THE UNIVERSITY OF MANITOBA

A METHOD OF LAND ANALYSIS AND CLASSIFICATION FOR THE CANADIAN SHIELD PORTION OF MANITOBA

by

Douglas H. Mazur

A THESIS SUBMITTED TO
THE FACULTY OF GRADUATE STUDIES
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR
THE DEGREE OF MASTER OF ARTS

DEPARTMENT OF GEOGRAPHY

WINNIPEG, MANITOBA

June 1979

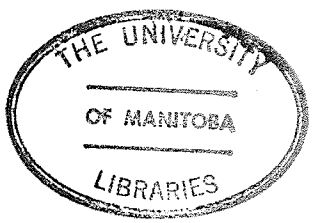
A METHOD OF LAND ANALYSIS AND CLASSIFICATION FOR THE CANADIAN SHIELD PORTION OF MANITOBA

BY

DOUGLAS HENRY MAZUR

A dissertation submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

MASTER OF ARTS



ACKNOWLEDGEMENTS

This thesis is dedicated to the memory of my father who served as a constant source of encouragement to strive for academic achievement and excellence; and also to my wife Kate who, while enduring five seemingly intolerable winters of hurried dinners and endless night-school classes, provided a continuing source of inspiration and encouragement.

Recognition is also given to Mr. T. Merkl who provided the background material incorporated in the Appendix.

Special acknowledgement is also extended to Mr. T. Mendis who provided draughting and editing services for the final text.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF MAPS

LIST OF PHOTOGRAPHS

INTRODUCTION

The purpose of land-use planning is to outline on the basis of a rational decision-making process how land and associated resources can be best allocated for existing and future generations. Unfortunately, due to the complexity of the resource base, there is no one consistent method of land analysis and classification applied to the land-use planning process. In addition to the problem of consistency, individual methodologies that have been developed for specific purposes elsewhere were found to be too costly to implement or could not be adapted, for a variety of reasons, to the specific task of identifying recreational sites in the Province of Manitoba. The purpose of this thesis is thus to outline a method of land analysis and classification that can be utilized to identify specific sites for recreational development in the Canadian Shield portion of Manitoba.

The first step in the process of developing an analysis and classification system for Manitoba was a review of several existing systems. This was done in order to determine if there are common problems inherent in existing methods, and to subsequently attempt to avoid those problems in the formulation of an analysis and classification system for the Manitoba Shield.

A major controlling tactic in the process of developing a method of land analysis and classification was that of cost. Funds were not available to undertake the development of a methodology, nor were they available to undertake the detailed inventory of the resource base which

would be necessary. In view of this problem it was necessary to develop the land analysis and classification system around existing sources of information. In reviewing information sources available in the Province of Manitoba it was found that the most comprehensive source of resource information is contained in the Forest Inventory. Hence, the Forest Inventory data is used as the base line data for the land analysis and classification method while other inventory-information sources, such as the Canada Land Inventory, are used to supplement the data base. In selecting the Forest Inventory information as the primary data base for the analysis and classification system it was recognized that the information was available only for the forested area of the Province of Manitoba. Further, since most recreational activity occurs in the Canadian Shield, the analysis and classification system was developed for specific application in the Canadian Shield. The principles of the system are, however, flexible enough to allow the application of the method to the forested and inventoried areas of the Province.

In selecting the Forest Inventory information it was recognized that, since the data base was originally generated for the purpose of forest management, it was necessary to establish a series of interpretative criteria indicative of suitability for recreational purposes. This was done through a process of experimentation and field checks over the course of five years. The final criteria are thus based on experience obtained over five years of experimentation and actual use of the criteria to finally locate and subsequently develop specific sites for recreational activities.

In order to place the land analysis and classification method described in this thesis into perspective two objectives have been identified:

i. to identify some primary general characteristics which should be inherent in a method of land analysis and classification, and

ii. to evaluate the proposed method of land analysis and classification relative to the primary characteristics which should be inherent in any method of land analysis and classification.

This thesis meets these objectives insomuch as Chapter I is devoted to the description and evaluation of three methods of analysing and classifying land. Chapter I thus sets the framework by outlining several problems common to land analysis and classification methods. Chapter II, on the basis of the data contained in Chapter I and a general literature review, outlines additional general primary characteristics which should be recognized in a method of land analysis and classification. Chapters I and II are thus devoted to meeting the first objective of this thesis. Chapter III outlines the three-stage method of land analysis and classification that has been formulated for the Canadian Shield portion of Manitoba. The second objective of this thesis is met in Chapters IV and V insomuch as Chapter IV is an evaluation of the method relative to the characteristics outlined in Chapters I and II, while Chapter V is a critique of the method. The thesis concludes with an Appendix which is a working example of the application of the method of land analysis and classification in the Canadian Shield portion of Manitoba.

SOME METHODS OF LAND ANALYSIS AND CLASSIFICATION

CHAPTER I

SOME METHODS OF LAND ANALYSIS AND CLASSIFICATION

Although the free market economy allows land to go to the highest bidder, this does not necessarily result in land being used in the manner to which it is best suited. In viewing this phenomenon it becomes necessary for governments or other institutions to control land use by assigning priorities for certain land occupance. Land is thus analysed, and subsequently classified, for the purposes of determining the use to which it is best suited.

This chapter outlines and evaluates three methods of analysing and classifying land for recreational purposes. It is recognised that there are numerous methods of analysis and classification in use. However, the intent of this chapter is not to conduct exhaustive research into the aspects of land analysis and classification. Its purpose is to outline desirable general characteristics which should be inherent in a method of land analysis and classification. Within this perspective, therefore, three methods of analysis and classification were selected for illustrative purposes only. These three systems have, in combination but not individually, primary characteristics that should be inherent in a method of land analysis and classification.

The three methods described and evaluated are:

i. The methodology for an inventory and classification of land

for recreational use, proposed by D.G. Taylor and C.W. Thomson.[1]

ii. A.R.D.A.'s outdoor recreation land capability classification system,[2] and

iii. Ontario's methodology for recreation land inventory.[3]

The description and analysis of each of these approaches follows.

A. Methodology for an Inventory and Classification of Land for Recreational Use[4]

1. Explanation

The two major objectives of this methodology are:

i. to suggest a relatively simple system of inventory that will indicate the potential of the physical landscape for recreational land use; and

ii. to suggest an approach that will allow for a logical sequence in varying the scale of intensity of that inventory.

In approaching the problem of inventory and classification the authors concluded that it could best be handled through a four-stage approach. The suggested approach proceeds from the general to the specific and then back to the general.

---

[1] G.D. Taylor and C.W. Thomson, "Proposed Methodology for an Inventory and Classification of Land for Recreational Use," The Forestry Chronicle, Vol.42, No. 2 (1966), 153-159.

[2] Agricultural Rehabilitation and Development Administration (A.R.D.A.), Field Manual--Land Capability Classification for Outdoor Development, (Ottawa: Canada, Department of Forestry and Rural Development, June 1967). This is an outline of the classification used in the Canada Land Inventory.

[3] Ontario, Department of Lands and Forests, Methodology for Ontario Recreation Land Inventory (Toronto: Queen's Printer, October 1968).

[4] G.D. Taylor and C.W. Thomson, op.cit.

The four stages of the inventory and classification include:

i. preliminary analysis of all lands,

ii. preliminary analysis of best lands,

iii. detailed site analysis, and

iv. generalised use classes.

a. Stage I

In general, the first stage presents only the potential units of the landscape as evaluated by specific control limits. The recreational potential at this stage is based on the combined effect of the very general criteria of water, vegetative cover, slope and relief. This stage provides the information and the framework for broad areal or regional analysis. It does not, however, have the detail for site evaluation[1]. This stage, which points out those areas that warrant closer attention on a national basis, is the initial step in a sophisticated approach to classification.

The control-limit guidelines established for each of the elements--water, cover, slope and relief--are as follows:

(1) Water

i. Sea, lake or major river: lake exceeds 320 acres, river more than half-a-mile wide;

ii. River from 100 feet to half-a-mile in width;

iii. Lake, river or stream: lake less than 320 acres, river less than 100 feet in width; and

iv. Lacks a water body.

---

[1] Ibid., p.153.

(2) Cover

i. Tree cover exists; and

ii. No tree cover.

(3) Slope

i. 30%-70% of area in slope less than 10%;

ii. Less than 30% of area in slope of 10% or less, more than 70% of area in slope of 10% or less; and

iii. No level land or all level land.

(4) Relief

i. From 100 feet to 500 feet in square mile;

ii. Less than 100 feet in square mile; and

iii. Exceeds 500 feet in square mile.

The information obtained by the application of the control limits to a particular area is then grouped into seven type areas. Table 1 indicates how the control elements are applied.

An interpretation from Table 1 is as follows: In type area E there may be a lake less than 320 acres in area or a river less than 100 feet in width. Less than 30% of the area is slope of 10% or less, or more than 70% of the area is slope of 10% or less. There is no tree cover, and relief varies from 100 feet to over 500 feet in a square mile.

TABLE 1

ELEMENT COMPLEX RATING[1]

Type Areas	Water	Slope	Cover	Relief
A	1	1	1	1
B	2	2	1	1
C	2	2	2	2/3
D	3	2	1	2/3
E	3	2	2	2/3
F	4	1	2	2/3
G	4	2	2	2/3

1. Water is the key element, and as water conditions become less important the limitation of the area for recreation increases.

2. Tree cover has been made permissive and has not placed a severe limitation on the area.

3. A variety of slopes and relief provide the most suitable background for recreational uses. Land too flat or too steep presents limiting factors.

4. Recognition is given to areas that lack usable water but have other suitable characteristics.

The type areas identified in Table 1 are arranged in descending order of significance and reflect the degree of limitation offered by the control limits. The significance is based on the limitations offered to development for recreational use. Areas with excessively steep slopes, with high local relief and lacking both water and tree cover are considered least desirable. Environments suitable for limited types of development or for single special uses only fall into intermediate categories[2].

---

[1] Ibid., p. 156.

[2] Ibid., p. 156.

