SEVERE	6	
	7	
	8	
THRESHOLD	9	Groups one, two, three

NOTE: vegetation with dense understory will suffer moderate impact.

PERCEPTUAL RESOURCE VULNERABILITY (A. REC.)

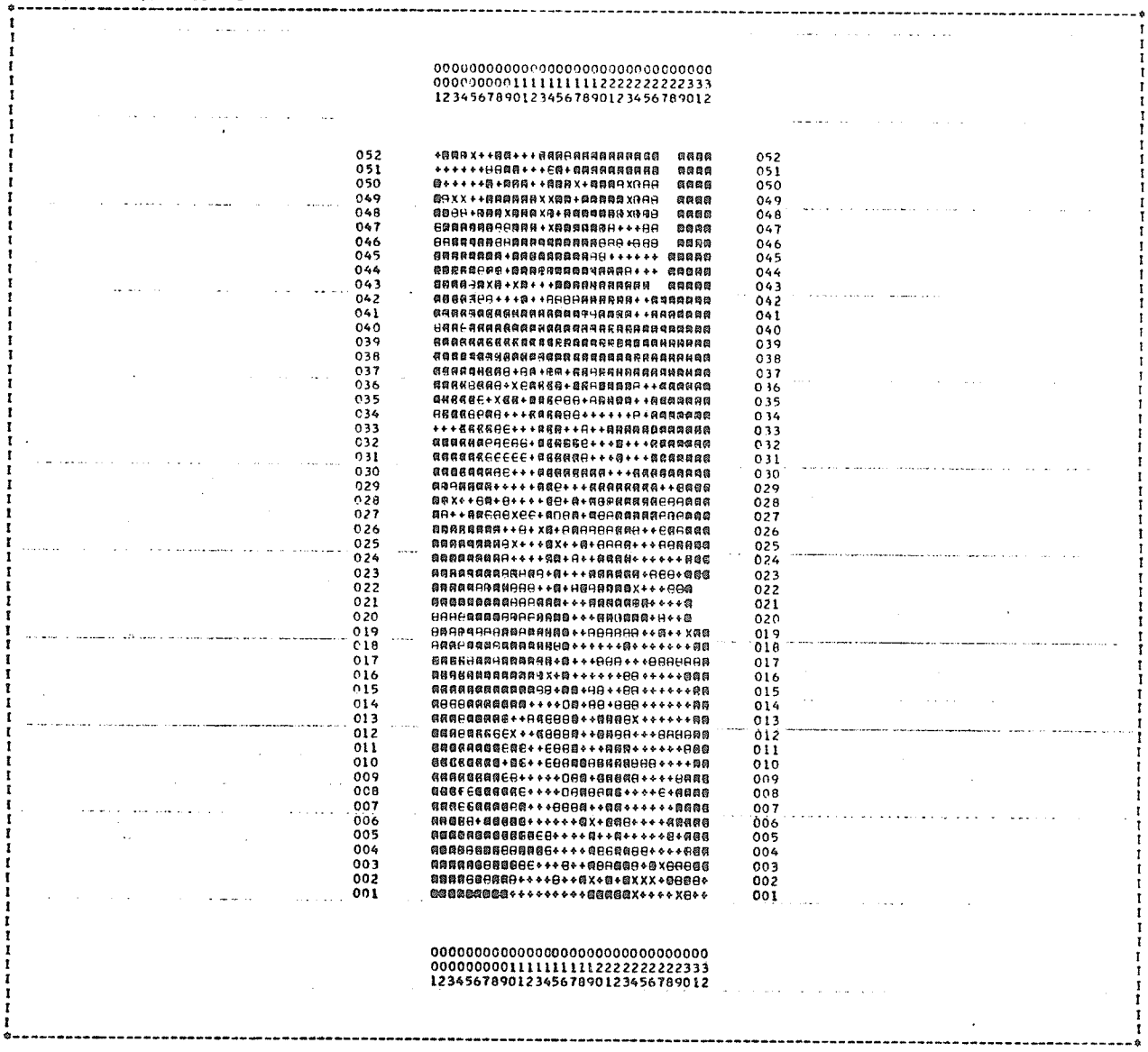
	0	water
	1	
COMPATIBLE	2	Groups five, six, seven, eight, nine
	3	
MODERATE	4	Groups one, two, three, four
	5	
SEVERE	6	
	7	
	8	
THRESHOLD	9	

(Groups defined by visual absorption capability of the landscape.)

COMBINED RESOURCE SYSTEM VULNERABILITY (A. REC.)

STAGE 'B'	WT.
VEGETATION VULNERABILITY	1.75
PERCEPTUAL RESOURCE VULNERABILITY	1.00

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

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ACTIVE RECREATION IMPACT ANALYSIS (STAGE 8)
LAND USE CODE

0 WATER
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	#	@	&	$	%	*
FREQUENCY	24	0	379	34	0	263	45	0	434	489

ROAD AND UTILITY INFRA-STRUCTURE (R. & U.)

Resource vulnerability and impact potential created by the construction of road and utility infra-structure under the following circumstances.

SOIL VULNERABILITY (R. & U.)

A) TOPOGRAPHIC SLOPE

	0	water
	1	
COMPATIBLE	2	0% - 4%, 4% - 8%
	3	
MODERATE	4	8% - 12%
	5	
SEVERE	6	
	7	
	8	
THRESHOLD	9	12% - 16%, 16% - 20%, over 20%

B) SOIL: BY COMPOSITION

	0	water
	1	
COMPATIBLE	2	well graded sand (gravel)
	3	
MODERATE	4	poorly graded sand (gravel)
	5	
SEVERE	6	sand, silt, clay
	7	
	8	
THRESHOLD	9	silt, clay and organic peat.

WATER REGIME VULNERABILITY (R. & U.)

A) SURFACE DRAINAGE

	0	water
	1	
COMPATIBLE	2	well drained
	3	
MODERATE	4	drainage pattern (heavy storms)
	5	
SEVERE	6	minor surface runoff (seasonal)
	7	
	8	
THRESHOLD	9	poorly drained wetlands, intermittent creek, swales.

B) SUB-SURFACE DRAINAGE

	0	water
	1	
COMPATIBLE	2	over 8 feet
	3	
MODERATE	4	6 feet - 8 feet
	5	
SEVERE	6	
	7	
	8	
THRESHOLD	9	0 feet - 2 feet, 2 feet - 4 feet, 4 feet - 6 feet

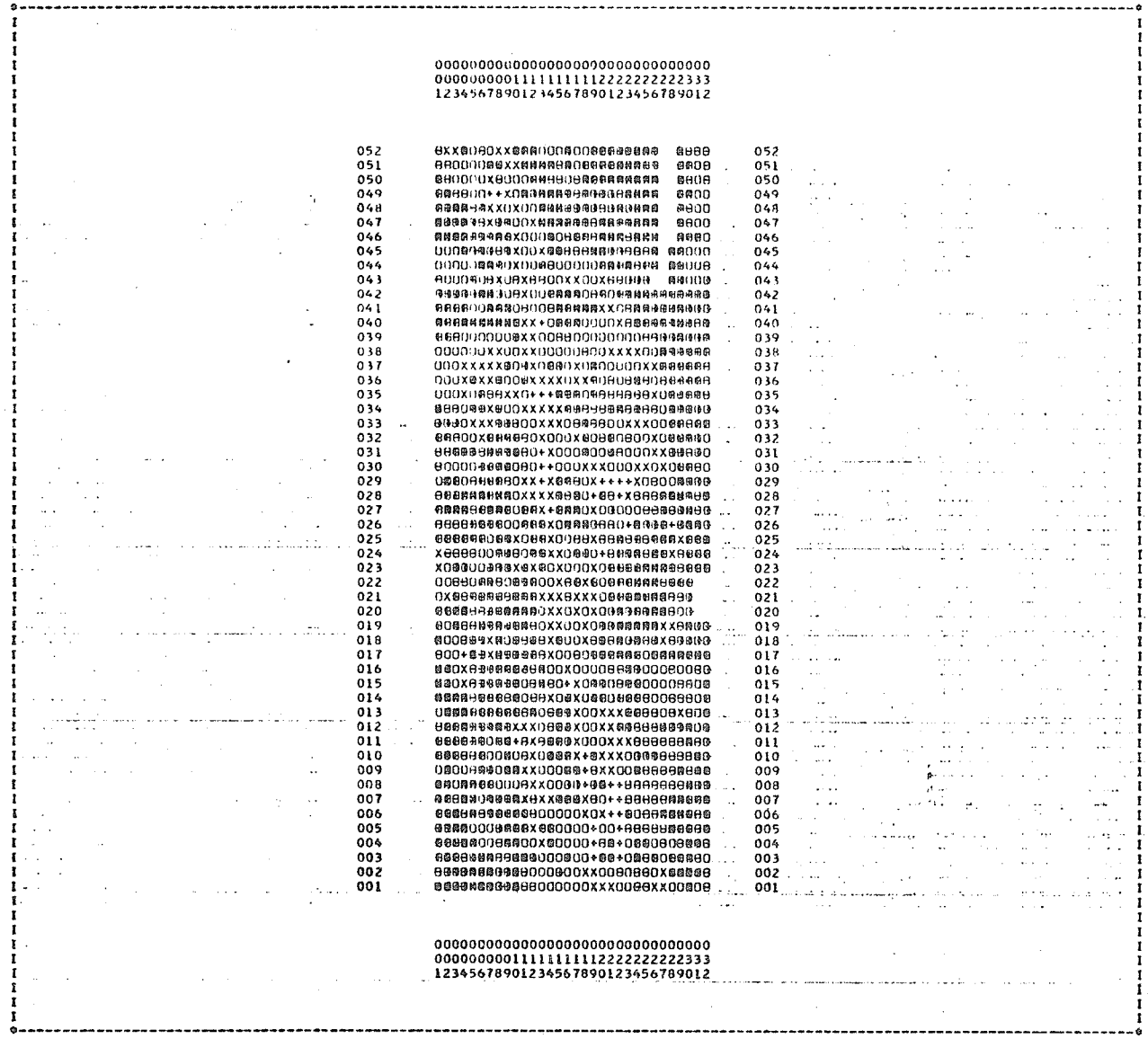
VEGETATION VULNERABILITY

	0	water
	1	
COMPATIBLE	2	Groups one, two, three
	3	
MODERATE	4	Groups six, eight
	5	
SEVERE	6	Group five
	7	
	8	
THRESHOLD	9	Groups four, five, nine

COMBINED RESOURCE SYSTEM VULNERABILITY (R. & U.)

	WT.
SOIL VULNERABILITY	1.50
WATER REGIME VULNERABILITY	1.50
VEGETATION VULNERABILITY	1.75

MAP 1, SHEET 1, DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

UNIVERSITY OF MANITOBA

ROAD AND UTILITY IMPACT ANALYSIS
LAND USE CODE

0 WATER
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	o	+	X	O	0	#	@	A	%
FREQUENCY	24	0	38	187	378	276	529	146	39	47

INDUSTRIAL INPUT (IND.)

Resource vulnerability and impact potential created by the location and construction input in the following circumstances.

STAGE 'A'

SOIL VULNERABILITY (IND.)

A) TOPOGRAPHIC SLOPE

	0	water
	1	
COMPATIBLE	2	0% - 4%
	3	
MODERATE	4	4% - 8%
	5	
SEVERE	6	8% -12%
	7	
	8	
THRESHOLD	9	12% - 16%, 16% - 20%, over 20%

B) SOILS: BY COMPOSITION

	0	water
	1	
COMPATIBLE	2	well graded sand (gravel)
	3	
MODERATE	4	poorly graded sand (gravel)
	5	
SEVERE	6	sand, silt, clay
	7	
	8	
THRESHOLD	9	silt, clay and organic peat

WATER REGIME VULNERABILITY (IND.)

A) SURFACE DRAINAGE

	0	water
	1	
COMPATIBLE	2	well drained
	3	
MODERATE	4	drainage pattern (heavy storm)
	5	
SEVERE	6	minor surface runoff (seasonal)
	7	
	8	
THRESHOLD	9	poorly drained wetlands, intermittent creek, swales

B) SUB-SURFACE DRAINAGE

	0	water
	1	
COMPATIBLE	2	over 8 feet
	3	
MODERATE	4	
	5	
SEVERE	6	6 feet - 8 feet
	7	
	8	
THRESHOLD	9	0 feet - 2 feet, 2 feet - 4 feet, 4 feet - 6 feet

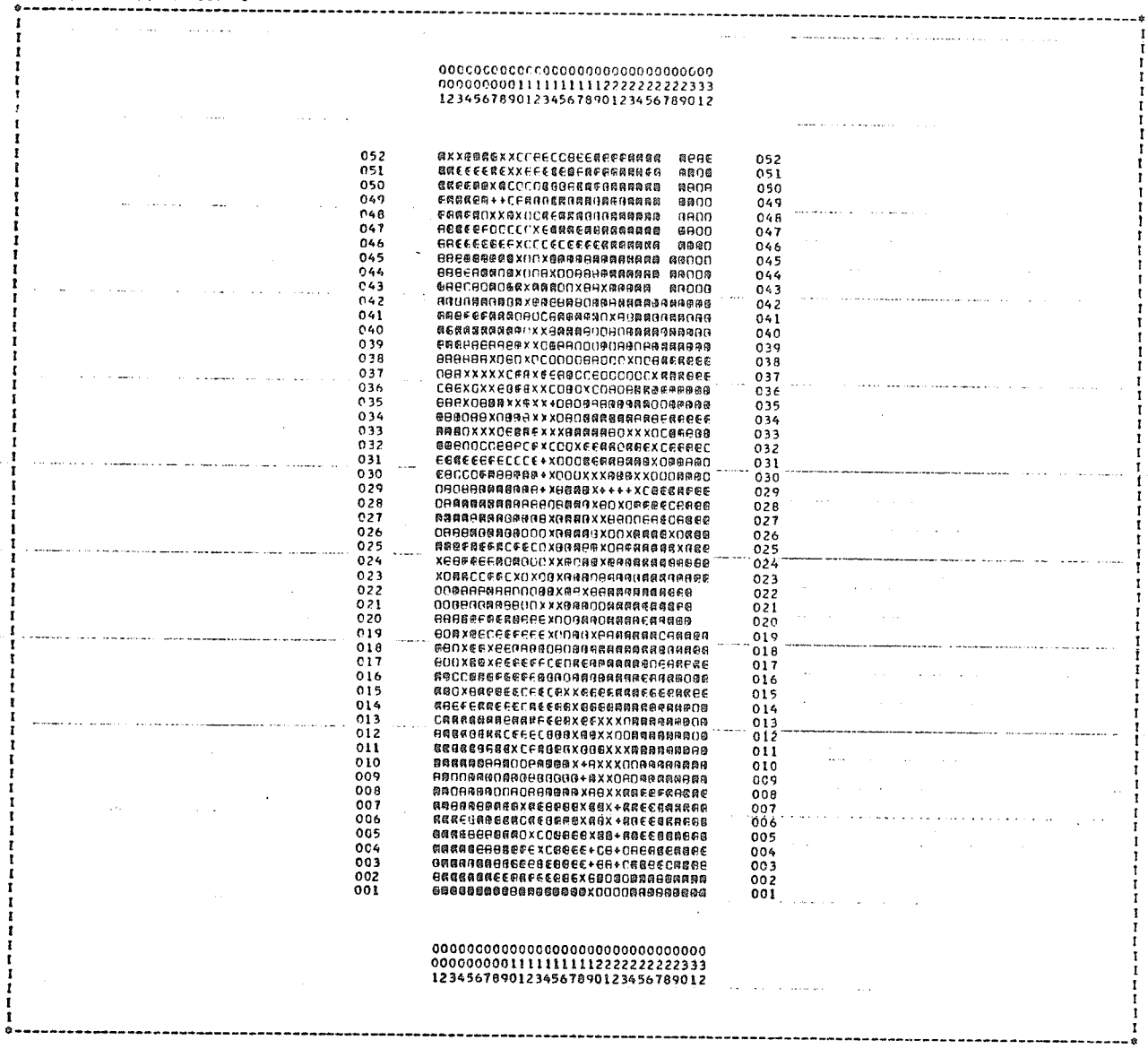
VEGETATION VULNERABILITY (IND.)

	0	water
	1	
COMPATIBLE	2	Groups one, two, three
	3	
MODERATE	4	Groups four, five
	5	
SEVERE	6	Group six
	7	
	8	
THRESHOLD	9	Groups seven, eight, nine

COMBINED RESOURCE SYSTEM VULNERABILITY (IND.)

STAGE 'A'	WT.
SOIL VULNERABILITY	1.25
WATER REGIME VULNERABILITY	1.50
VEGETATION VULNERABILITY	1.75

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

UNIVERSITY OF MANITOBA

INDUSTRIAL IMPACT ANALYSIS (STAGE A)
LAND USE CODE

0 WATER
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	.	+	X	O	E	@	A	#	-
FREQUENCY	24	0	19	141	238	240	550	335	50	67

INDUSTRIAL INPUT (IND.)

STAGE 'B'

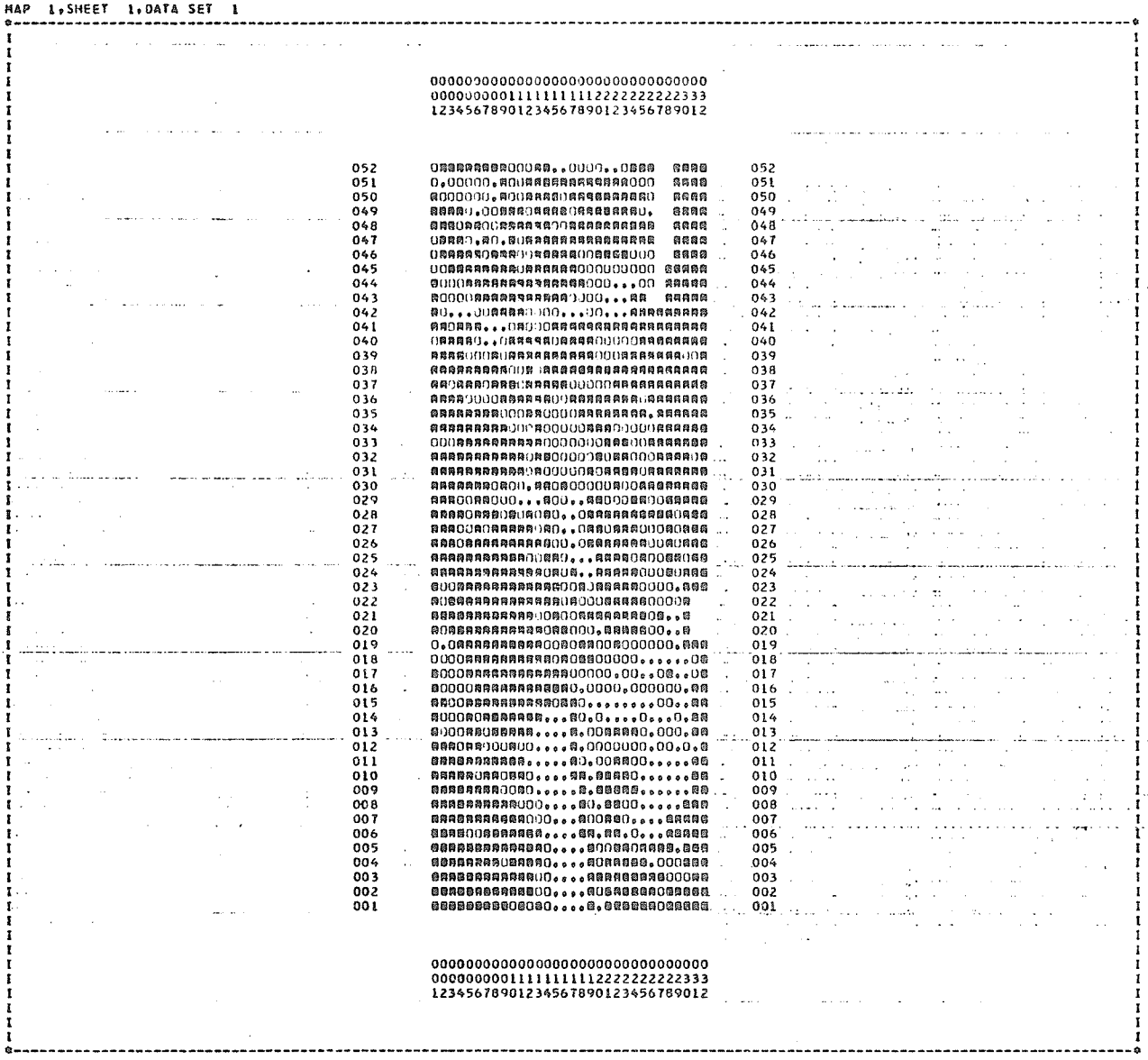
PERCEPTUAL VULNERABILITY (IND.)

	0	water
	1	
COMPATIBLE	2	Groups eight, nine
	3	
MODERATE	4	Groups six, seven
	5	
SEVERE	6	Groups four, five
	7	
	8	
THRESHOLD	9	Groups one, two, three

COMBINED RESOURCE SYSTEM VULNERABILITY (IND.)

STAGE 'B'	WT.
PERCEPTUAL RESOURCE VULNERABILITY	1.00

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

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UNIVERSITY OF MANITOBA

INDUSTRIAL IMPACT ANALYSIS (STAGE 8)
LAND USE CODE

0 WATER
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	.	.	X	O	@	@	@	@	@
FREQUENCY	24	190	0	0	416	0	0	0	0	1034

COMMERCIAL INPUT (COM.)

Resource vulnerability and impact potential is created by the construction of commercial establishments in the following circumstances.

STAGE 'A'

SOIL VULNERABILITY (COM.)

A) TOPOGRAPHIC SLOPE

	0	water
	1	
COMPATIBLE	2	0% - 4%
	3	
MODERATE	4	4% - 8%
	5	
SEVERE	6	8% -12%
	7	
	8	
THRESHOLD	9	12% - 16%, 16% - 20%, over 20%

B) SOILS: BY COMPOSITION

	0	water
	1	
COMPATIBLE	2	well graded sand (gravel)
	3	
MODERATE	4	poorly graded sand (gravel)
	5	
SEVERE	6	sand, silt, clay
	7	
	8	
THRESHOLD	9	silt, clay and organic peat

WATER REGIME VULNERABILITY (COM.)

A) SURFACE DRAINAGE

	0	water
	1	
COMPATIBLE	2	well drained
	3	
MODERATE	4	drainage pattern (heavy storms)
	5	
SEVERE	6	minor surface runoff (seasonal)
	7	
	8	
THRESHOLD	9	poorly drained wetlands, intermittent creek, swales

B) SUB-SURFACE DRAINAGE

	0	water
	1	
COMPATIBLE	2	over 8 feet
	3	
MODERATE	4	
	5	
SEVERE	6	6 feet - 8 feet
	7	
	8	
THRESHOLD	9	0 feet - 2 feet, 2 feet - 4 feet, 4 feet - 6 feet

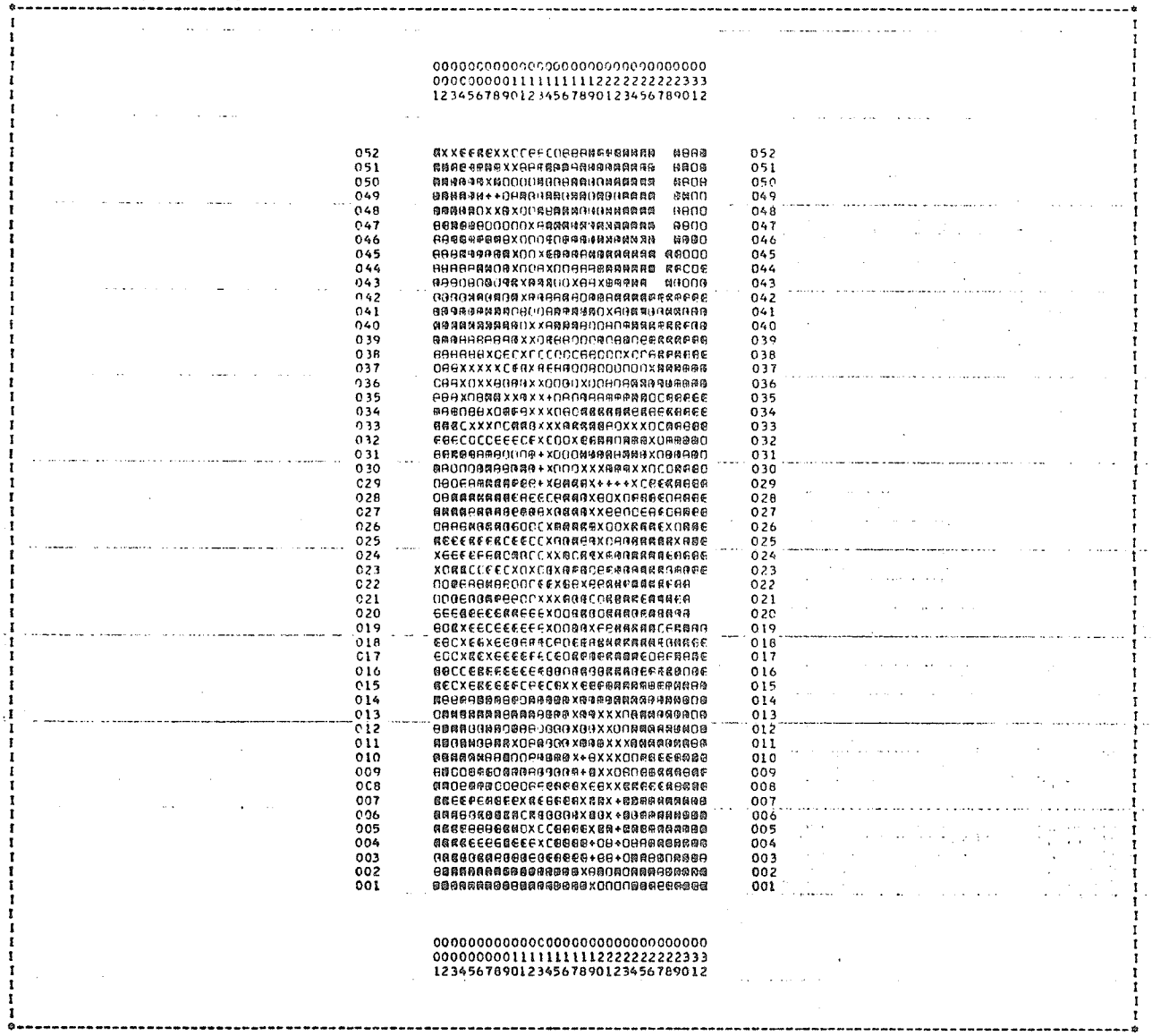
VEGETATION VULNERABILITY (COM.)

	0	water
	1	
COMPATIBLE	2	Groups one, two, three
	3	
MODERATE	4	Groups four, five
	5	
SEVERE	6	Group six
	7	
	8	
THRESHOLD	9	Groups seven, eight, nine

COMBINED RESOURCE SYSTEM VULNERABILITY (COM.)

STAGE 'A'	WT.
SOIL VULNERABILITY	1.00
WATER REGIME VULNERABILITY	1.50
VEGETATION VULNERABILITY	1.75

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

UNIVERSITY OF MANITOBA

COMMERCIAL IMPACT ANALYSIS (STAGE A)
LAND USE CODE

0 WATER
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	.	X	O	E	A	R	S	W	T
FREQUENCY	24	0	19	141	238	240	550	335	50	67

COMMERCIAL INPUT (COM.)

STAGE 'B'

VEGETATION VULNERABILITY (COM.)

	0	water
	1	
COMPATIBLE	2	Groups four, six, seven, eight
	3	
MODERATE	4	Groups nine, five
	5	
SEVERE	6	
	7	
	8	
THRESHOLD	9	Groups one, two, three

NOTE: vegetation with dense understory will suffer moderate impact

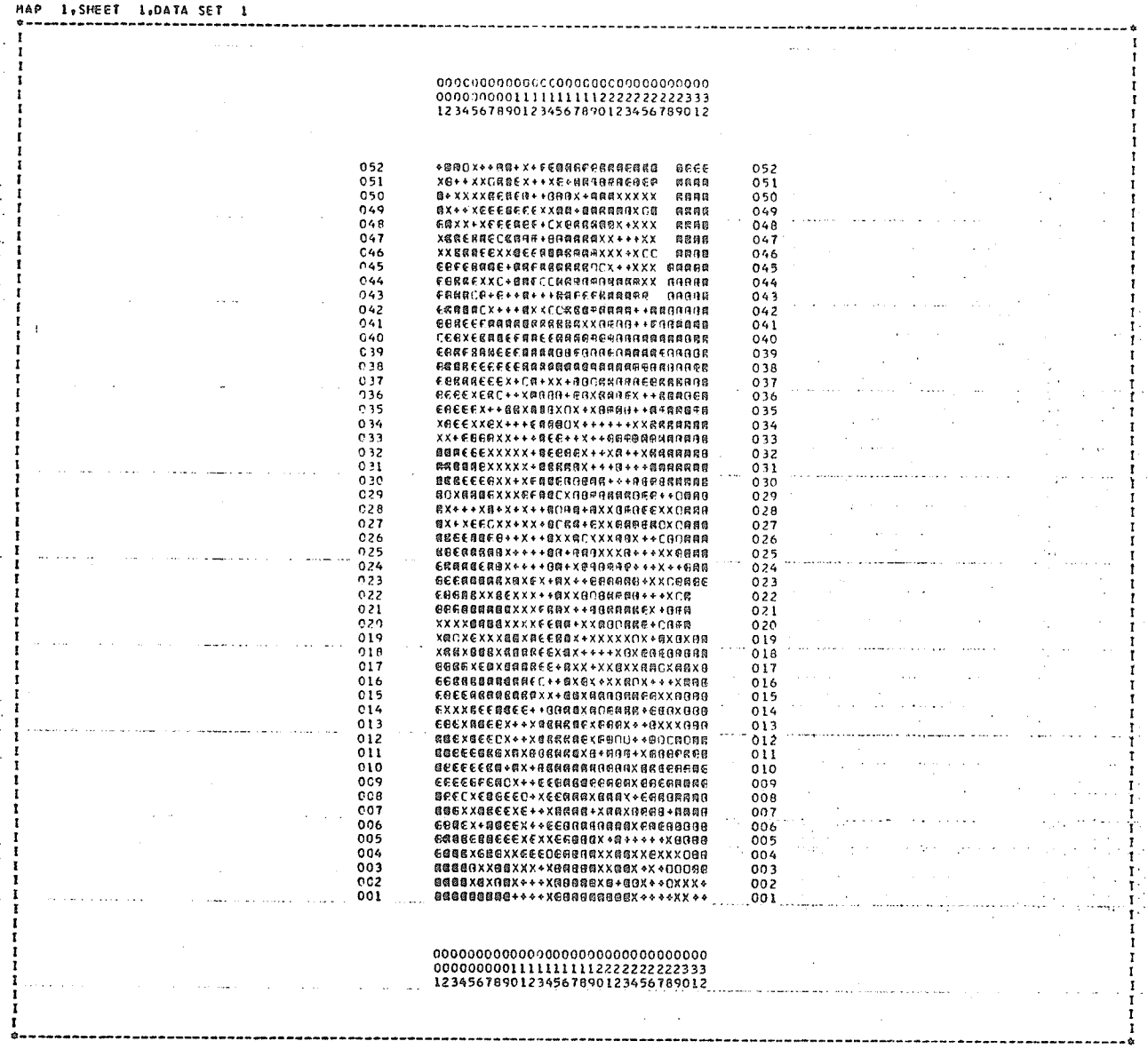
PERCEPTUAL RESOURCE VULNERABILITY (COM.)

	0	water
	1	
COMPATIBLE	2	Groups four, five, six
	3	
MODERATE	4	Groups three, eight
	5	
SEVERE	6	Groups two, eight
	7	
	8	
THRESHOLD	9	Groups one, nine

COMBINED RESOURCE SYSTEM VULNERABILITY (COM.)

STAGE 'B'	WT.
VEGETATION VULNERABILITY	1.75
PERCEPTUAL RESOURCE VULNERABILITY	1.75

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

CAVIC JOHNS M. ARCH. 1972

UNIVERSITY OF MANITOBA

COMMERCIAL IMPACT ANALYSIS (STAGE 8)
LAND USE CODE

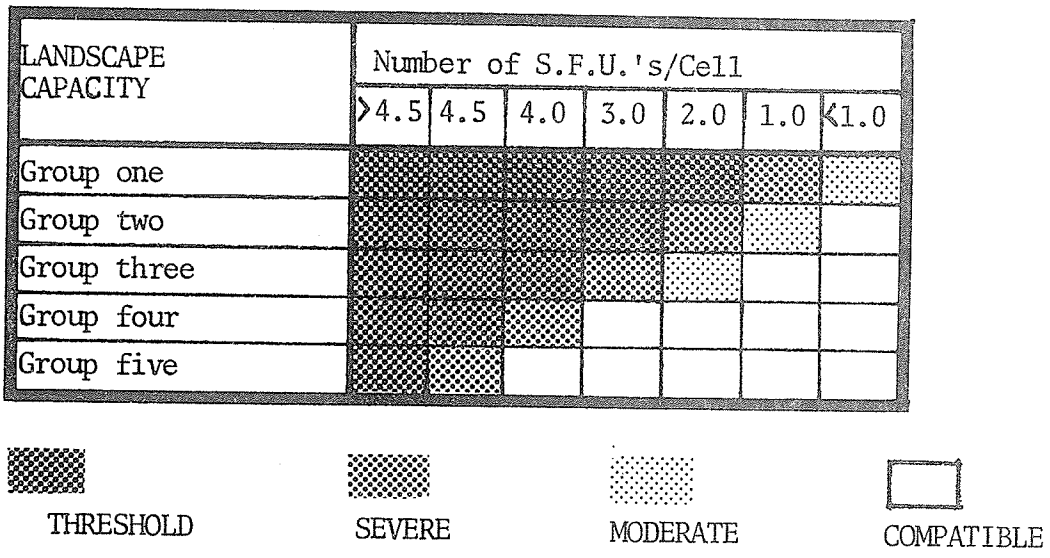
0 WATER
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	.	+	X	0	8	@	#	=	-
FREQUENCY	24	0	207	284	60	0	536	251	0	302

A) PERCEPTUAL VULNERABILITY

The degree of impact on the desired perceptual benefits for 'point' inputs is a function of the buffer qualities of the vegetation types and the quantity of land-use input imposed. Feasibility proposals suggesting greater density of input than is specified by the guidelines will create a situation in which the visual goals could not be achieved. The unwanted loss of desired perceptual benefits will be considered as having a negative impact on the visual and perceptual health of the community and thus will be liable to the environment impact rating scale. (see perceptual impact guidelines for 'point' inputs below.)

PERCEPTUAL IMPACT

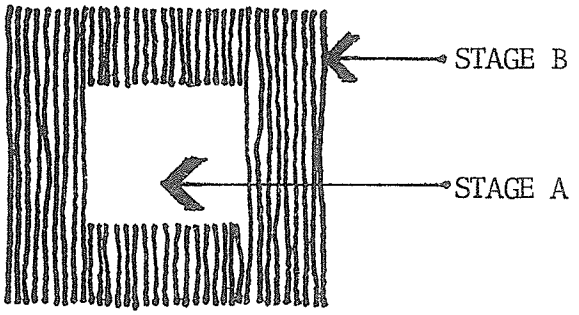


F.19

The 'visual' impact guidelines establishes areas in which the land-scape will absorb the activity to a compatible degree. The success of the feasibility will be represented by an environmental impact rating. This measurement will be cross-checked with the quantity of input that the area can support and will be reflected in a 'perceptual' impact rating. Thus, an activity can be located in an appropriate absorptive area but the quantity suggested would result in a loss of the original perceptual qualities

that made the site suitable. The feasibility proposals will receive an impact rating commensurate with the degree of overdevelopment.

Perceptual Vulnerability is measured at two stages as indicated in the following diagram. Visual guidelines at stage B establish visual impact criteria for the periphery vegetation and are considered under RESOURCE VULNERABILITY. Therefore perceptual vulnerability in this section is concerned only with stage A of the development. The guidelines established under Resource Impact technique (SITE CAPABILITY SECTION) are used to evaluate stage A of development proposals.



visual guidelines:
-capability studies.

perceptual guidelines:
-totally developed - compatible impact.
-underdeveloped - threshold impact.

F.20

2) ENVIRONMENT / BENEFIT ANALYSIS

The environment / benefit analysis can best be described as a relative score of how well the feasibility proposals have taken advantage of the site. This will be accomplished by analysing the feasibility proposals in terms of the relation between the location of the land-use inputs and the suitability ratings of those locations for that input. (Refer to Suitability Maps). Since the suitability ratings are a reflection of engineering, economic, environmental, and aesthetic ability of the resource base the benefits of locating in a high suitability rating accrued in many ways. For example:

1) A high suitability rating of a site suggests that optimal resource conditions exist for a specific land use. The less the rating the less suitable the site is for the input and the potential of a misfit increases between the land use and one or all of the engineering, economic, environmenta, and aesthetic requirements.

Thus feasibility proposals that locate land uses in areas where the suitability for that land use is high will not only take advantage of the optimal site conditions but will also minimize the potential hazards and conflicts of less suitable sites.

