

THE DELPHI TECHNIQUE:
A SITE SELECTION METHODOLOGY
FOR URBAN DEVELOPMENTS
IN NORTHERN ENVIRONMENTS

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BY

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the University of Manitoba in partial fulfillment of the requirements
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"The basic task of ecology is not to tinker with technology, but to create an awareness and understanding among policy makers to the vital necessity to slow down the rush towards environmental disaster and the progressive destruction of the earth's irreplaceable resources. This concept of making rational use of the earth's resources is often referred to as conservation. Some confusion exists as to the relationship between ecology and conservation-- ecology is a science, conservation an art; ecology supplies the facts, conservation the philosophy."

James Woodford, 1972.

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CHAPTER I

INTRODUCTION

"Unless Canadians are successful in developing attractive communities that are able to provide all the services and amenities to the residents that are being enjoyed by their counterparts residing in southern areas, the future of our resource industries in the north are in considerable jeopardy of failure."

-A. E. Moss (1975).

I. THE OBJECTIVE

In an age when there is great concern for depleting natural resources there is the growing dependency upon development of the Canadian North, still largely virgin territory rich in raw materials.

Future development in the North is to a great extent based upon the assumption that the present energy crisis will continue to deplete many of our natural resources e.g., minerals, timber, natural gas, oil etc. Based upon this assumption the following postulates are put forth.

- (1) Further depletion of these resources will cause a northward expansion of associated industries in order that known northern reserves may be tapped. Additionally there will be an increase in activity in the northland for discovery of other deposits.*
- (2) This activity in the Canadian North will warrant the construction of New Towns to provide the services to resource communities which for the most part will be industrial towns existing to a large extent in isolation from similar towns or larger centres.
- (3) Because of the isolation factor the new towns will not function as regional centres (with perhaps a few exceptions as a community expands over a long period of time). Rather they will be largely independent--

*The controversial MacKenzie Valley Pipe Line is sighted as an example.

there only for the purpose of extracting natural resource and dependent for supplies from larger centres in the south.*

- (4) Inhabitants of northern communities will serve industries dependent upon a high degree of technology. Therefore many of those who become members of the community will be highly skilled and educated. More so than has been necessary in the past. The community will cater to a cross section of the population but the population as a whole will demand a better life style and standard of living than those who inhabited northern communities 15 or 20 years ago. (Jackson and Poushinsky, 1971).
- (5) Past practices, so far as industrial towns are concerned have shown that the prime motivators in the community have been largely economic in nature. There has been little regard for the natural environment. (Moss, 1975).
- (6) If such practices are carried into future northern communities the consequences can be easily forecast. Northern environments are more susceptible to environmental damage and recovery time is greater than it is in more southerly communities. Failure to take into consideration critical environmental factors could result in tremendous detrimental consequences for the natural environment.

With the increasing need for northern development comes the increasing concern for the impact new communities will have upon the natural environment. We have long been aware of the problems of pollution created in existing urban centres.** We are also aware of the fact that the problems are not a localized phenomenon centered

*The implication is not necessarily that the communities will be single enterprise; the major industry will likely be natural resource oriented.

**It is noteworthy that the effects of pollution from the mining operation in the vicinity of Sudbury, Ontario have been so devastating that the surrounding natural environment now resembles a lunar landscape. For this very reason the National Aeronautics and Space Administration (NASA) chose this area as a training and testing ground for men and equipment which were to be associated with the Apollo moon missions.

around large urban areas, rather they have been transferred into the environmental ecosystems and have reached a global scale. (Carson, 1962; Commoner, 1972; Ward and Dubois, 1972). Northern environments are fragile in the sense that while the plants themselves may be more hardier than their species in more southerly regions, and therefore more suited to harsh climatic conditions, their recovery time, due to the harsh environment, is greatly increased (Dunbar, 1973). Erosion of soil also occurs much more readily once the surface cover has been removed. Climatic conditions are more severe. Consequently the environmental impact is much quicker and more devastating (Johns, 1973).

New towns are being developed to provide the necessary facilities and services required as mining claims go into production, timber reserves opened, hydro generating stations built across the northern rivers, and oil and natural gas are piped to urban Canada and the United States from the remote northland.

Mistakes have been made which are most difficult if not impossible to rectify. However we can learn from past error and take steps not to repeat them in the future.

The objective of this thesis is to define the manner in which a decision making process, the Delphi Technique, may be adapted to the process of selecting a specific geographic townsite from among a number of given alternative locations in northern environments. Because of the nature of the technique, to be defined in a later chapter, it is hoped that its implementation in a site selection process has the potential of reducing the negative effects of environmental impact generated by man's interference with the natural environment.