The authors stress that the sole purpose of the areal analysis is to determine the recreational potential of the country. It does not cover all but only certain types of mass recreation that have common physical requirements. The type category assigned to an area indicates the possibility of finding the type of recreational site that is required, and the limitations therein.

Table 2 translates the information contained in Table 1 into descriptive terms related to the probability of finding a recreational site.

TABLE 2[1]

DESCRIPTION OF ELEMENT COMPLEX RATING

Type Areas	Probability of Locating Recreational Site	Physical Limitations That May Exist
A	Excellent	None
B	Good	Little
C	Fair	Moderate
D	Fair	Moderate
E	Fair	Moderate
F	Poor	Severe
G	Poor	Severe

b. Stage II

Stage II of the process suggests that, dependent on demand, more detailed investigations be conducted in areas designated as Class A or lower. This stage involves the identification of features such as beaches, waterfalls, canyons and ravines, which have some attraction for recreation within specific areas.

[1] Ibid., p. 157.

By assigning priorities to the types of recreation--camping, hiking, viewing--attractions can be ranked against each other. Or, by establishing physical criteria, attractions in one area can be ranked against similar attractions in other areas[1].

This stage of the methodology indicates that comparisons should be made. It does not, however, provide criteria for such comparisons.

c. Stage III

At this stage potential sites for recreational activity have been identified. Stage III is the detailed analysis of each specific site. The scale of the analysis will, however, be dependent on the purposes of the information and on the time and personnel available. The option is left to individual agencies to pursue detailed site analysis according to their particular style or requirements.

d. Stage IV

Stage IV organises the information generated in stages I to III into a classification system. The suggestion is made that the classification should consist of categories of declining capability, must cover all areas of land and must be based on physical resources.

The recommended approach is to place valuations on the variables: physical quality, attraction, size and the opportunities for recreational use. In this way, measurable divisional points would be established which would indicate differences in quality.

---

[1] Ibid., p. 157.

Table 3[1] indicates the concept, and illustrates the use, of categories of declining capability. Areas identified as "1" on the rating scale are the most suitable, decreasing to those rated as "5".

TABLE 3

VALUATIONS OF VARIABLES

Rating Scale	A	B	C	D
	Size	Physical Quality	Attraction	Recreational Use
1	Exceeds 1000 acres	No limitations or very minor	Many attractions sand beach 1 mile plus	Will support many activities
2	↓	↓	↓	↓
3	↓	↓	↓	↓
4	↓	↓	↓	↓
5	Less than 10 acres	Many limitations	Lacks beach	Few activities

The concluding phase recommends that the variables be combined into a system of classification. It is suggested that this could be done by assigning a value to each variable (A, B, C and D) or by applying a weighting system to them. The exact procedure is not identified.

2. Analysis

In reviewing this methodology the following observations are made.

---

[1] Ibid., p. 158.

i. The methodology does not cover all recreational activities. It concentrates on mass activities, primarily water-associated, which have common physical requirements. In view of the limited scope of the data base the classification method does not meet the total informational requirements of the planning process. This problem partially resolves itself in the second and third stages of the system when more specific information is added.

ii. The methodology as proposed is a national system and, as such, its effectiveness on a local scale is questionable. At best, the information provided would merely confirm what should be known locally (as to potential) and would place that within a national context.

iii. The methodology suggests that stages II and III of the process be left to individual agencies. The lack of standard control-mechanisms during these stages could lead to the introduction of varying degrees of subjective interpretation by individual agencies. This, in turn, would result in a lack of consistency in the detailed analysis and may make comparisons between areas difficult. This issue of subjectivity is recognised by Taylor and Thomson in so much as they state, "Judgements will always play an important role in classification, and as such the more precise limits that can be placed upon the criteria, the less variation due to individual bias there should be in the results."[1] The allowance of individual agencies to undertake stages II and III of the system without consistent guidelines is inconsistent with the recognition of subject-

---

[1] Ibid., p. 159.

ivity being an undesirable characteristic of a classification system.

iv. The methodology does not identify recreational sites. It merely indicates the probability, on the basis of attraction considerations (the existence of water, relief, slope and vegetation), of finding a site. The system therefore provides only an indication of probability, and hence it requires additional time and manpower to determine actual potential. It is possible, therefore, to expend much time and money investigating probable sites with no positive result.

B. Land Capability Classification for Outdoor Recreation[1]

1. Explanation

This classification system was developed to provide an inventory of national outdoor recreation resources. The system was to be applied across Canada in a uniform manner for purposes of indicating comparative levels of recreational capability for non-urban lands.

The objectives of this outdoor recreation land capability classification system were:

i. to provide a reliable indication of the quality, quantity and distribution of natural recreational resources in the settled parts of Canada;

---

[1] Agricultural Rehabilitation and Development Administration (A.R.D.A.), Field Manual--Land Capability Classification for Outdoor Recreation (Ottawa: Canada, Department of Forestry and Rural Development, June 1967).

ii. to indicate comparative levels of recreational capability for non-urban levels, based on current popular preferences;

iii. to indicate the type of recreation to which land is best suited;

iv. to identify, where possible, lands or features possessing outstanding or unique recreational values;

v. to provide basic information to aid governments in the formulation of policies and programs related to their functions of promotion, development and regulation of lands for recreation; and

vi. to provide a mapping framework within which Provinces may, within reasonable limits, gather and record (for management purposes) data on the physical characteristics of significant recreational resources[1].

The overriding guideline for this classification system is that it is based on the land's natural capability to provide opportunities for recreation.

The system recognises 25 components as contributing to the classification procedure. These are:

---

[1]Thomas S. Searth, "Land Classification for Outdoor Recreation" (unpublished M.A. Thesis, University of Calgary, 1970), p.67.

A: Angling
B: Beaches
C: Canoeing
D: Deep inshore water
E: Vegetation
F: Waterfalls and rapids
G: Glaciers
H: Historic sites
J: Gathering and collecting
K: Organised camping
L: Landforms
M: Small surface waters
N: Lodgings
O: Upland wildlife
P: Cultural landscape patterns
Q: Topographic patterns
R: Rock formations
S: Skiing areas
T: Thermal springs
U: Deep-water boating
V: Viewing
W: Wetland wildlife
X: Miscellaneous
Y: Family boating
Z: Man-made features

The capability class identified for a particular land unit is based on the opportunities for outdoor recreation provided by one or more of the aforementioned components and on the quality or intensity of use a land unit is capable of supporting. Other factors which contribute to the designation of the capability class are uniqueness and accessibility of the recreational component or components.

The A.R.D.A. classification system employs a seven-class rating scale, with class 1 having a very high and class 7 having a very low capability for outdoor recreation. A land unit classified in any of the three upper classes should be able to support high to moderately high total annual use by intensive to moderately intensive

forms of outdoor recreation. Conversely, capability classifications of classes 4 to 7 represent lands which have the capability to sustain moderate to low total annual use by dispersed or extensive forms of outdoor recreation.

The information gathered was placed on 1:50,000-scale maps while in the field and later transferred to a 1:250,000-scale map for publication purposes. On the maps, each classified land unit was assigned a combination of symbols indicating the capability class, the type of land unit, and up to three recreational features indicated in order of significance.

2. Analysis

In reviewing this methodology the following observations are made:

i. The system does not consider situations, present land use or present access in the assignment of classification units. Since no consideration is given to land acquisition costs, road construction costs or demand for recreation at a site, the classification system is not reflective of realistic developmental potential. A site may therefore have a high natural capability for recreational development but a low probability of development. This discrepancy could distort the actual recreational potential of a region or area.

ii. The system relies on subjective interpretation to determine the final capability class of a given land unit. In instances where there is some question as to the capability class a subjective decision based on intuition and experience is made to determine the land class.

iii. The system recognises only the three primary potentials or qualities of a site. Hence, less significant potentials are not recorded and a complete perspective of the land unit is not provided.

iv. The system assumes uniform accuracy. However, since several people in different areas undertook the inventory there is a great deal of bias. The bias is further compounded by the degree of subjective interpretation allowed in assigning capability classes.

v. The inventory is based on capability to sustain intensive recreation and, as such, is not a valid indicator for resource-oriented recreational areas such as wilderness preserves. In addition, it is of little value for evaluating wild, scenic and recreational waterways.

vi. Sites may be identified as having a high attraction for intensive recreation. However, no consideration is given to the ability of that site to sustain, without severe impact, that level of use.

Searth, in his thesis[1], confirms these observations and suggests the following improvements to the system:

i. Reducing of Subjectivity. Subjectivity in classification should be reduced by providing a more specific and explicit

---

[1] Op. cit., pp. 224-228.

description of the role of individual quality criteria in deriving the final capability classification. Some measures, such as inventory data schedules, should be employed for systematically recording and storing information without respect to specific quality criteria. In addition to reducing subjectivity, the storing of such information would provide more useful information to its users.

ii. Removal of the Demand Factor. The main determining factor in the selection of a capability class for a land unit depends on whether or not a land unit is capable of supporting intensive or extensive forms of outdoor recreation. Capability classes in the upper half of the classification scale are suitable for intensive forms of outdoor recreation, while capability classes in the lower half of the classification scale are suitable for extensive forms of outdoor recreation. The demand for, or popularity of, forms of outdoor recreation at the time of the inception of the A.R.D.A. system is the main determining factor in the allocation of a capability class to a land unit. As the popularity of forms of outdoor recreation changes over space and time, information classified under the A.R.D.A. system may become incorrect.