The measurement will quantify the relative differences of each feasibility proposal, as to how well or poorly each of the proposals would use the intrinsic natural resources within the context of the established land-use goals.

The impact ratings plus the environment/benefit analysis should give a realistic appraisal of the positive and negative of each feasibility proposal. Another significant contribution of these analysis capabilities will occur when other than purely environmental planning ramifications will be considered. These techniques will be able to predict the possible environmental consequences of actions that have sociological, political or functional motives. Thus these benefits can be weighed against the environmental consequences in tangible & measureable terms.

IMPACT ANALYSIS

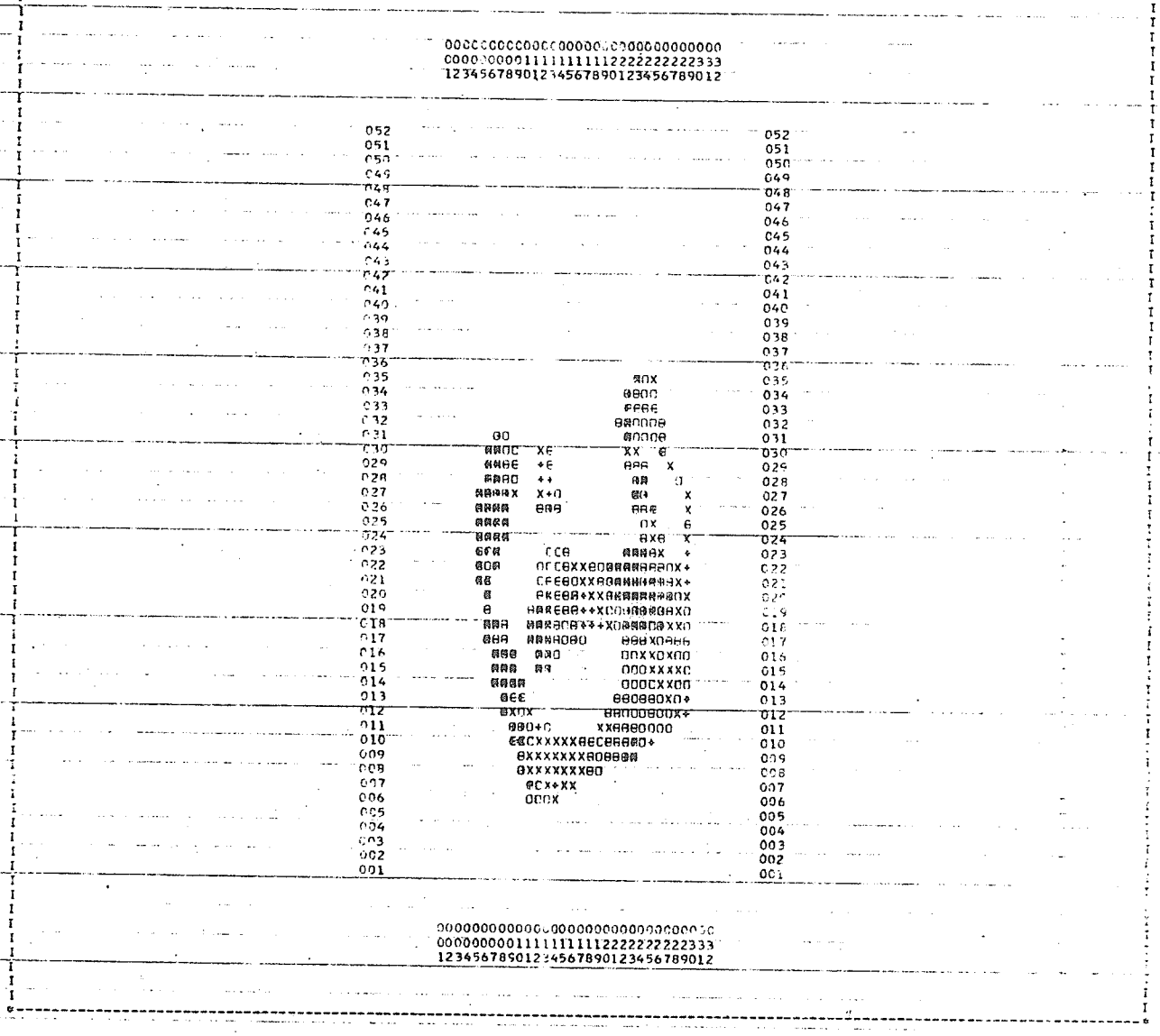
IMPACT : 7.01
CONTROL DESIGN

8

TYPE	MAPS
ECOLOGICAL	MI.12 - MI.22
PERCEPTUAL	MI.23 - MI.24
ENVIRONMENT/ BENEFIT	MEB.01 - MEB.11

NOTE: The darker tones on the IMPACT maps reflect a greater potential of environmental damage while the darker tone on ENVIRONMENT/ BENEFIT maps indicate an optimal use of the resource base.

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

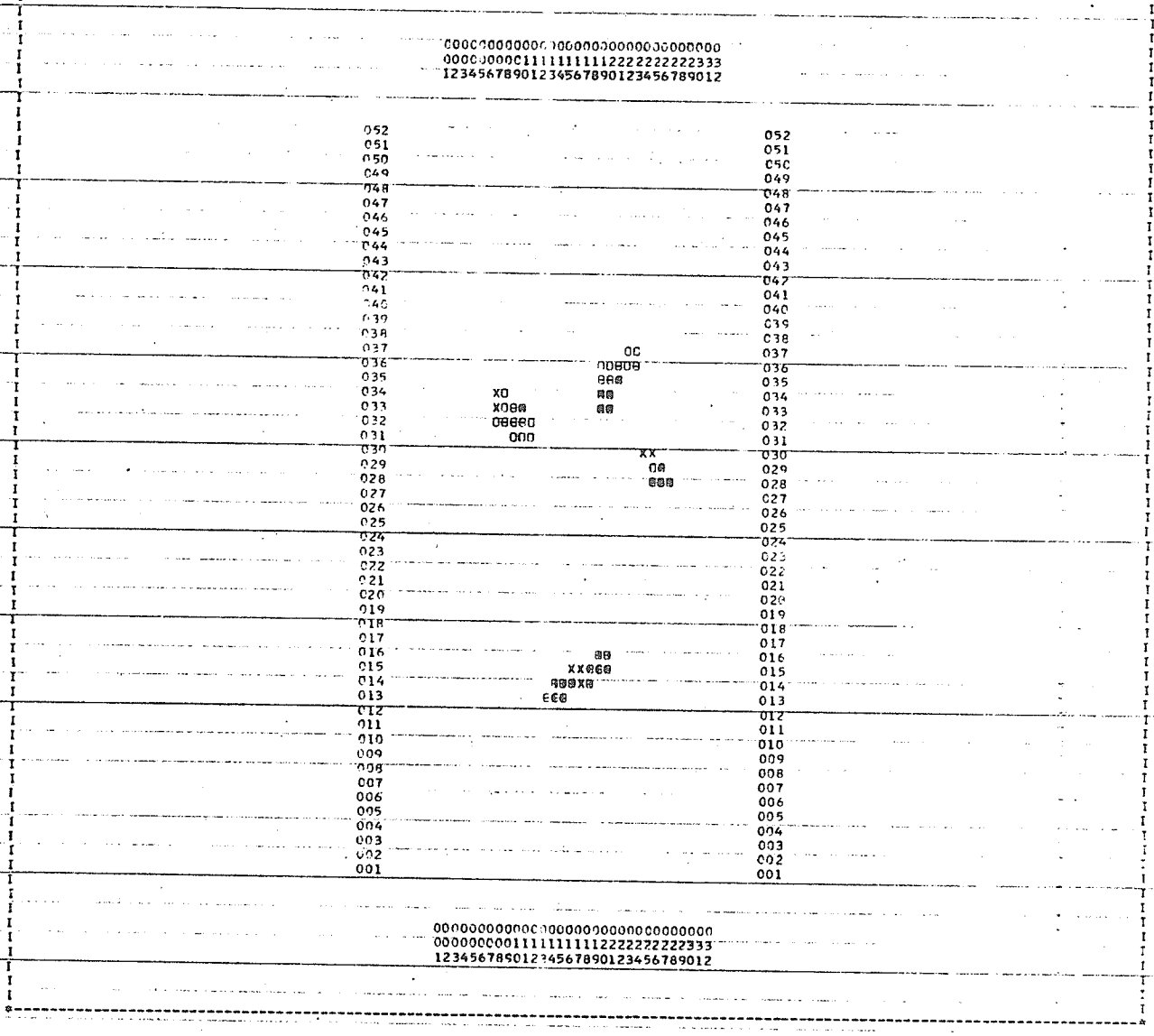
ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
SINGLE FAMILY UNIT IMPACT ANALYSIS
LAND USE CODE

0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	8	A	@	H	R	#
FREQUENCY	1313	0	18	66	76	79	38	26	38	10

MAP 2,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

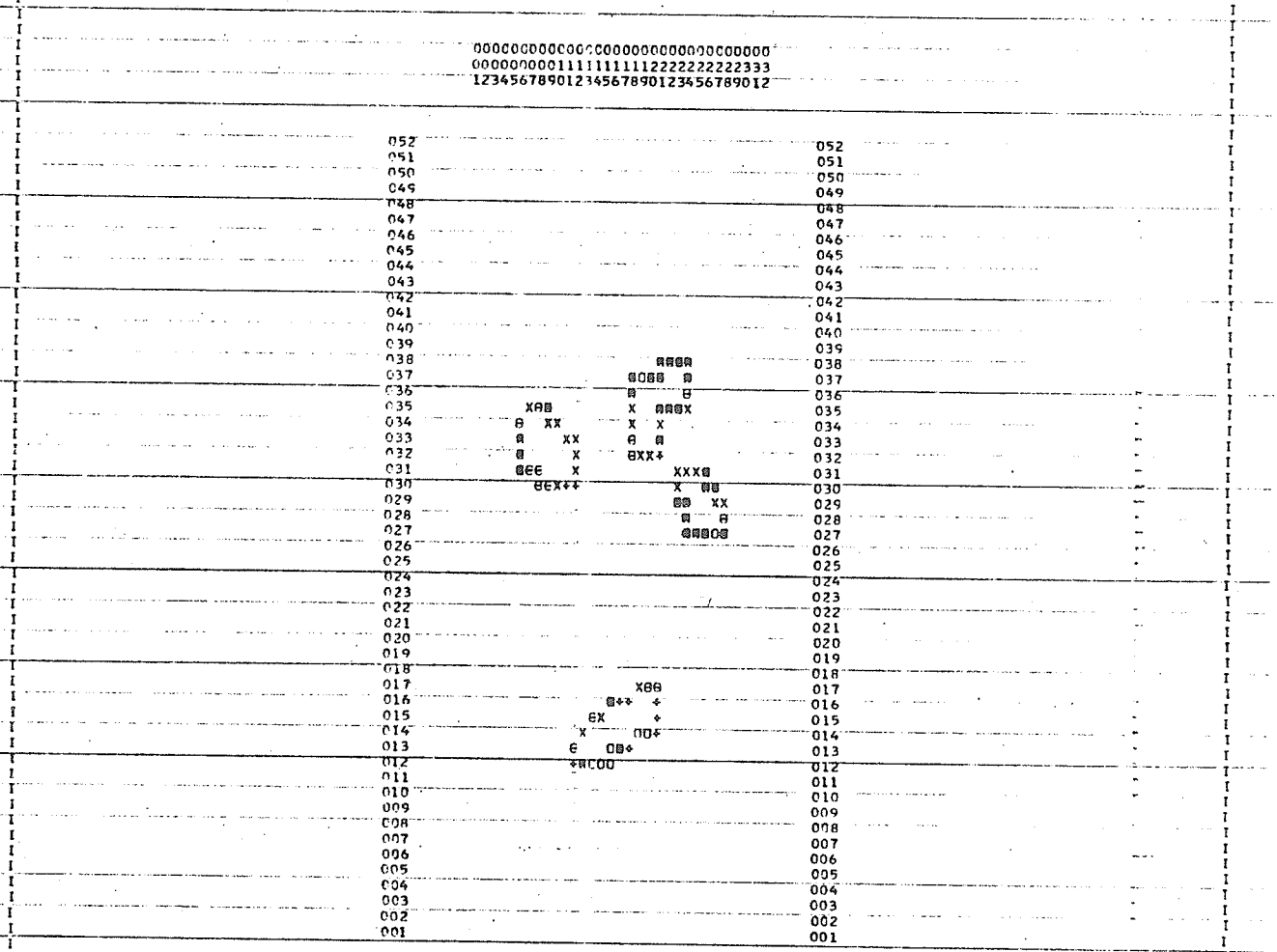
ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
MULTI-FAMILY UNIT IMPACT ANALYSIS (STAGE A)
LAND USE CODE

0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	. + X O A E C @									
FREQUENCY	1614	0	0	7	13	9	16	5	0	0

MAP 3, SHEET 1, DATA SET 1



LEAF RAPIDS PLANNING STUDY

CAVIC JOHNS M. ARCH. 1972

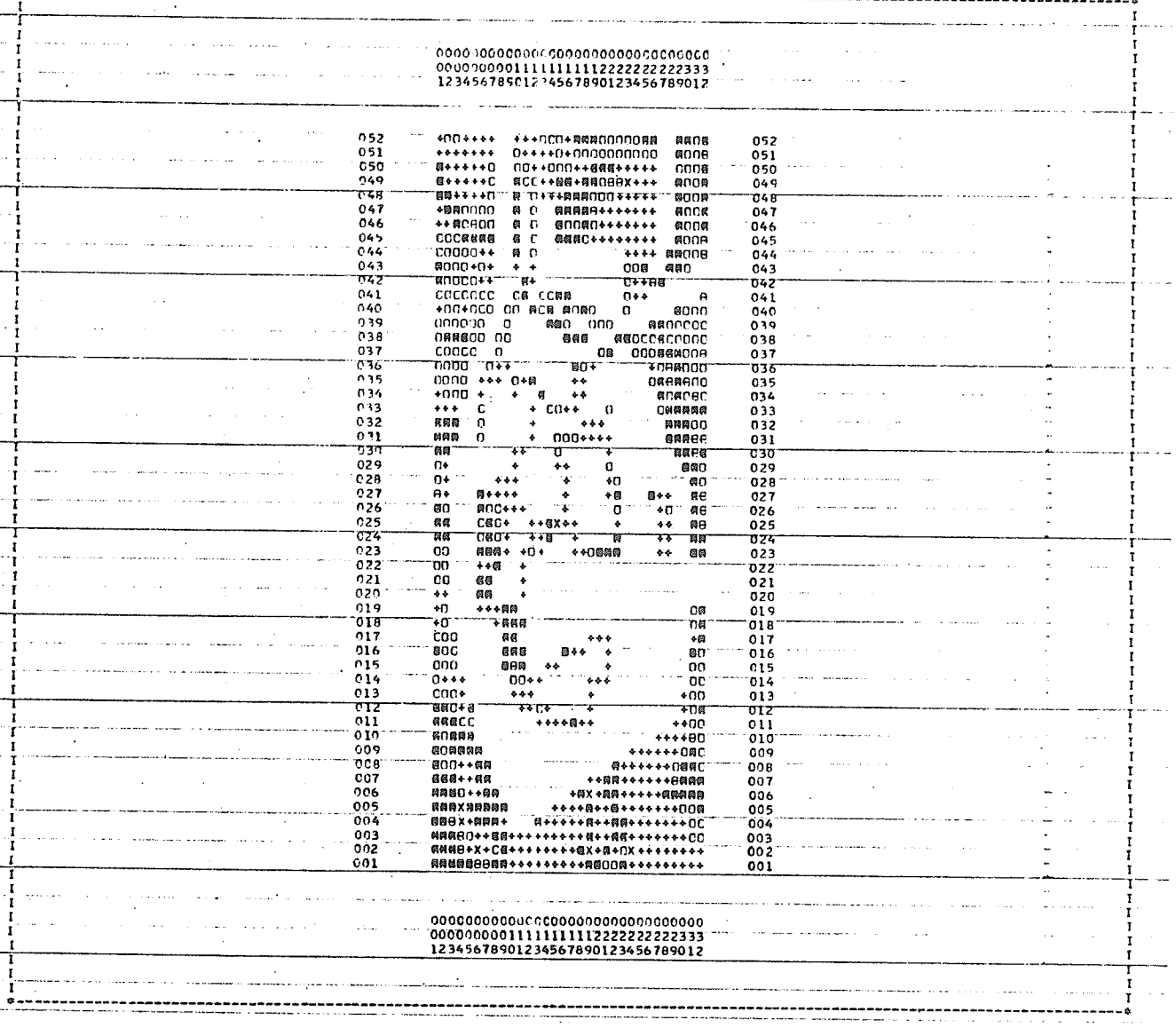
ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
MULTI-FAMILY UNIT IMPACT ANALYSIS (STAGE B)
LAND USE CODE

0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	C	E	A	8	#	@	
FREQUENCY	1579	0	10	23	8	14	0	1	6	23

MAP 4, SHEET 1, DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

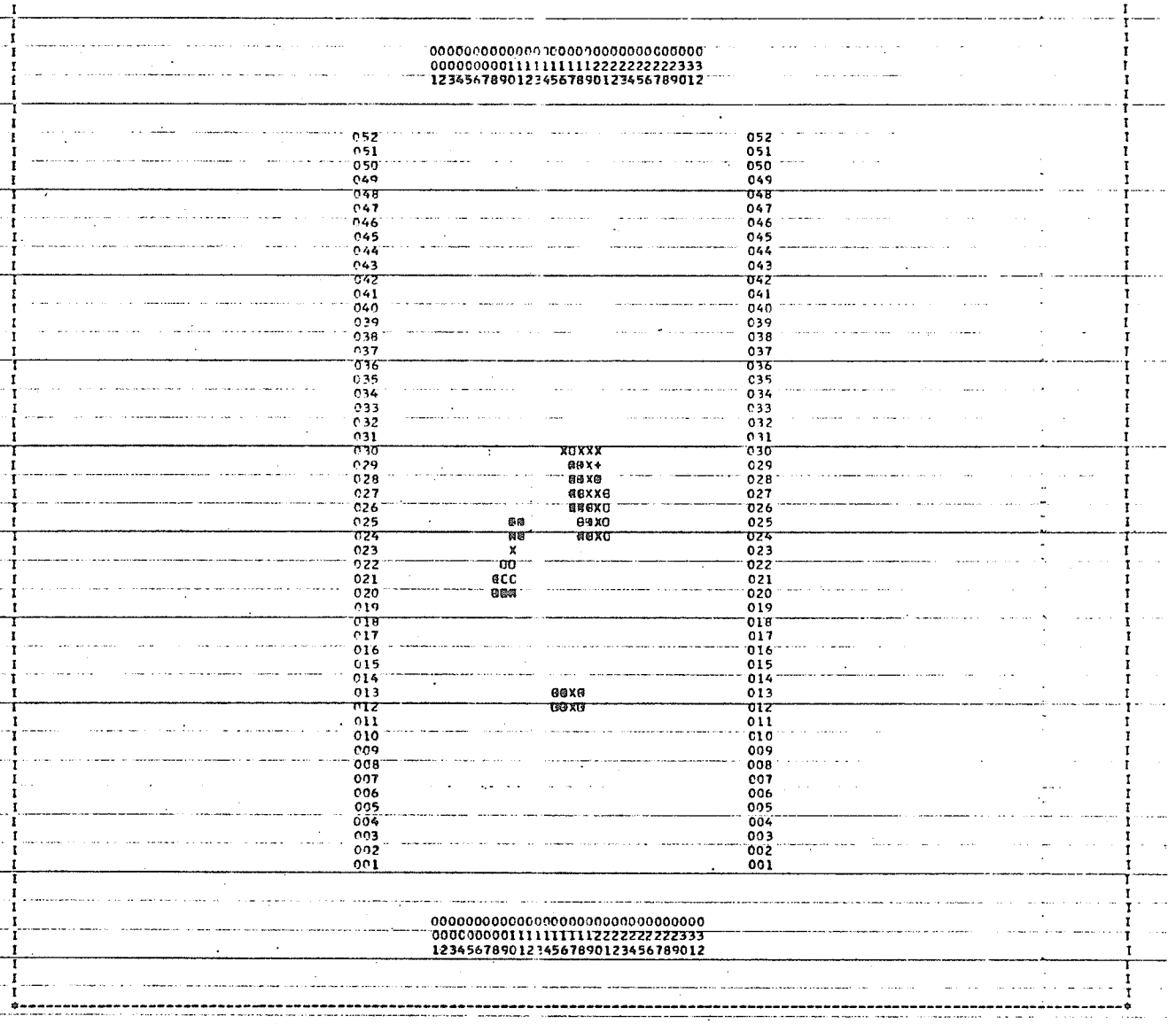
ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
PASSIVE RECREATION IMPACT ANALYSIS
LAND USE CODE

0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	#	@	A	B	C	D
FREQUENCY	740	0	355	8	269	29	0	125	138	0

MAP 5,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

CAVIC JOHNS N. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
ACTIVE RECREATION IMPACT ANALYSIS (STAGE A)
LAND USE CODE

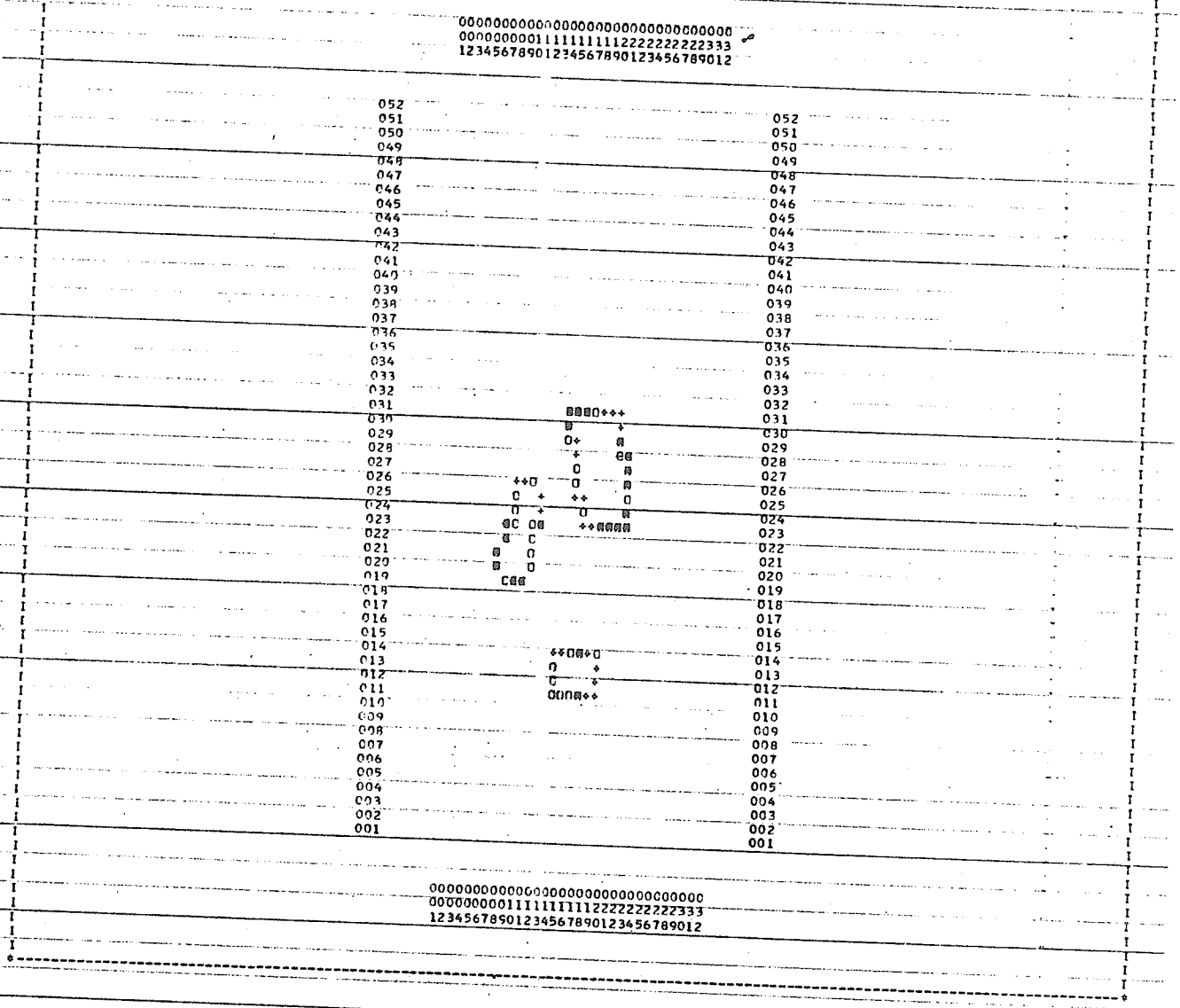
0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS 0 1 2 3 4 5 6 7 8 9

SYMBOLS

FREQUENCY 1612 0 1 14 6 4 18 7 2 0

MAP 6,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
ACTIVE RECREATION IMPACT ANALYSIS (STAGE B)
LAND USE CODE

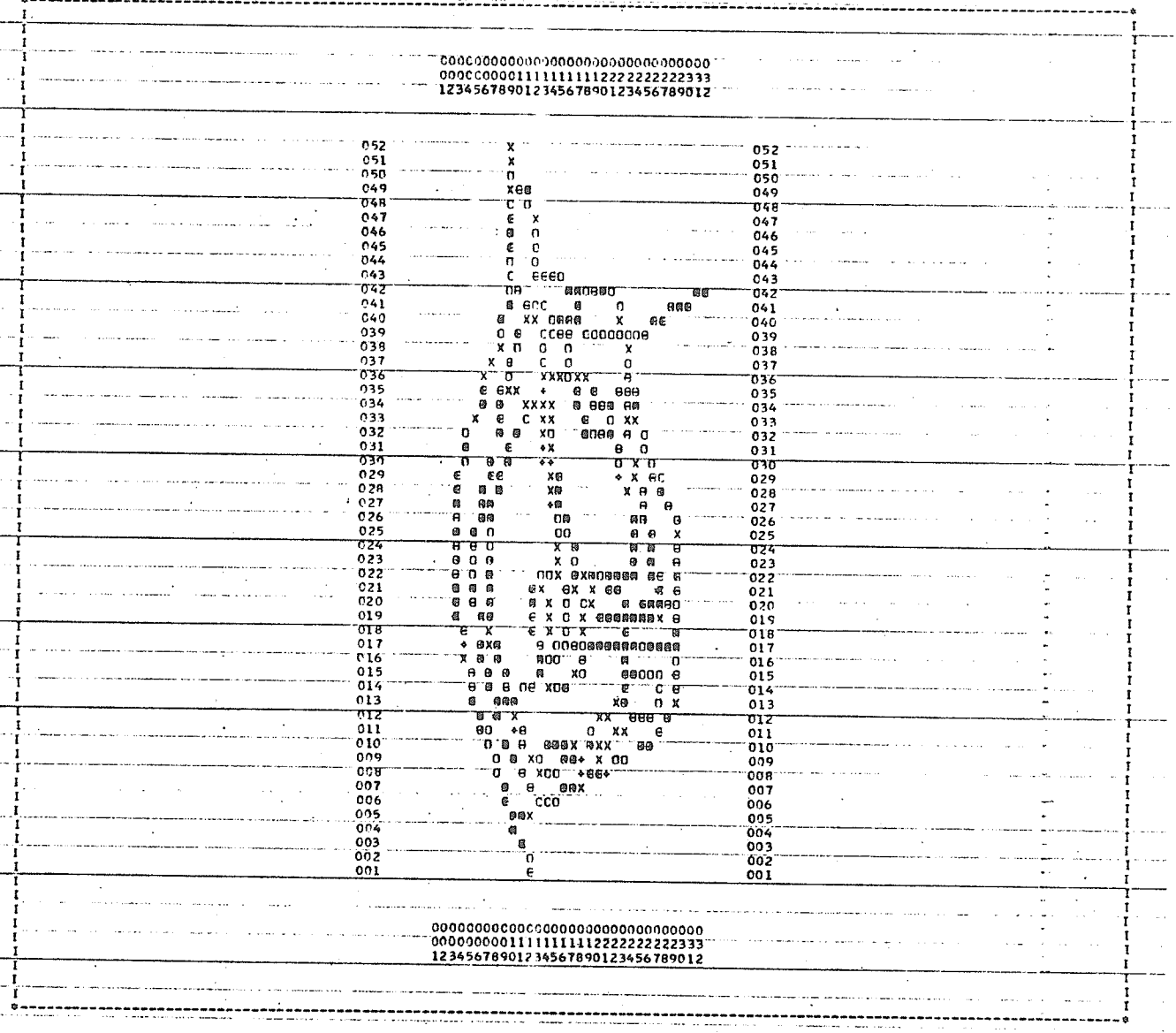
0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS 0 1 2 3 4 5 6 7 8 9

SYMBOLS

FREQUENCY 1598 0 21 0 22 1 0 11 11 0

MAP 7,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

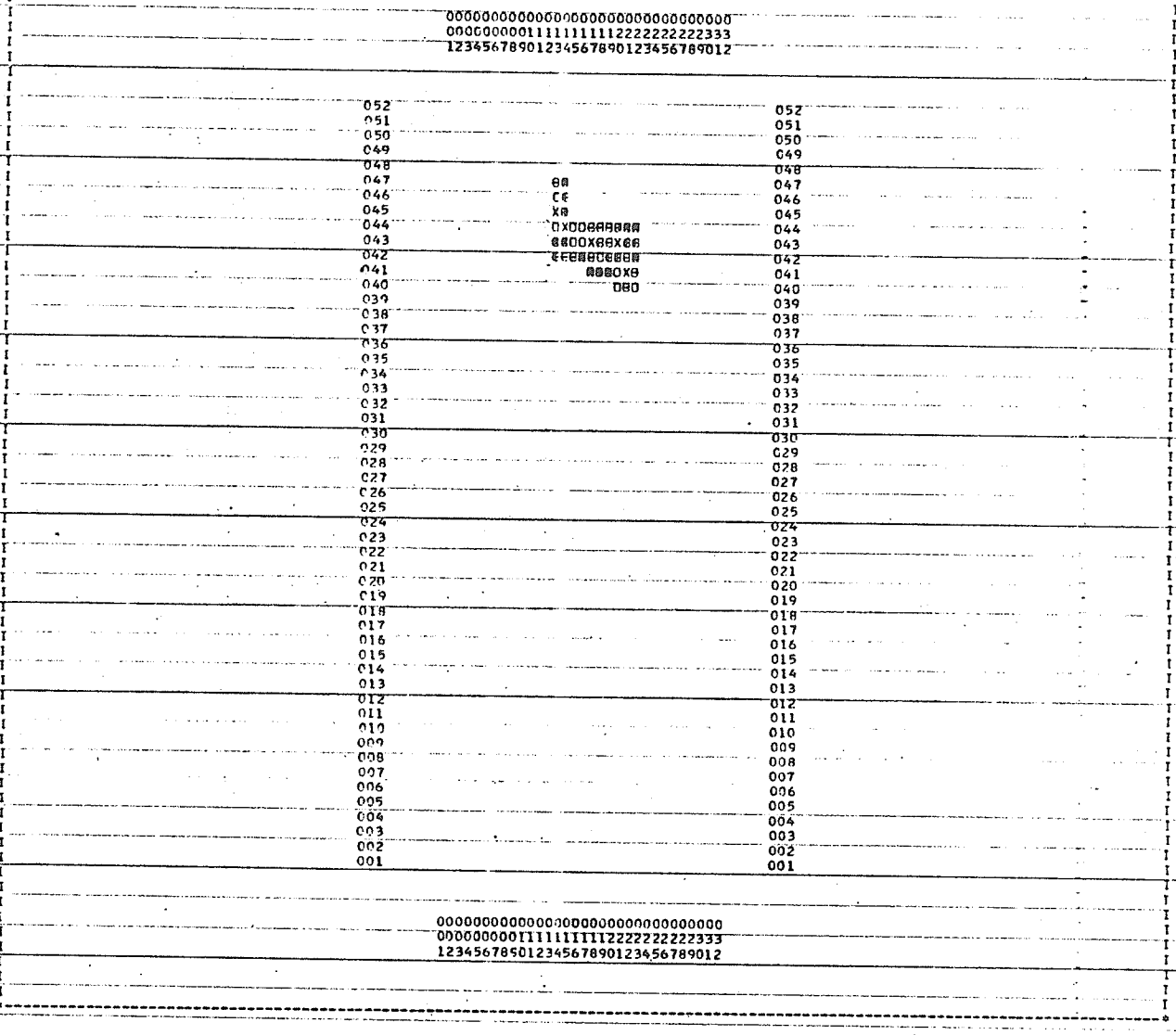
ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
ROAD AND UTILITY IMPACT ANALYSIS
LAND USE CODE

0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	.	+	+	X	0	@	#	R	R
FREQUENCY	1278	0	11	69	90	57	114	30	6	9

MAP 8,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
INDUSTRIAL IMPACT ANALYSIS (STAGE A)
LAND USE CODE

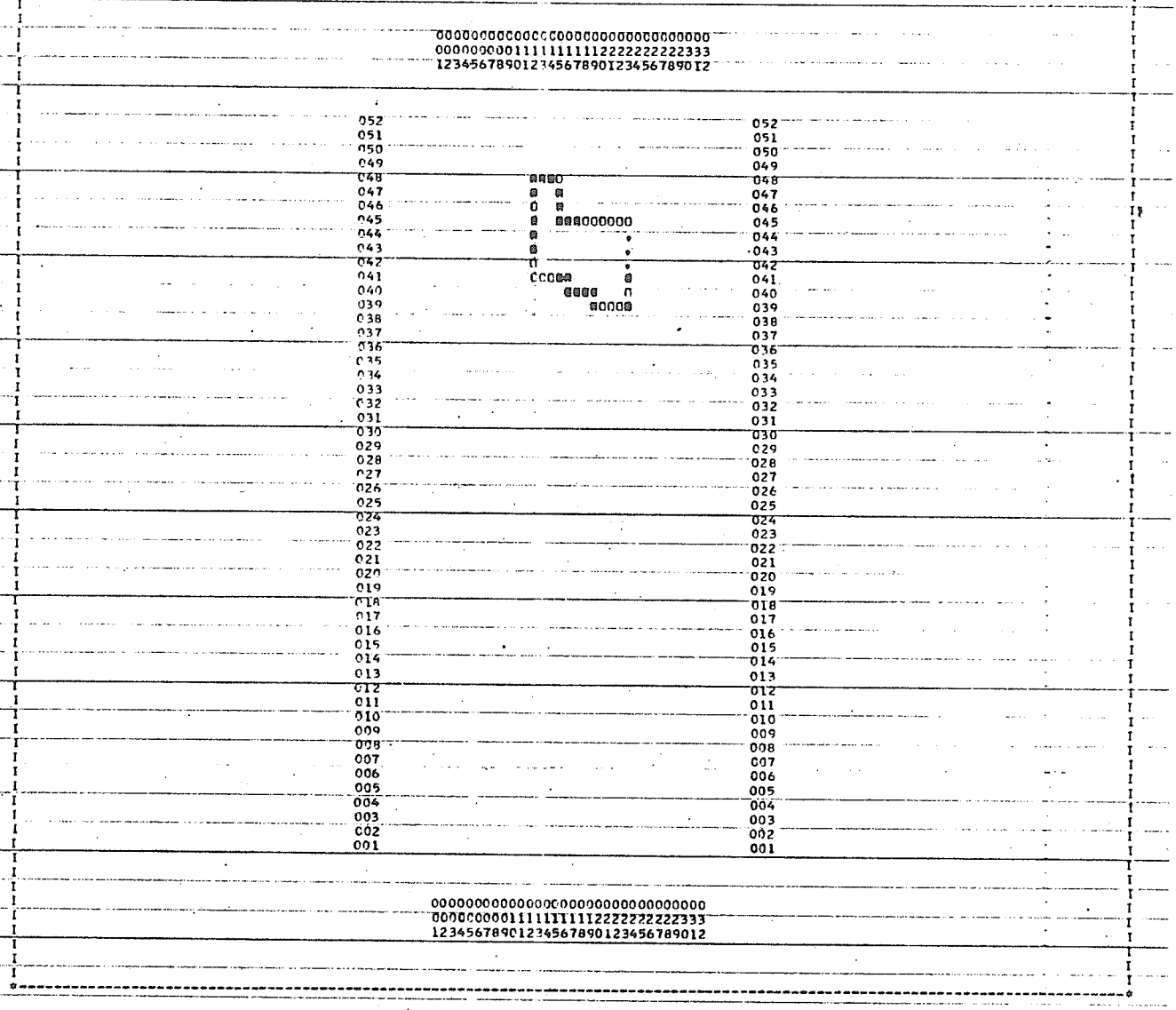
0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS 0 1 2 3 4 5 6 7 8 9