II. NORTHERN URBAN AREAS: A DEFINITION

In the conventional sense the North may be thought of in terms of obscure concepts relating to those lands and territories which lie within the boundaries of arctic and subarctic regions. Alternatively it may include only that area which lies north of the 53rd parallel or perhaps regions to the north of the most southern limit of the discontinuous permafrost zone. Further, the North may be defined as all territory lying northward of the agricultural zone including regions of boreal forest. With the exception of the 53rd parallel, the boundaries that would encompass the North (in the context of the foregoing definitions) are not at all well defined and are anything but congruent.

Rather than attempt to define the northern region of this country in geographical or climatical terms, it is perhaps more feasible for the purposes of this thesis to concern ourselves with the characteristics of the communities with which we are attempting to deal. From this viewpoint a northern community may be independent of a specific geographical location or climatic conditions but as a requisite for definition may exhibit the following characteristics:

- the community may be relatively isolated in terms of accessibility i.e., it is not likely to be located on or in close proximity to a major transportation corridor; it may exist at the terminus of a transportation route created solely for access to the community. (Such routes may be extended over time to link new communities as they develop.)
- the community is not likely to engage in or be dependent for its existence upon agricultural production.
- the community will in all probability be natural resources based i.e., the prime purpose for its

location will be as a direct result of a base industry involved in mining, timber, fishing, natural gas and oil extraction or hydro-electric power.*

Figure I.1 indicates the approximate area which may be encompassed by the term "north" in consideration of the foregoing characteristics. The dotted line is not intended to define the absolute southern limit of northern territories, rather its function is to provide some indication as to the geographic area relevant to the major concerns of this thesis.

III. THE NECESSITY OF POSITIVE PLANNING IN NORTHERN DEVELOPMENTS

Man as a technological animal has many qualities and characteristics which enable him to adapt to most any environment over short or extended periods of time. However this adaptability provides no guarantee that man will remain in a hostile environment.

With the exception of a select minority, few have accepted the inhospitable climate of Canada's Northland and even fewer have elected to stay. Those who did were the pioneers of Canada's future in the North. Their determination and perseverance provided the foundation upon which many northern settlements were built. These settlements were often an uncontrolled growth of shacks and tents (Figure I.2). The shacks and tents slowly gave way to structures of a more permanent nature. Towns emerged, cities were built and industry flourished to extract our natural resources.

*This does not by necessity exclude military installations or towns which have grown up around communication, radar, or weather station installations.