The demand factor should be removed from classification. This step would provide for a truer representation of the natural capability of recreational resources for forms of outdoor recreation. It would also provide for comparableness of classified information over longer periods of time.

iii. Classification for Land and Water Units. Separate classifications should be provided for land and water units. This procedure would make specific information available on the recreational capability of both types of resources for land-oriented and water-oriented forms of outdoor recreation.

iv. Classification for Individual Forms of Outdoor Recreation. Land and water units should be classified for individual forms of outdoor recreation. This would provide specific information with respect to the capability of classified units for individual recreational activities and facilities. It is stated that one of the objectives of the system is to indicate the type of recreation to which land is best suited. By describing the capability of a classified unit for up to three recreational features, and for a number of recreational features which are not specific with respect to their association with individual forms of outdoor recreation, the classified information is not specific. In particular, the system should be made more specific with respect to identifying the capability of classified units for extensive forms of outdoor recreation such as hiking and hunting.

v. Flexibility. By reducing subjectivity and making the method of classification and the presentation of classified information more explicit and specific, the flexibility of the system would be greatly improved.

vi. Inventory Procedure. One of the objectives of this system is to provide a mapping framework within which Provinces may, within reasonable limits, gather and record (for management purposes) data on the physical characteristics of significant recreational resources. Had the proper inventory procedures been used for recording and storing information in the enumeration stage of classification, specific information on the physical characteristics of recreational resources could have been provided to some extent. This procedure would have reduced the Provinces' resurveying for certain of these specific characteristics, which in turn would result in the more efficient and effective use of available working resources.

C. Methodology for Ontario Recreation Land Inventory[1]

1. Explanation

This system uses an inventory and subsequent evaluation of the inventory data to determine the relative capability of the landscape to attract and sustain intensive recreational use based on the inherent physical quality of existing and potential recreation sites. The approach to classification first consists of describing the area, and second, of classifying and ranking the area for recreational use. The descriptive process is given great emphasis for its informational contribution for future kinds of recreational activities.

---

[1]Ontario, Department of Lands and Forests, Methodology for Ontario Recreation Land Inventory (Toronto: Queen's Printer, October 1968).

This system uses broad areal units called landscape units, and small land and water units within the broad landscape units are classified. A landscape unit is defined as an area of land and/or water that is at least 16 square miles in size which can be delineated and used as a convenient planning or management unit. The size and shape of each landscape unit is determined by specialists in landscape identification. Landscape units are to be as homogeneous as is reasonably possible, although the physiographic, social and economic factors used in determining homogeneous areas could vary from one landscape unit to another. In order to evaluate a landscape unit it is necessary, first, to evaluate the nuclear or smaller units and features within the landscape unit. These smaller units and features are called

i. shoreland units;

ii. water units;

iii. land units; and

iv. special or specific features.

The designation of land and water units is based entirely on physical criteria. These nuclear units and what is evaluated within a landscape unit are as follows:

i. Shoreland Units

(a) Bathing and camping.

(b) Lodging or cottaging and deeper shore activities.

(c) Wetland wildlife, hunting or viewing.

ii. Water Units

(a) Boating and viewing.

(b) Angling.

(c) Wetland wildlife.

(d) Canoeing.

(e) Yachting.

iii. Land Units (General)

(a) Travelling and viewing.

(b) Upland game hunting or viewing.

(c) Wetland game hunting or viewing.

iv. Special or Specific Features

(a) Viewpoints.

(b) Ski hills.

(c) Waterfalls and other special features.

Each of these nuclear units are evaluated relative to a small group of related recreational activities (as in (a), (b) and (c) under Shoreland Units) or individual forms of outdoor recreation. This information is then ranked on a scale of 1 to 7 based on the level and degree of the physical limitations of the recreational resources for the landscape unit. The degree of limitation is used as the negative scoring method to determine rank (Table 4).

The recreational features which are evaluated relative to the following table are: angling water, bathing beach, canoe route, deep shore water, unique vegetation, waterfalls or rapids, grounds for parking, historic site, unique wildlife habitat, collecting and gathering area, campsite, lodging or cottaging site,

pattern of small lakes or streams, natural landform or topography of special interest, pattern of land use, miscellaneous, rock formation (cave, cliff, canyon), ski hill, travelling and viewing area, upland game site, viewpoint, wetland wildlife site, small craft boating water, yachting water or yacht harbour, and Man-made features.

TABLE 4

RELATIONSHIP BETWEEN RANK, CAPABILITY AND LIMITATION

Rank	Level of Capability	Level of Limitation	Degree of Limitation
1	Very High	Insignificant	0
2	High	Slight	1
3	Moderately High	Medium	2
4	Moderate	Severe	4
5	Moderately Low	Very Severe	6
6	Low	Extremely Severe	8
7	Very Low	Most Severe	10

A description of the procedures, using shoreland units, points out the complexity of the classification system.

The first step is to delineate shoreline boundaries. The boundaries are established on the basis of

i. interpretation of aerial photographs;

ii. visual inspection by low and slow-flying aircraft; and

iii. ground inspection by boat and foot.

After the shoreline boundaries have been established, the physical features of the shorelines are described relative to the parameters indicated in Table 5.

TABLE 5

LEGEND FOR SHORELAND DESCRIPTION OF PHYSICAL FEATURES[1]

1. Wet Beach

	Slope %	Width
F = Flat	<2	250+
G = Gentle	2-7	66'-250'
M = Moderate	7-15	33'-66'
S = Steep	15-30	16'-33'
V = Very steep	30-100	5'-16'
P = Precipitous	100+	5'
K = Mixed (steep+) slopes		

2. Beach Material

a - angular stones 3"-12"
b - boulders 12"+
c - clay
d - cobbles or shingles 3"-12"
f - fragments 12"+
g - gravel + pebbles <3"
i - silt
k - mixed stones
l - loam or till
m - marl
o - organic material
p - jagged bedrock
r - smooth bedrock
s - sand
n - aquatic nuisances

3. Layered Materials

o/s, $\frac{o}{s}$ = ooze over sand

4. Mapping Aquatic Nuisances

T - submerged-floating
⊥ - emerged
Ψ - wetland
ʎ - deadhead stumps

[1] Ibid.

TABLE 5-Continued

5. Dry Beach Width

E - extremely wide 250'+
W - wide 66'-250'
N - narrow 5'-66'

6. Quantity

(n) - localized but dense 10%
n - scattered
n - fairly abundant
n - very abundant

7. Bank or Cliff

I = 5'-10'
II = 10'-30'
III = 30'-100'
IV = 100'-500'
V = 500'+
Ⓘ = rounded
Ⅲ = broken

8. Backshore

Slope - same symbols as wet beach except
L = low and wet
Ⓖ = negative slope
Material - same symbols as wet beach except
d = dune sand
u = unconsolidated material

9. Topography

G^1 = gentle slope with a 10' break
G^2 = gentle slope with a 20' break, etc.

10. Soil Depth

u,s,c, etc = deep 3'+
u,s,c, etc = shallow with localized bare bedrock
r = bare bedrock with localized shallow
Ⓡ = all bare bedrock

Note: For proportions use "mixed conditions" procedure.

TABLE 5-Continued

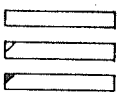
11. Mixed Conditions

G (M)	localized M<10%
G-M	mostly G
G M	equality
G:M	progression at right
200 300 ft. from shore	angles from shore

12. Mapping Wet Beaches

Sand	-	orange
Gravel	-	brown
16'-66'	-	1 line
66'-250'	-	2 lines
250'+	-	3 lines

13. Reliability Index



A.P. only
Air check
Ground check

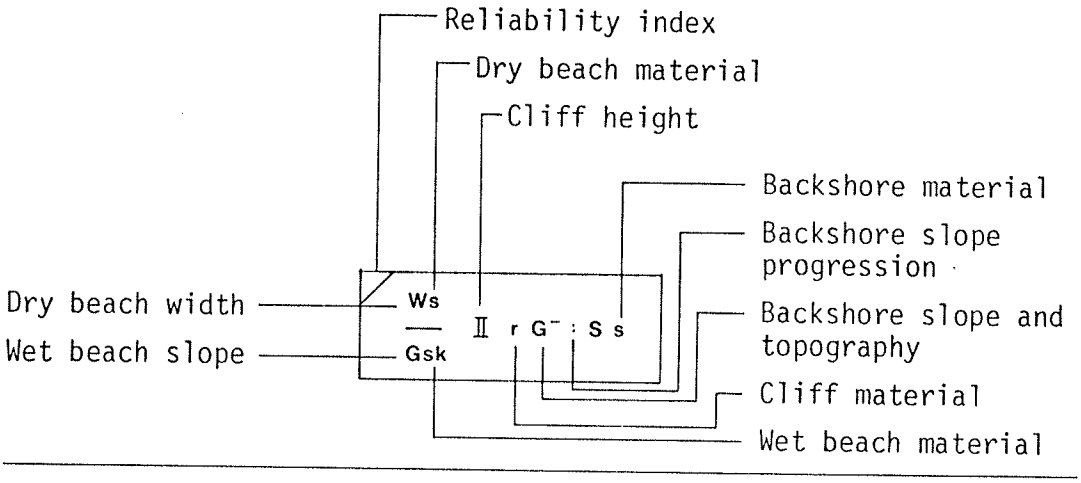
14. Limitations

	Beach	Ground
a -		area
b -		bank or cliff
c -	cold water	N-aspect
d -	depth problem deep or shallow	
e -		erosion
f -		too dry
i -	irregular water level	
l -	lacks good beach	
m -	material	
n -	aquatic or herb nuisances	
p -	pollution	
r -	bedrock at or near surface	
s -	stones	
f -	topography	
u -	current	

TABLE 5-Continued

Beach	Ground
v - lack of viewing chance	
W - Width problem: too wide or narrow	wetness
z - exposed to wind	

15. Example



In classifying at 4 inches to the mile, the physical features are described as in Figure 1 on the inventory maps (Maps 1 and 2):