SYMBOLS

FREQUENCY 1619 0 0 5 9 13 9 8 0 1

MAP 9,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

LAVID JOHNS M. ARCH. 1972

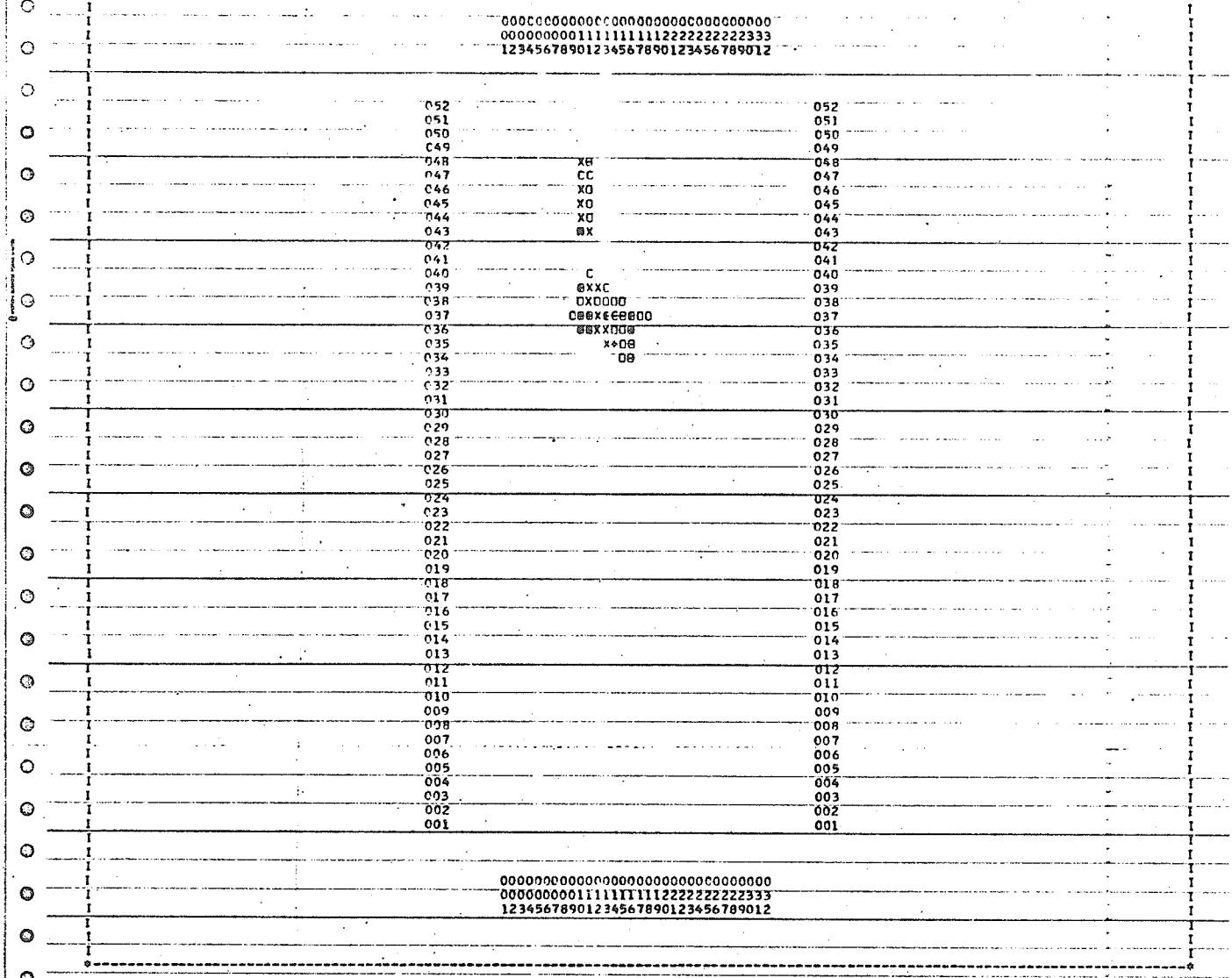
ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
INDUSTRIAL IMPACT ANALYSIS (STAGE 8)
LAND USE CODE

0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	1624	3	0	0	16	0	0	0	0	21

MAP 10,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

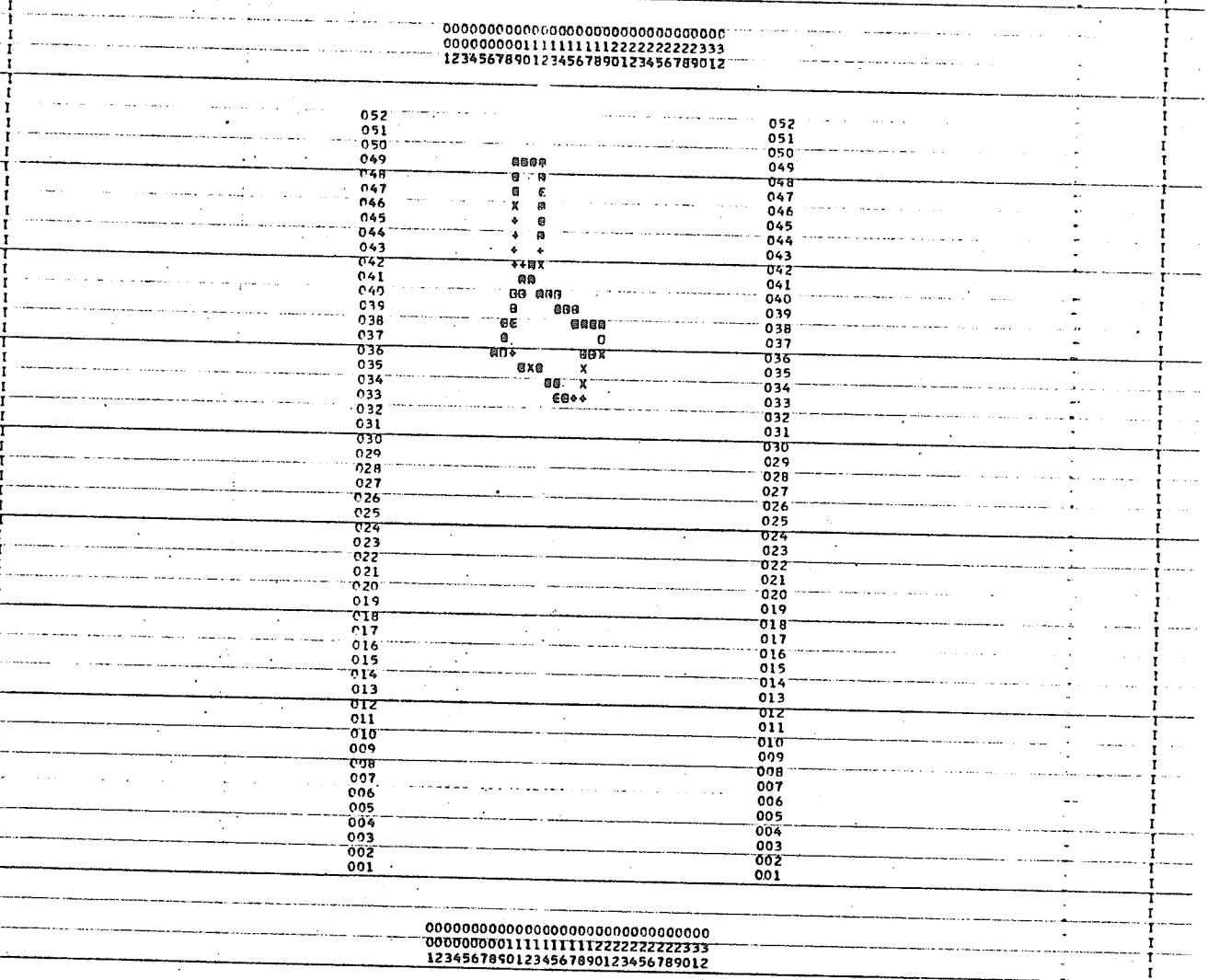
ONE SYMBOL EQUALS ONE ACRE

COMMERCIAL IMPACT ANALYSIS (STAGE A)
LAND USE CODE

0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	1618	0	1	12	19	5	8	1	0	0

MAP 11,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

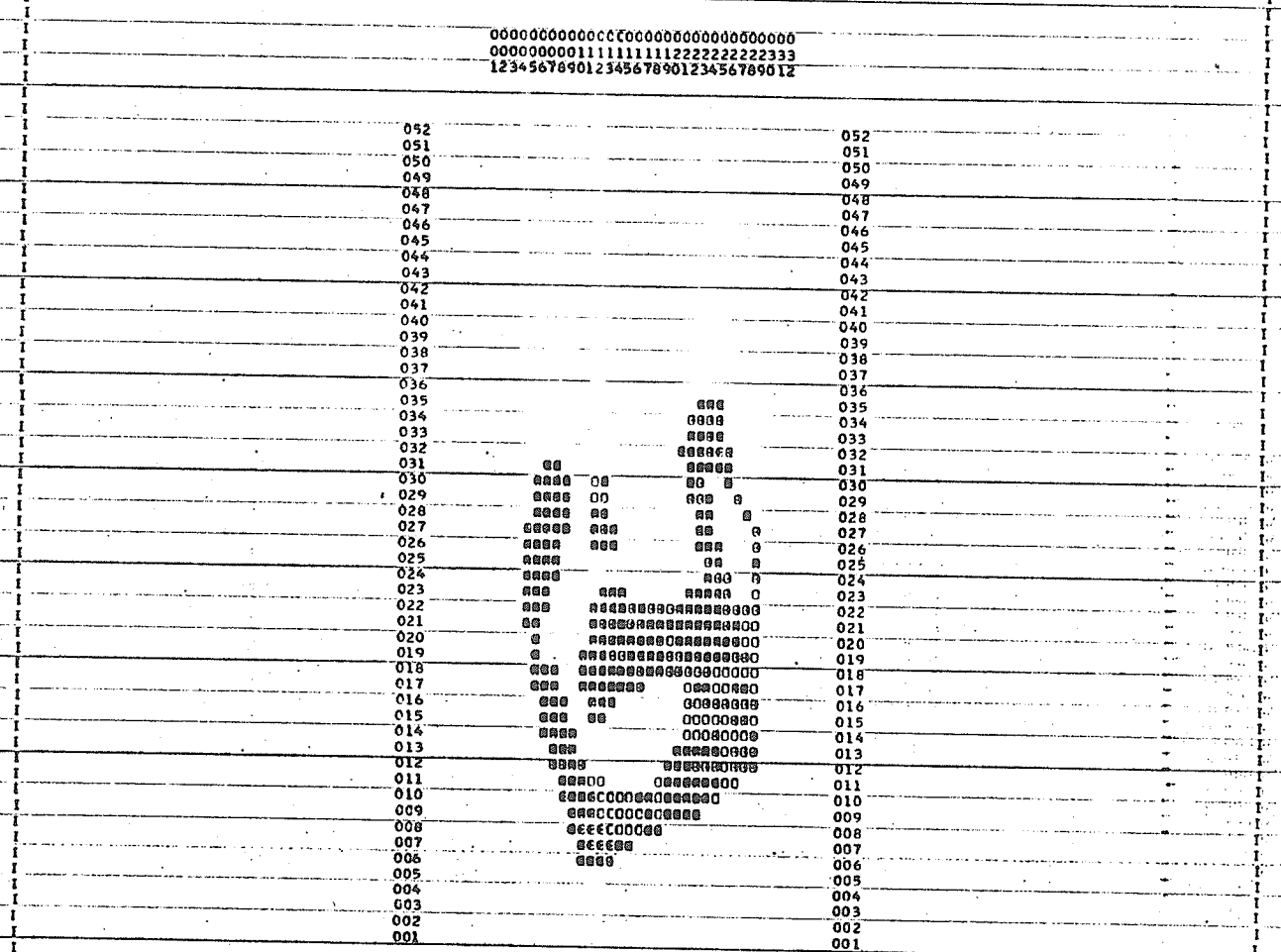
ONE SYMBOL EQUALS ONE ACRE

COMMERCIAL IMPACT ANALYSIS (STAGE 8)
LAND USE CODE

0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	@	@	@	@	@	@
FREQUENCY	1608	0	9	6	2	0	23	5	0	11

MAP 3,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

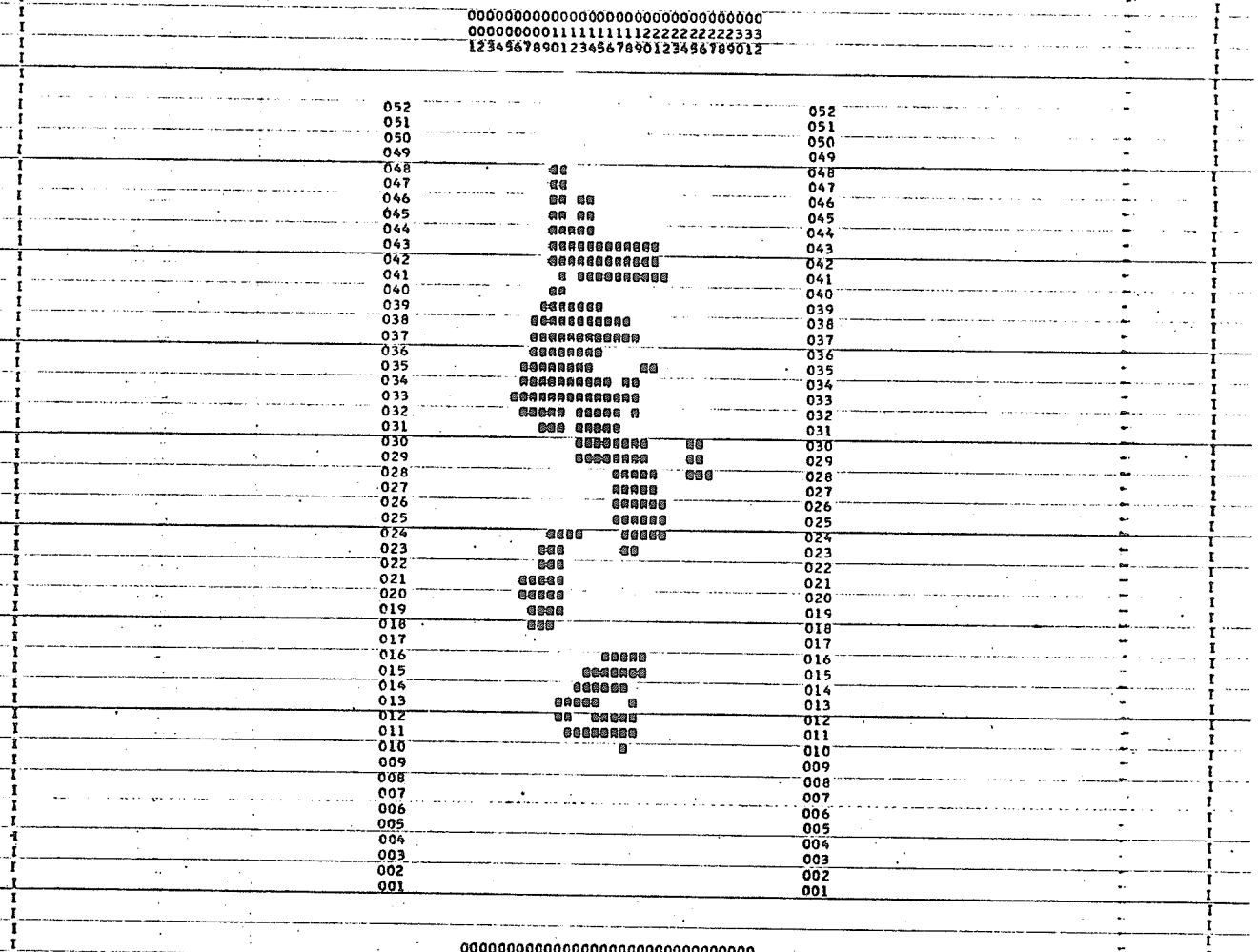
ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
PERCEPTUAL IMPACT "POINT LAND USES"

0 NO IMPACT
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	C	E	@	@	@	@
FREQUENCY	1313	0	0	0	55	0	116	0	0	180

MAP 4,SHEET 1,DATA SET 1



1389

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

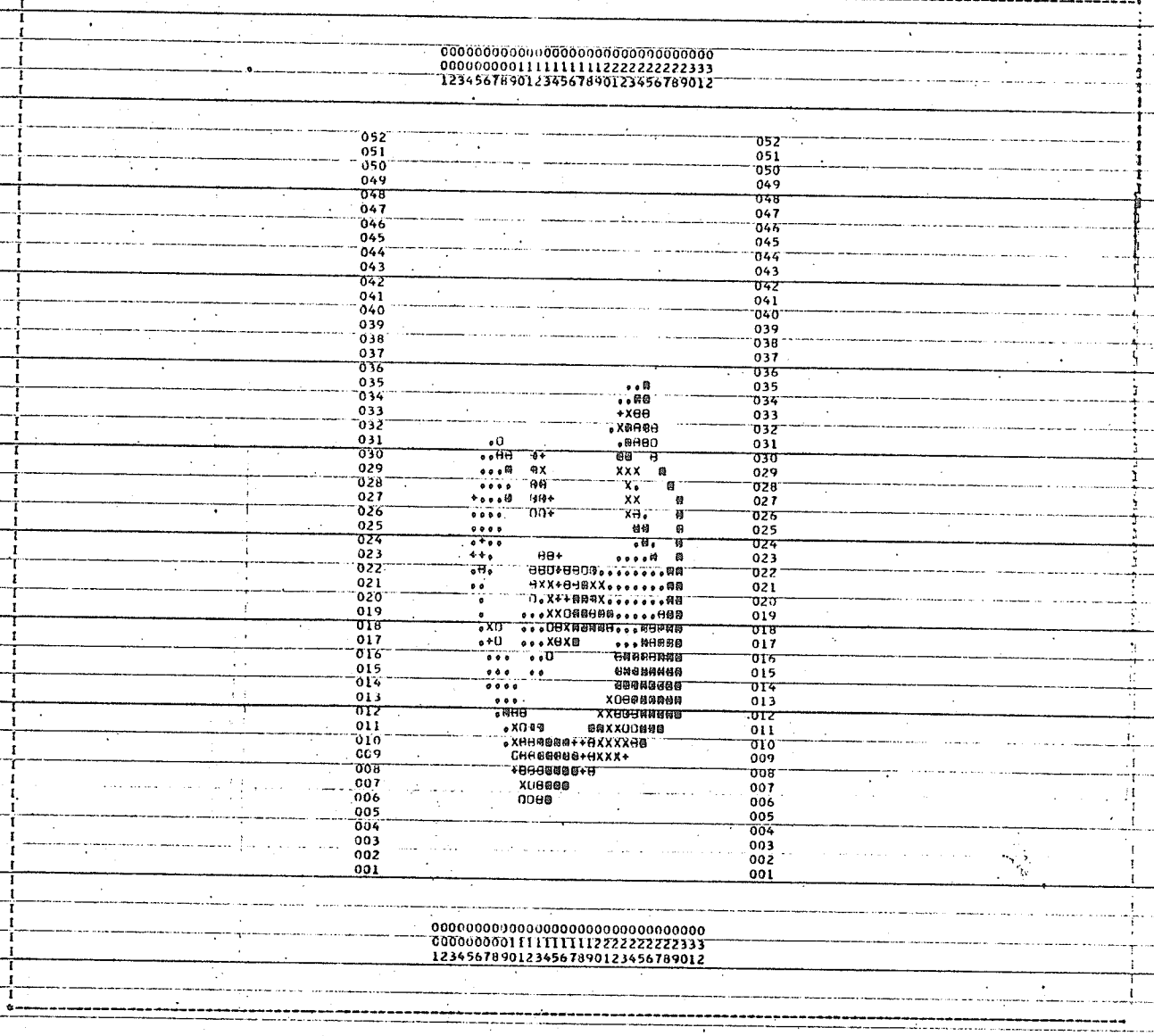
ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
PERCEPTUAL IMPACT "STRIP OR CLUSTER LAND USES"

0 NO IMPACT
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	. + X O € @ ■ ■ ■ ■									
FREQUENCY	1398	0	0	0	0	0	0	0	0	266

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

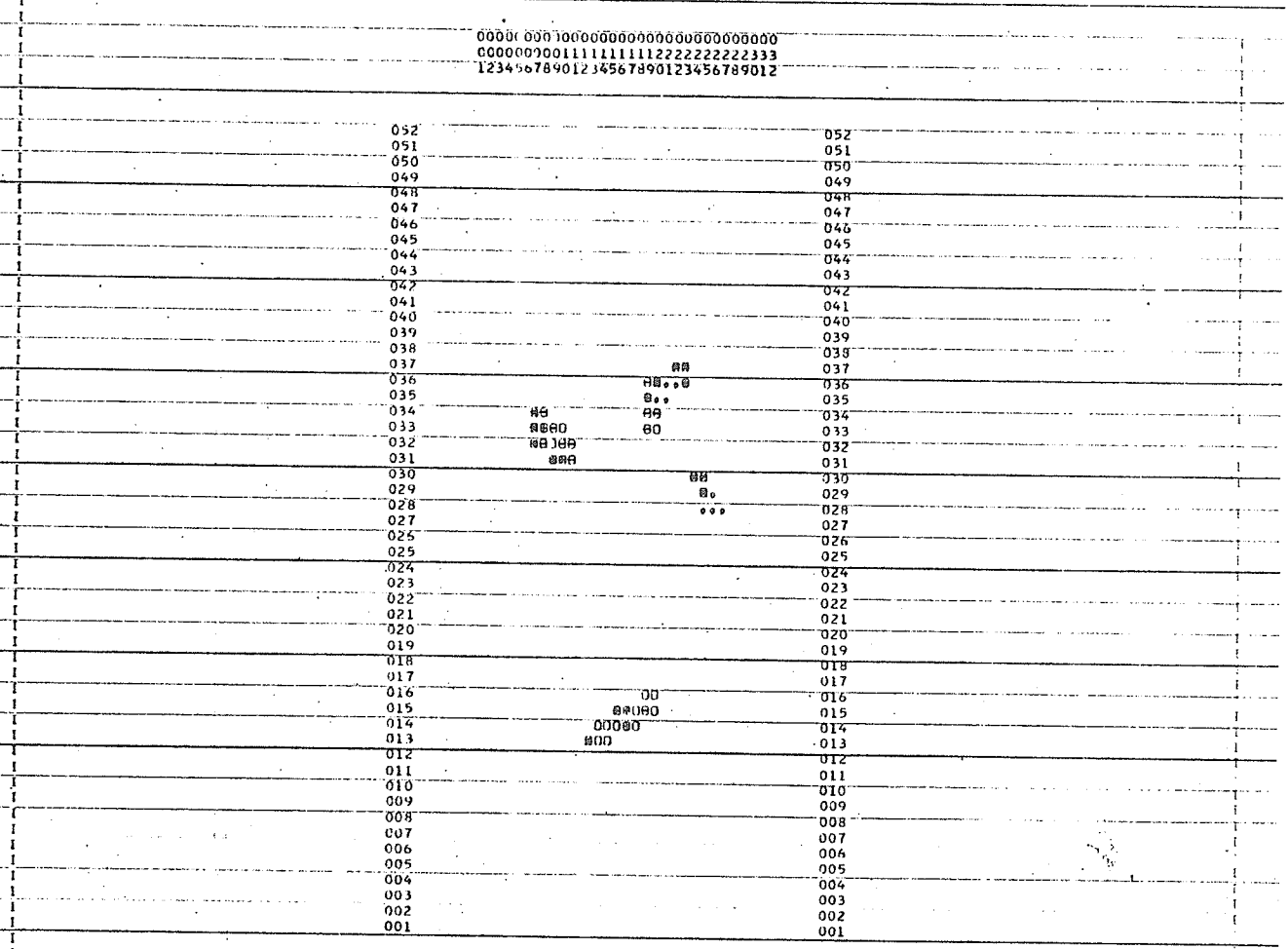
ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
SINGLE FAMILY UNIT

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	,	+	X	0	#	@			
FREQUENCY	1313	110	20	37	18	49	55	29	24	9

MAP 2,SHEET 1,DATA SET 1



4400

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

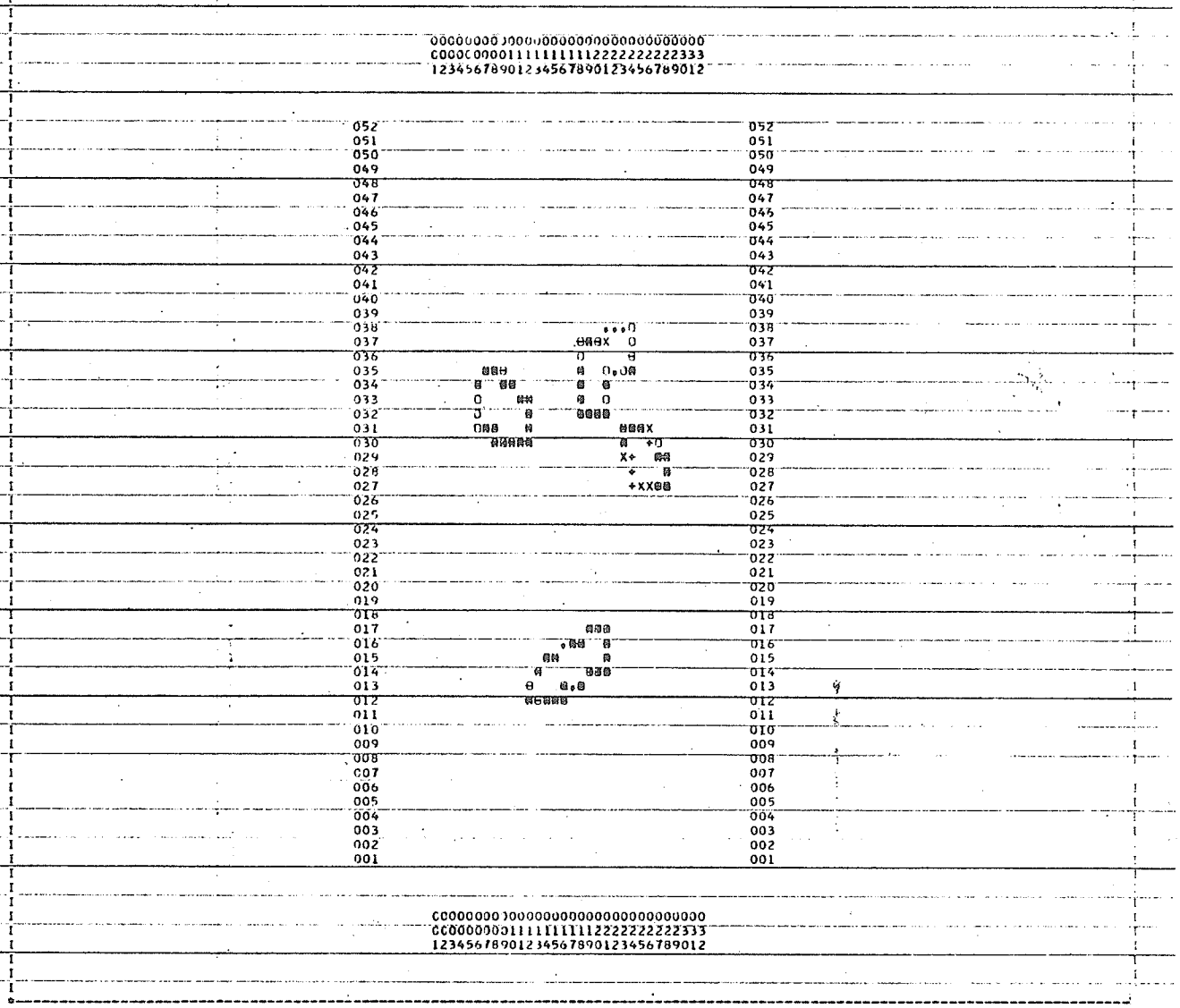
ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
MULTI-FAMILY UNIT (STAGE A)

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	#	@				
FREQUENCY	1614	8	0	0	13	11	9	4	4	1

MAP 3,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

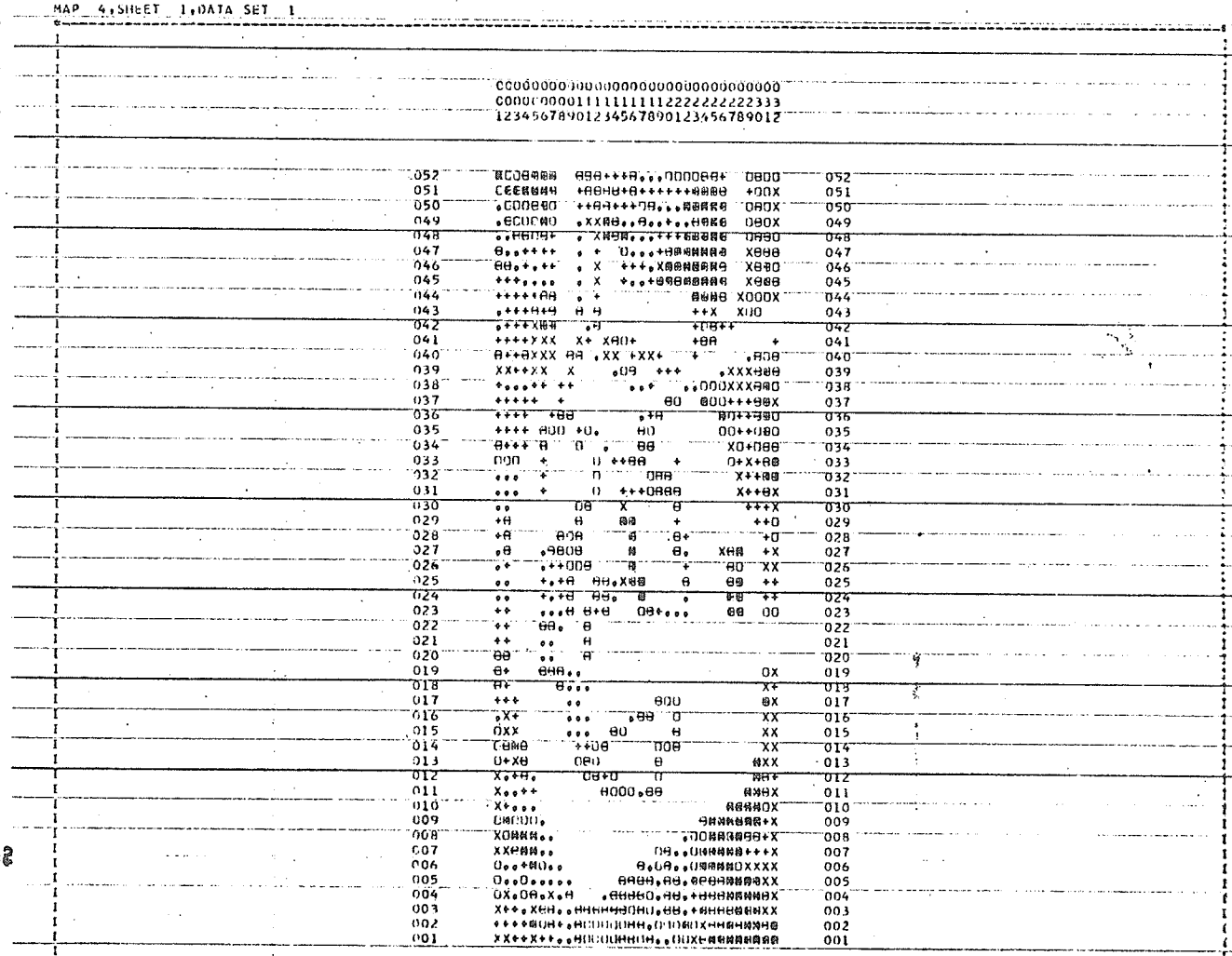
ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
MULTI-FAMILY UNIT (STAGE B)

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	#	@	A	B	C	D
FREQUENCY	1579	6	4	5	10	6	11	15	15	13

MAP 4,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

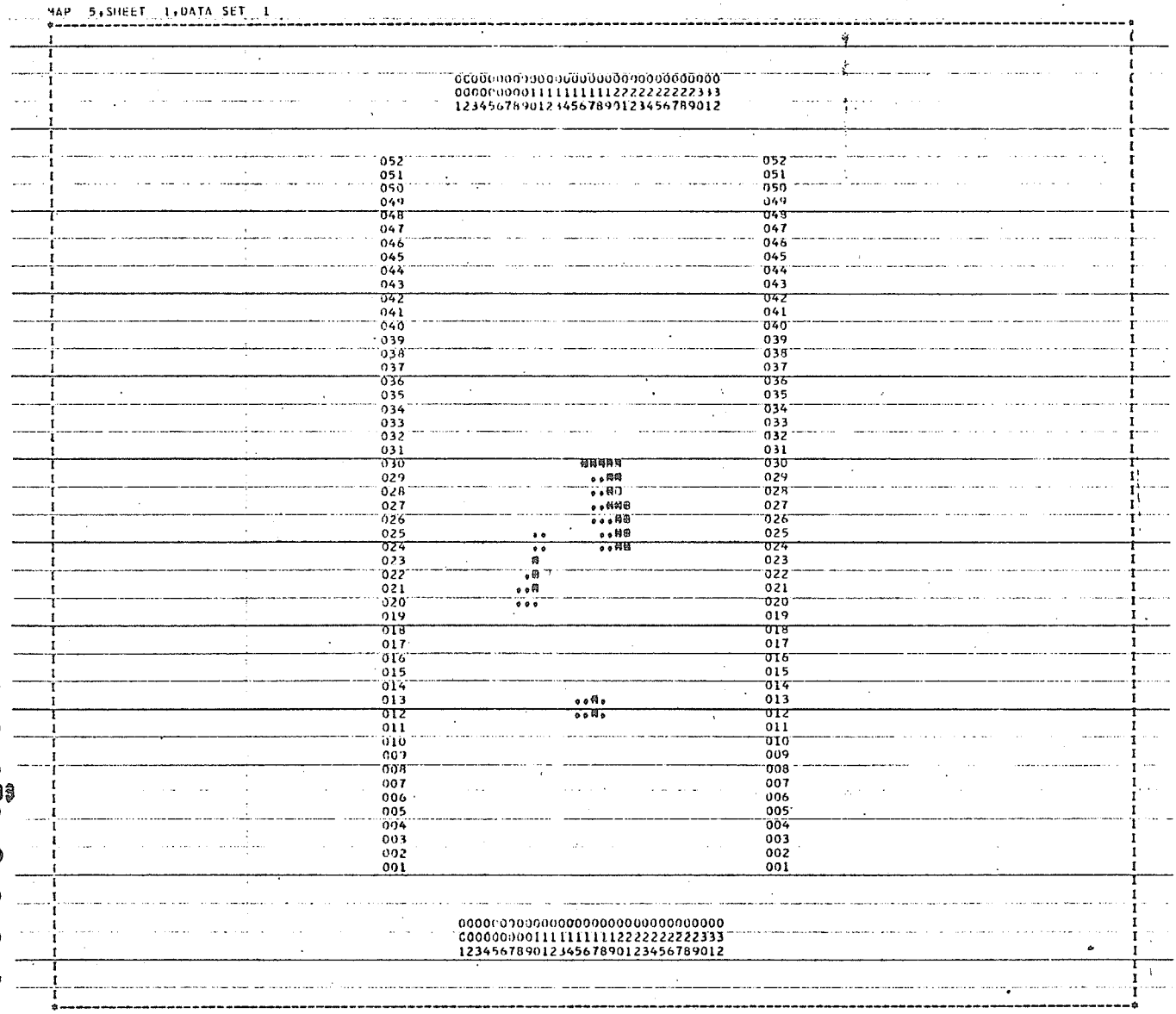
ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
PASSIVE RECREATION

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	740	153	191	97	136	203	75	52	14	3

MAP 5,SHEET 1,DATA SET 1



4403

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

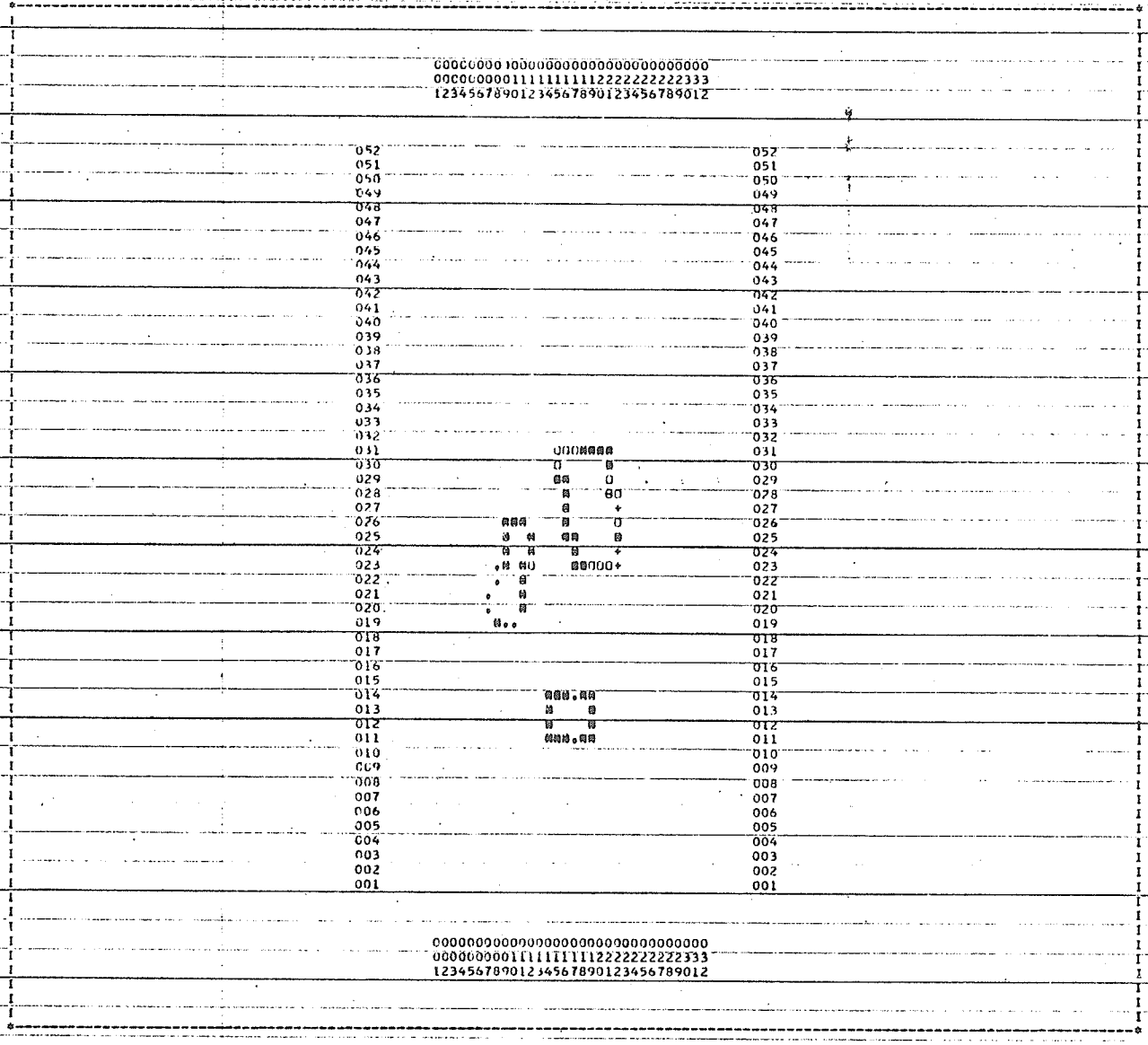
ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
ACTIVE RECREATION (STAGE A)