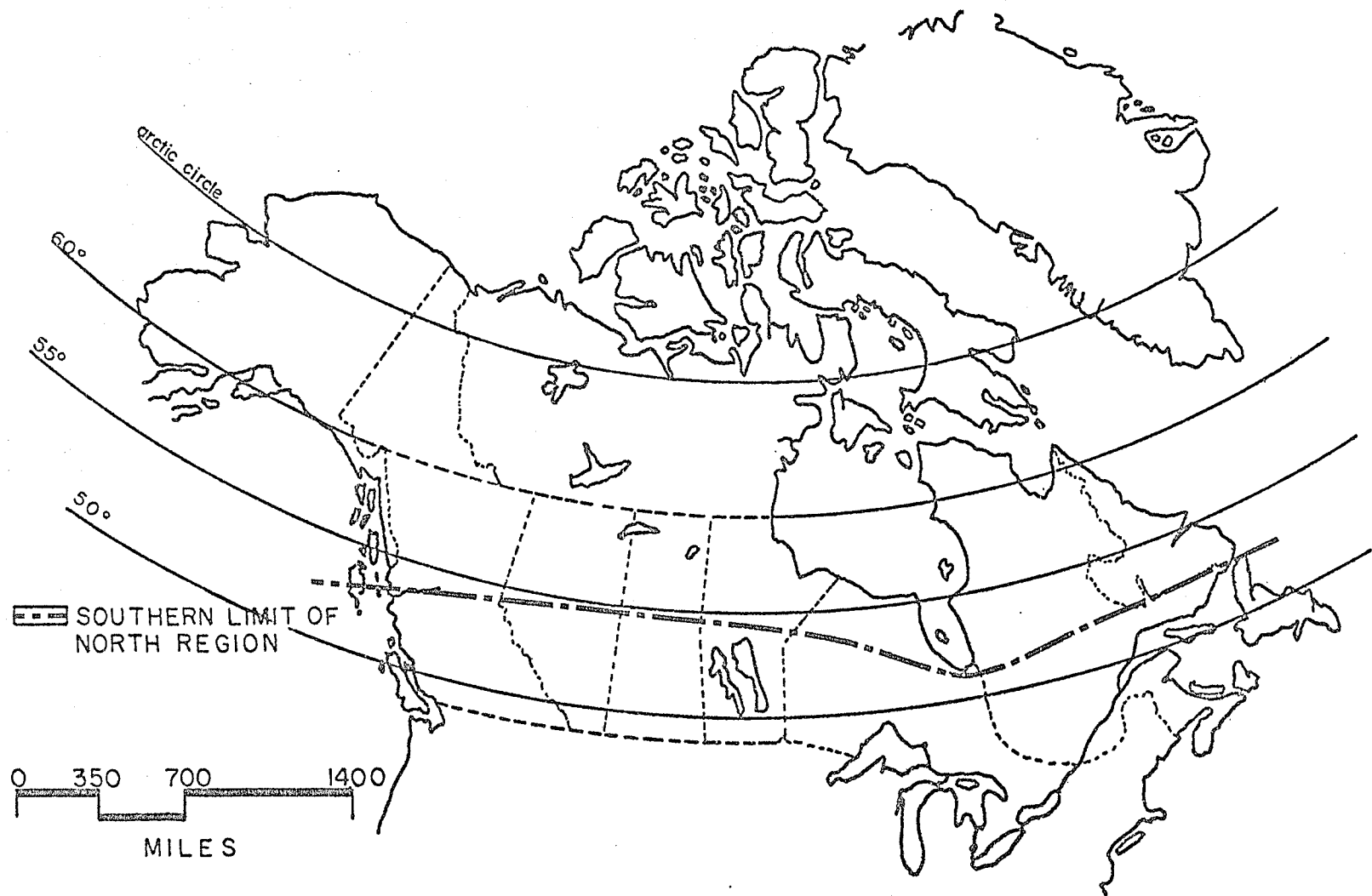


Fig. I. 1 Approximate "Northern" Regions

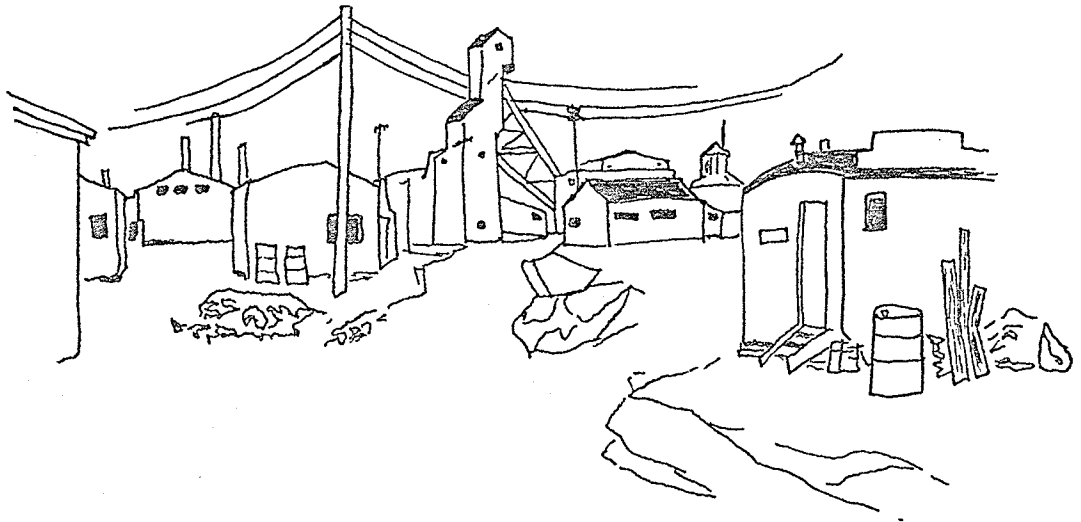


Fig. I. 2. Uncontrolled Development Around the Mine Shaft.

Source: Siemens, L.B. Single-Enterprise Community Studies in Northern Canada, Series 5: Occasional Paper No. 7, Center for Settlement Studies, University of Manitoba, 1973, p. 5.

There are a variety of problems encountered in the planning processes of any community but problems are increased in number and often compounded for a town which is to function as a service centre for an isolated resource community.

In the majority of cases, with some exceptions, new towns in the north will be built from scratch rather than rejuvenate older existing communities. For this reason the towns must cater to the needs of those who will develop and sustain the industry, namely the workmen and the professional administrators and technologists responsible for the overall operation; the people employed by the supportive non-basic industries which will follow and; those essential for community health, education and protection. These people along with their families must be willing to leave their homes in the south and become part of a new frontier. If they are to put down roots and build a new community which will endure the people must be offered amenities at least comparable to those which were left behind and preferably better (Moss, 1975).