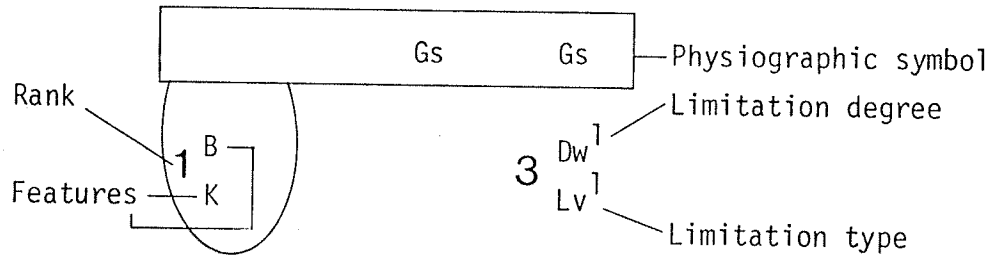


FIGURE 1

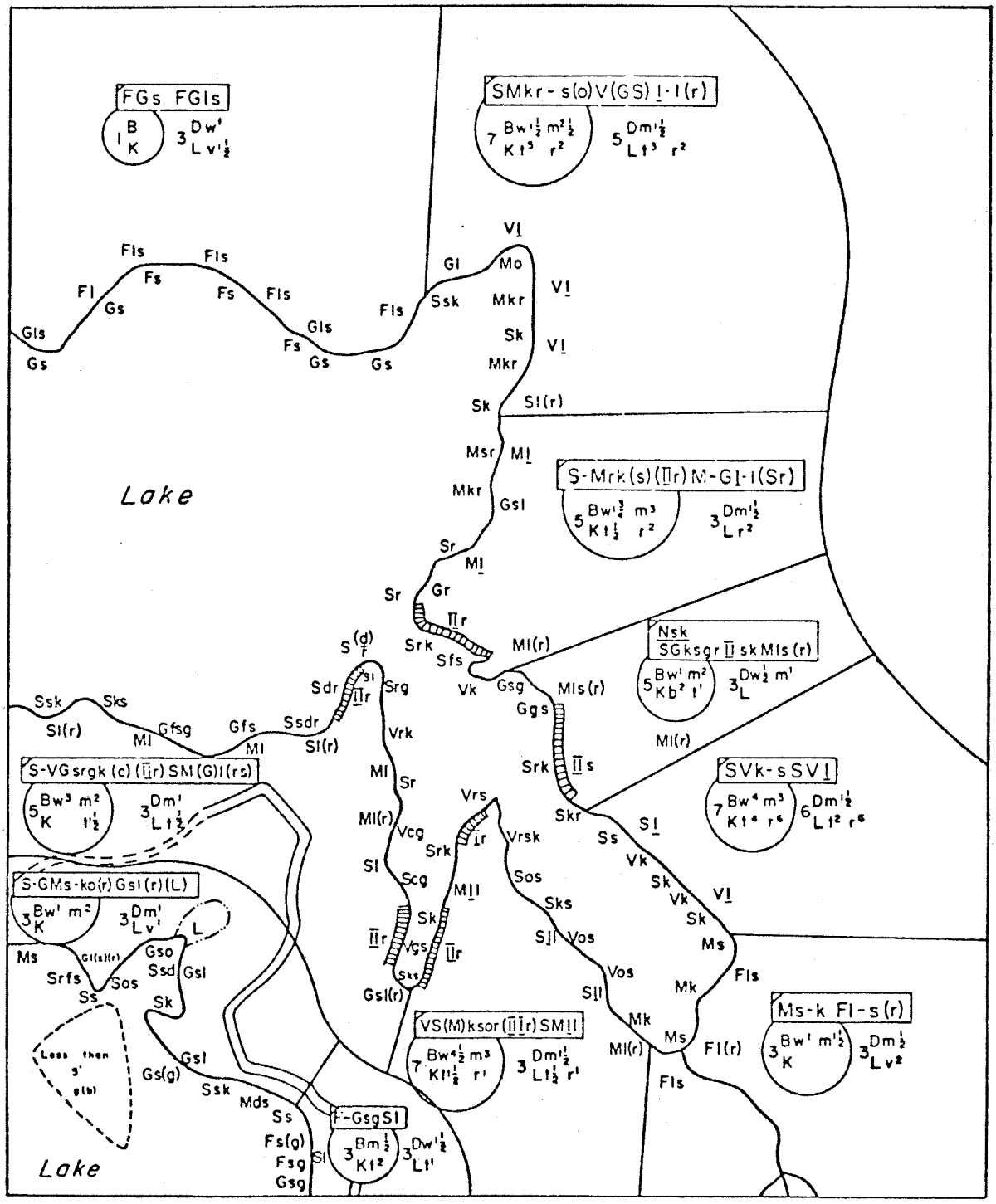
DESCRIPTION OF PHYSICAL FEATURES

4 INCHES : 1 MILE

ONTARIO RECREATION CLASSIFICATION OF SHORELANDS

STANDARD DETAIL

SCALE : 4 inches = 1 mile

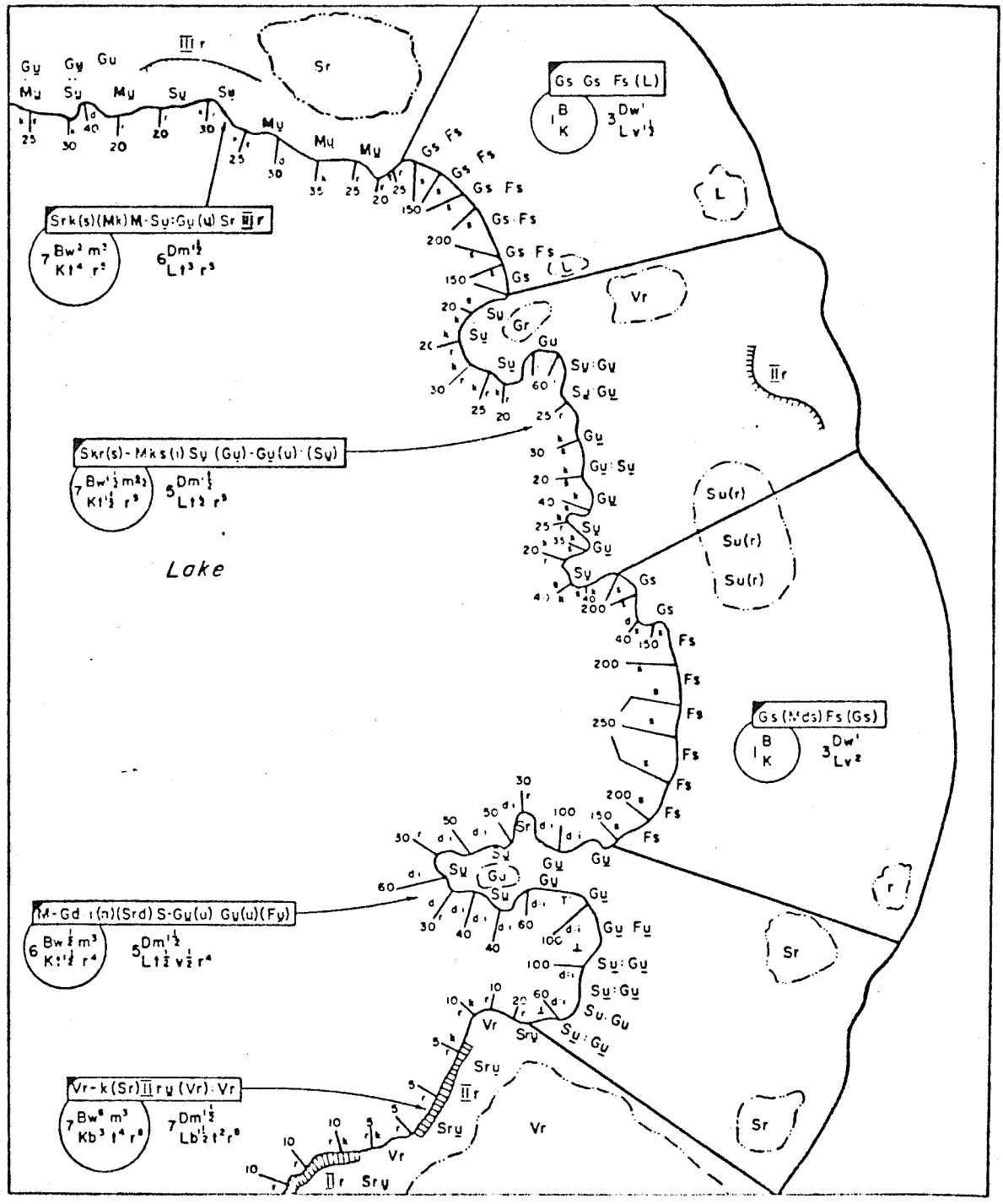


Source : Ontario Department of Lands and Forests, Methodology For Ontario Recreation Land Inventory (October 1968).

MAP 1

ONTARIO RECREATION CLASSIFICATION OF SHORELANDS DETAILED

SCALE : 4 inches = 1 mile



Source : Ontario Department of Lands and Forests, Methodology For Ontario Recreation Land Inventory (October 1968).

MAP 2

In addition, symbols for identifying cliffs or banks, and aquatic plants or nuisances are recorded on the map where appropriate. In classifying at 1:50,000, the physical features are described as in Figure 2 on the inventory map (Map 3).