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	0	0	0	0	0	0
FREQUENCY	1612	29	0	0	1	0	4	5	6	7

MAP 6,SHEET 1,DATA SET 1



4400

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

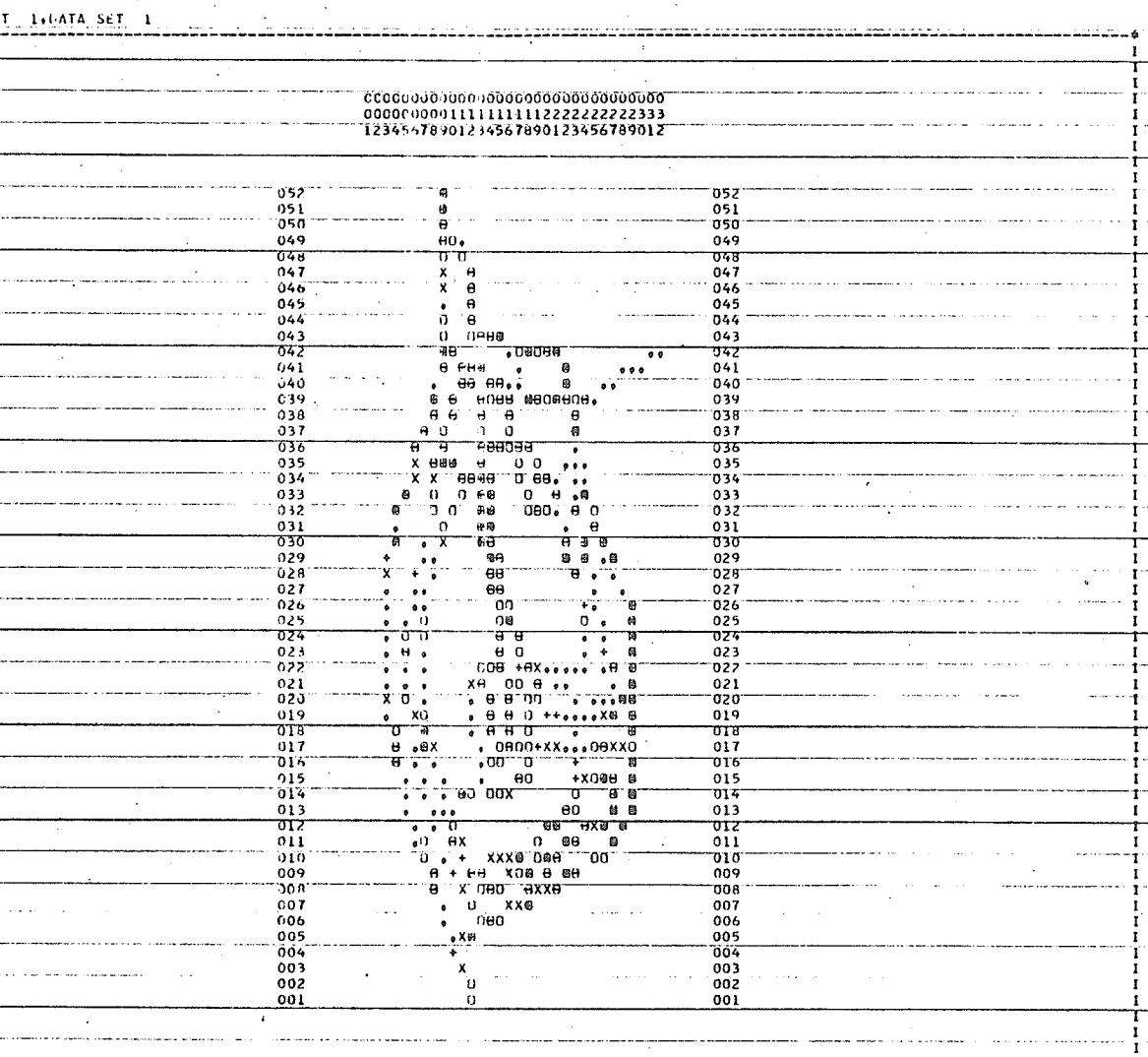
ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
ACTIVE RECREATION (STAGE B)

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	#	@	▒	▓	▒	▓
FREQUENCY	1598	8	3	0	11	1	0	24	0	19

MAP 7,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

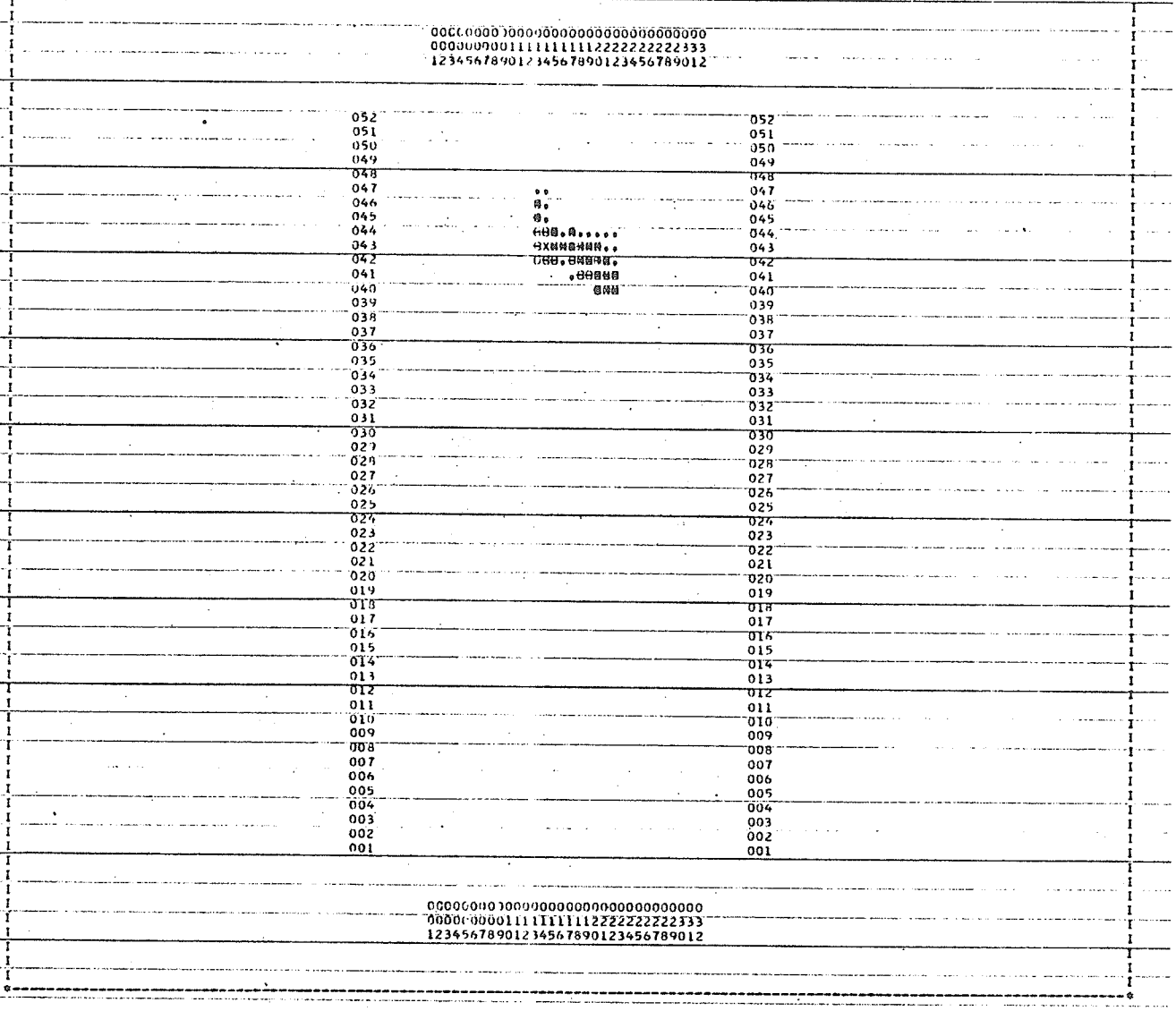
ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
ROAD AND UTILITY

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	#	@	A	B	C	D
FREQUENCY	1278	106	13	32	74	94	49	14	3	1

MAP 8,SHEET 1,DATA SET 1



4400

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
INDUSTRIAL (STAGE A)

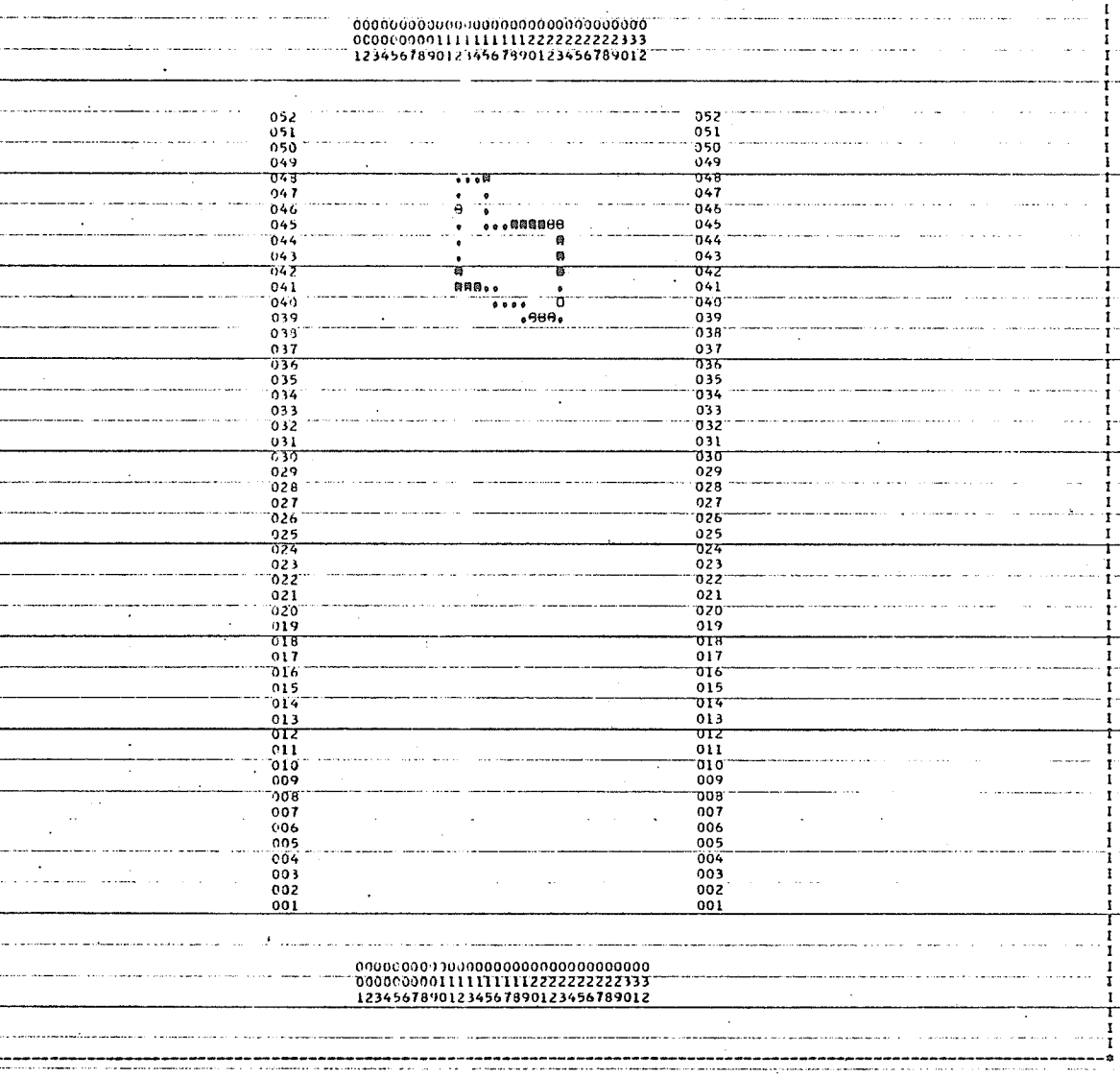
0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS 0 1 2 3 4 5 6 7 8 9

SYMBOLS

FREQUENCY 1619 15 0 1 1 8 1 11 7 1

MAP 9,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

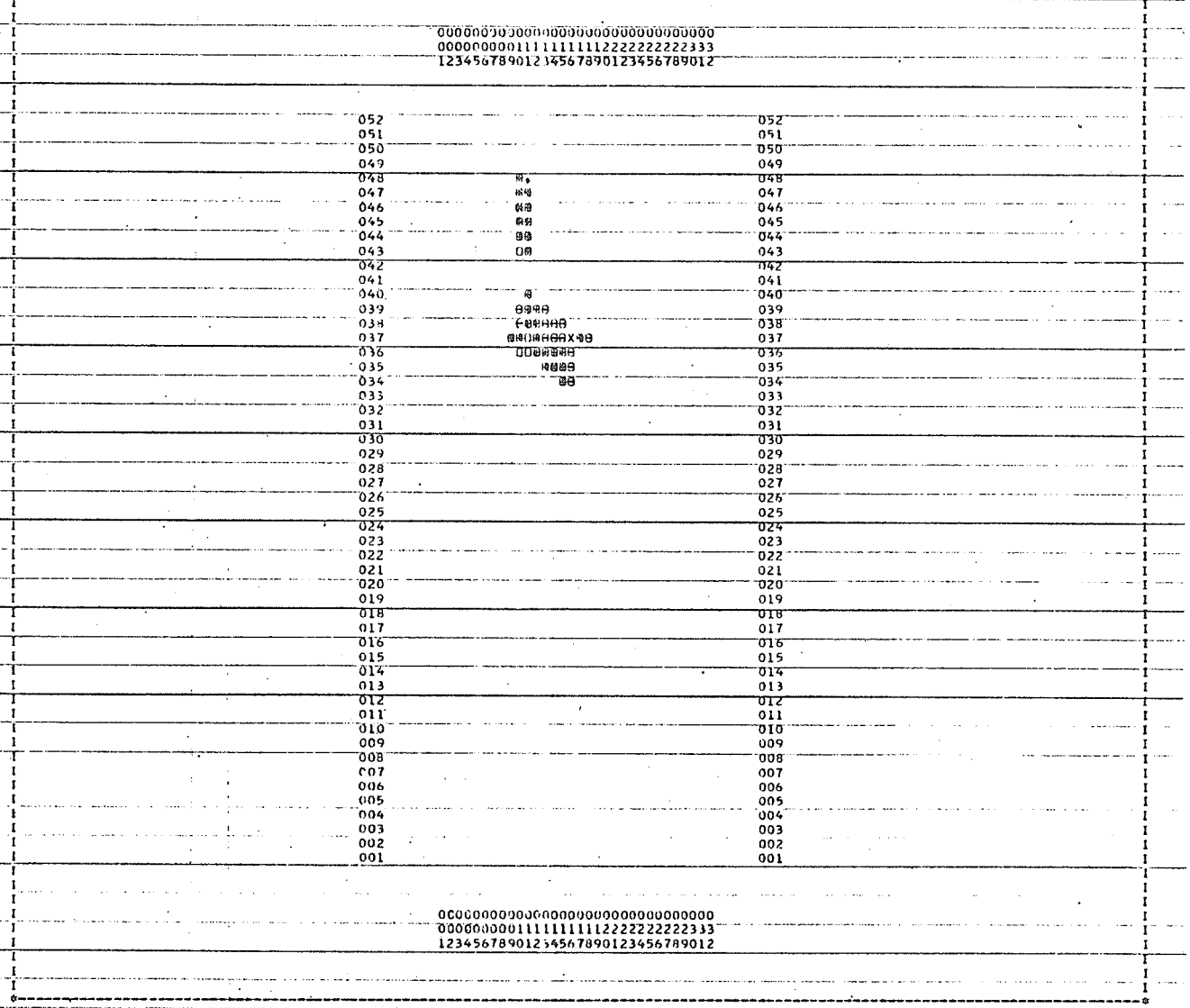
ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
INDUSTRIAL (STAGE 8)

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	#	@	@	@	@	@
FREQUENCY	1624	21	0	0	0	7	0	0	0	12

MAP 10,SHEET 1,DATA SET 1



4408

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

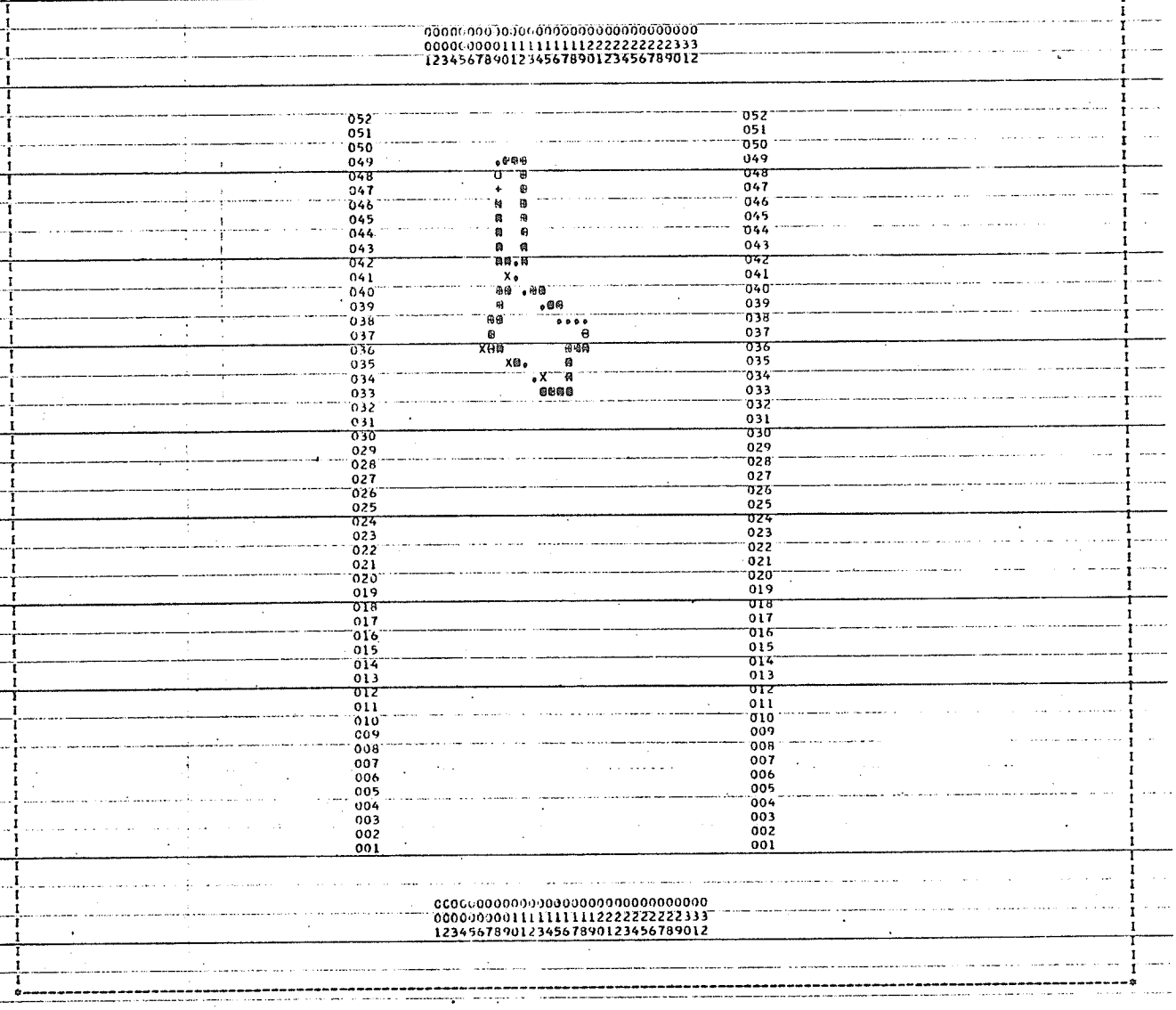
ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
COMMERCIAL (STAGE A)

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	8	9	6	3	4	7
FREQUENCY	1618	1	0	1	4	13	25	2	0	0

MAP 11,SHEET 1,DATA SET 1



4409

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

7.01 CONTROL DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
COMMERCIAL (STAGE B)

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	#	#	#	#	#	#
FREQUENCY	1609	11	1	4	1	2	22	2	4	9

IMPACT ANALYSIS

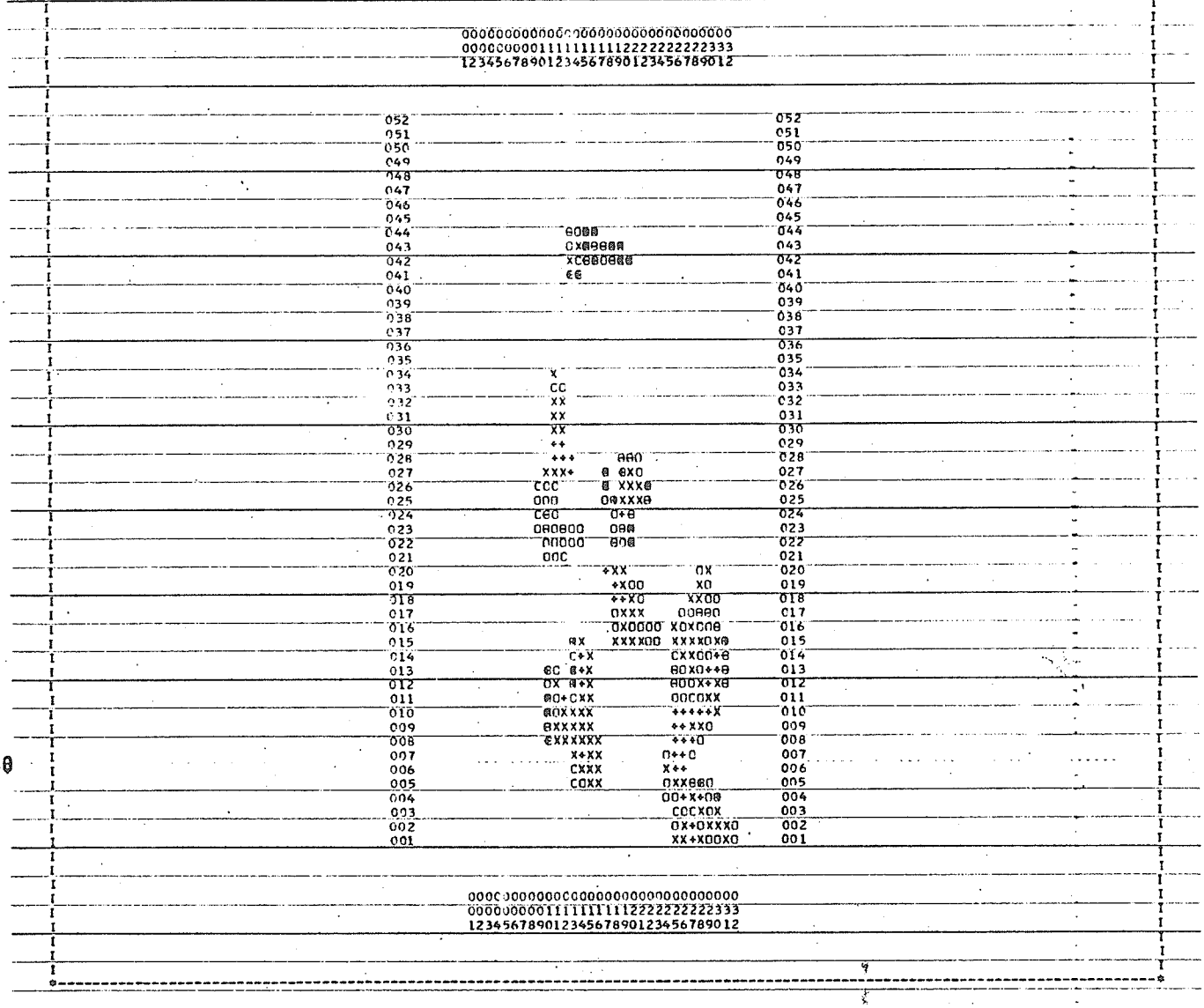
IMPACT : 7.02 ENVIRONMENT MOTIVATED DESIGN

8

TYPE	MAPS
ECOLOGICAL	MI.25 - MI. 35
PERCEPTUAL	MI.36 - MI. 37
ENVIRONMENT/ BENEFIT	MEB.12 - MEB.22

NOTE: The darker tones on the IMPACT map reflect a greater potential of environmental damage while the darker tones on ENVIRONMENT/ BENEFIT maps indicate an optimal use of the resource base.

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

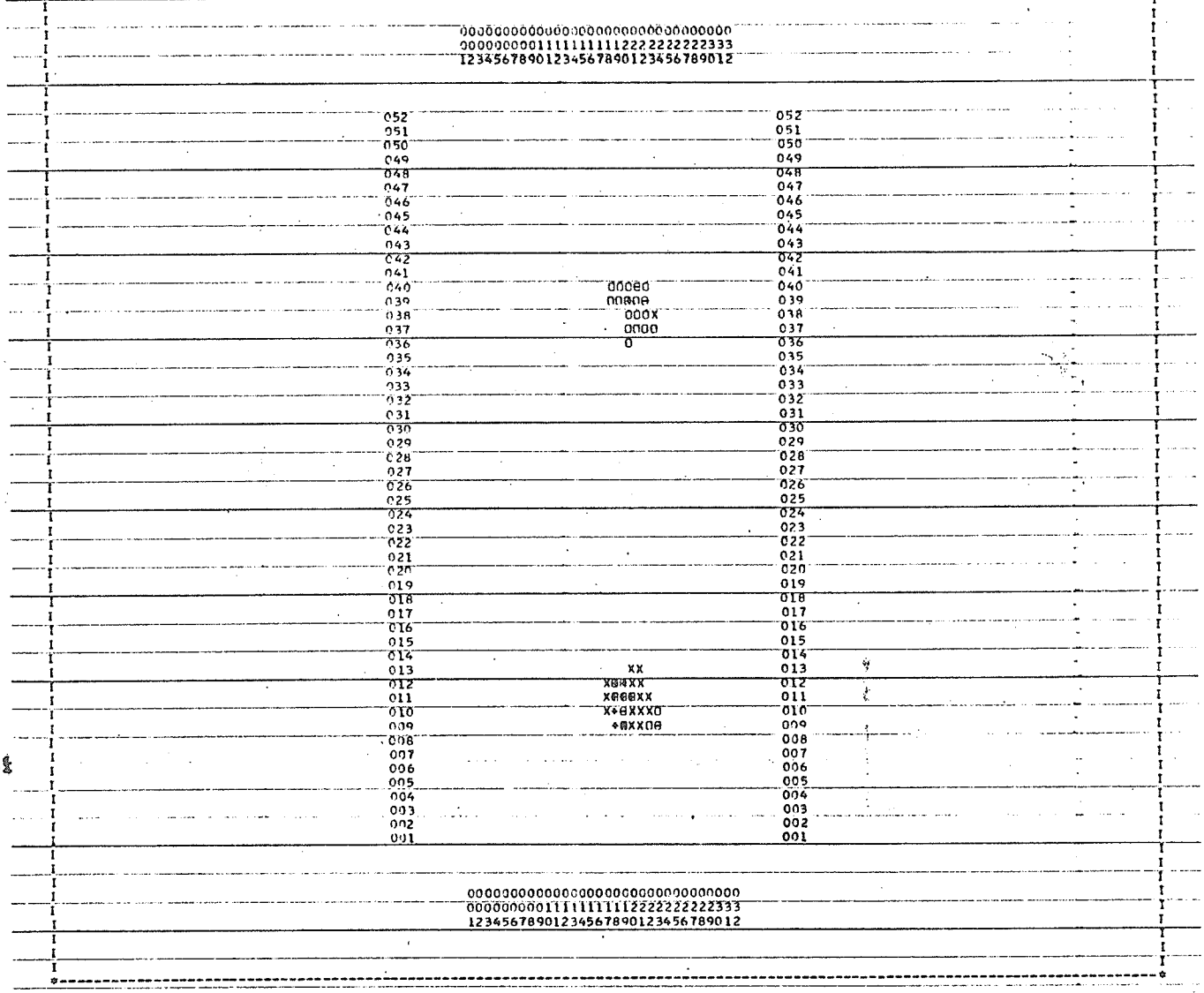
ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT MOTIVATED DESIGN
SINGLE FAMILY UNIT IMPACT ANALYSIS
LAND USE CODE

0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	@	#	&	$	%	A
FREQUENCY	1386	0	38	96	92	25	14	11	2	0

MAP 2,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

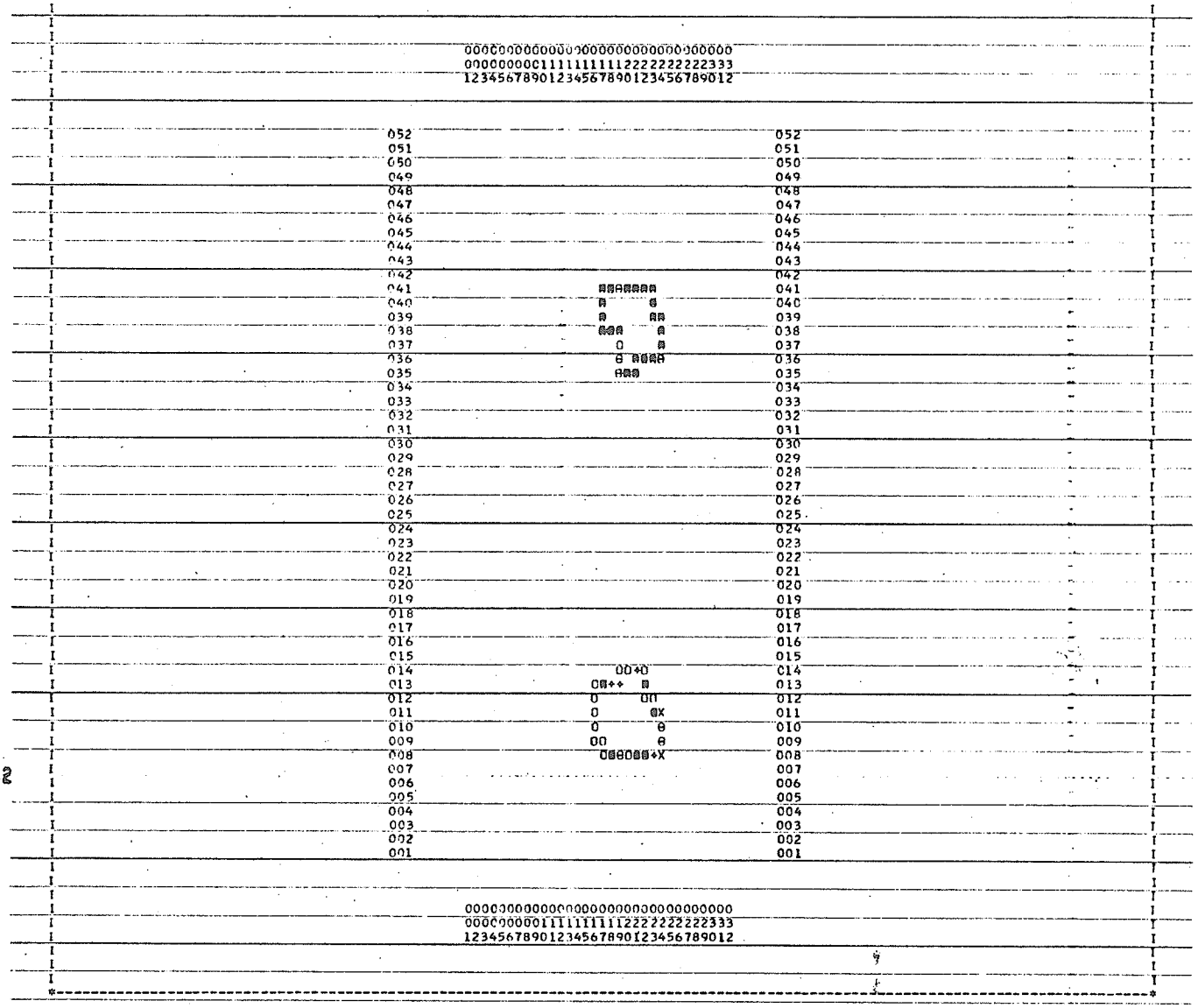
ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT ACTIVATED DESIGN
MULTI-FAMILY UNIT IMPACT ANALYSIS (STAGE A)
LAND USE CODE

0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	1619	0	2	15	16	5	6	1	0	0

MAP 3, SHEET 1, DATA SET 1



7642

LEAF RAPIDS PLANNING STUDY

CAVID JOHNS M. ARCH. 1972

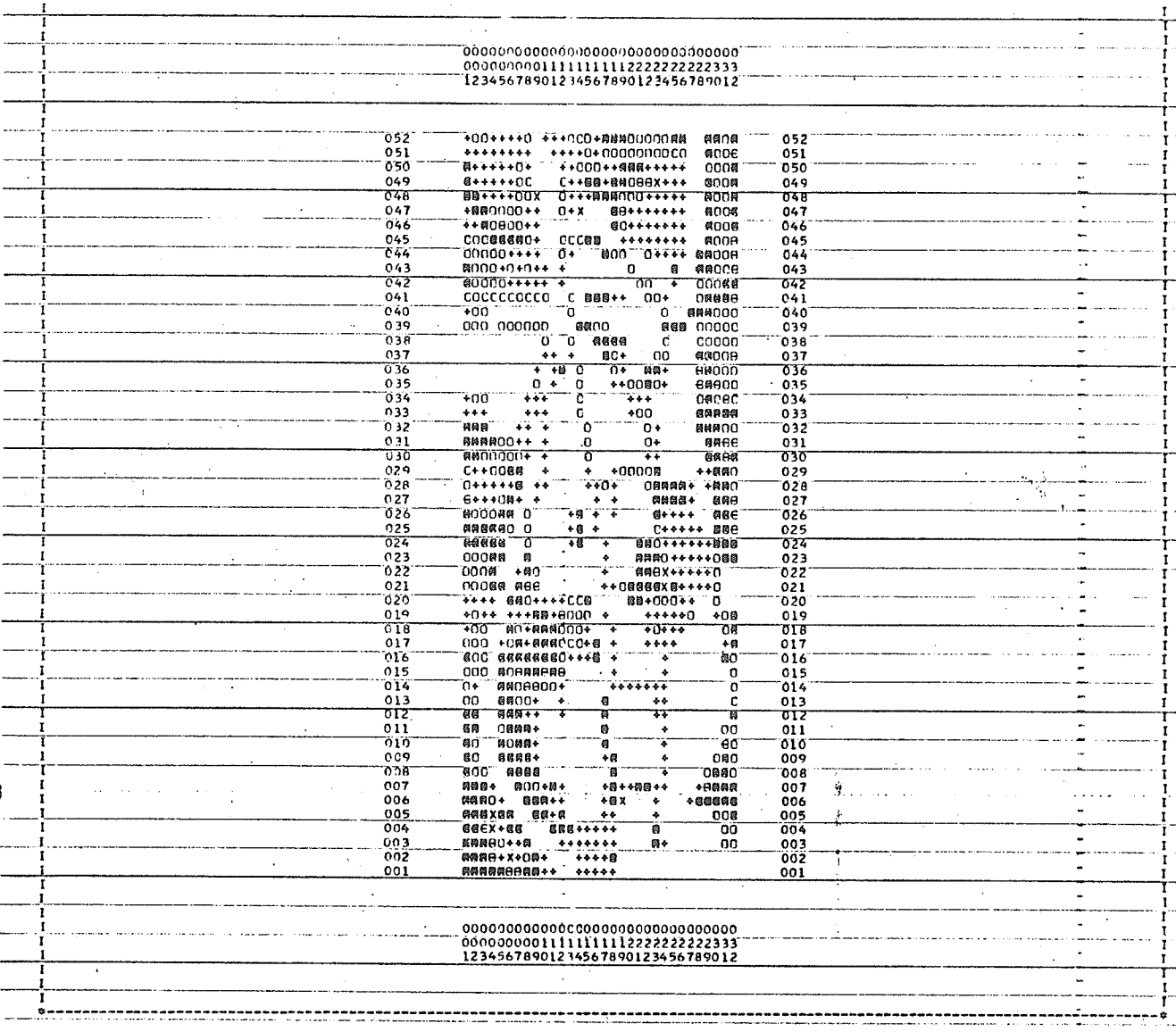
CNE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT MOTIVATED DESIGN
MULTI-FAMILY UNIT IMPACT ANALYSIS (STAGE B)
LAND USE CODE