The community, regardless of location may be thought of as being comprised of three integrated elements: the natural environment; that environment which is built or man-made, and the populace which inhabit the community.

The planning processes which involve urban development are concerned with the manner in which the integration of the elements can best be achieved to promote, or instill in the people, a social cohesiveness and sense of community identity which will enhance community living and a desire to remain in the community. To accomplish this end it becomes imperative that amenities be provided in terms of an aesthetic

living environment coupled with financial opportunity (i.e., job opportunity and security) together with those facilities necessary to support the daily activities and social requirements of the inhabitants. These amenities may include such facilities as adequate shopping, recreation, education, health needs (i.e., medical, dental, social services, etc.) as well as housing facilities.

Because of the isolation factor characteristic of many northern urban developments the amenities play a more sensitive role in maintaining the community. When northern communities lack sufficient amenities people become dissatisfied with their environment* and look to greener pastures (Jackson and Poushinsky, 1971, pp. 42-43, pp. 100-101).

The aesthetics of the living environment are derived from both the built and natural environments. Architecture, functional in terms of climate, can be further enhanced by taking advantage of the natural surroundings. Natural vegetation, ground cover, scenic vistas, etc. are all natural tools of the architect. Without them he becomes restricted and it becomes more difficult to create a more pleasant living environment.

The natural environment precedes the other basic community elements yet it has been the case in many instances to ignore the importance of the role played by the natural environment in the planning and development processes of northern communities.

*Environment in this context refers to social and physical amenities, e.g., no job future, high cost of living, poor housing, poor shopping isolation, climate.

The Canadian North is scattered with examples of industrial communities which have developed with greater emphasis on consideration of economic feasibility than on consequences of environmental impact (Moss, 1975). They have not only lost potential aesthetic value but have engaged in the decay and destruction of natural ecosystems through chemical pollution and unnecessary removal of the natural vegetation cover. Much of this could have been avoided had the time been taken to reallocate priorities and apply sensible technology in the proper selection and presentation of potential townsites prior to implementation of development stages (McHarg, 1971).

Many of the problems may have arisen due to failure, not of technology per se, but to recognize the complexities involved when dealing with the natural environment.

Perhaps J.W. Forrester (1971) put it best when he said:

"The problem is not shortage of data, but rather our inability to perceive the consequences of the information we already possess". (p. 41).

IV. FOUNDATIONS FOR RESEARCH

The foundations of this thesis are built largely upon library research and first hand knowledge acquired by the author through direct contact with planning consultants who are themselves actively engaged in northern community design.

The Delphi Process was developed by the Rand Corporation in the early 1950's as "Project Delphi" through sponsorship by the United States Air Force. Since its inception it has been used as a decision making tool by the military, the government, and industry to assess

"the direction of long-range trends*, with special emphasis on science and technology..." (Linstone and Turoff, 1975, p. 10). It has not, to the best of the author's knowledge, been widely applied as a standard procedure in the selection of northern townsites. In fact the only instance the author is aware of where the process has been applied for such a purpose was for the selection of the Lake St. Joseph townsite in northern Ontario.

V. EVALUATION OF THE LAKE ST. JOSEPH PROJECT

Through the application of the Delphi Process to the proposed Lake St. Joseph development it was hoped that some of the problems which had plagued earlier northern urban communities could be alleviated. Of special concern was environmental impact due to the imposition of urban development on what may essentially be a more fragile natural environment than is normally encountered in more southern areas.

Unfortunately, because of circumstances beyond the influence of the designers, this project has not yet been put to a test. The development has not proceeded largely because of economic considerations totally divorced from development criteria and costs of the site per se.

Assessment is therefore made somewhat difficult as the project at this point exists only on paper. However a general evaluation of Delphi as applied to site development will be offered in the concluding chapter.

*Long range was defined as ten to fifty years.

CHAPTER II

THE NEED FOR RE-EVALUATION OF DESIGN CONSIDERATIONS EFFECTING
THE PHYSICAL DEVELOPMENT OF NORTHERN URBAN DEVELOPMENTS

No development, no matter how well planned, can totally meet the requirements of the community at large nor can the impact upon the natural environment created by urban development be made totally negligible. Environmental impact can, however, with proper technological application be minimized. Figure II.1 below illustrates a possible relationship between northern urban development, time, environmental impact and ecological technology.