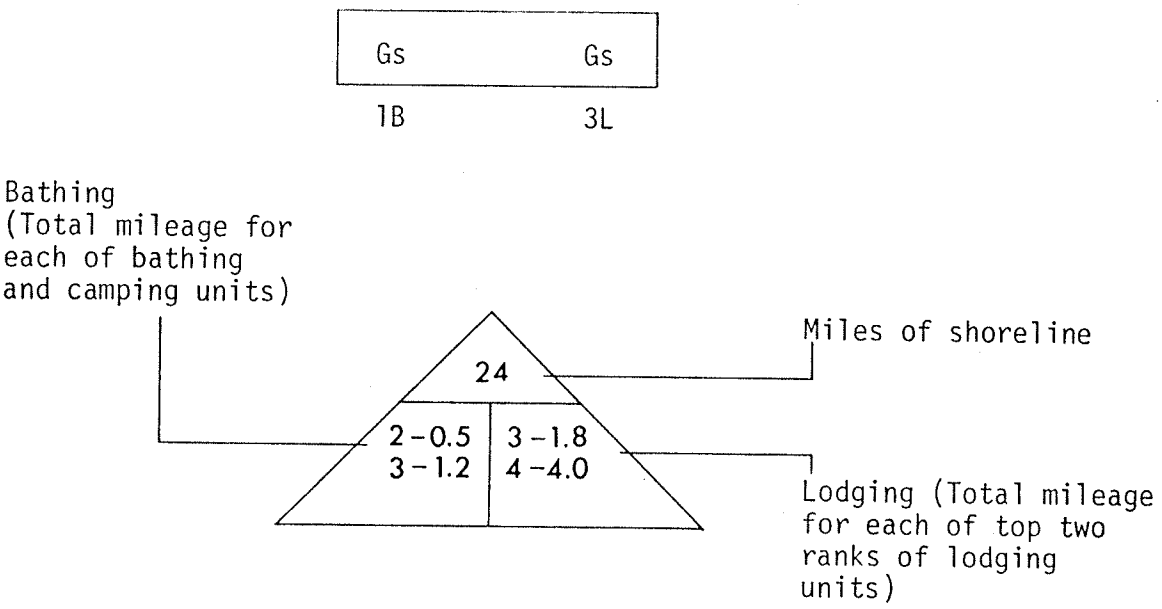


FIGURE 2

DESCRIPTION OF PHYSICAL FEATURES

1 : 50,000

Shoreland units are usually ranked and classified in two ways:

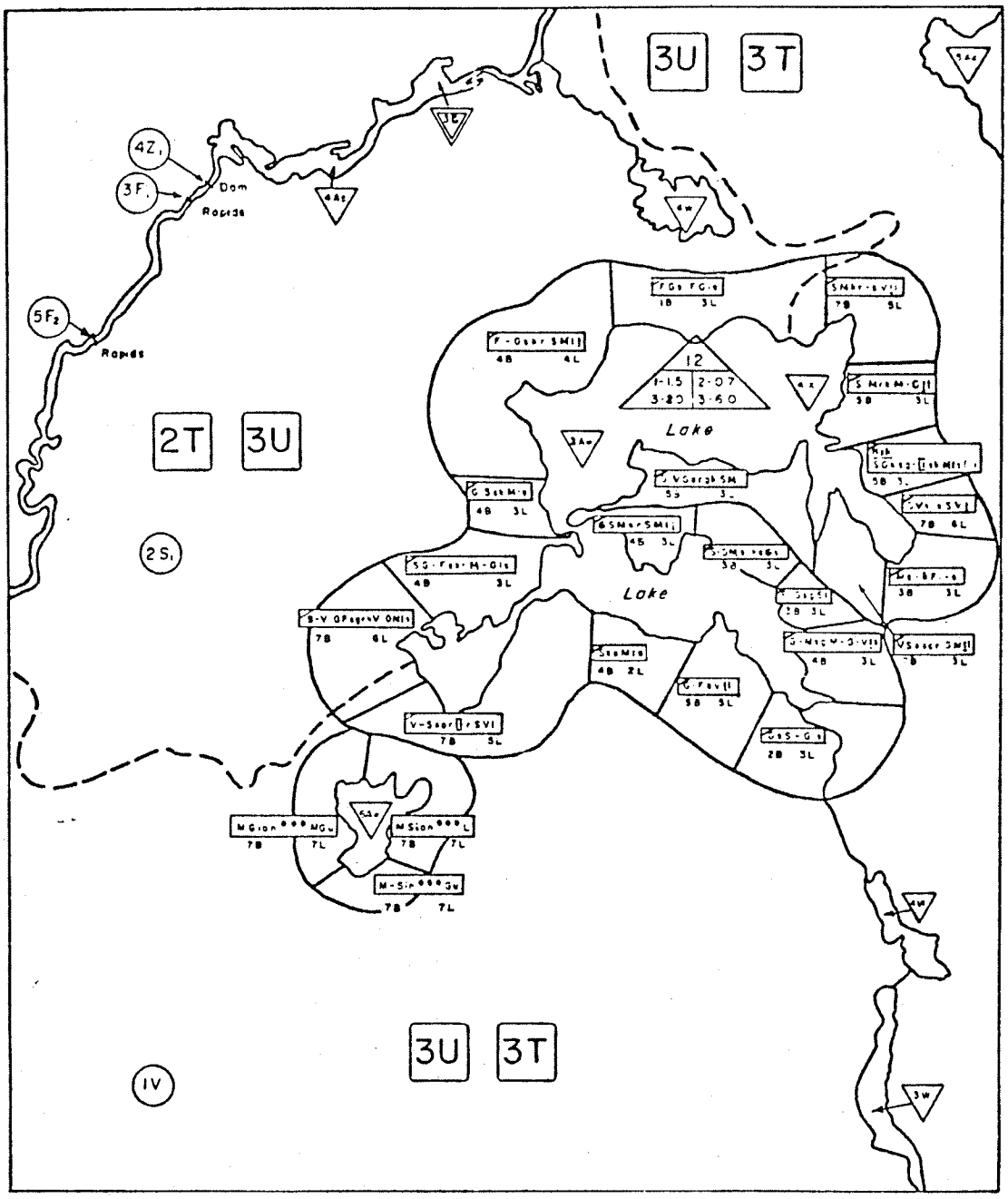
i. for bathing (B) and camping (K); and

ii. for deep shore water activity (D) and lodging (L).

A classification of the rank of a unit is arrived at by adding up the limitations of a unit with respect to a specific recreational use (Table 6). Shoreland ranking is usually restricted to lakes and rivers (minimum 5 feet deep and 100 feet wide) which are considered to be navigable by small craft, while extremely small

ONTARIO RECREATION CLASSIFICATION

SCALE : 1 : 50,000



F - 30' falls at dam
F - 10' falls
Z - Ontario Government Dam
S - 400' ski hill

T - travelling and viewing
U - upland game hunting or viewing

Source: Ontario Department of Lands and Forests, Methodology For Ontario Recreation Land Inventory (October 1968).

MAP 3

TABLE 6

EXAMPLE OF ONTARIO RANKING TABLE FOR SHORELANDS

Bathing and Camping

Rank	Degree of Limit.	BEACH (w) Slope, width	BEACH (m) Material	BANK (b)	BACKSHORE Slope (f)	BACKSHORE Material Type (m)	BACKSHORE Depth (r)
1	0	G 66'-250' F 250'+	Sand		F G	Loam Sand	60%+ deep <10% r
2	1	M 33'-66'	Gravel		M	Clay Gravel	40-60% deep <10% r
3	2	S 16'-33'	Smooth r Cobbles Loam	I	S	Wetness limitations could range from 1-10	10-40% deep <10% r
4	4		k, clay, silt Boulders	II			10% deep <10% r
5	6	V 5'-16'	Jagged bedrock Angular stones		V		all shallow <10% r
6	8		Fragments	III			shallow & bare <90% r
7	10	P <5'	Deep ooze	IV	P		100% bare

Cottaging or Lodging

**** BEACH Slope, width (w)	Material (m)	BANK (b)	BACKSHORE Slope view	BACKSHORE Material Type (m)	BACKSHORE Depth (r)
M, S, or V 5'-66'	Sand Gravel Smooth rock		M 4 tiers G (v') 100% view	Loam Sand	60%+ deep <10% r
G 66'-250' (w)	Cobbles Loam	I	S (f') 2 tiers	Clay	40-60% deep <10% r
P 0'-5' (d) F 250'+ (w)	k, clay, silt Boulders	II	F (v²)		10-40% deep <10% r
All too deep 10'+ (d)	Jagged bedrock Angular stones		V (f⁴)	Wetness limitations could range from 1-10	10% deep <10% r
All too (d) shallow 3'-5'	Fragments	III			all shallow <10% r
	Deep ooze	IV	P (f⁸)		shallow & bare <90% r
<3' water (d)		V			100% bare

* 1. Above limitations are for both hard and soft cliffs at waters edge. If dry beach is present reduce degree of limitation up to 2, for a narrow dry beach and up to 4 for a wide dry beach.

** 2. Add topographic limitations (if any) to slope limitation, e.g. $S^1 = I^3$ for camping.

*** 3. For soil depth use soil type symbol where known, e.g. s, l, c, etc, otherwise use u.

4. Circled letters above indicate the limitation symbol to use, e.g. (w) (f)

**** 5. First rank lodging sites require 4 chains of wide sand wet beach or equivalent (e.g. 8 chains of narrow sand wet beach) per 20 chains of shore units

6. First rank lodging sites require excellent viewing - 2 miles plus variety. Excellent viewing can upgrade any shore unit up to 2 degrees of limitation

Source : Ontario Department of Lands and Forests, Methodology For Ontario Recreation Land Inventory (October 1968).

lakes (less than 160 acres) are not normally ranked for shoreland use.

After all of the nuclear units within a landscape unit are examined and ranked, the capability of the whole landscape unit is ranked on a scale of one to seven. In this way, the features of the smaller units are combined to give one total rank for the landscape unit; the final ranking being a reflection of the significance of the features in terms of relative rank within the system, the size of the features, their uniqueness, and the distribution and relation to the features in the area. The rank and recreational features of a landscape unit are mapped as follows:

$$\frac{\text{II}}{\text{BLX}}$$

II —The Rank
BLX —The features

Map 4 provides a representative indication of the application of the ranking of landscape features.

2. Analysis

In reviewing this methodology the following observations are made.