0 NO LAND USE OF THIS TYPE
1
2 COMPATIABLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	@	#	=	-	:	A
FREQUENCY	1610	0	4	2	14	7	0	1	0	26

MAP 4,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

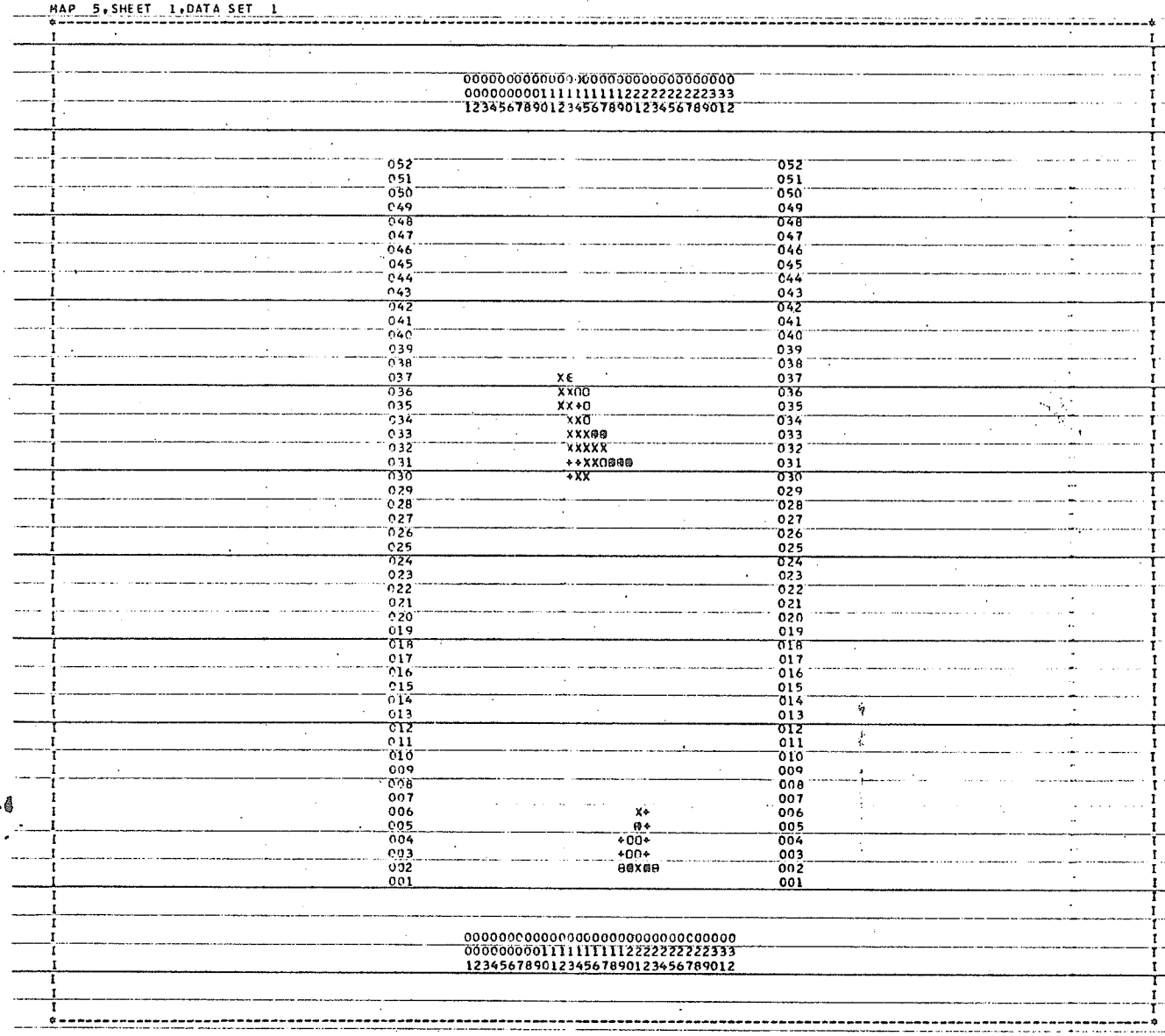
ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT ACTIVATED DESIGN
PASSIVE RECREATION IMPACT ANALYSIS
LAND USE CODE

0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	.	+	X	O	@	#	#	#	#
FREQUENCY	686	0	366	29	289	47	0	193	114	0

MAP 5, SHEET 1, DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

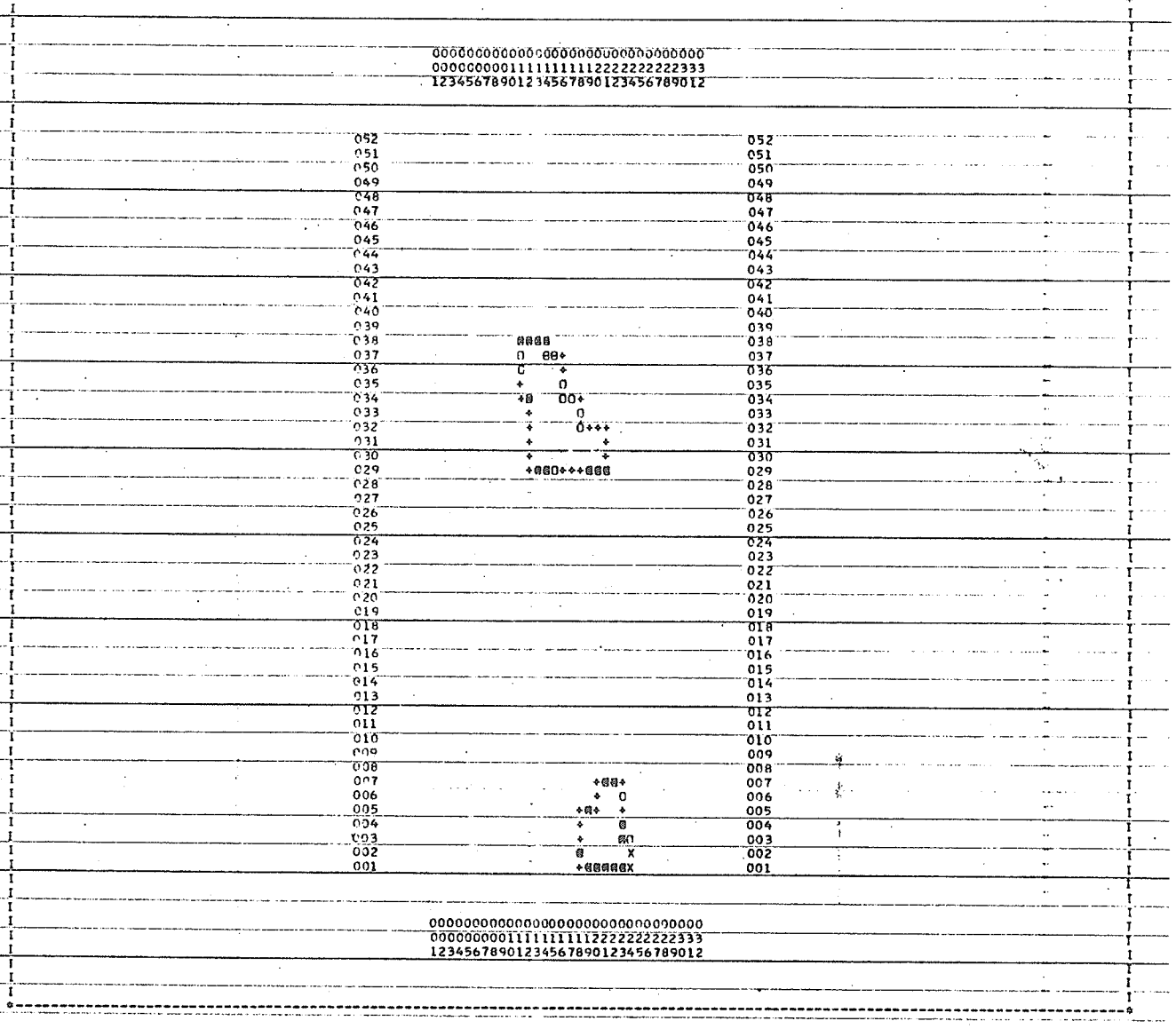
7.02 ENVIRONMENT MOTIVATED DESIGN
ACTIVE RECREATION IMPACT ANALYSIS (STAGE A)
LAND USE CODE

0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	@	@	@	@	@	@
FREQUENCY	1613	0	10	21	9	2	9	0	0	0

7646

MAP 6,SHEET 1,DATA SET 1



7645

LEAF RAPIDS PLANNING STUDY

CAVID JOHNS M. ARCH. 1972

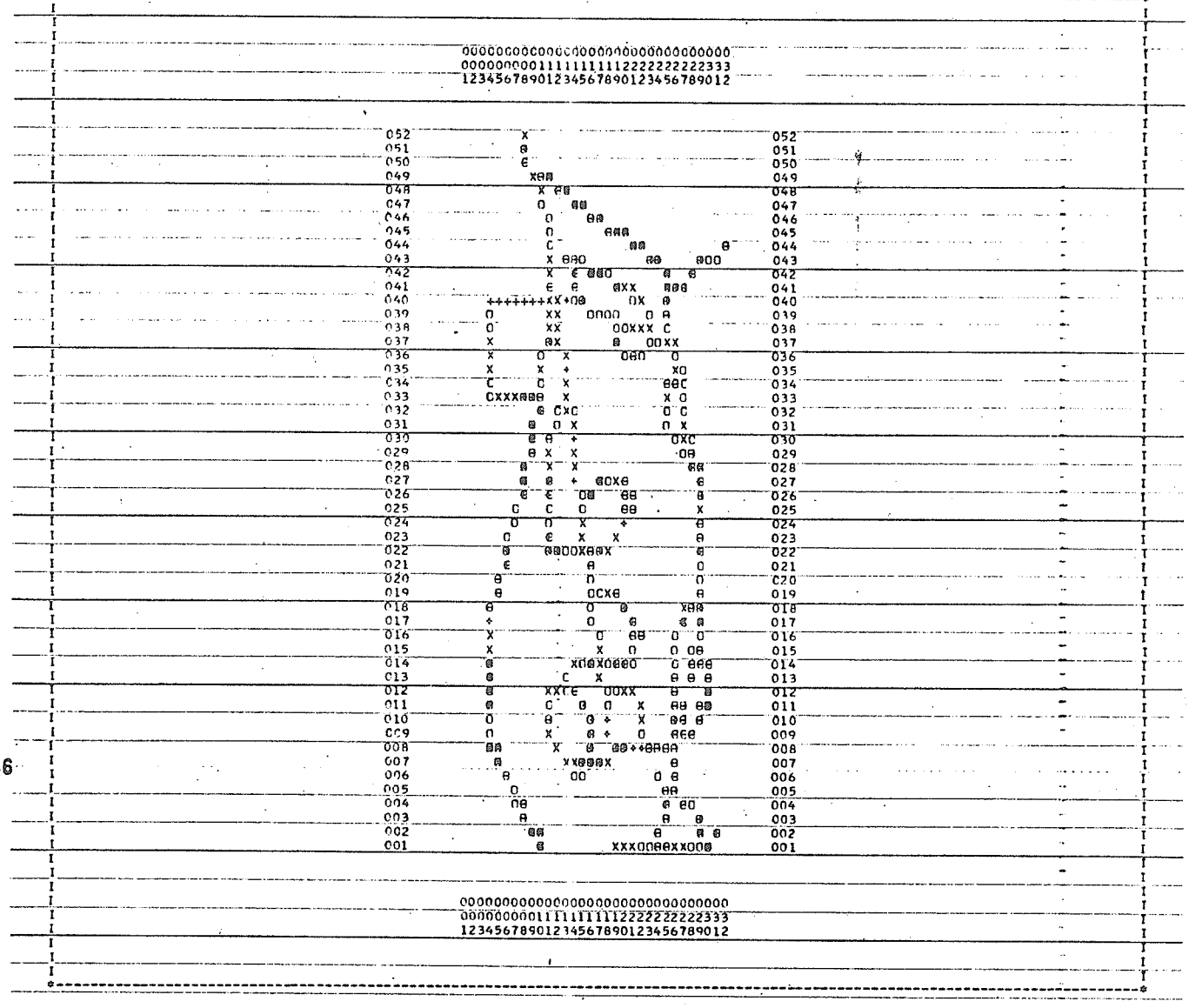
ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT MOTIVATED DESIGN
ACTIVE RECREATION IMPACT ANALYSIS (STAGE 8)
LAND USE CODE

0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	8	#	@	A	B	C
FREQUENCY	1597	0	27	2	10	2	0	9	10	0

MAP 7,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT MOTIVATED DESIGN
ROAD AND UTILITY IMPACT ANALYSIS
LAND USE CODE

0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS										
FREQUENCY	1336	0	18	71	83	73	53	19	5	7

MAP 8, SHEET 1, DATA SET 1

```
                                                  000000000000000000000000000000000
                                                  000000000111111111122222222223333
                                                  123456789012345678901234567890123
052                                                                                052
051                                                                                051
050                                                                                050
049                                                                                049
048                                                                                048
047                                                                                047
046                                                                                046
045                                                                                045
044                                                                                044
043                                                                                043
042                                                                                042
041                                                                                041
040                                                                                040
039                                                                                039
038                                  @@@@@@X@                                      038
037                                  @@XXXXX                                       037
036                                  @@XCXX@                                       036
035                                  @@X0@@                                        035
034                                    0@@X                                        034
033                                    0XXX                                        033
032                                    0000                                        032
031                                                                                031
030                                                                                030
029                                                                                029
028                                                                                028
027                                                                                027
026                                                                                026
025                                                                                025
024                                                                                024
023                                                                                023
022                                                                                022
021                                                                                021
020                                                                                020
019                                                                                019
018                                                                                018
017                                                                                017
016                                                                                016
015                                                                                015
014                                                                                014
013                                                                                013
012                                                                                012
011                                                                                011
010                                                                                010
009                                                                                009
008                                                                                008
007                                                                                007
006                                                                                006
005                                                                                005
004                                                                                004
003                                                                                003
002                                                                                002
001                                                                                001
                                                  000000000000000000000000000000000
                                                  000000000111111111122222222223333
                                                  123456789012345678901234567890123
```

7643

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

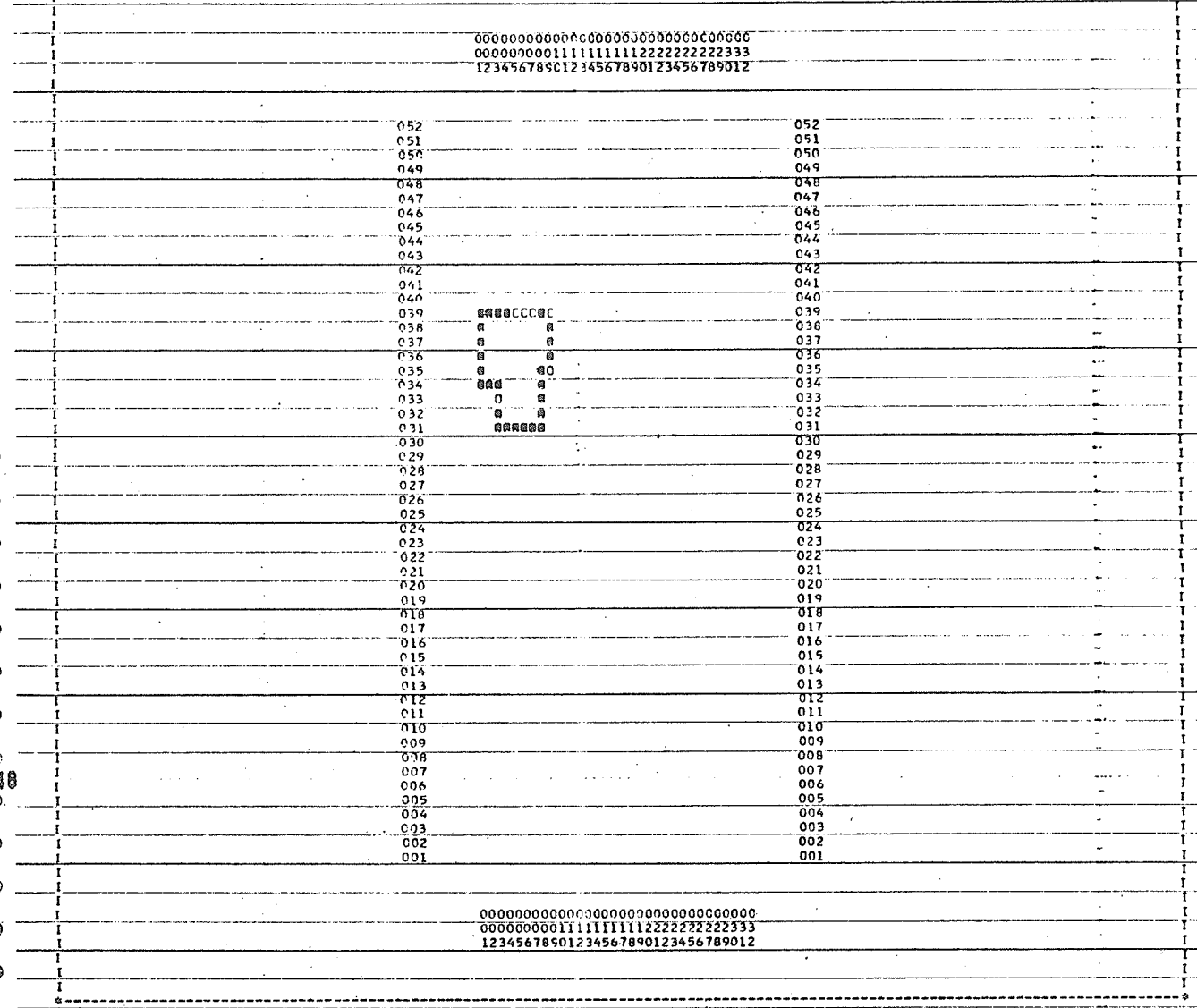
ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT MOTIVATED DESIGN
INDUSTRIAL IMPACT ANALYSIS (STAGE A)
LAND USE CODE

0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS		• • • • • • • • •	+ + + + + + + + +	X X X X X X X X X	O C O C O C C C C	E E @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @
		• • • • • • • • •	+ + + + + + + + +	X X X X X X X X X	O C O C O C O O O	E E @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @
		• • • • • • • • •	+ + + + + + + + +	X X X X X X X X X	O C O C O C O O O	E E @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @
		• • • • • • • • •	+ + + + + + + + +	X X X X X X X X X	O C O C O C O O O	E E @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @
		• • • • • • • • •	+ + + + + + + + +	X X X X X X X X X	O C O C O C O O O	E E @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @	@ @ @ @ @ @ @ @ @
FREQUENCY	1625	0	0	14	9	15	0	1	0	0

MAP 9,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

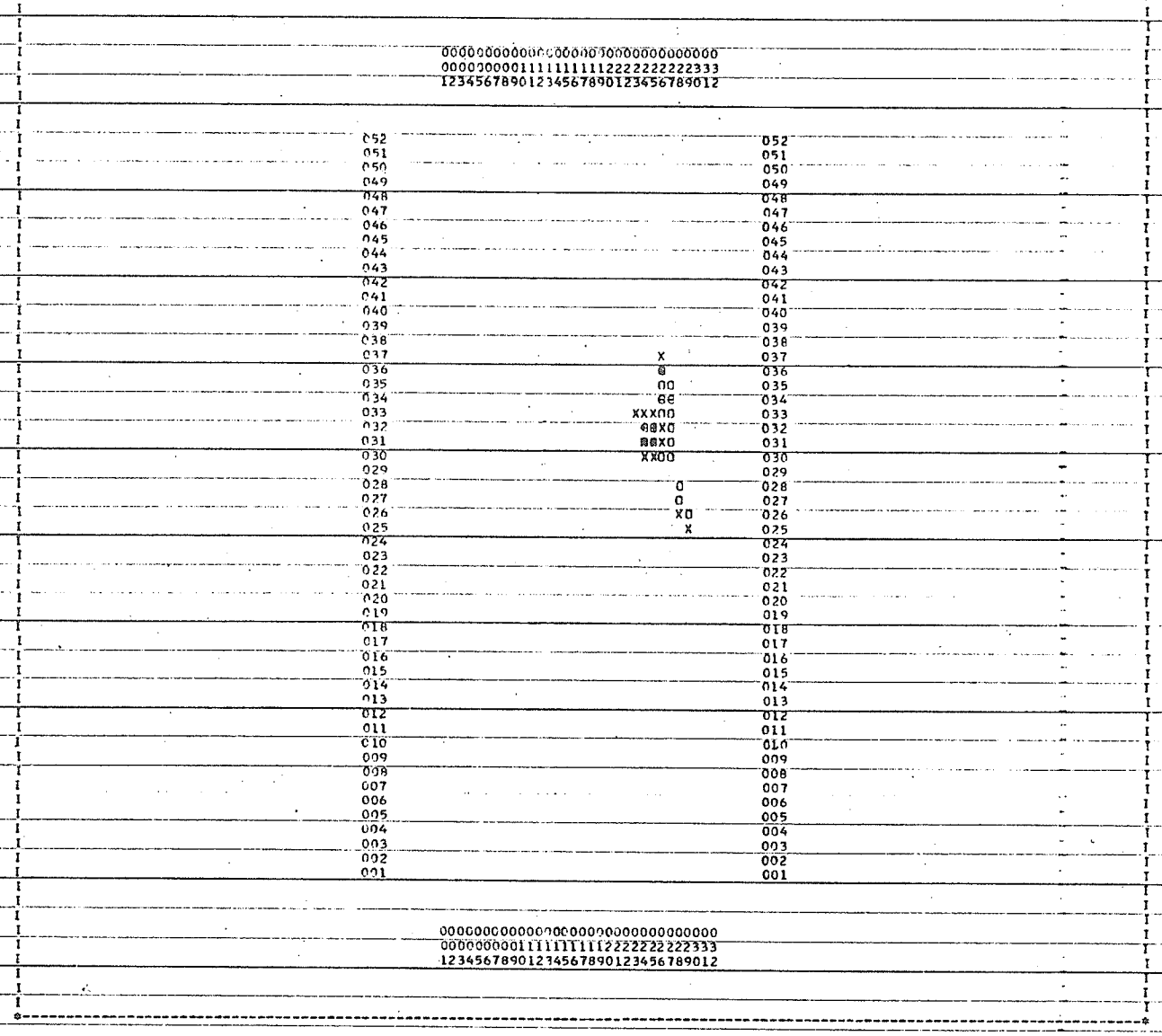
ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT MOTIVATED DESIGN
INDUSTRIAL IMPACT ANALYSIS (STAGE 8)
LAND USE CODE

0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	,	+	X	0	@	#			
FREQUENCY 1632	0	0	0	6	0	0	0	0	26	

MAP 10,SHEET 1,DATA SET 1



7640

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

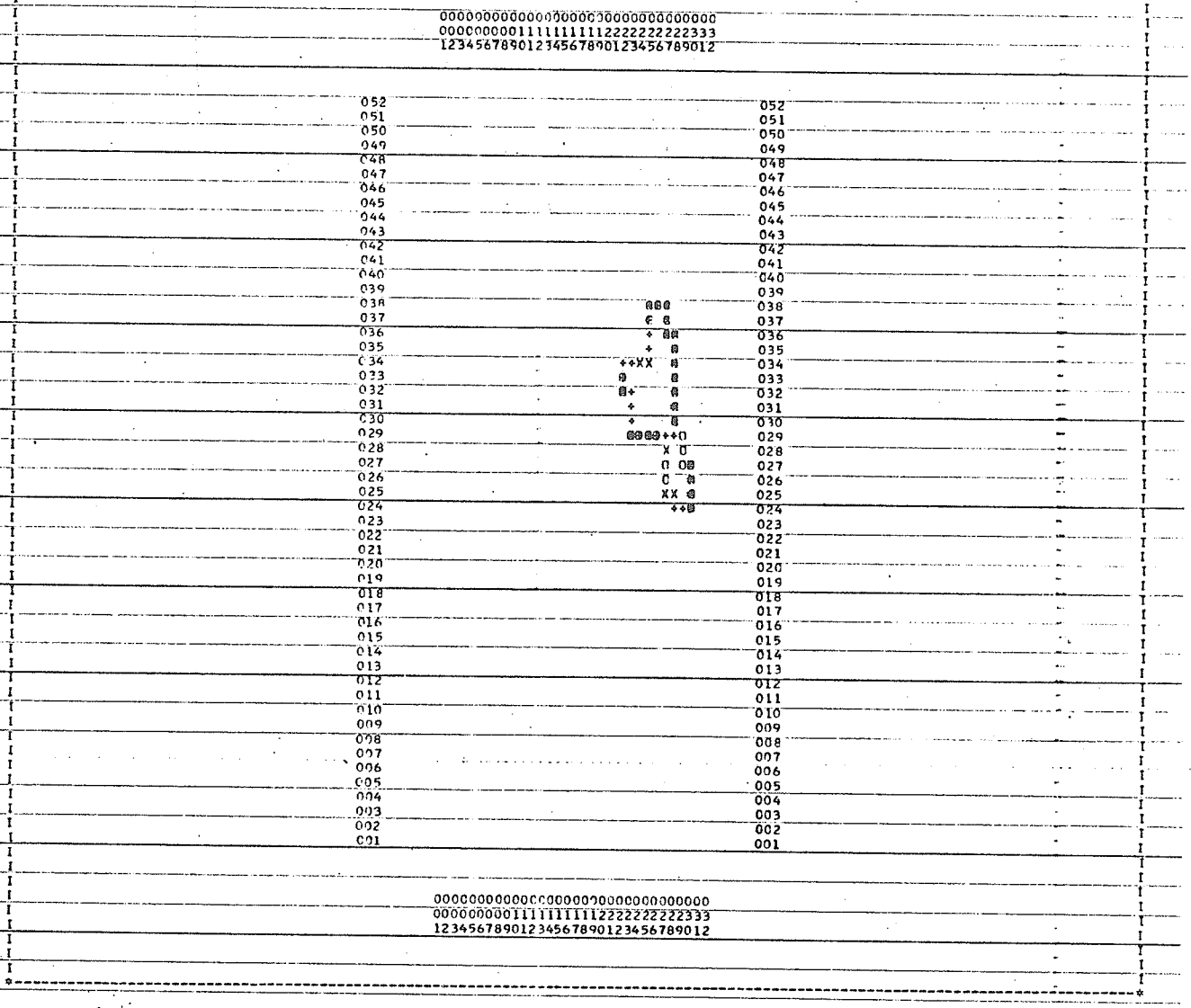
ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT MOTIVATED DESIGN
COMMERCIAL IMPACT ANALYSIS (STAGE A)
LAND USE CODE

0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	C	E	@	A	B	D
FREQUENCY	1636	0	0	10	11	2	4	1	0	0

MAP 11,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT MCTIVATED DESIGN
COMMERCIAL IMPACT ANALYSIS (STAGE 8)
LAND USE CODE

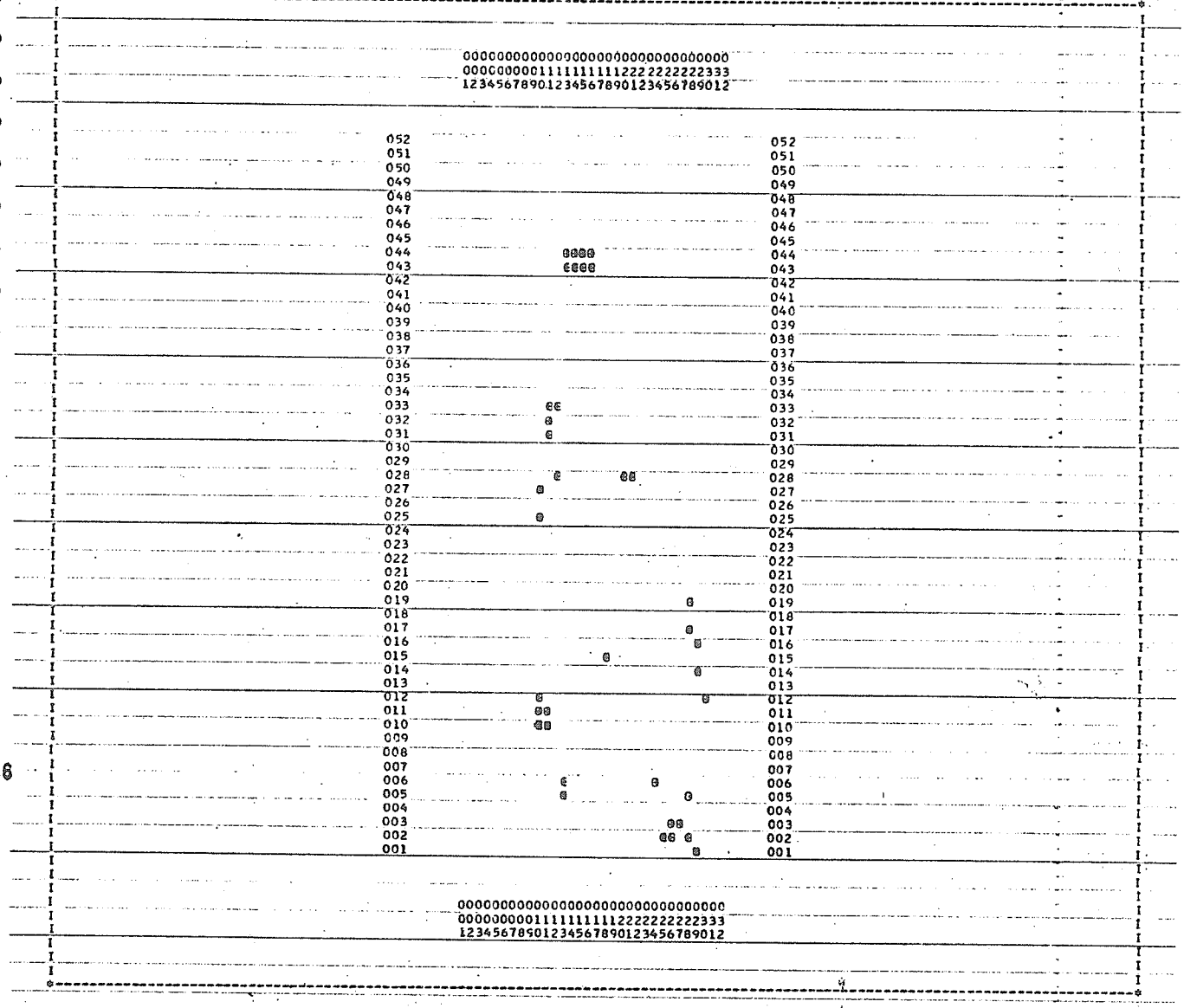
0 NO LAND USE OF THIS TYPE
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS 0 1 2 3 4 5 6 7 8 9

SYMBOLS

FREQUENCY 1620 0 11 5 5 0 8 9 3 6

MAP 1,SHEET 1,DATA SET 1



1386

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

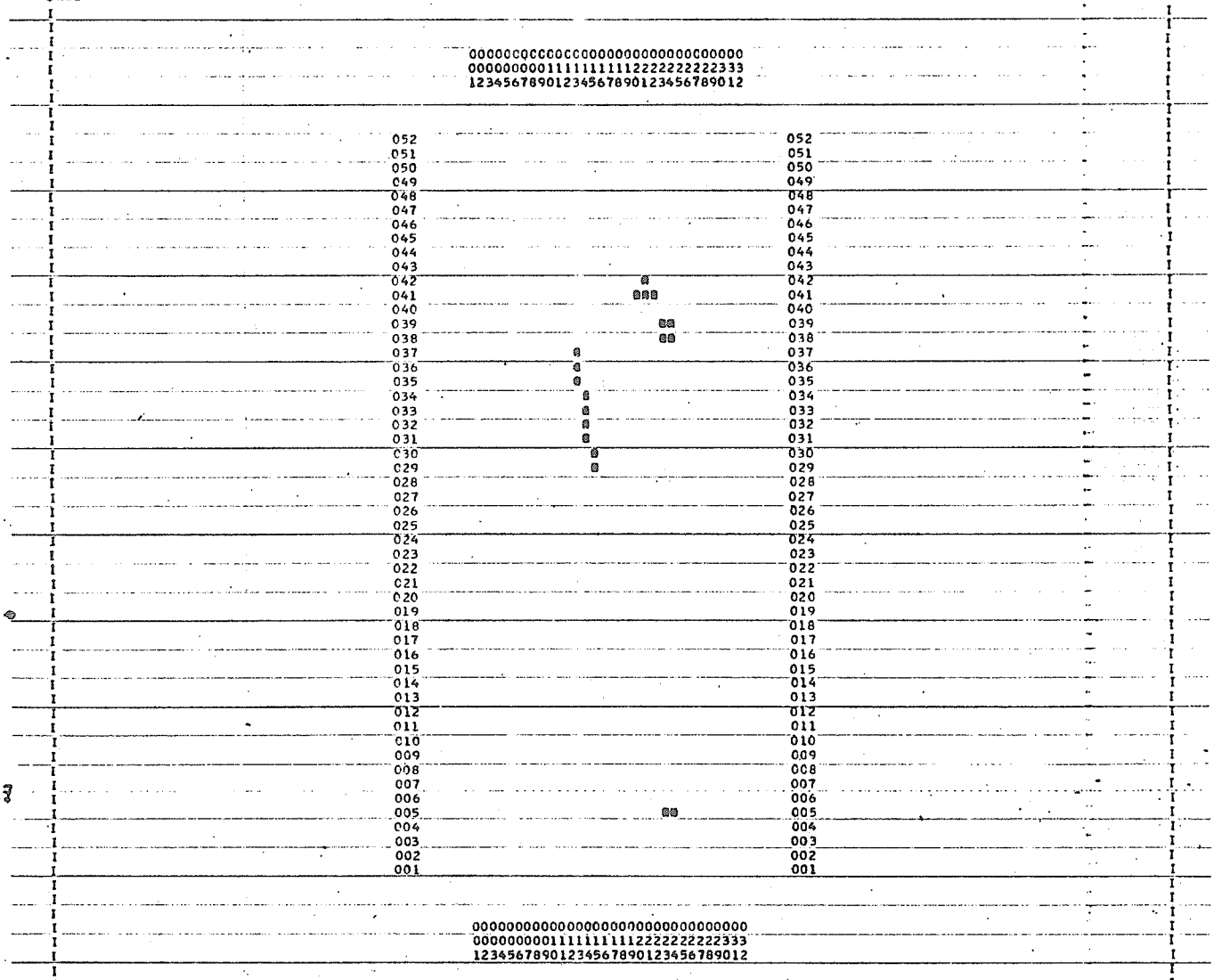
ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT MOTIVATED DESIGN
PERCEPTUAL IMPACT "POINT LAND USES"