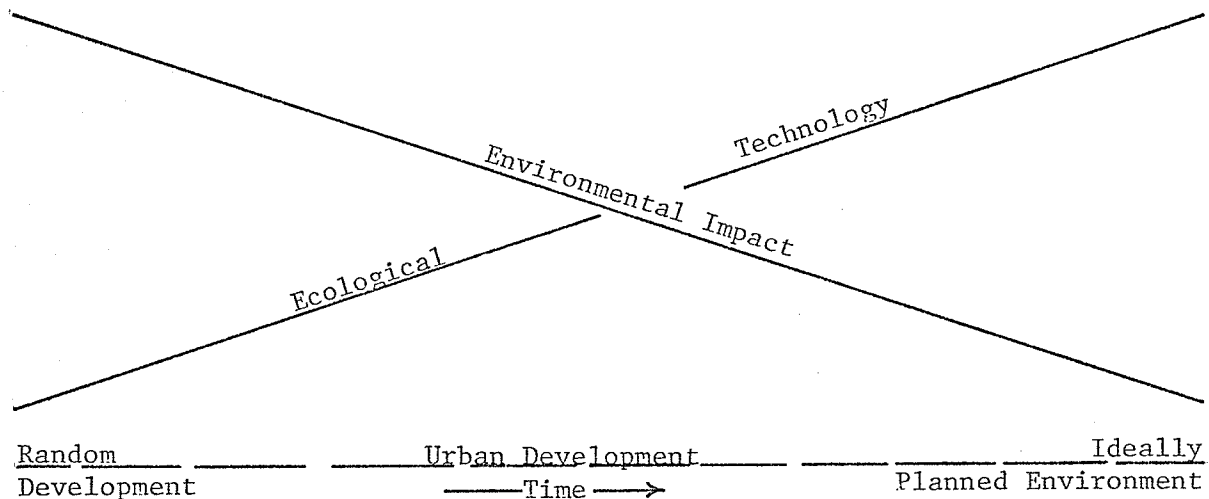


Fig. II. 1. Urban Development and Environmental Impact

The model does not consider economic costs of urban development nor the abstract qualities of a living environment (e.g. quality of life, happiness, etc.) the model is concerned only ecological engineering (e.g., engineering, architecture, biology etc.) for the purposes of environmental control from a purely physical standpoint.

The model conceptualizes the progressive stages of urban development in the north from an undesirable random development pattern towards the ideally planned community--the extreme in the opposing direction. Where applied ecological technology is lacking, as it has in many early industrial developments, damage to the natural environment is high. With the progression of time and assuming advances in the environmental sciences (i.e., zoology, biology, engineering, etc.) as well as the application of the technology, damage to the natural environment through urban development should be reduced. The ultimate objective is a Utopia, a completely harmonious existence between man's built environment and the natural environment onto which he has imposed his demands.

Although the ultimate goal is an ideal, and therefore unattainable state, the logic of the argument would appear to be valid. While we can not achieve the ideal end, we do possess sufficient technological knowledge which, if applied, would considerably reduce the negative* effects of environmental impact (i.e., the unnecessary destruction of the natural environment) (Commoner, 1972; Forrester, 1971, Grainage, 1976; Johns, 1973; McHarg, 1971; Moss, 1975).

Technological development must, by necessity, be precluded by knowledge based upon a lesser degree of a previous technology. That is to say, with an increase in knowledge (i.e., data base) technological improvement can follow. So it has been with the development of northern communities.

*Positive effects of environmental impact may be thought of in terms of economic gain, both financial and in terms of raw and/or finished products.

For this reason a comparative analysis of the three communities which will be discussed would be difficult to say the least (and possibly invalid) due to the fact the data and the knowledge upon which was formulated the basis for the more modern developments simply did not exist over half a century ago. Even in the short span of time which occurred between the more modern developments concepts changed and technological advances (even though they may have been slight) were gained.

The intent of the ensuing discussion, therefore, is not to draw a detailed comparative analysis between the communities, but rather the intent is to emphasize the progressive changes in development patterns and input into physical designs and design considerations which have occurred over the years.

To illustrate the progression in development of northern communities the author has selected three mining towns in northern Manitoba which developed over different points in time since the turn of the century to the present.

Flin Flon has been used to illustrate those northern communities of a "boom town" era; the communities mushroomed almost overnight in a hodge podge fashion, heedless of the environment--meeting only the basic needs of an industry who's sole purpose was to extract a rich body of ore, and the basic needs of the supporting population.

By the time Thompson was developed technology and environmental knowledge had come a long way from the early days of the boom towns. Thompson was in the beginning, and is presently, much closer to the ideal community of the north than Flin Flon ever was. Thompson was totally pre-planned--Flin Flon was not--Thompson was developed according