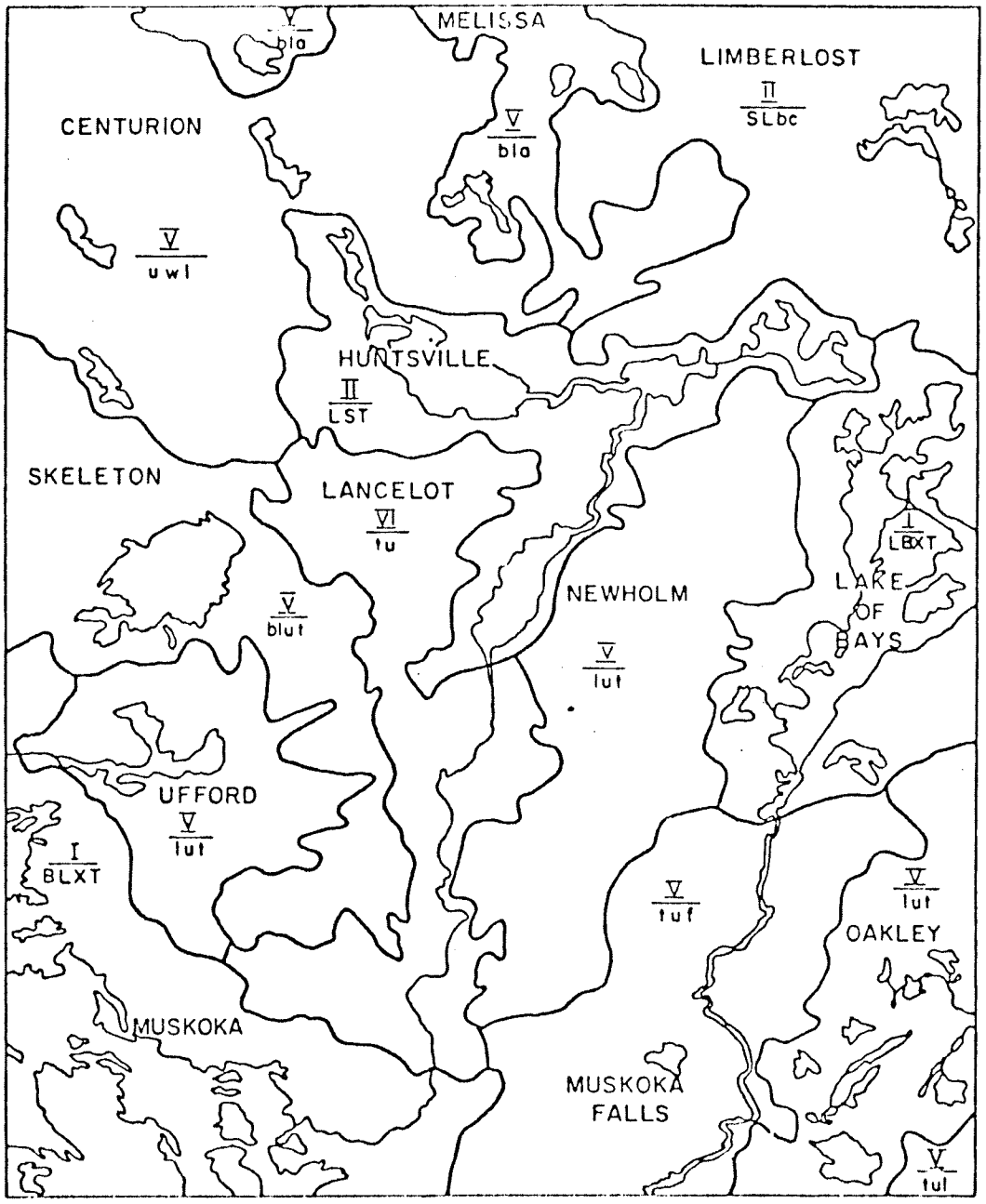
i. The classification system is extremely complex, hence individuals using the system must be well trained in the area of resource inventory.

ii. The classification system requires a significant amount of time, manpower and money to complete. Hence, it is possible to expend large amounts of capital and manpower on the inventory and analysis of areas that have a limited potential.

iii. The system is based entirely upon value judgements. However, an effort is made to standardise the value judgements of individuals involved in the analysis.

ONTARIO RECREATION CLASSIFICATION FOR LANDSCAPE UNITS

SCALE - 1 : 250,000



Source : Ontario Department of Lands and Forests, Methodology For Ontario Recreation Land Inventory (October 1968).

MAP 4

iv. The amount of information obtained from the inventory is extremely voluminous. Hence, it may tend to confuse the accuracy of the final ranking.

v. The system deals only with potential recreational opportunities. Hence, it is not related to the feasibility or practicality of development. In other words, a site may be developable but costs of access or limited demand may make development impossible.

CHAPTER II

MAJOR DESIRABLE GENERAL CHARACTERISTICS OF METHODS OF LAND ANALYSIS AND CLASSIFICATION

This chapter describes the general desirable characteristics that should be inherent in a method of land analysis and classification. The characteristics discussed are based on the evaluations in the previous chapter of

i. G.D. Taylor's and C.W. Thomson's "Proposed Methodology for an Inventory and Classification of Land for Recreational Use"[1];

ii. A.R.D.A.'s Land Capability Classification for Outdoor Recreation[2];

iii. Methodology of Ontario Recreation Land Inventory[3];

iv. Literature on land classification in general; and

v. Dr. P.J. Dooling's "Perspectives on Alternative Approaches to an Evaluation Criteria of Recreation-Resource

---

[1] The Forestry Chronicle, Vol. 42,No. 2 (1966), pp. 153-159.

[2] This is an outline of the classification used in the Canada Land Inventory, published by the Federal Department of Forestry and Rural Development in June 1967.

[3] Publication of the Ontario Department of Lands and Forests (October 1968).

Inventory and Assessment Systems for Provincial, Regional and Site Plans."[1]

The major desirable general characteristics which should be associated with a land analysis and classification system follow.

i. The inventory and analysis method should be easy to apply and be relatively inexpensive to use.

A good method of inventory analysis is one wherein the complexity of the technique and sophistication of the tools used reflect the resources typically available to the intended users (including manpower, budget and hardware resources).[2] Given the small staff and budget of most outdoor recreation agencies, methods of inventory and analysis should attempt to avoid the need for highly trained personnel and costly instrumentation. Furthermore, instrumentation that is bulky, heavy, breakable or is not normally operable, and which thereby prevents ease of movement in the field, should be avoided. Since data collection is expensive it must be approached with efficiency. Similarly, clear guidelines for the inventory procedures should be provided to avoid inconsistencies and to reduce or eliminate situations needing time-consuming judgements. For example, the Canada Land Inventory Land Capability Classification for Outdoor Recreation provided limited guidelines for determining how much each

---

[1]Dr. Peter J. Dooling, "Perspectives on Alternative Approaches to an Evaluation Criteria of Recreation-Resource Inventory and Assessment System for Provincial, Regional and Site Plans" (Paper presented at the Wildlands Recreation Conference, Banff, Alberta, February 28th-March 3rd, 1977).

[2]Ibid.

limitation affects the capability class rating of any given land unit. Personnel involved in the inventory were thus left in some doubt. Hence, time which could have been spent on the inventory was required to make interpretative decisions.

ii. Inventory data that is to be analysed should only document the conditions and characteristics of the natural resources; it should not include recommendations for land use.

The decision to allocate land for a certain use should be based upon the analysis of the information provided by the total inventory. This is a responsibility of the land use planner, not the inventory technician. Hence it should be kept separate from the inventory process. The inventory process should be limited to documenting the conditions and characteristics of the natural resources. This does not decrease the value of the inventory; it merely recognises that the function of the inventory is to document resource conditions and characteristics.

iii. The purpose of any inventory and analysis should be clearly defined prior to the initiation of any field work.

An incorrect understanding of the way in which the information is to be used or what information is required for subsequent decision-making could result in the collection of inappropriate data. If an inventory collects inappropriate data it is an inefficient use of personnel's time, it lessens the emphasis on the more important variables and it clutters the mind of the interpreter.

The selection of data variables to be included in an inventory is based on availability and anticipated needs. Hence, the more useful inventory is the one that addresses the needs of a varied array, but not necessarily all, of the potential users.[1] For example, the Canada Land Inventory Land Capability Classification recognised the benefits of establishing an inventory for a variety of users. The objective was to indicate the type of recreation to which land is best suited. Unfortunately, due to mapping limitations, the lack of appreciation of the combined effects of recreational features, and the wide variety of recreational pursuits, this objective was not achieved. The system did not recognise that no one method can provide all inventory data needed to assess a site's potential for each recreational type without becoming so complex as to lose its functional value. Specific limitations as to recreational potential for defined types of recreation should therefore have been delimited in the Canada Land Inventory Land Capability Classification System. This would have reduced the complexity and increased the accuracy and appropriateness of the method for planning purposes.

iv. Inventory and analysis methods should be accurate.

The initial inventory of the resource base is a key element in subsequent analysis and decision-making. Hence accuracy is essential as all future evaluations and/or assumptions will be predicted on the original base data. Information which is inaccurate could severely distort the subsequent evaluation of the resource base.

---

[1] Ibid., p.10.

v. Methods of inventory and analysis should be as objective as possible.

Methods of inventory and analysis should be as free as possible of biases; and the ideal method would be one that minimises the application of personal judgement. Assumptions and intuition should be replaced with proved facts wherever and whenever possible, as the objective is to promote greater precision and reliability. For example, in the Canada Land Inventory Land Capability Classification little or no framework was provided to keep personal judgement to a minimum. The definitions of the seven classes do not provide clear distinctions within the continuum of class types, e.g. the point when a class 3 land unit becomes a class 4 is not definitely established, and hence much personal judgement is required. Furthermore, the class rating is mainly dependent on the number and severity of the limitation but the limiting factors are poorly defined and, therefore, judgement on their severity is demanded. Furthermore, the method does not indicate which limitations tend to be more serious and which are deserving of more consideration.[1]

vi. The method of inventory and analysis used should be straightforward and be capable of reproduction by others.

Persons having skills and training similar to those who develop a technique should, in using the same method of inventory and analysis, consistently make the same recommendations concerning

---

[1] Ibid., p. 12.

the potential of a particular site. The findings or recommendations concerning a site would shift not for reasons of the method but only if conditions at the site or those meaningfully related to it change (e.g. policy or funds).

vii. Any method of inventory and analysis should consider resource contingencies.

A method of inventory and analysis should identify, if possible, resource contingencies which could have an influence on the resources being inventoried and analysed. For example, a method of inventory and analysis applied to a study area for the purposes of determining the potential for recreational development should consider the mineral potential of the area, since the development of mining could severely detract from the area's long-range recreational use.

viii. Any method of inventory and analysis should consider the recreational resources in combination.