0 NO IMPACT
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	@	#	&	$	A	E
FREQUENCY	1626	0	0	0	0	0	34	0	0	4

MAP 2,SHEET 1,DATA SET 1



1387

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

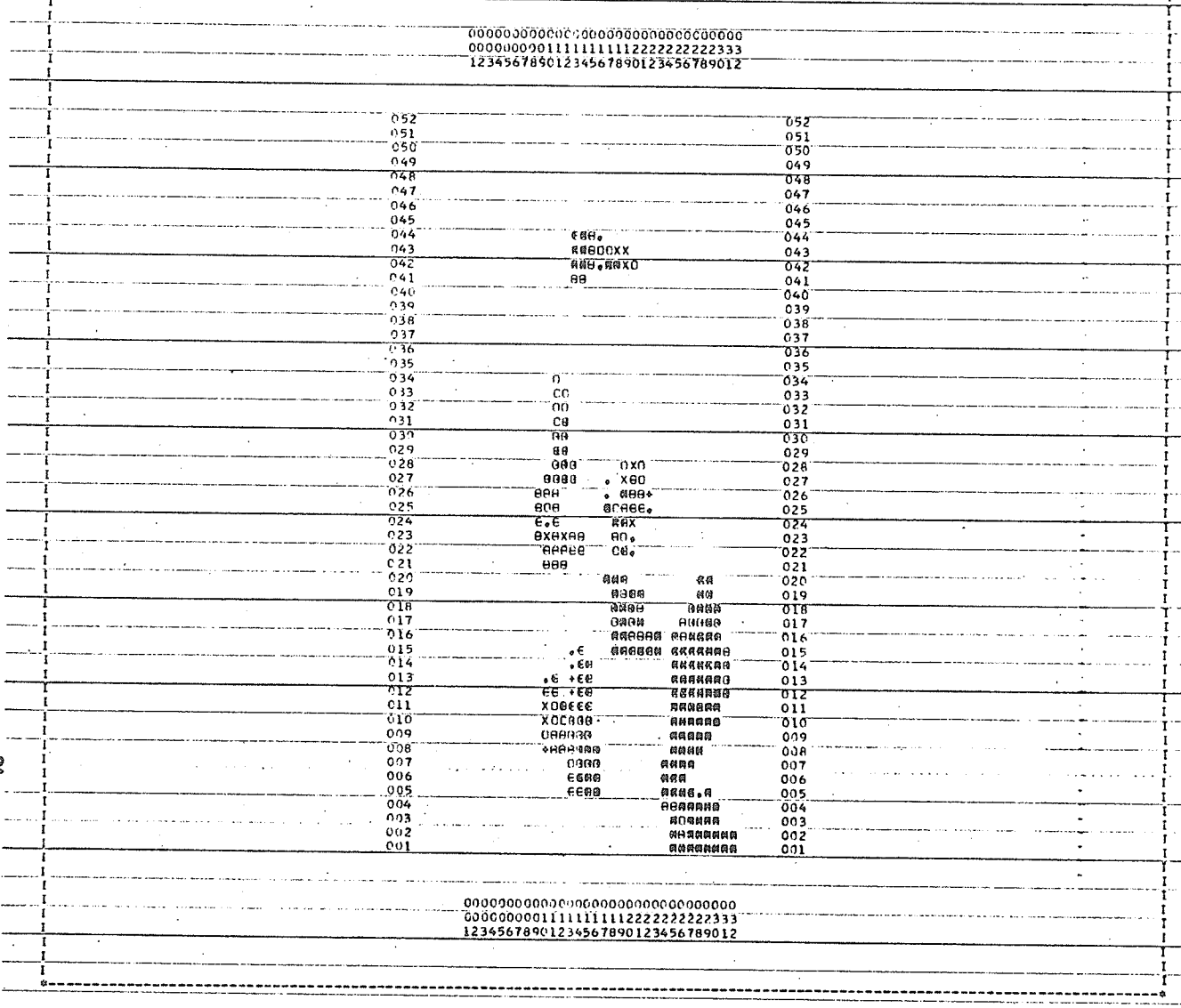
ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT MOTIVATED DESIGN
PERCEPTUAL IMPACT "STRIP OR CLUSTER LAND USES"

0 NO IMPACT
1
2 COMPATIBLE
3
4 MODERATE
5
6 SEVERE
7
8
9 THRESHOLD

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	@					
FREQUENCY	1645	0	0	0	0	0	0	0	0	19

MAP 1,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

CAVIC JOHNS M. ARCH. 1972

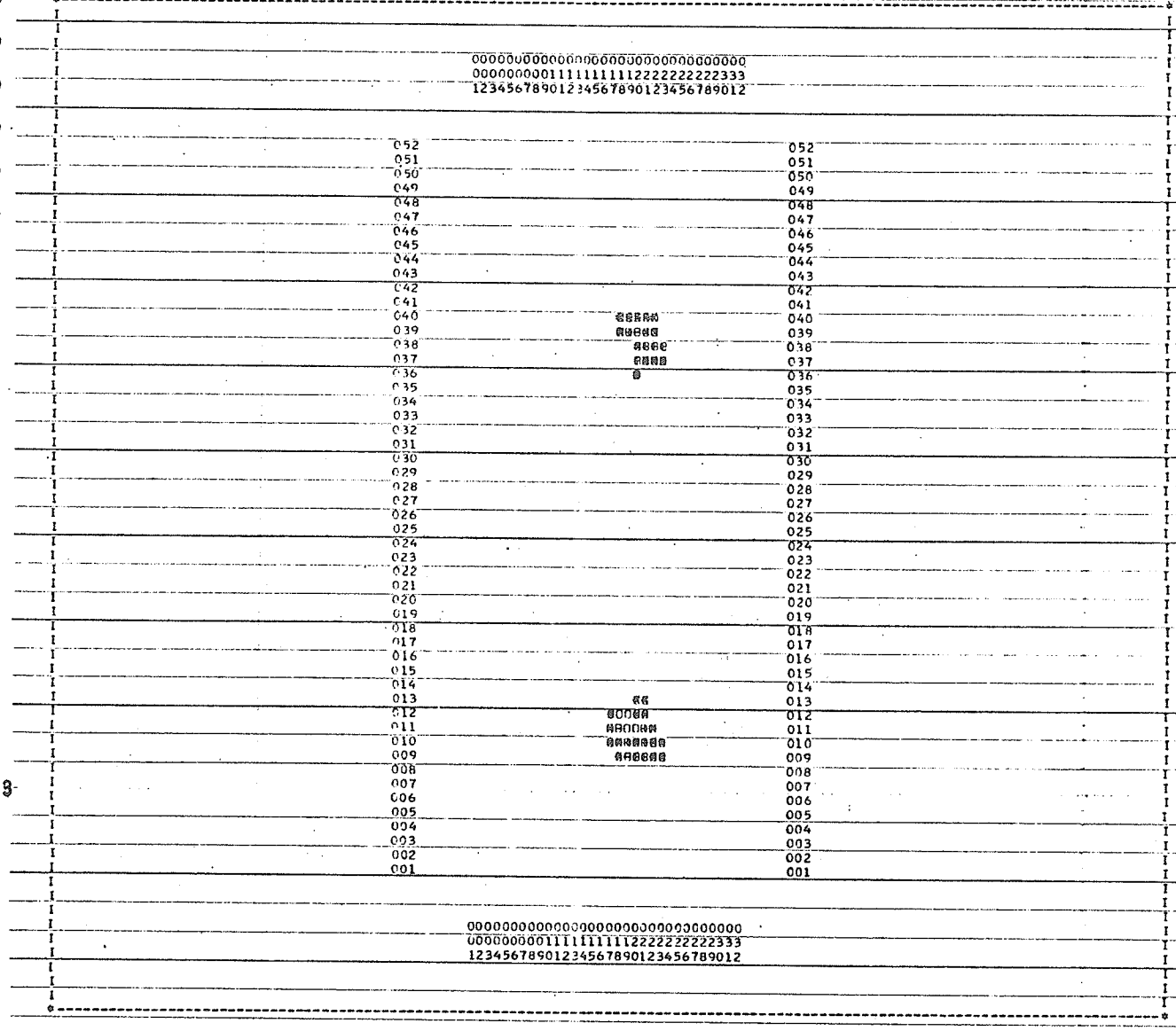
ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT MOTIVATED DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
SINGLE FAMILY UNIT

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	O	C	E	#	#	#
FREQUENCY	1386	12	4	10	13	62	64	50	38	25

MAP 2,SHEET 1,DATA SET 1



7543

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

ONE SYMBOL EQUALS ONE ACRE

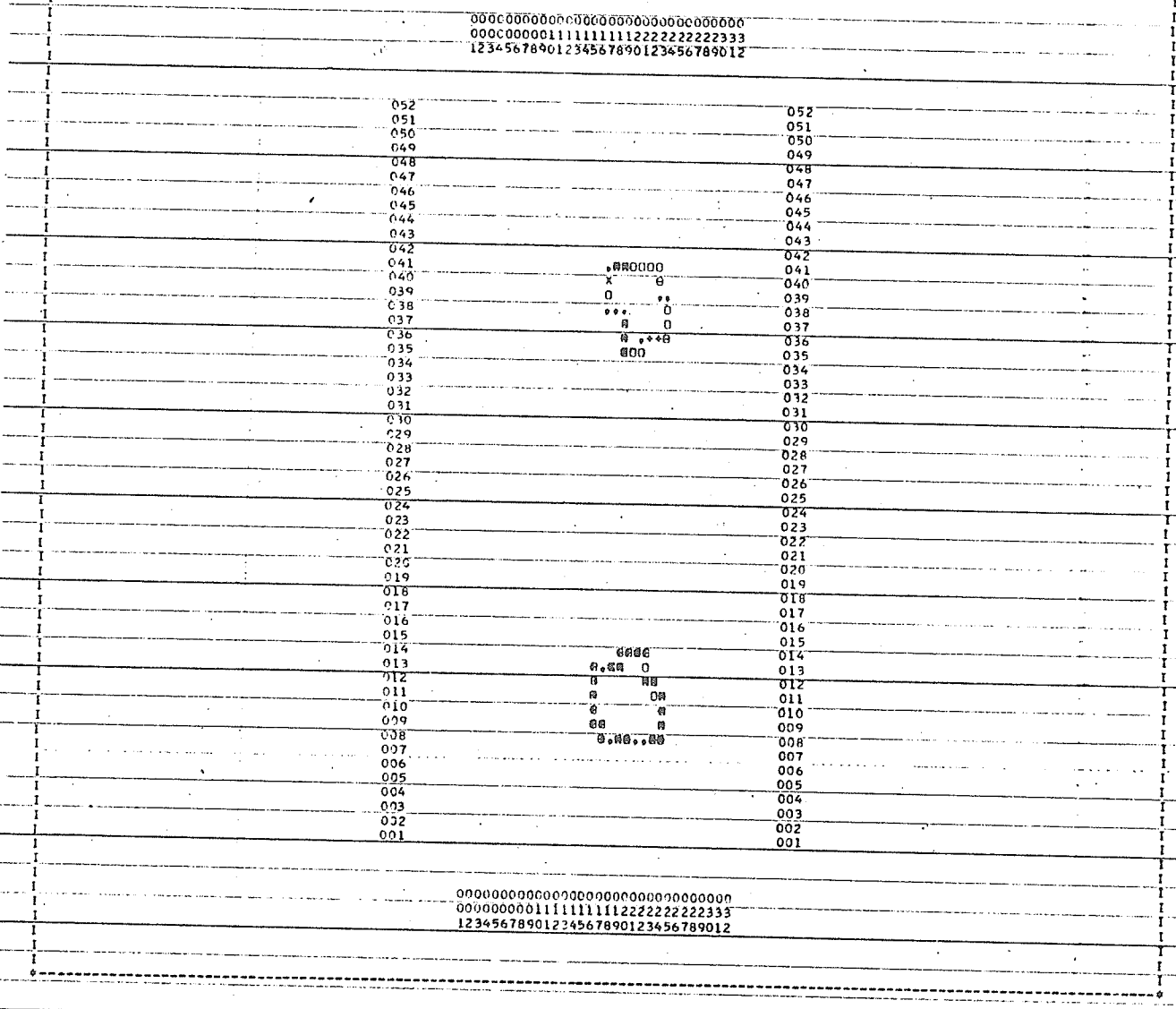
7.02 ENVIRONMENT MOTIVATED DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
MULTI-FAMILY UNIT (STAGE A)

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	#	@	&	%	!	$
FREQUENCY	1619	0	C	0	4	3	10	9	18	1

MEB.13

MAP 3,SHEET 1,DATA SET 1



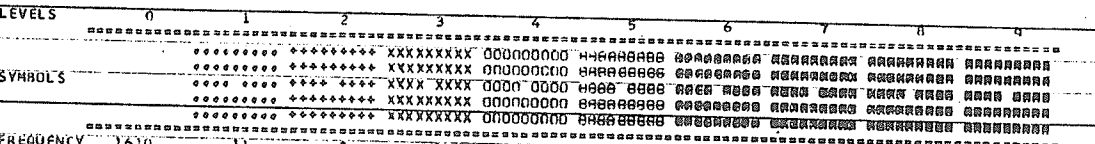
LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

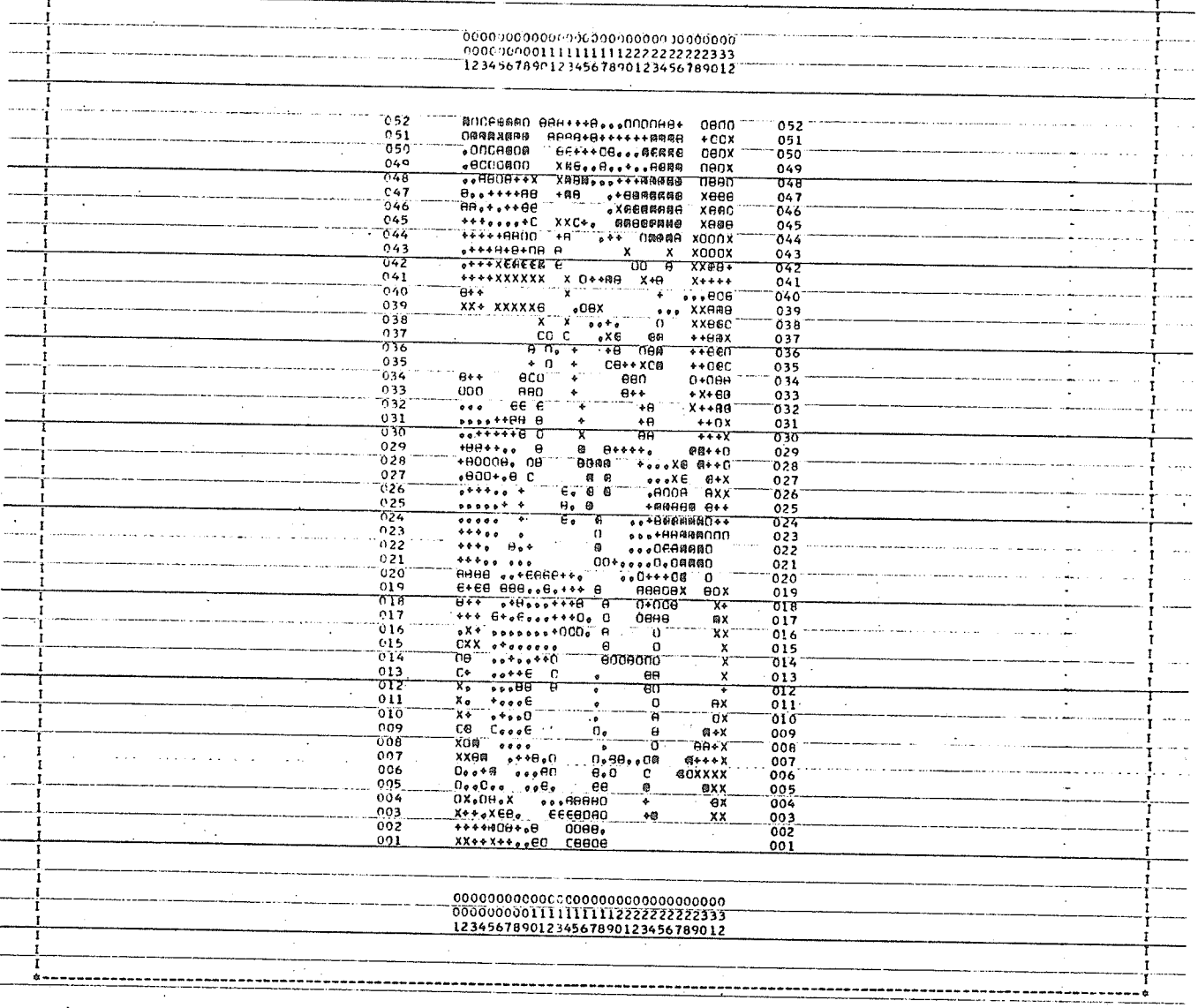
ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT MOTIVATED DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
MULTI-FAMILY UNIT (STAGE B)

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT



MAP 4,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

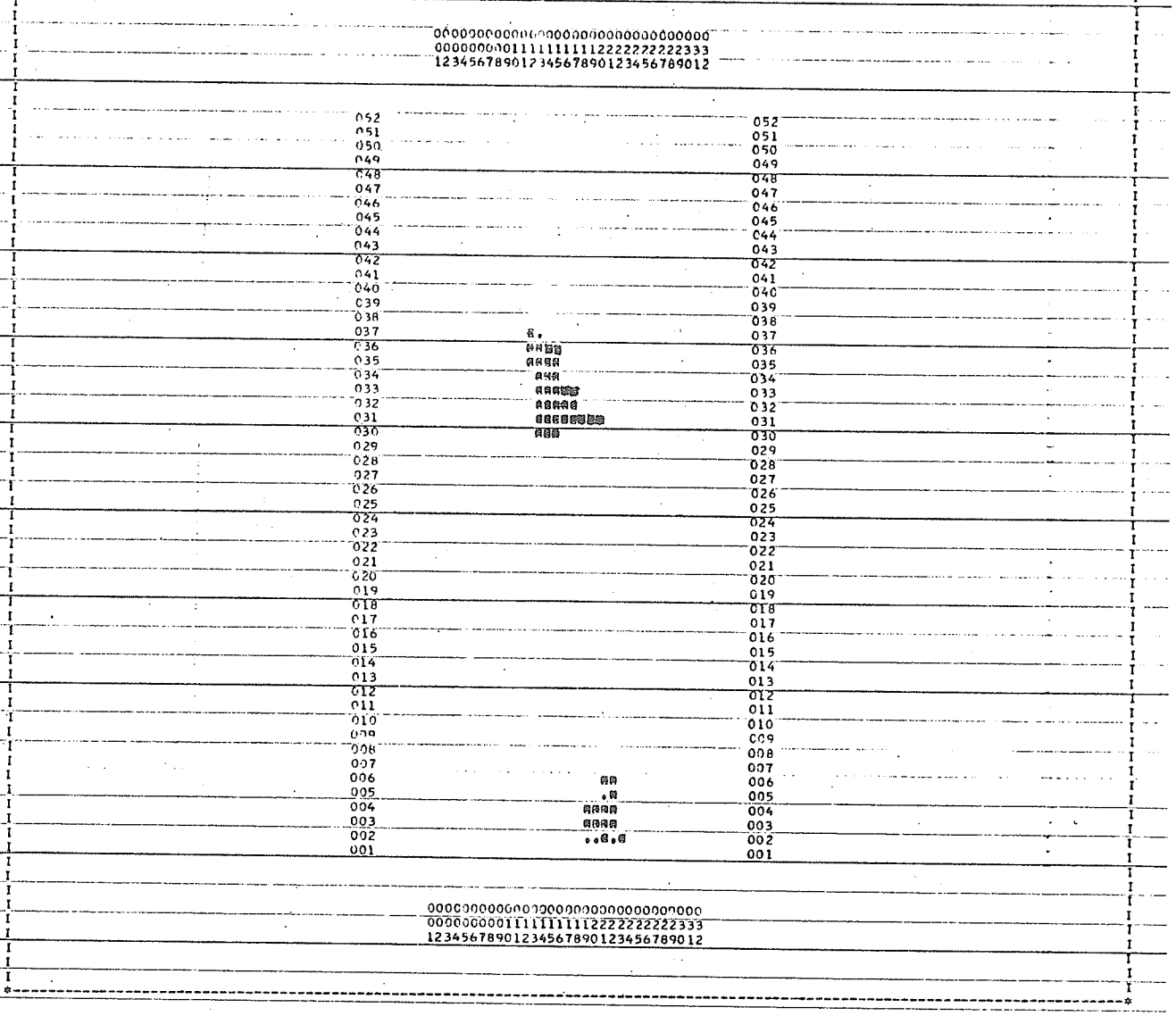
ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT ACTIVATED DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
PASSIVE RECREATION

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	o	+	X	0	8	@	#	=	A
FREQUENCY	686	178	196	87	150	201	92	58	16	0

MAP 5,SHEET 1,DATA SET 1



7546

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

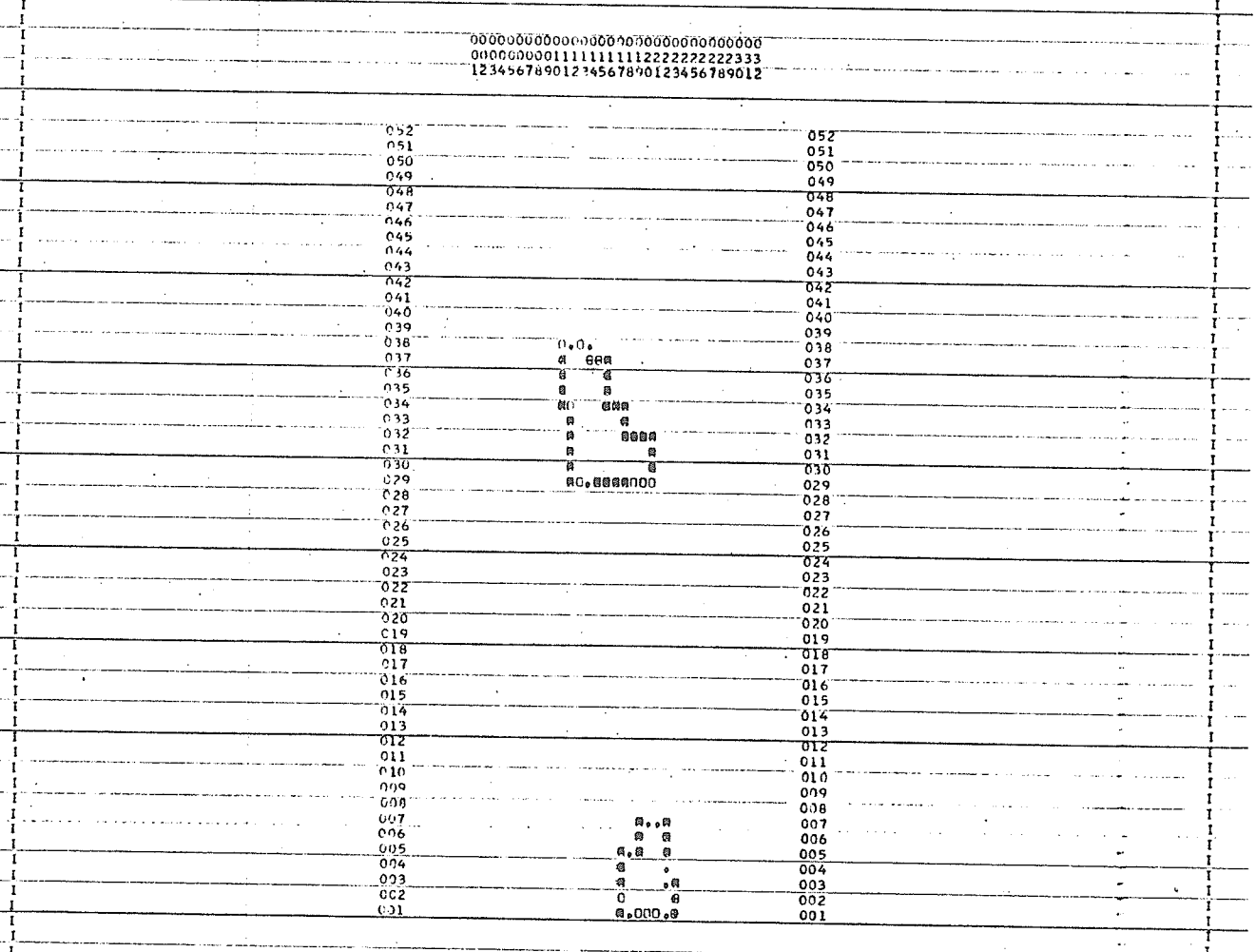
ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT ACTIVATED DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
ACTIVE RECREATION (STAGE A)

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	@	#	&			
FREQUENCY	1613	5	0	0	0	0	4	8	11	23

MAP 6,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

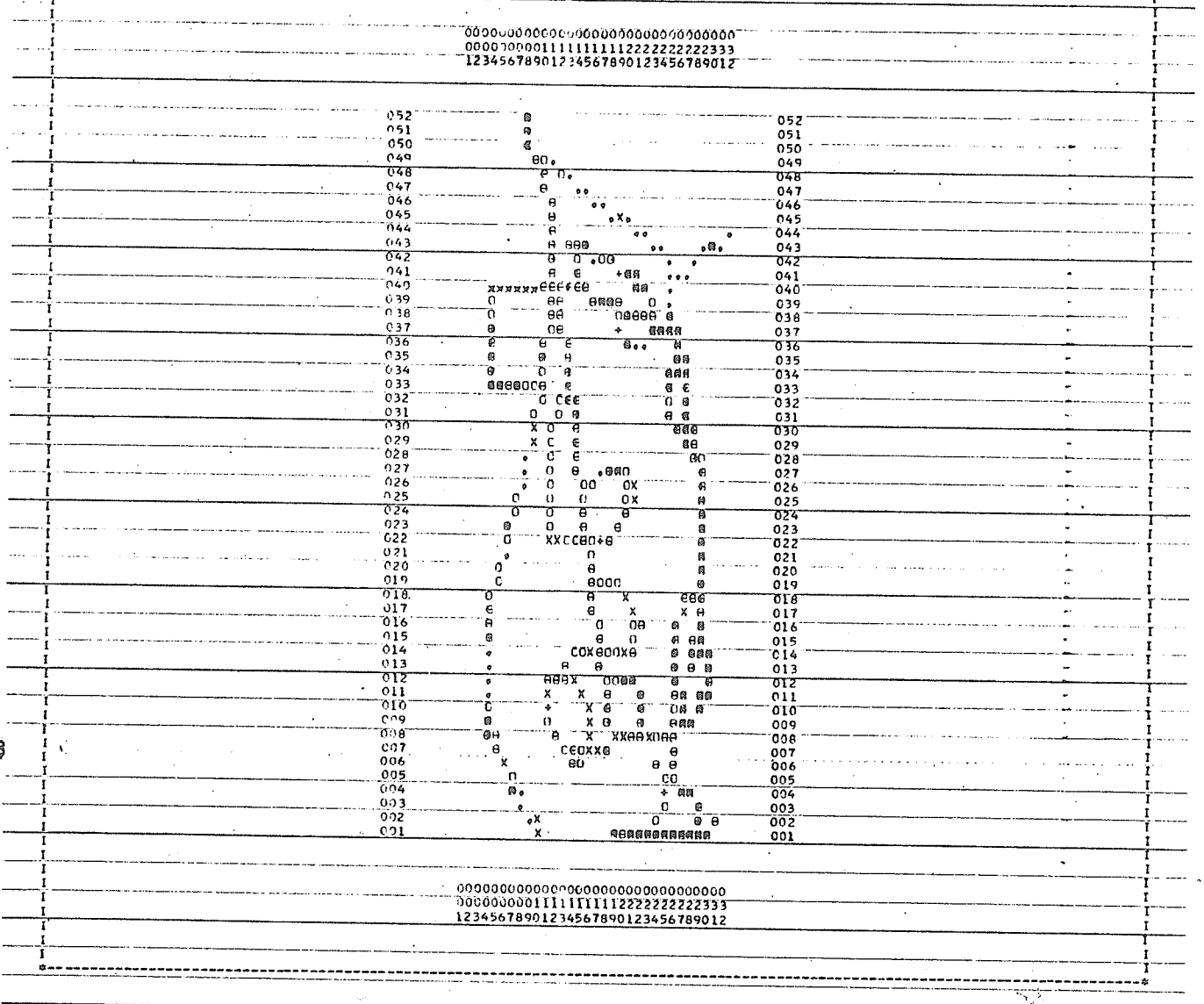
ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT MOTIVATED DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
ACTIVE RECREATION (STAGE B)

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	0	#	@	&	%	A	$
FREQUENCY 1597	10	0	0	11	2	2	10	0	27	

MAP 7,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

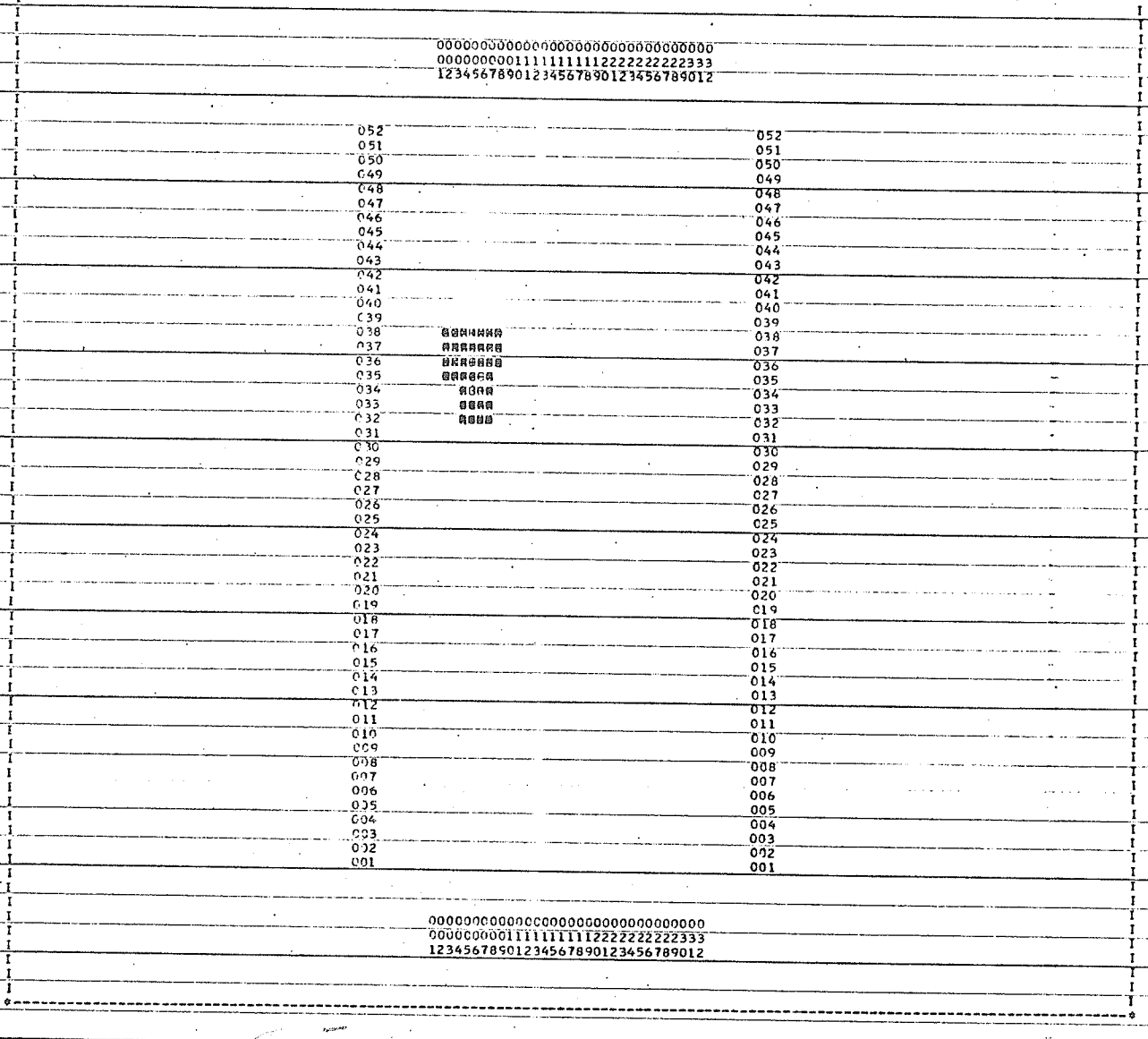
ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT MOTIVATED DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
ROAD AND UTILITY

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	.	+	X	O	C	E	@	A	H
FREQUENCY	1336	37	5	32	65	79	57	30	18	5

MAP 8,SHEET 1,DATA SET 1



7549

LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

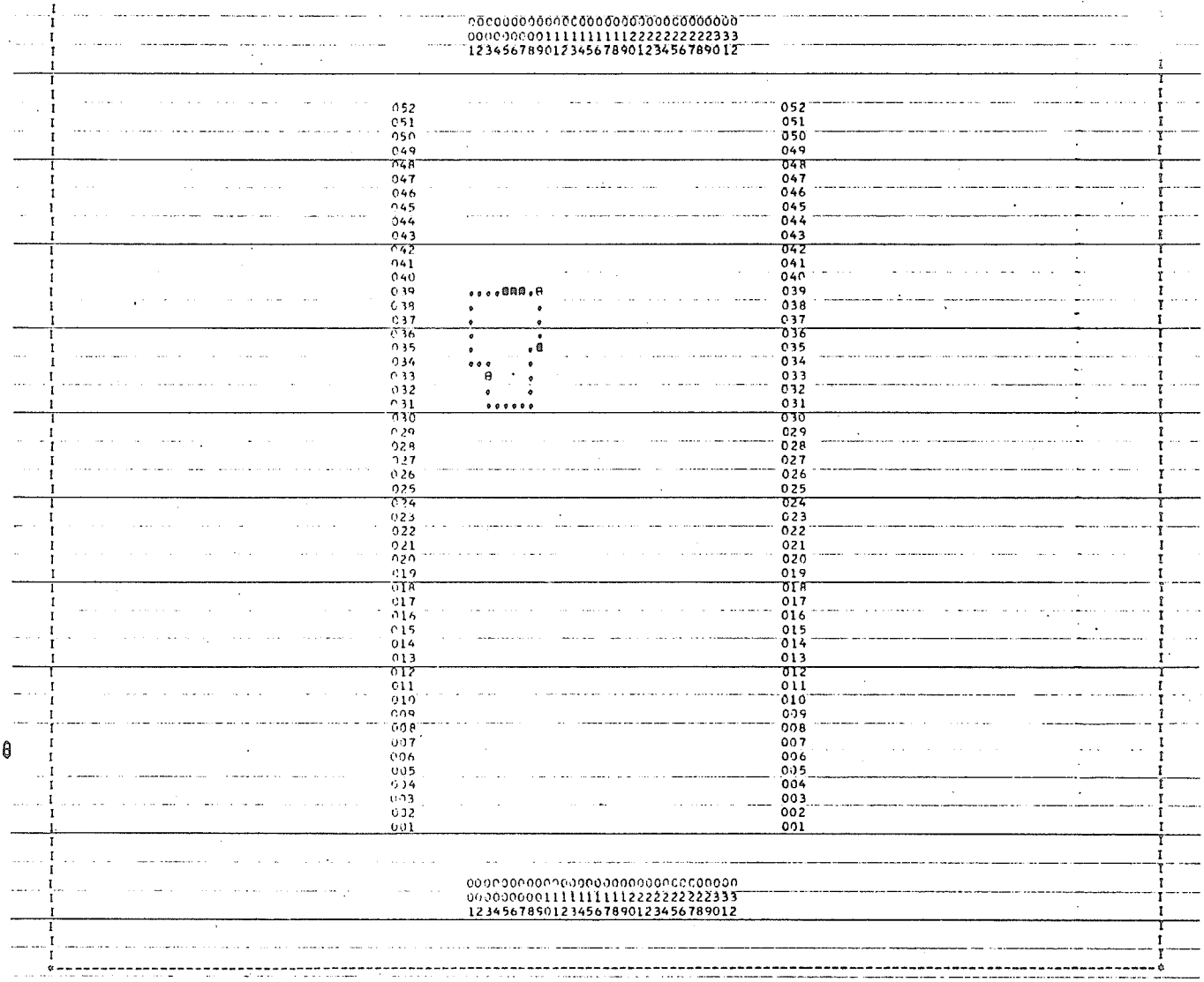
ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT MOTIVATED DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
INDUSTRIAL (STAGE A)

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	8	#	@	&	%	$
FREQUENCY	1625	3	6	6	0	1	4	10	13	11

MAP 9,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

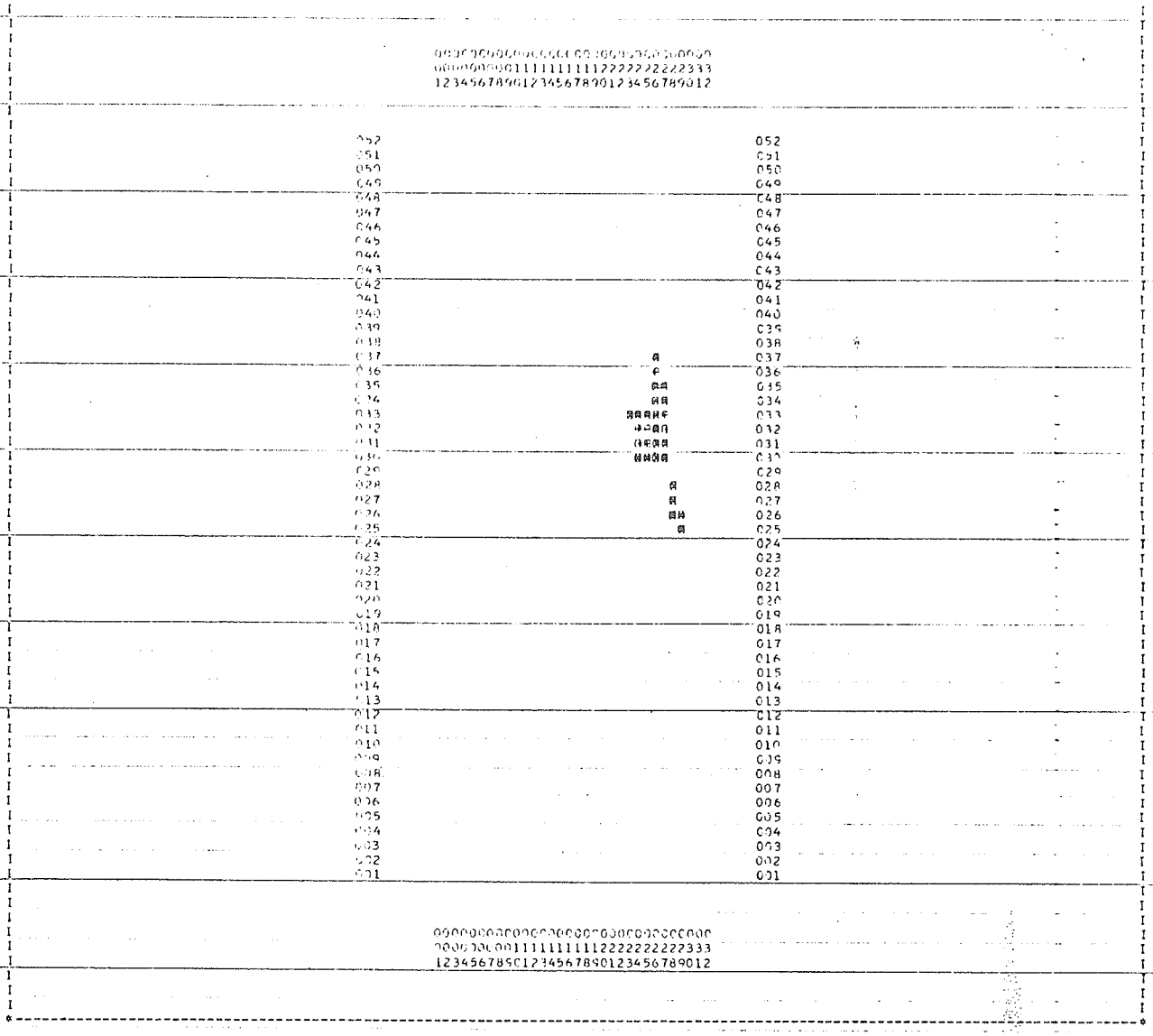
ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT MOTIVATED DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
INDUSTRIAL (STAGE B)

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	O	@	A	E	R	S	B
FREQUENCY	1632	26	6	6	0	2	0	0	0	4

MAP 10,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

DAVID JOHNS M. ARCH. 1972

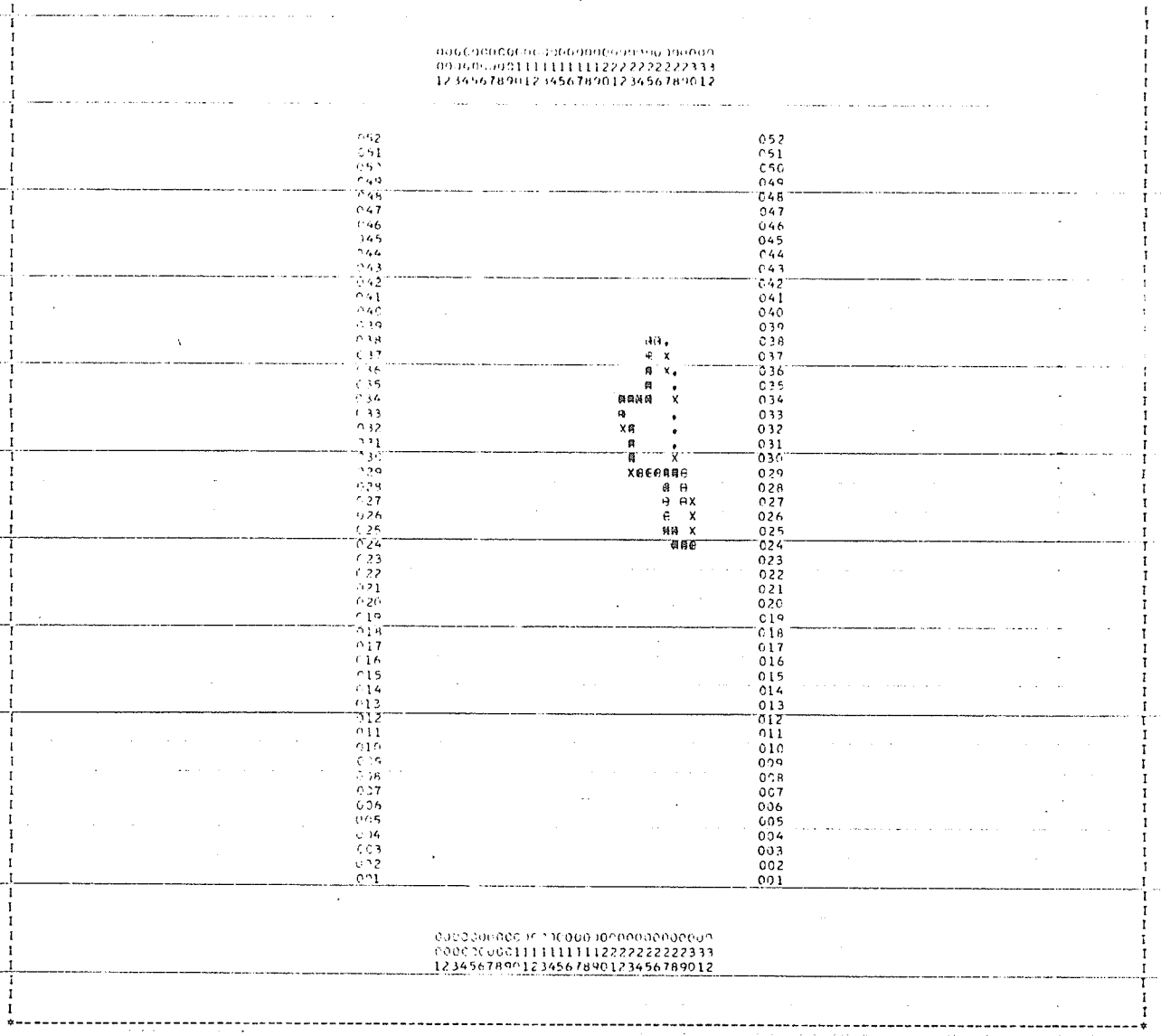
ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT MOTIVATED DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
COMMERCIAL (STAGE A)

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	:	+	X	0	A	#	@	§	&
FREQUENCY	1636	0	0	0	0	1	6	9	2	10

MAP 11,SHEET 1,DATA SET 1



LEAF RAPIDS PLANNING STUDY

CAVIC JOHNS M. APR. 1972

ONE SYMBOL EQUALS ONE ACRE

7.02 ENVIRONMENT MOTIVATED DESIGN
ENVIRONMENT/BENEFIT ANALYSIS
COMMERCIAL (STAGE B)

0 NO LAND USE OF THIS TYPE
1 LEAST BENEFIT
2
3
4
5
6
7
8
9 MOST BENEFIT

LEVELS	0	1	2	3	4	5	6	7	8	9
SYMBOLS	.	+	X	C	E	#	@	A	R	S
FREQUENCY	1620	6	9	9	0	5	8	1	4	11

7552

DESIGN EVALUATION

9

EVALUATION METHOD

COMMUNITY DESIGN

SCORES

CONCLUSION

EVALUATION METHOD

The two plans are evaluated by comparing the frequency distribution of IMPACT and ENVIRONMENT/BENEFIT ratings. The results are represented in two forms; paragraph and finite score. By comparing the curves of the bar graphs, one can achieve a more detailed understanding of the differences between the two plans. The finite scores, although simplistic, offer a second advantage of being able to perceive an over all impression of the two plans.

The finite impact and environment/benefit scores result from the multiplication of the number of grid cells times their respective grid cell rating. In an attempt to achieve representative scores it was necessary to apply an additional weighting system to the IMPACT ratings. It was felt that the differences between the four levels of impact were not of equal magnitude (ie. the difference between a moderate and a severe impact is not the same as between severe and threshold impacts.) Therefore for the purposes of calculating impact an adjusted value was applied to each impact level, reflecting more accurately their relative positions. Retaining the 10 point scale, the subsequent weights were derived.

IMPACT LEVEL	ADJUSTED WEIGHT
1) COMPATIBLE	0
2) MODERATE	1
3) SEVERE	3
4) THRESHOLD	9

These weights suggest, for example, that a threshold impact is 3 times more detrimental to the well-being of the community than a severe impact. This value system was derived as a result of a consensus of professional opinions. Linear regression analysis techniques could be used in the future to assess the accuracy of these weights. The ordinal nature of the ENVIRONMENT/BENEFIT scores was felt to be sufficiently representative of site conditions as to require no adjusted value systems.

Each plan varies in the number of grid cells which are being utilized in order to satisfy program requirements. This variation can be accomodated within the impact calculations but generates inaccuracies within the environment/benefit scores. For example; if one plan uses more cells than another plan the extra utilization of the resource base is reflected in comparable increases in the impact score. Since environment/benefit scores are concerned with the efficient use of appropriate cells, an increase in the score should result from the use of cells with higher suitability ratings rather than an increase in the number of cells being used. Therefore to make meaningful comparisons between land uses requiring different numbers of cells, the scores must be normalized. In order to normalize the scores of the land-uses, the average grid cell ratings are multiplied by a constant number of grid cells. (The constant is derived for each land-use type by using the largest number of grid cells specified for a given land use by either plan.)

In evaluating the two plans it was also felt necessary to make a distinction between the relative importance of Stage A and Stage B. Since the resource requirements were found to be more demanding and impacts more serious in Stage A than Stage B, a commensurate adjustment process was necessary. This was accomplished by multiplying Stage B scores by .25, thus making these considerations a quarter as important as those in Stage A. (Refer to following pages for test results.)

IMPACT

SCORE

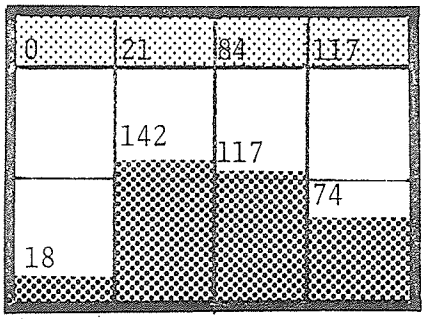
ADJUSTED WEIGHT

CELL RATING

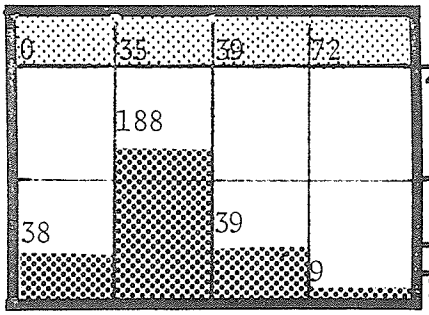
7.01

7.02

SINGLE FAMILY UNITS



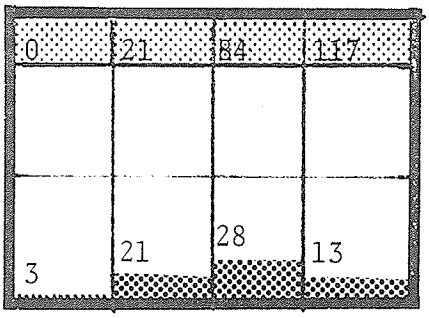
1159



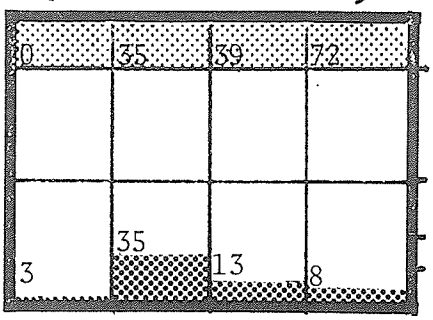
442

TOTAL

MULTI-FAMILY UNITS (STAGES A&B)



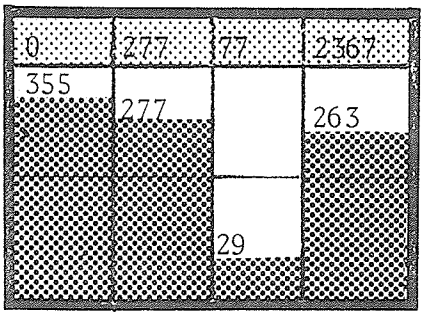
222



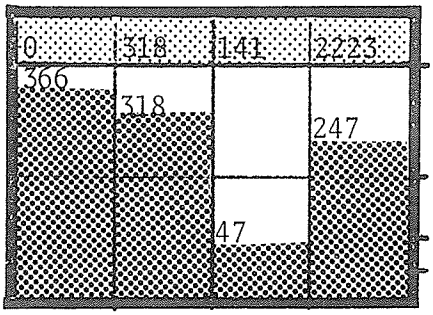
59

TOTAL

PASSIVE RECREATION



2721



2682

TOTAL

0	1	3	9
1-2	3-4	5-6	7-9

0	1	3	9
1-2	3-4	5-6	7-9

IMPACT

SCORE

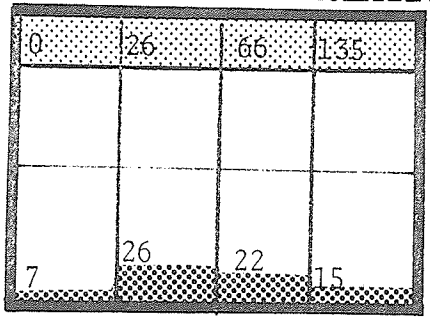
ADJUSTED WEIGHT

CELL RATING

7.01

7.02

ACTIVE RECREATION (STAGES A&B)



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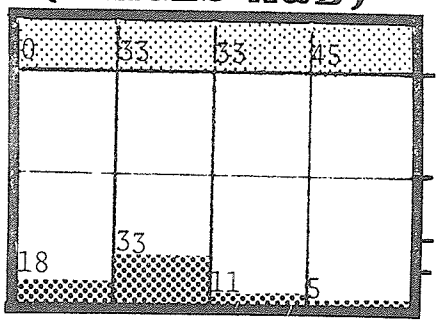
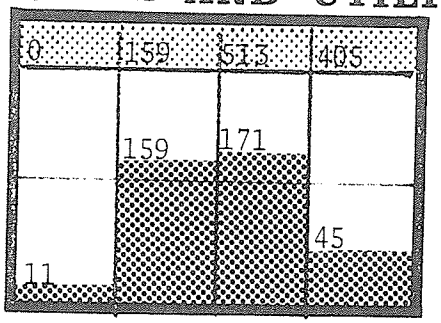


111

TOTAL

ROADS AND UTILITIES



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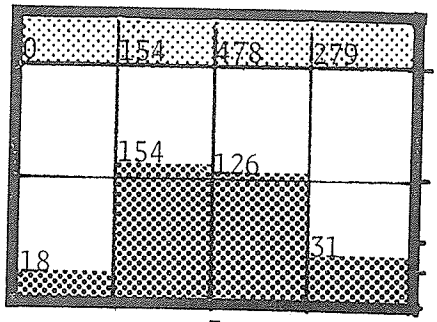

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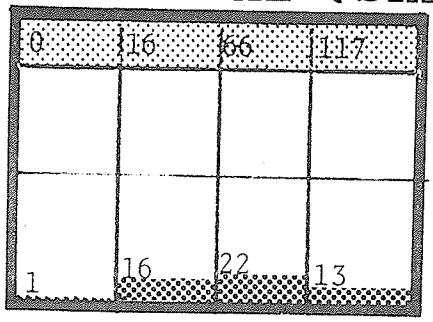
TOTAL

INDUSTRIAL (STAGES A & B)



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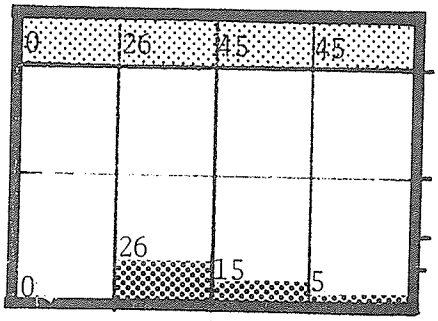


116

TOTAL

0	1	3	9
1-2	3-4	5-6	7-9

0	1	3	9
1-2	3-4	5-6	7-9

IMPACT

SCORE

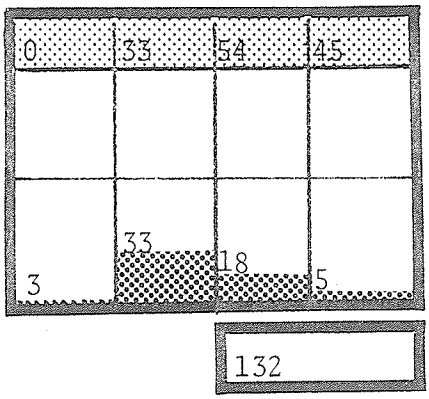
ADJUSTED WEIGHT

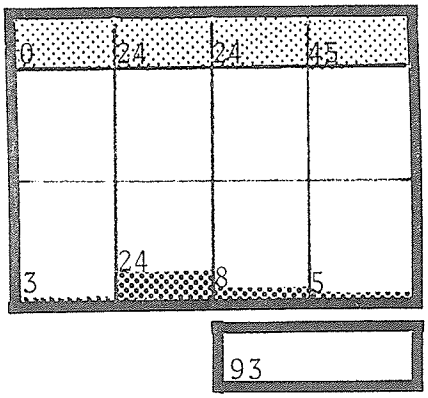
CELL RATING

7.01

7.02

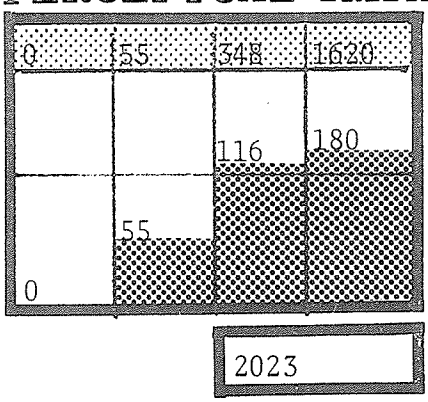
COMMERCIAL (STAGES A&B)

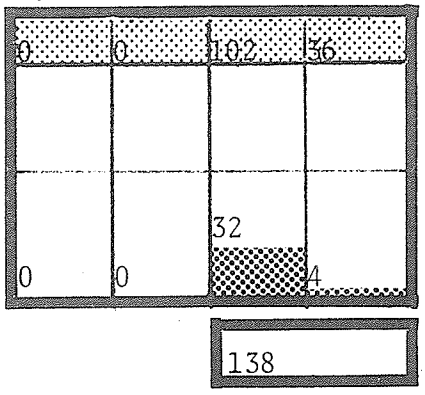




TOTAL

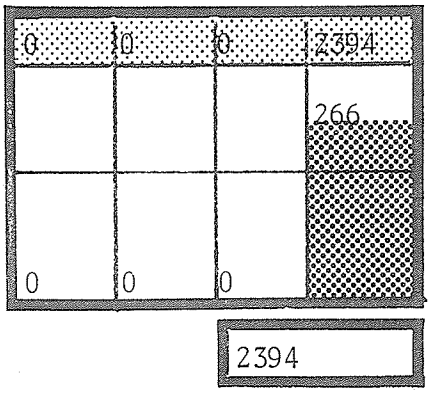
PERCEPTUAL IMPACT (POINT)

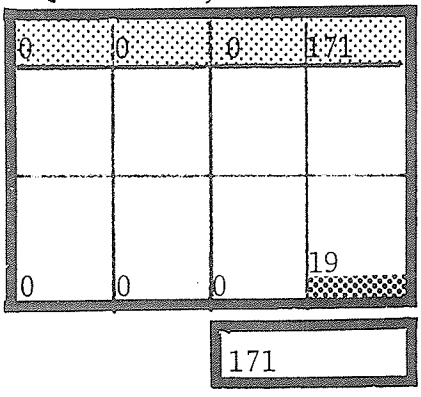




TOTAL

PERCEPTUAL IMPACT (STRIP, CLUSTER)





TOTAL

0	1	3	9
1-2	3-4	5-6	7-9

0	1	3	9
1-2	3-4	5-6	7-9

ENVIRONMENT / BENEFIT

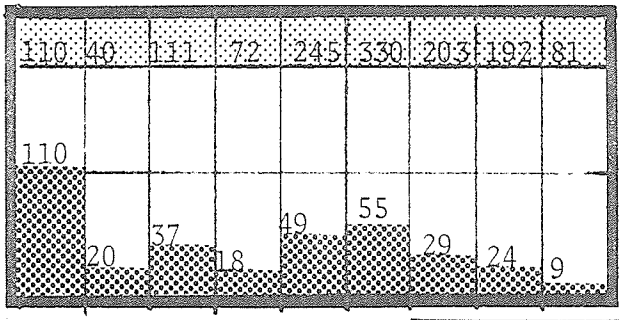
SCORE

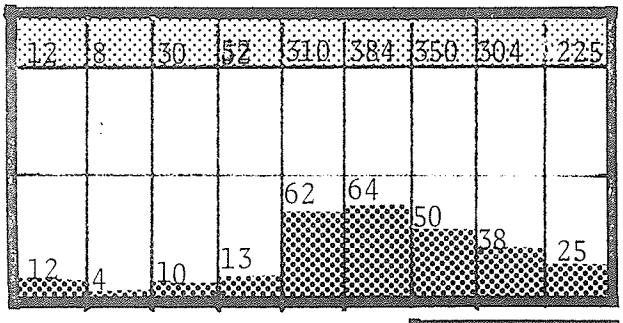
CELL RATING

7.01

7.02

SINGLE FAMILY UNITS



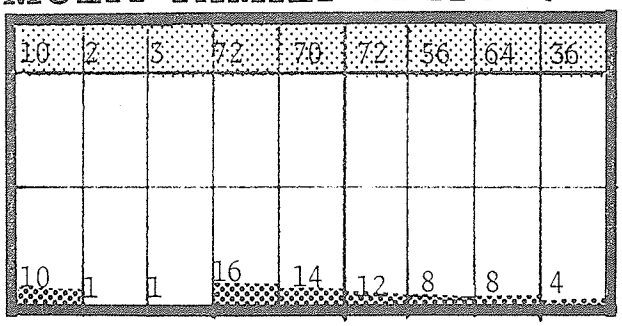


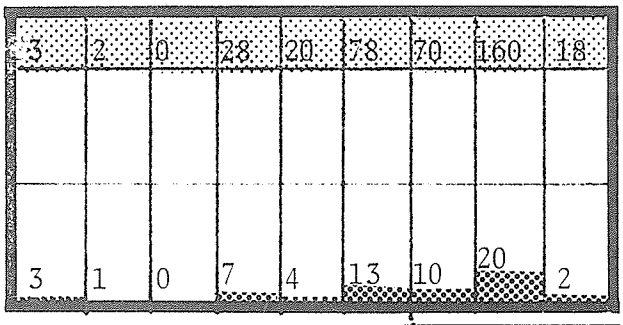
TOTAL normalized

1384

2106

MULTI-FAMILY UNITS (STAGES A & B)



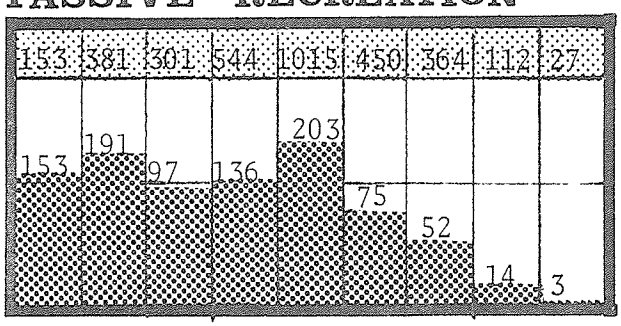


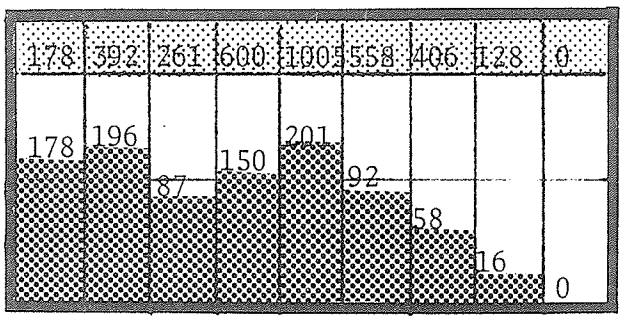
TOTAL normalized

385

483

PASSIVE RECREATION





TOTAL normalized

2347

2410

1 2 3 4 5 6 7 8 9

1 2 3 4 5 6 7 8 9

ENVIRONMENT / BENEFIT

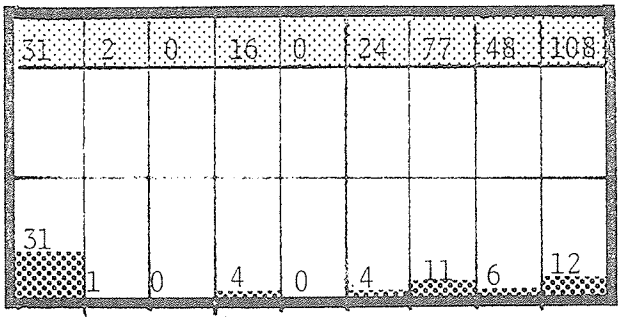
SCORE

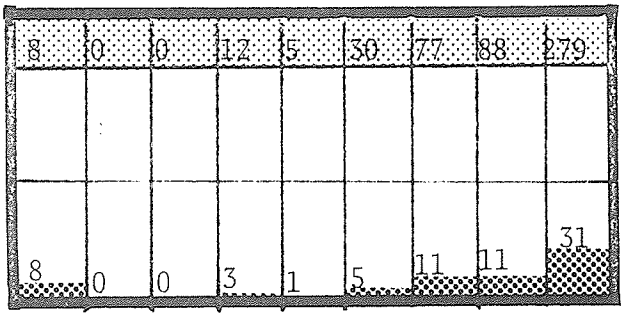
CELL RATING

7.01

7.02

ACTIVE RECREATION (STAGES A & B)



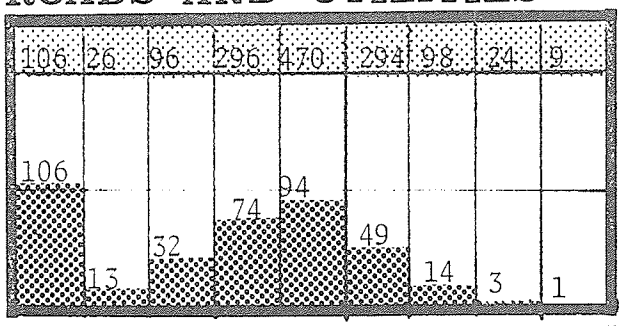


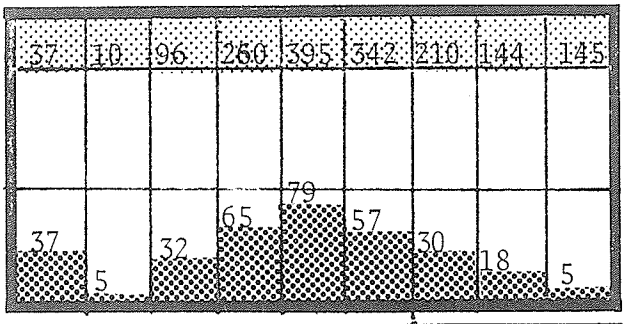
TOTAL normalized

306

519

ROADS AND UTILITIES



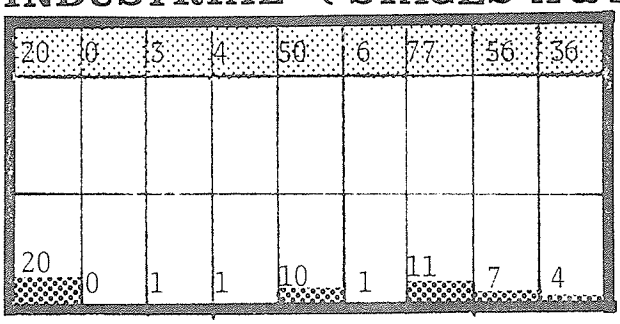


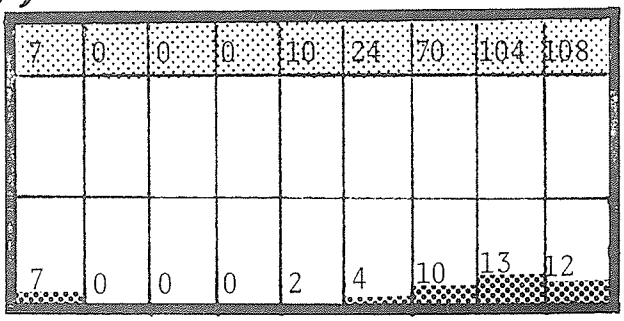
TOTAL normalized

1419

1814

INDUSTRIAL (STAGES A & B)





TOTAL normalized

252

391

1 2 3 4 5 6 7 8 9

1 2 3 4 5 6 7 8 9

ENVIRONMENT / BENEFIT

SCORE

CELL RATING

7.01

7.02

COMMERCIAL (STAGES A&B)

4	0	6	16	70	186	21	8	18
4	0	2	4	14	31	3	1	2

2	0	6	0	10	48	56	24	117
2	0	2	0	2	8	9	3	13

TOTAL normalized

329

378

1	2	3	4	5	6	7	8	9

1	2	3	4	5	6	7	8	9

F.22

RESULTANT SCORES

	7.01	7.02
IMPACT	10,154	4,723
ENVIRONMENT/ BENEFIT	6,422	8,101

F.23

Accepting the value systems employed in this study, the low impact scores of plan 7.02 indicate a dramatic reduction of potential ecological and perceptual damage caused by development activities. The substantially larger environment/benefit scores of plan 7.02 connotes a more efficient and effective use of the natural resources of the site.

APPLICATION

It is the opinion of the author that the results of this study indicate that the planning method developed in this study can be an extremely useful planning tool, when applied to community development. The expenditure of time and money required to complete such a study is very realistic under present planning practices.

As the quantity and complexity of planning decisions multiplies, the efficiency of computer-aided planning methods increases. The capability of the computer to handle vast amounts of information not only allows for substantial refinement and growth in its' present use but also expansion into other planning considerations such as time/distance criteria and performance zoning. The flexibility within the system also allows:

1) The opportunity to test any number of plans with minimal effort.

2) The re-adjustment of value systems at any time during the planning proceedure.

This aspect becomes important as inter-disciplinary involvement in community planning increases.

CONCLUSION

A general planning technique has been established in this study which is able to trace the holistic relationships of community components, thus enabling each component to be placed in a proper perspective. The ability to quantify the community components is an essential requirement of this planning technique. Since the planning implications of the natural environment were of major concern, this necessitated the construction of measurement techniques which quantified the aesthetic,perceptual and ecological aspects of the environment. The community plan forwarded by the author in this study results from a value system which places great emphasis on the benefits accrued to a community by optimizing the positive attributes of a site and minimizing the negative consequences to the natural environment. One should be mindful of the fact that it would be just as erroneous to consider this value system as comprehensive planning criteria as it would if only engineering and economic efficiency were considered.

With the introduction of the remaining community components, the potential clearly exists for the development of a comprehensive and sensitive planning tool. In order to achieve this ultimate goal, it is necessary to develop quantitative techniques for the remaining community components not already analysed as such. Thus, in addition to the planning criteria already developed, future land-use models can include values placed on specific grid cells due to their proxemic or functional relationship to desired facilities. For example, if it was established that the majority of children were to live in single family units and proxemity to school and playground facilities was a desirable asset, grid cells close to these facilities would receive an increased attractiveness rating for single family units. Another source of land-use planning criteria could emanate from behavioral sources. For example, if increased resident interaction was desired and it was found that single family units situated juxtaposed to childrens' play areas would be condusive to social interaction, cells with these suitability relationships would receive an increased attractiveness score for that type of development.

In a similar manner, the other community planning considerations could be introduced to further expand and develop it as a planning tool. By adding

more criteria and initiating follow-up tests to determine the accuracy of the predictions, a constant process of refinement could be established. Knowledge gained from past mistakes and successes allows one using this planning technique to accumulate an extensive experiental base upon which planning decisions could be based, thus avoiding constant repetition of similar errors.

APPENDICES

10

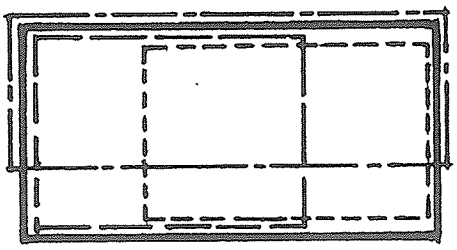
A.1 BOUNDARY DEFINITION
A.2 PREFERENCE TESTING METHOD
A.3 VISUAL ABSORPTION
A.4 VISUAL INPUTS
A.5 BUFFER CAPABILITY
A.5.1 CARRYING CAPACITY CALCULATIONS

B.1 MAPPING PROCESS
B.2 TWO LEVEL MAPPING TECHNIQUE

APPENDIX A-1

BOUNDARY DEFINITION

For each potential community location a boundary condition was proposed. Within this boundary three equal sized subsets (2/3 full size) were evaluated according to the frequency distribution of their suitability scores. The results of each subset were compared to the other two.



EXAMPLE

If the distribution was found not to be consistent the boundaries were adjusted and the process repeated until the distribution of scores within the three subsets were equal.

The resultant boundary represented the homogeneous area and assured that any changes of boundaries within this larger area would not alter the frequency distribution of suitability scores.

To further ensure the validity of the boundaries of the four sites, the edge conditions were adjusted to maximize the high suitability ratings while avoiding less desirable ratings. In comparing the resultant average grid cell scores of the four sites the following conclusions were drawn:

1) Each site made approximately equal increases in their average score thus not affecting their relative order.

2) The boundary shapes necessary to maximize the high suitability ratings would often present unworkable boundary configurations thus creating serious planning constraints.

These two checks satisfied the author that the boundary conditions as depicted on map B (p. 96 were satisfactorily located and a viable comparison can be made between the four sites.

APPENDIX A.2

PREFERENCE TESTING METHOD

GENERAL DISCUSSION

The preferential survey will aid the form given in understanding the perceptual needs of the future residents. A failure to understand environmental quality as perceived by both professional and lay groups surely will detract from the completeness of any planning proposal. A major objective of this is to develop a technique to incorporate lay value responses to existing visual conditions into professional responses.

Circumstances did not allow this author to return to Lynn Lake to conduct the preferential survey of the actual future residents of Leaf Rapids. Although this would have been the optimal situation it was not felt absolutely necessary due to the fact that the thrust of this thesis is to establish a procedure, thus a sample test group would suffice.

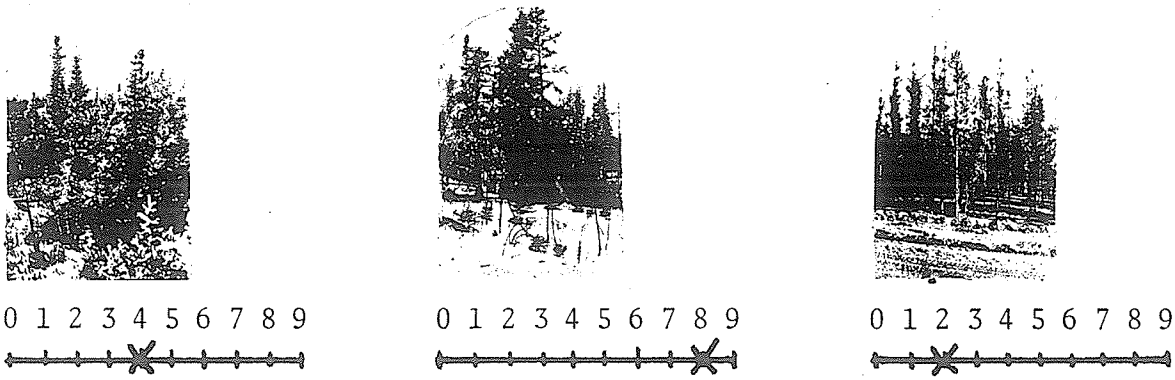
A significant function of the preferential survey is that it structures an otherwise unorganized lay interpretation of environmental quality. (The important aspect of going through the procedure is to expose the potential working relationship between professional and lay input and how it relates to the decision-making process.)

Ideally, vegetation preference studies should involve both summer and winter foliage conditions. Due to the timing of the thesis, only a set of winter photographs of all vegetation types being considered were able to be procured. The winter foliage conditions are however especially important as this condition exists for approximately 3/4 of the year.

TESTING FORMAT

The vegetation types were presented in the form of coloured slides. (same vegetation classification as vegetation stability). It was assumed that the photographs adequately represented the existing vegetation qualities. The object of the test was to determine in which type of vegetation the

residents would prefer to have each activity located. This was qualified with the assumption that the development of the site would not significantly alter the perceptual experience of the vegetation. The total series of slides was presented in a random order to establish a context from which decisions could be based. On the second presentation the respondents were shown the series of vegetation types and were asked to respond: "In which vegetation type would you prefer your single family dwelling to be located. Rate your preference on a 0 - 9 scale respectively from least preferred to most preferred." This was repeated for all other pertinent land uses. Three typical test examples are illustrated below in F.24.



F.24

In order to determine the consistency of responses to the vegetation types presented, several different slides of the same vegetation were shown and often the same slide would be reversed. A variance of about 10% was found in the test responses which indicate sufficient consistency for the study at this time. Elaborate and sophisticated test controls were felt to be beyond the scope of the project. It should be noted that much research in this area recently has produced extremely precise visual measurement tools and if required these could be implemented.

Test group responses were tabulated and resulted in the formulation of a preferential scale. Some vegetation types were much more preferred than others and corresponding weights have been applied to reflect the scale of divergency in preference. This vegetation preference scale is used as one of the components in analysing resource CAPABILITY for specific land uses.