An area has recreational potential not only because it has specific resources, but more so because of the combination of these resources giving the area a character.[1] Hence, any methodology which merely inventories and analyses those resources on site is not measuring the location's true recreational potential. The method should thus consider the combinations of resources present as the basis for analysis. This aspect would also recognise complementary and conflicting land uses, at or near the potential site, which could influence the recreational potential or character of the area.

---

[1] Ibid., p. 15.

ix. Any method of inventory and analysis should provide information on the relativity of the developmental potential of specific sites.

A method of inventory and analysis should compare potential recreation sites to assist the actual establishment of priorities for development. The bases for comparison should be confined to the natural-resource capabilities of the sites.

In addition, the information generated should be easily translated and useful as a communicative tool.

x. Any method of inventory and analysis should use existing sources of information to their fullest extent to generate new information.

Prior to the initiation of any method of inventory and analysis it should be determined if other sources can provide the level and type of information required. At times, information of a general or even specific nature is gathered and used for a specific purpose and, once used, is forgotten. In some instances this type of data could be invaluable to different agencies. The use of existing information would obviate duplication of the research efforts of other agencies. A good example is the forest inventory data gathered for the purpose of calculating and allocating timber resources but which provide considerable information useful for recreation inventory and analysis. Hence, use of existing data can save time and money, but use of such data will be dependent on its accuracy and appropriateness to the study at hand.

This chapter has described desirable characteristics which should be inherent in methods of land inventory and analysis. The intent of outlining these characteristics is to provide some guidelines for the evaluation of the method of analysis and classification presented in Chapter III.

CHAPTER III

LAND ANALYSIS AND CLASSIFICATION FOR THE CANADIAN SHIELD PORTION OF MANITOBA

The intent of this chapter is to outline a method of land inventory and analysis which is rational and consistent, and which can be used with confidence in the decision-making process. The method to be described is entitled "A Method of Land Analysis and Classification for the Canadian Shield Portion of Manitoba."

A. Categorisation

The method of analysis and classification was initially developed on the basis of two observations:

i. each tree species requires a certain combination of site conditions for optimum growth; and

ii. in some instances the required site conditions for optimal growth can be common to more than one species.

These observations were made during the course of five years of exposure to different forest environments, while employed as a Regional Planner with the Parks Branch of the then Department of Tourism, Recreation and Cultural Affairs, and from a review of the literature pertaining to species growth requirements and characteristics. The publication which provided the greatest detail and which

is a common source is Native Trees of Canada[1].

This publication summarises several individual research papers related to the distribution, characteristics and site requirements of tree species native to Canada.

The information in the publication that relates to tree species of the Canadian Shield is summarised below.

i. Balsam Fir (Abies balsamea (L.) Mills.)[2]

This species is usually from 15-21 metres in height and 30-60 centimetres in diameter.

PHOTO 1

BALSAM FIR

[1]Canada, Department of Fisheries and Forestry, Canadian Forestry Service, Native Trees of Canada, by R.C. Hosie (Ottawa: Queen's Printer, 1968).

[2]Ibid., p.88.

The root system is shallow and the tree is not windfirm.

Common associates of the species are trembling aspen, white birch, white spruce and black spruce.

It is adaptable to a variety of soils and climates.

ii. Balsam Poplar (Populus balsamifera (L))[1]

This species averages 12-18 metres in height with a diameter of 30-60 centimetres.

It is mostly confined to rich moist soils such as the banks of streams and bottom lands when found in small pure stands or mixed with willows, alders, white birch, fir and the spruces.

PHOTO 2

BALSAM POPLAR

[1] Ibid., p. 124.

It is tolerant of shade.

It is susceptible to heart rot in the late stages of maturity.

iii. Black Spruce (Picea mariana (Mill.) BSP)[1]

This species averages 9-15 metres in height and 15-25 centimetres in diameter.

PHOTO 3

BLACK SPRUCE

[1] Ibid., p. 72.

The tree is windfirm only when growing in pure stands.

It can usually be found growing under a variety of conditions. However, pure stands are often in association with moist conditions.

Its common associates are balsam poplar and balsam fir.

iv. Cedar (Thuja occidentalis (L))[1]

This is a small tree averaging 13.5 metres in height and 30 centimetres in diameter, although sometimes it reaches a height of 24 metres and a diameter of 90 centimetres.

PHOTO 4

CEDAR

[1] Ibid., p. 98.

It commonly occurs in swamps, around springs and lakes or on similar wet sites.

It would thrive on thin, often dry soil or limestone ridges.

It grows in pure stands or in mixtures of spruce, balsam fir, tamarack, black ash, speckled alder and white elm.

v. Jack Pine (Pinus banksiana (Lamb.))[1]

In open or unfavourable situations the jack pine is stunted and scrubby, but when growing in closed stands on good sites it develops a straight trunk which may reach a height of 24 metres and diameter of 60 centimetres.

PHOTO 5

JACK PINE

[1] Ibid., p. 50.

It grows in pure stands on poor soils, and in pure stands or mixed with black spruce, the aspens and white birch on deep, dry, sandy soils.

It is very rarely found on very moist or wet sites.

It can be found in association with white spruce, balsam fir and balsam poplar on occasion.

The root system is wide-spreading and moderately deep.

vi. Tamarack (Larix laricina (Du Roi) K. Koch)[1]

This is a medium-sized tree 18-21 metres in height and 30-60 centimetres in diameter.

PHOTO 6

TAMARACK

[1] Ibid., p. 56.

The root system is shallow but wide-spreading and provides moderate windfirmness.

It grows best on moist, poorly drained soils.

On better-drained sites its associations are trembling aspen, white birch and balsam fir.

When in pure stands conditions are generally moist.

vii. Trembling Aspen (Populus tremuloides (Michx.))[1]

The species averages 24 metres in height with a diameter of 20-25 centimetres.

It grows best on a well-drained loam, but is commonly found on a wide variety of soils.

PHOTO 7

TREMBLING ASPEN

[1] Ibid., p. 210.

It is intolerant of dense shade and occurs most frequently in pure stands, or mixed with other light-demanding species such as white birch or balsam poplar.

viii. White Birch (Betula papyrifera (Marsh.))[1]

This species rarely grows over 24 metres in height or 60 centimetres in diameter.

It is found on a variety of soils and conditions.

It is most common on well-drained sites within either pure stands or in association with jack pine, white spruce, trembling aspen or balsam poplar.

PHOTO 8

WHITE BIRCH

[1] Ibid., p. 160.

ix. White Spruce (Picea glauca (Moench) Voss)[1]

The best examples of the tree are found in mixed stands on well-drained but moist, silty soils.

Its commonest associates are trembling aspen, white birch and balsam fir.

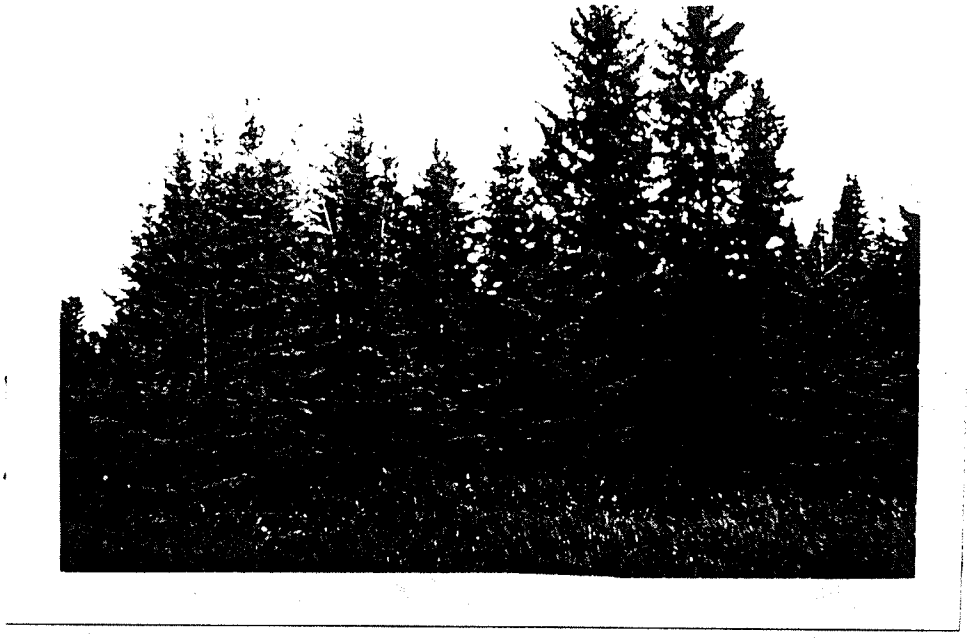


PHOTO 9

WHITE SPRUCE

[1] Ibid., p. 64.

The preceding descriptions enable the following observations to be made:

i. some tree species individually or in combination tend to grow in well-drained soils, while others tend to grow in wet soils, and

ii. some tree species have root systems which make the tree windfirm, while other species have root systems which make them susceptible to windthrow. Species susceptible to windthrow and/or which have shallow root systems are extremely dangerous in a recreational development.

These conclusions suggest that it should be possible to project site conditions on the basis of associated tree species. Two general categories can be identified:

i. Category 1: Sites which are well drained and contain sound tree species. Tree species which are found on well-drained sites and are windfirm include jack pine, white spruce, trembling aspen and white birch.

ii. Category 2: Sites which are imperfectly drained and contain species subject to windthrow. Tree species found on this type of site and which exhibit susceptibility to windthrow include black spruce,

tamarack, cedar, balsam poplar and balsam fir. These will hereafter be referred to as indicator species.

Topography being similar, category 1 species and site conditions should be most suitable for recreational development, while category 2 species and site conditions should be least suitable. Recognising that each tree species can grow under a range of conditions and with a number of associated species, it is necessary to establish a number of different categories ranging from those containing only the original category 1 species to those containing only the original category 2 species (indicator species). The establishment of a range of categories thus logically leads to the following conclusion:

> The lower the percentage composition of indicator species (black spruce, tamarack, cedar, balsam poplar, balsam fir) on a site, the more likely the site will be well-drained and contain sound species. Conversely, the higher the percentage composition of indicator species on a site, the more likely the site will be poorly drained and subject to windthrow.