APPENDIX A.3

VISUAL ABSORPTION

GENERAL DISCUSSION

This analysis technique attempts to evolve a series of visual measures which will be able to predict the degree to which various landscapes will be able to absorb land-use activities. This measurement will be used in formulating design specifications or guidelines governing the desired visual impact of development within this landscape context in a pattern that most satisfies these objectives.

The visual model developed by Jacobs and Way[1] states that:

VISUAL ABSORPTION	= K+(.14)	VEGETATION DENSITY	+(.27)	TOPOGRAPHIC CLOSURE	+(.40)	VISUAL COMPLEXITY

VEGETATION DENSITY - is a function of the size, texture and structure of foliage characteristics of the vegetation which create visual opaqueness.

TOPOGRAPHIC CLOSURE - is defined as the extent of visual field accessible from a specific topographic situation assuming no vegetation cover.

VISUAL COMPLEXITY - is the degree of visual clarity (perceptual intensity) and the amount of visual information that the viewer is asked to sort and evaluate. (The less the amount of information and the greater the clarity the less complex.)

The corollaries from the preceeding equation are that:

1) Landscapes that are visually transparent with little visual

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[1] Jacobs, Way - Visual Analysis of Landscape Development, Graduate School of Design, Harvard University, 1969. P.10.

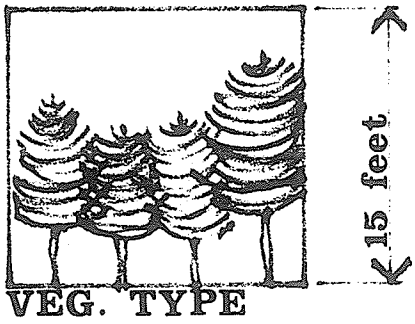
complexity are most susceptible to visual impact.

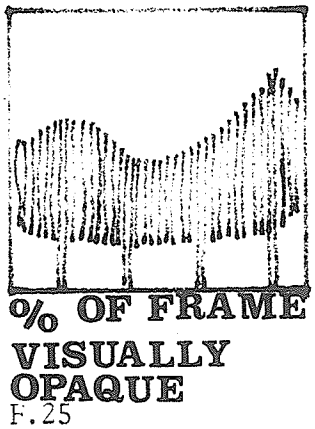
2) Landscapes that are visually opaque and composed of a high degree of visual complexity will be most absorptive and least susceptible to visual impact.

FIELD SURVEY TECHNIQUES*

1) VEGETATION DENSITY

The vegetation density analysis envolves a ground level measurement that records the visual characteristics of each vegetation type.





F.25

Vegetation density is considered as the degree of visual opaqueness created by foliage characteristics. A 'vegetation to void' measurement is used to establish the degree of visual opaqueness created by the vegetation. A hypothetical 15 foot frame** is superimposed on the vegetation and the percentage of the frame visually opaque establishes the vegetation density rating. This technique allows for quick and sufficiently accurate vegetation density ratings for field surveys and was applied at the Leaf Rapids site. All measurements were taken on minimal slopes so that topographic closure would not influence the measurements.

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* Field survey techniques have been developed by the author of this thesis to reflect the subarctic context and to reflect the time constraints imposed upon planners under normal circumstances.

** The viewing height of a second story window of a single family unit is approximately 15 feet $\pm$.

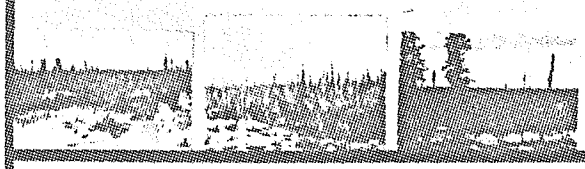
A survey of the site was conducted and a complete range of vegetation densities was compiled. The position of each unique vegetation density was accurately spotted on air photo mosaics and maps of the site. This allows similar vegetation types to be located by air photographs enabling a rapid interpretation of the whole site. The range of vegetation densities has been adjusted to fit a nine level classification system. This classification will form the basis for rating the vegetation densities of the Leaf Rapids site. See following page.

VEGETATION DENSITY

1

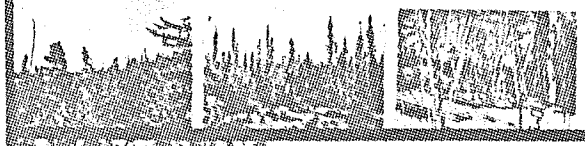
- PEAT BOG, 6" - 12" HERBACIOUS PLANTS
- DWARF BLACK SPRUCE 1' - 2' IN HEIGHT
- VERY POORLY DRAINED
- MAXIMUM VISUAL PENETRATION

2



- MAINLY DWARF BLACK SPRUCE
- TREES 1' - 5' IN HEIGHT AND 1'-10' APART
- POOR SOIL CONDITIONS
- POORLY DRAINED (PERMAFROST)
- TREES BENEATH EYE LEVEL

3



- MAINLY DWARF BLACK SPRUCE
- TREES 3' -12' IN HEIGHT AND 3'-5' APART
- POORLY DEVELOPED BRANCHING SYSTEM
- BIRCH TREES 1'-10' APART, NO FOLIAGE

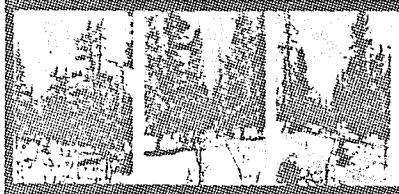
4

- OVER MATURE DENSE JACK PINE 30'-50' IN HEIGHT
- BRANCHING AND FOLIAGE BEGIN AT 10'-15'
- TREE TRUNKS PROVIDE SOME OPAQUE QUALITIES
- YOUNG POPLAR STAND 20' IN HEIGHT
- TREE TRUNKS PROVIDE SOME OPAQUE QUALITIES

5

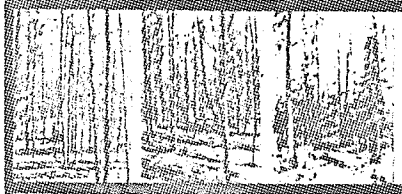
- YOUNG DENSE JACK PINE 10'-20' IN HEIGHT AND 1'-3' APART
- SPARSE FOLIAGE
- THE MANY BRANCHES PROVIDE CONSIDERABLE OPAQUENESS

6



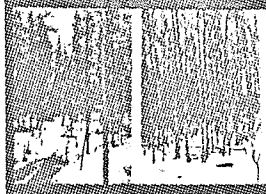
- MATURE OPEN JACK PINE
- TREES 30'-50' IN HEIGHT AND 5'-15' APART
- FOLIAGE CONTINUES TO THE GROUND
- SOME WHITE SPRUCE AND WHITE BIRCH

7



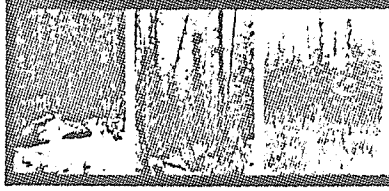
- YOUNG JACK PINE
- TREES 15'-30' IN HEIGHT AND 1'-5' APART
- FOLIAGE BEGINS 5' FROM GROUND
- DENSE MATURE JACKPINE
- FOLIAGE TO GROUND

8



- DENSE MATURE JACK PINE
- TREES 30'-40' IN HEIGHT AND 1'-5' APART
- VERY WELL DEVELOPED BRANCHING SYSTEM
- VERY DENSE POPLAR 30' IN HEIGHT AND 1'-5' APART

9



- A MIXTURE OF SPRUCE, JACK PINE AND BIRCH
- VARIATIONS IN SIZE OF PLANTS CREATES VISUAL SCREEN
- WELL DEVELOPED DENSE BRANCHING SYSTEM

2) VISUAL COMPLEXITY

Areas of high visual complexity have a multitude of information sources, a lack of perceptual intensity or dominancy of any symbol or form, and a lack of perceivable formal definitions.

Areas with low visual complexity have much less information with one or two strong dominant symbols having formal definitions.

The site was surveyed for a range of visual complexity using the above criteria. The resultant classification system reflects the range of natural visual stimuli to be found on the site. A complete range from 0 - 9 was difficult to delineate for the range was too large for the groups to be distinct. Thus, sub groups were devised to allow the differences between classes to be more easily perceived. (See following page for classification).

VISUAL COMPLEXITY

1

2

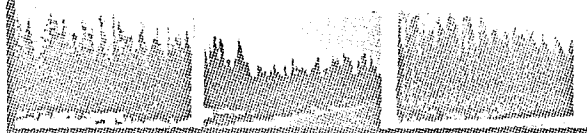
- STRONG DOMINANT SYMBOL
- SMALL AMOUNT OF VISUAL INFORMATION
- FORMAL DEFINITION
- SIMPLE FORMS

3

- STRONG DOMINANT SYMBOL
- ADDITIONAL INFORMATION SUCH AS WATER AND VEGETATION INCREASE VISUAL COMPLEXITY

4

5



- VEGETATION WALL CREATES MONOLITHIC FORM
- BRANCHING SYSTEMS AND TRUNKS ADD TO THE VISUAL INFORMATION
- NO VISUAL PENETRATION THROUGH VEGETATION WALL

6

- VEGETATION SCREEN ALLOWS VISUAL PENETRATION AND SEVERAL DEPTHS OF INFORMATION
- FORMAL CHARACTERISTICS BREAK DOWN BUT STILL PRESENT STRONG THEMES

7

8

- MANY STRONG VISUAL SYMBOLS NONE TAKING VISUAL DOMINANCY
- MUCH INFORMATION VARYING IN INTENSITY AND THEME (DIVERSITY)
- RICHNESS OF VISUAL FORMS

9

- MULTITUDE OF INFORMATION SOURCES ON A WIDE VARIETY OF THEMES
- NO FORMAL DEFINITIONS OR DOMINANT SYMBOLS
- LACK OF PERCEPTUAL INTENSITY - DIFFICULT TO SORT INFORMATION

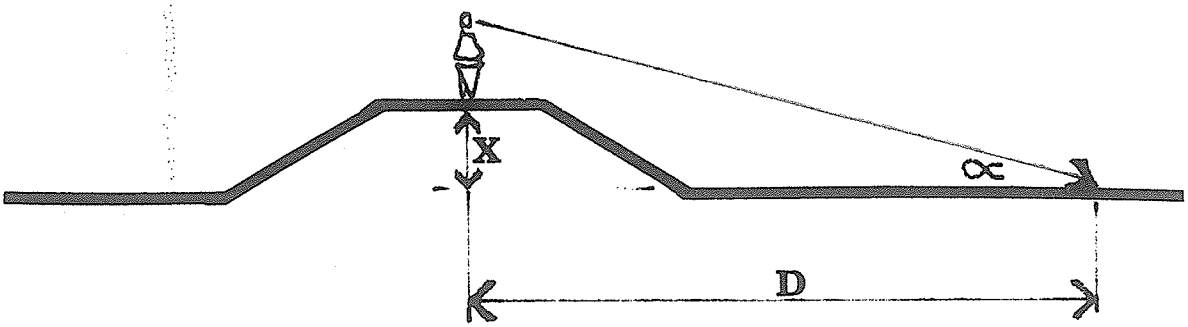
3) TOPOGRAPHIC CLOSURE

It was not necessary to establish unique field survey techniques for this variable due to the universality of its application. Therefore the basic topographic types established by Jacobs and Way have been accepted. It is hypothesized that:

> " The viewer located on a hilltop can see a certain distance "D" at an angle to the ground and rotate his view through 360 degrees which exposes him to a view "V" in square feet of ground surface."[2]

The following formula expresses the extent of view from a topographic situation.

TOPO VALUE EQUATION



$$V = \left(\frac{X}{SIN\alpha}\right)\left(\frac{R}{360^{\circ}}\right)$$

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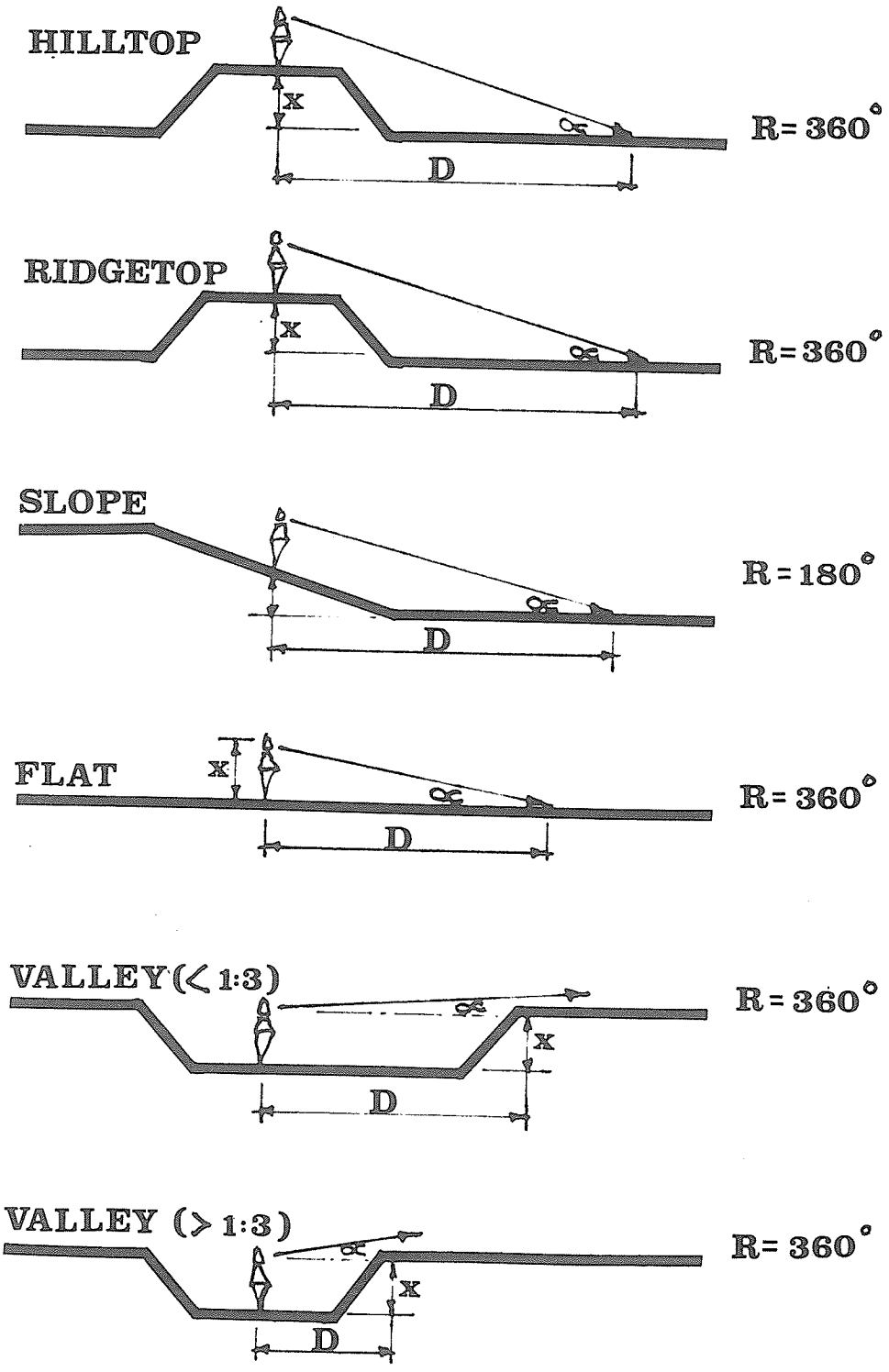
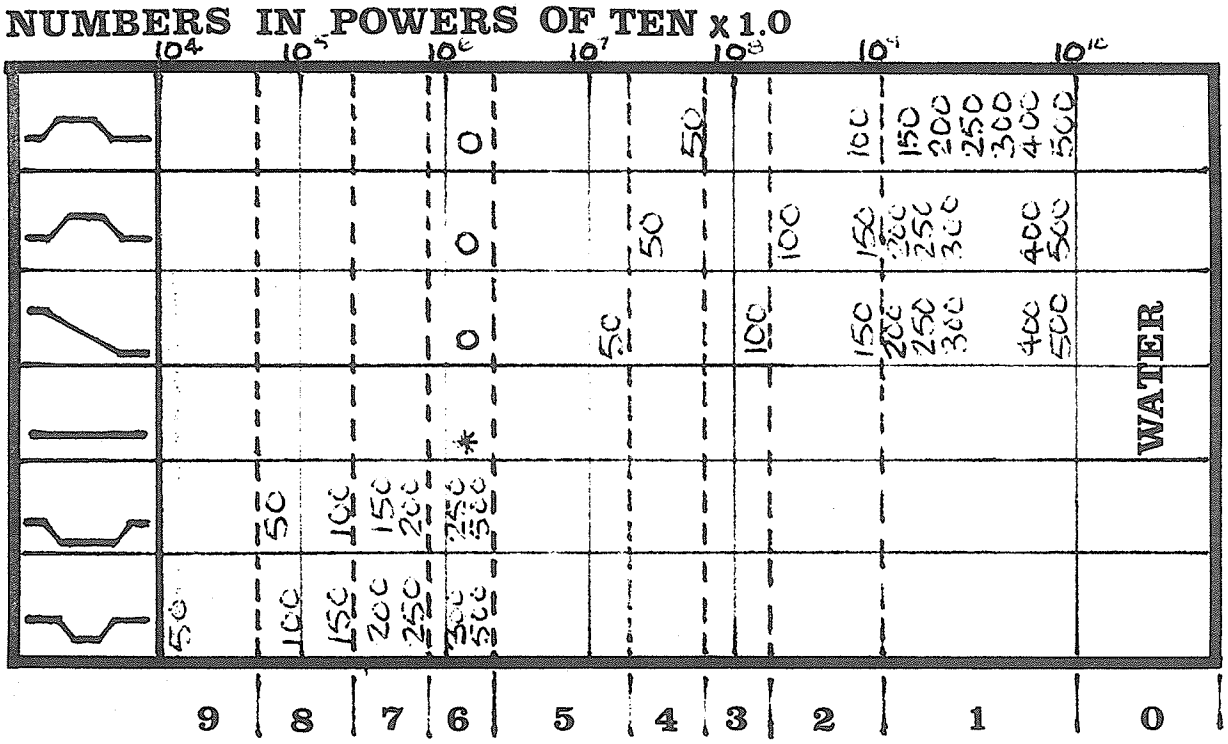
2 Ibid. P. 45

The following six topographic conditions are arranged in order of decreasing visual access.

BASIC TOPO TYPES



The conversion table established in the study calculates the approximate viewing field for a range of different heights in each of the six topographic conditions and relates the degree of viewing access to a 0 - 9 scale. This scale has been slightly amended to conform to the rating system established in this thesis.



The interior of the chart gives relative X values for each land type.

APPENDIX A.4

LAND-USE INPUTS

The relative value for the land-use activities is determined by the following equation:

LAND-USE INPUT = (.32) SCALE + (.20) COMPATIBILITY (LIKE OR DISLIKE) - (.10) TEXTURE [2]

The degree of visual input which land-use activities exert upon the natural resource system is a function of both formal characteristics and associate visual responses. Thus, the equation suggests that a high visual input is a function of strongly negative responses and a large relative scale and texture. Conversely, a positive affective response and a small relative scale and texture will yield a low visual input.

An assumption underlying both the absorption and input equations is that visual absorption is the converse of visual input. Thus, as the visual input rating increases the more difficult it is to absorb. Since the future residents were not surveyed, interpolated results from the studies conducted by Jacobs and Way will form the basis for the input scale. The values of the anticipated visual inputs are therefore as follows:

LOW VISUAL INPUT	1	Passive Recreation
	2	Active Recreation
	3	Single Family Units
	4	Multi-family Units
HIGH VISUAL INPUT	5	Industrial
	6	Commercial

The degree to which each of the land-uses inputs are exposed or absorbed is defined by the visual guidelines established for the community. The

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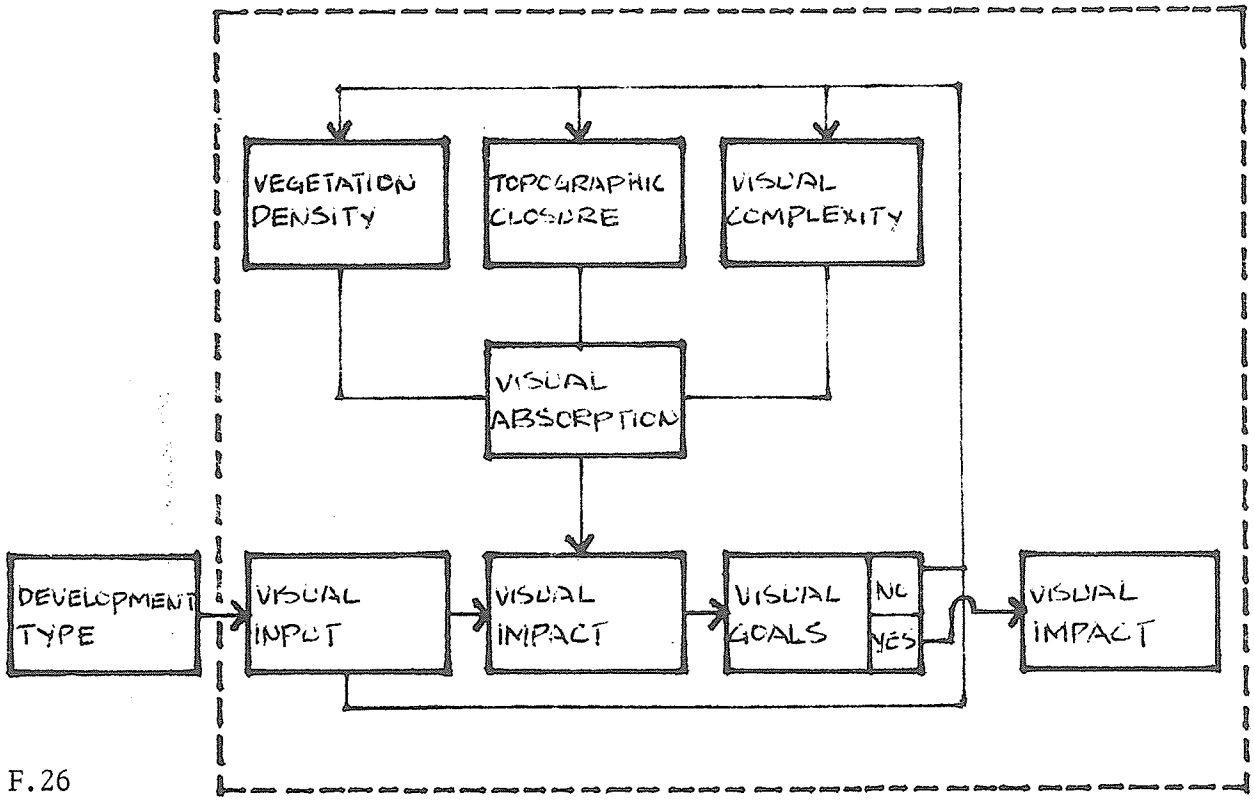
2 Ibid., P.11

subsequent model represents how the visual guidelines control visual 'inputs', with respect to landscape 'absorption' ratings to create the desired visual impact. [3]



F.26

[3] Ibid., P. 34

APPENDIX A.5

BUFFER CAPABILITY

TESTING PROTOCOL

1) Representative stands of vegetation on the site were located by field survey. A special effort was made to attempt all measurements on flat sites in order to eliminate topographic influences on vegetation buffer capabilities.

2) A consistent edge condition in the vegetation was sought and survey cut lines were found to satisfy this condition.

3) All perceptual measurements were made from a point 5 feet to 10 feet away from the vegetation edge by a trained observer (the author). A second person was used to measure the distances required to satisfy the buffer definitions.

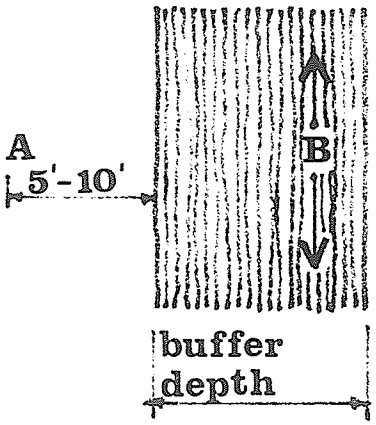
4) Location of each set of measurements was accurately spotted on air photo masaics and maps of the site for future classification and interpretation.

5) For each vegetation type measurements were all taken in the same order, from the major buffer to the no buffer potentials. This procedure was employed to facilitate a consistency in evaluation.

'MAJOR BUFFER' TEST

'The major buffer creates total visual separation:

A second person penetrated the vegetation perpendicular to the edge of vegetation until a point had been reached where observer 'A' stated that movement could no longer be perceived. At this point person 'B' moved parallel to the edge of the vegetation. If movement could be detected, 'B'

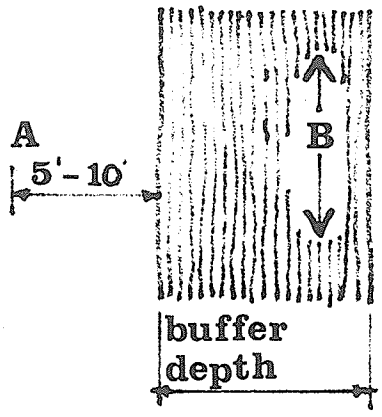


F.27

would preceed further into the vegetation and the procedure repeated until no movement could be perceived. Person 'B' then paced off the perpendicular distance from his land position to the vegetation's edge. This distance was then recorded as the major buffer depth for that specific vegetation type.

'MODERATE BUFFER' TEST

'A moderate buffer allows visual penetration but segregates the two spaces.'



F.27

In the same vegetation type, open coves with no major vegetation were sought. In each cove person 'B' moved parallel to the edge of the vegetation. When the depth of vegetation between the cove and the observed 'A' satisfied the buffer definition, person 'B' paced off the perpendicular distance to the edge of the vegetation. This was then noted as the moderate buffer depth for that specific vegetation type.

'MINOR BUFFER' TEST

'A minor buffer creates minor visual interference. This is not sufficient enough to segregate two spaces thus the spaces are perceived as one.'

Open coves in the vegetation were sought in the same manner as previously stated. When a vegetation depth was sufficient to create a psychological fence between the two spaces, but still allowed good visual contact this distance was noted as the minor buffer depth.

'NO BUFFER' TEST

Many vegetation types and spacings exhibited no buffer capabilities or the distances required to satisfy the buffer definitions would make their use prohibitive. These vegetation types were noted on the air photo mosaics as having no buffer potential.

TEST RESULTS

VEGETATION TYPES	UNDER-STORY	MAJOR TREE SPACING	MAJOR BUFFER	MODERATE BUFFER	MINOR BUFFER	NO BUFFER
TEST ONE-MIXED vegetation - Jack pine, white spruce, birch.	moderate mixed	5 ft. to 15 ft.	90 yds. to 100 yds.	25 yds.	15 yds.	over 15 yds.
TEST TWO - poplar stand (some birch)	None	5 ft. to 10 ft.	70 yds. to 80 yds.	15 yds. to 20 yds.	10 yds.	over 10 yds.
TEST THREE - immature Jack pine (20 ft. in height.)	None	1 ft. to 3 ft.	45 yds. to 55 yds.	10 yds. to 15 yds.	5 yds.	over 5 yds.
TEST FOUR - mature Jack pine (40 ft. in height).	None	6 ft. to 12 ft.	150 yds.	35 yds. 40 yds.	15 yds.	over 15 yds.
TEST FIVE - mixed Jack pine, white spruce, white birch.	heavy mixed	1 ft. to 5 ft.	35 yds.	5 yds. 10 yds.	5 yds.	over 5 yds.
TEST SIX - dense white spruce.	None, branching to ground	2 ft. to 6 ft.	30 yds. 35 yds.	10 yds.	5 yds.	over 5 yds.
TEST SEVEN - Jack pine (50 ft. in height.)	moderate branches low	5 ft. to 10 ft.	75 yds.	20 yds.	10 yds.	over 10 yds.
TEST EIGHT - Jack pine (30 ft. to 40 ft. in height.	minor	5 ft. to 10 ft.	50 yds. to 60 yds.	20 yds.	5 yds. to 10 yds.	over 5 yds.
TEST NINE - poplar stand (30 ft. in height).	None	1 ft. to 5 ft.	50 yds.	10 yds.	5 yds.	over 5 yds.
TEST TEN - white birch.	minor	3 ft. to 30 ft.	NO BUFFER POTENTIAL			
TEST ELEVEN - Jack pine.	None	1 ft. to 15 ft.	70 yds.	20 yds. 25 yds.	10 yds.	over 10 yds.
TEST TWELVE - black spruce - stagnant.	None	1 ft. to 20 ft.	NO BUFFER POTENTIAL			

TEST DISCUSSIONS

The vegetation types with buffer similarities have been combined into five distinct groups which makes handling the information less difficult (P.85). The buffer rating of a vegetation type on a flat site will be correlated with its absorption rating. (all buffer capability studies were carried out on flat sites.) Thus, landscapes with a particular absorption rating will be assumed to have a specific buffer capability. This will take into consideration both the topographic and perceptual factors vital to buffer capabilities. For example: a vegetation on a slope will in fact receive a lower buffer rating than the same vegetation type in a valley, because the topography influences the buffer capability of a vegetation.

The following correlations between visual absorption and perceptual carrying capacity were found.

PERCEPTUAL CARRYING CAPACITY	VISUAL ABSORPTION RATINGS
GROUP ONE	1, 2, 3
GROUP TWO	4
GROUP THREE	5
GROUP FOUR	6, 7
GROUP FIVE	8, 9

It is expected that professional judgement would vary to some degree on the vegetation depths necessary to satisfy the buffer definitions. But, it is felt that the definitions are sufficiently precise that an acceptable degree of consistency can be expected. Thus, this method allows for an expedient analysis of vegetation that should fit easily within the planners' time constraints.

A.5.1

The number of single family units per cell is calculated using the following planning practices.

F.29

A vegetation loss of five yards beyond the excavation is assumed as a result of construction practices and of perturbation to the surrounding eco-system. The specified buffer level for the vegetation type is calculated from five yards either side of the dwellings. This is true for all four directions. Development that encroaches upon the specified buffer widths will be considered as creating an impact on the perceptual benefits of the vegetation.

Calculations to determine the quantity of single family units per cell were based on a large sample of cells and excluded 30% of each grid cell to facilitate such future contingencies as road and utility infra-structures.

APPENDIX B.1

Mapping Process

The possible number of combinations of between two and six maps of nine levels each is 81 and 531,411 respectively. In order to reduce the number of combinations the basic component maps are limited to three composite ranges resulting in a reasonable number of combinations to work with. These combinations are then converted to a ten level resultant map.

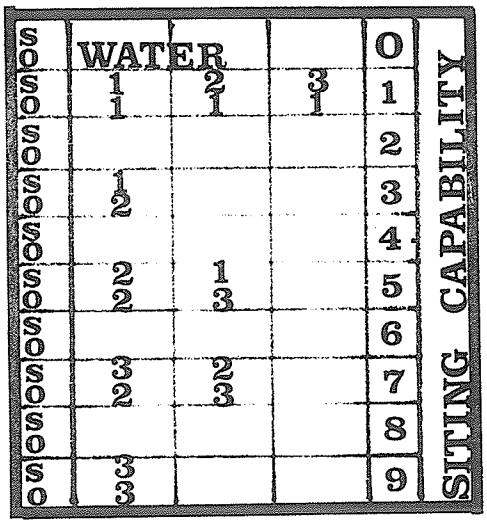
SLOPE WT. 1.0		ORIENTATION WT. 1.0		
0	water	0	water	
1	20%	1	North	1
2	0% - 4%	2	North east	
3		3	North west	
4	4% - 8%	4	flat	
5	8% - 12%	5	East	2
6		6	West	
7	12% - 16%	7	South east	
8		8	South west	3
9	16% - 20%	9	South	

The respective weights of these variables are the same which means that an orientation value of 2 has the same value as a slope of 2 when combined to form siting capability. Where weights differ these differences are reflected in the resultant values of the possible combinations.

POSSIBLE COMBINATIONS

		RESULTANT VALUES
1,1	1,1	2
2,1	1,2	3
2,2	2,2	4
3,1	1,3	4
3,2	2,3	5
3,3	3,3	6

The possible combinations result in five different values of site capability. This is then converted to the accepted ten level scale. The 'conversion table' reverts the five different values and the adjusted values back to the ten level scale.



CONVERSION TABLE

F.30

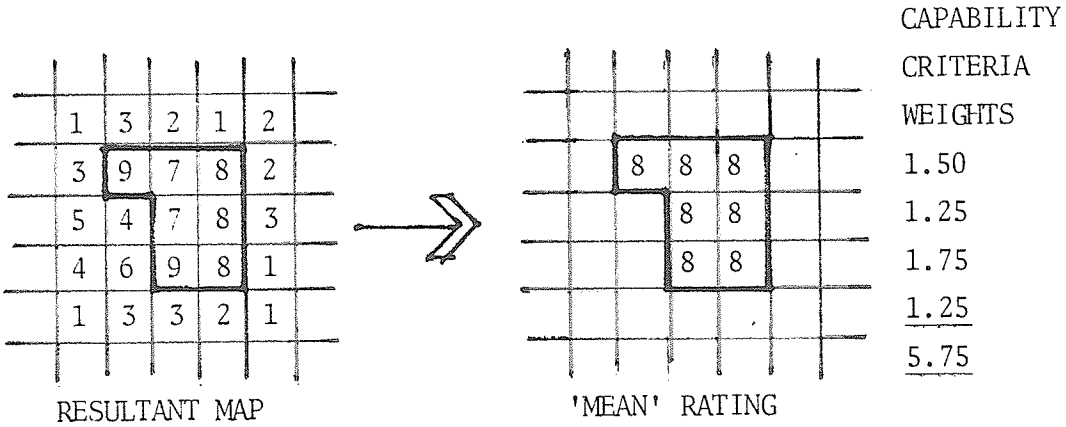
The computer is then given these converted values which satisfies all possible combinations of slope and orientation resulting in a 'siting capability' score. This has been the most simple possible combination example and as the number of variables increases the possible number of combinations accumulates in exponential proportions.

APPENDIX B.2

TWO LEVEL MAPPING TECHNIQUE

STAGE 'A' (the area to be totally replaced by the development complex).

EXAMPLE:



RESULTANT MAP 'MEAN' RATING

F.31

The edge condition of a stage 'A' area is delineated by the following criteria:

1) The area requirements of proposed land uses are stated in the program. A quick check of the quantity required compared with the number of grid cells with high capability ratings will establish a capability range that will fulfill the area requirements. This will establish an edge between cells considered capable and those cells not considered capable. For example: if there is not a sufficient number of grid cells with a capability rating of seven and over to satisfy the requirements, the grid cells rated six and over will be considered capable. This will increase the number of cells and the area being considered.

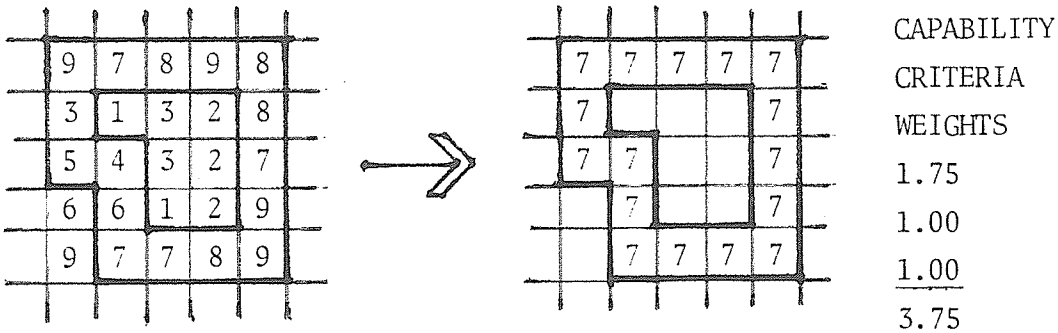
2) Incorporated within the quantity of area required should be a sufficient amount of extra area to provide a reasonable

flexibility of choice. (This will vary according to the number and kind of external constraints.)

This example uses a capability rating of seven and over to establish the edge condition.

STAGE 'B' (the area on the periphery of the development.)

A periphery vegetation of one grid cell in depth for each development is considered both ecologically and perceptually adequate. This means that there would be a minimum of two grid cells of vegetation separating major developments. If there is only one grid cell between the stage 'A' development areas the smaller area will not be considered a viable site.



RESULTANT MAP 'MEAN' RATING

F.31

NOTE: The value of each grid cell has changed reflecting a different set of capability criteria.

RESULTANT MAP RATING FOR TOTAL SITE

Both areas are included in the rating of the total site. The mean rating of the two stages forms the resultant suitability score for the total site. The mean rating of the two levels includes the (number of cells) (rating of each cell) (total weight of each stage).

STAGE 'A'

(7) (8) (5.75) = 322

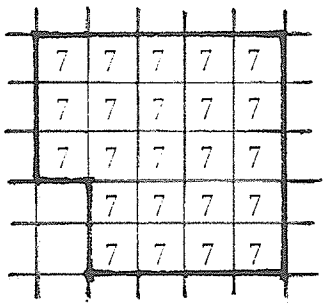
STAGE 'B'

(16) (7) (3.75) = 419.5

SUITABILITY SCORE

$$\frac{322 + 419.5}{[(7)\ (5.75)] + [(16)\ (3.75)]} = 7.41$$

This score is rounded off to seven and forms the suitability score for the total site.



SUITABILITY
SCORE

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