The above conclusion is consistent with the results of a study conducted in the United States. The results stated:

> "Everything considered, all the forest associations found in the Harvard Forest seem to represent a continuous gradational series correlated with successional stage and moisture. . . Without taking into consideration the successional development of the stands the occurrences of the various species were found to vary significantly with the moisture gradient. While pine and white spruce are of major improtance on dry sites; sugar maple, red maple, yellow birch and hemlock on moist sites; and balsam fir and northern white cedar on wet sites. Jack pine and black spruce are found commonly on both dry and wet sites, but are poor competitors under intermediate moisture conditions."[1]

---

[1] R.C. Allison and R.S. Leighton, Evaluating Forest Campground Sites (Burlington, Vermont: University of Vermont, 1965) p. 237.

On the basis of the foregoing, the four categories indentified include:

i. Category 1 : 0% indicator species.

ii. Category 2 : 10%-30% indicator species.

iii. Category 3 : 40-60% indicator species.

iv. Category 4 : 70%+ indicator species.

Categories 2 and 3 are considered transitional in nature and have been included to recognise that no distinct lines can be drawn between acceptability and unacceptability. Ranges of conditions can, however, be identified.

Since the four categories represent different ranges of site and moisture conditions which would be associated with different combinations of tree species growing together, the first step of the procedure is to determine the category (1, 2, 3, 4) of each stand number identified on the Forest Inventory Maps covering the respective study area.

Prior to further explanation of the methodology and to avoid confusion the following outline of the forest inventory mapping program is offered. The purpose of the inventory is to measure the existing timber resource in the Province. The information is used to calculate what annual allowable harvest could be allowed in the Province on a sustained basis. The concept is basic to forest management, and put simply is: The volume of timber harvested shall not exceed the volume of timber regenerated. In order to provide the type of information necessary for the calculation of annual allowable harvest it was necessary to inventory the forest resources of the Province. This, it was decided, could best be accomplished through interpretation of

aerial photographs and occasional random field checks. The end result to the process was the production of a series of Township maps which cover the entire forested portion of the Province of Manitoba. The map scale used is 1:1320 (4"=1 mile). In addition, for the purposes of easy retrieval and reduction of the amount of paper used, the data was coded and computerised. Hence, each map is accompanied by an individual computer print-out which provides an interpretation of the data shown on each map.[1] Map 5 is an example of the type of map produced, while Table 7 is an example of the corresponding computer print-out.

Proceeding with the categorisation of the data on the Forest Inventory Maps, the information of primary concern at this stage is the meaning of the numbers thereon. This information is found by locating the corresponding number (under the column "STAND") in the computer print-out. Once this number is found, the composition of the tree species in that stand can be read under the far right column headed "SPECIES COMP." Tree species have been abbreviated in the computer print-out as follows:

BA : Balsam Poplar
BF : Balsam Fir
BS : Black Spruce
EC : Cedar
JP : Jack Pine
TA : Trembling Aspen
TL : Tamarack
WB : Birch
WS : White Spruce

---

[1]The map shown is a small portion of a larger map which covers an entire Township. Since the map is being used for example purposes only it was not considered necessary to provide a fold-out map for the Township, when a smaller map 8 1/2 x 11" would provide an equivalent reference.

MAP 5

FOREST RESOURCE INVENTORY, TOWNSHIP 20

TABLE 7

AREA LISTING FOR MANAGEMENT UNIT 33,

TOWNSHIP 20, RANGE 66

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
1	06 2 2 3	6	1	115	JP7,BS2,TA1
2	04 2 2 4	6	1	1	JP6,BS1,TA1
3	04 1 2 4	6	1	80	JP10
4	13 2 2 3	6	1	114	BS8,JP1,TL1
5	04 1 6 3	6	1	3	JP8,TA2
6	06 1 2 4	6	1	52	JP5,BS4,TA1
7	04 1 2 3	6	1	29	JP8,BS2
8	06 2 3 3	6	1	12	JP7,BS3
9	13 2 3 2	6	1	16	BS10
10	06 2 2 3	6	1	270	JP7,BS2,TA1
11	13 2 3 2	6	1	33	BS9,TA1
12	06 2 2 3	6	1	88	JP7,BS2,TA1
13	83 1 3 3	6	1	35	TA6,JP3,BS1
14	13 2 3 3	6	1	34	BS8,TL2
15	13 2 2 3	6	1	55	BS10
16	13 2 2 3	6	1	27	BS10
18	06 1 3 3	6	1	29	JP6,BS2,TA1
19	46 1 3 3	6	1	59	TA4,JP5,BS1
20	04 1 2 4	6	1	72	JP8,BS1,TA1
21	54 1 3 3	6	1	73	TA4,BS3,JP3
22	06 1 2 4	6	1	18	JP6,BS2,TA2
23	05 2 4 3	6	1	14	JP7,BS3
24	05 2 4 3	6	1	16	JP7,BS3
25	06 1 3 3	6	1	49	JP5,BS4,TA1
26	46 1 4 3	6	1	50	JP5,TA3,BS2
27	04 1 4 4	6	1	37	JP8,BS1
28	14 2 3 3	6	1	19	BS6,JP3,TA1
29	13 2 3 2	6	1	33	BS8,TL2
30	06 2 3 3	6	1	88	JP5,BS1,TA2
31	04 2 3 3	6	1	10	JP8,BS1,TA1
32	46 1 3 3	6	1	28	JP5,TA3,BS2
33	04 2 3 2	6	1	8	JP8,TA2
34	06 2 3 3	6	1	4	JP7,BS2,TA1
35	16 1 3 3	6	1	14	BS7,TL2,TA1
36	06 1 3 3	6	1	20	JP6,BS2,TA2
*37	13 2 3 3	6	1	42	BS8,TL2
38	04 1 3 3	6	1	9	JP8,TA2
*39	44 1 3 3	6	1	59	JP6,TA3,BS1
40	46 1 3 3	6	1	20	JP5,TA4,BS1
41	04 1 3 3	6	1	12	JP8,WS1,TA1
42	06 2 3 3	6	1	7	JP6,BS1,TA1
43	46 1 3 3	6	1	28	JP4,TA4,WS2
44	14 1 1 4	6	1	54	BS6,JP2,PE1,TA1
45	04 1 3 3	6	1	25	JP8,BS1,TA1
46	46 1 3 3	6	1	16	JP5,TA4,BS1
47	15 1 3 4	6	1	22	BS7,PE2,TA1
48	83 1 4 3	6	1	22	TA5,JP4,BS1
49	04 1 3 3	6	1	144	JP8,BS1,TA1
50	06 1 3 3	6	1	3	JP7,BS3
51	13 2 2 3	6	1	13	BS10
52	06 2 3 3	6	1	42	JP6,BS2,TA2

AREA LISTING FOR [illegible] TOWNSHIP [illegible] RANGE [illegible] PAGE [illegible]

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
53	13 2 3 3	6	1	11	BS2,JP1
54	06 2 3 3	6	1	19	JP7,BS2,TA1
55	06 2 3 3	6	1	5	JP7,BS2
56	06 2 3 3	6	1	134	JP7,BS2,TA1
58	13 2 3 3	6	1	[illegible]	BS1?
59	06 2 3 3	6	1	29	JP7,WS2
60	13 2 3 3	6	1	56	BS1?
61	06 2 4 2	6	1	13	JP6,WS2,BS2
62	13 2 3 3	6	1	69	BS2,TL?
63	06 2 3 2	6	1	118	JP5,BS3,TA2
64	06 1 3 3	6	1	32	JP5,BS3,TA2
65	06 1 3 4	6	1	19	JP7,TA2,BS1
66	13 2 3 3	6	1	32	BS8,JP2
67	04 1 3 3	6	1	15	JP2,BS1
68	06 2 3 2	6	1	105	JP6,BS2,TA2
69	06 1 3 3	6	1	16	JP7,BS3
70	06 2 3 3	6	1	51	JP6,WS2,TA2
71	13 2 3 2	6	1	127	BS1?
72	06 1 3 3	6	1	86	JP7,TA2,BS1
73	06 2 3 3	6	1	55	JP7,BS3
74	84 1 4 3	6	1	58	TA6,JP2,WS1,BS1
75	04 1 3 4	6	1	29	JP8,BS2
76	13 2 3 3	6	1	27	BS8,TL?
77	06 2 3 3	6	1	98	JP7,BS2,TA1
78	13 2 2 4	6	1	46	BS6,TL1
79	06 1 3 3	6	1	76	JP7,BS2,TA1
80	13 2 2 3	6	1	50	BS10
81	06 1 4 3	6	1	76	JP6,WS2,BS2,TA2
82	83 1 3 4	6	1	13	TA5,JP3,BS1
83	04 2 3 2	6	1	58	JP8,BS2
84	06 1 3 2	6	1	54	JP5,BS3,TA2
85	06 2 2 3	6	1	53	JP6,BS2,TA2
86	13 2 2 3	6	1	55	BS8,TL?
87	06 1 3 4	6	1	32	JP7,BS2,TA1
88	14 1 3 3	6	1	78	BS7,TA2,JP1
89	04 1 3 3	6	1	10	JP8,TA2
90	06 2 3 3	6	1	153	JP6,BS2,TA2
91	14 1 4 3	6	1	16	BS6,JP2,TA2
92	13 1 3 3	6	1	32	BS9,JP1
93	46 1 3 3	6	1	19	TA4,JP4,BS2
94	04 1 3 4	6	1	126	JP8,TA1
95	04 2 3 2	6	1	15	JP9,WS2
96	06 1 3 4	6	1	96	JP7,BS2,TA1
97	14 1 3 3	6	1	13	BS7,JP3
98	54 1 3 3	6	1	42	BS5,TA3,JP2
99	46 1 3 4	6	1	80	TA4,JP4,BS2
100	04 2 3 3	6	1	9	JP8,BS1,TA1
101	13 2 3 3	6	1	8	BS8,TL?
102	46 1 3 3	6	1	153	JP5,TA3,BS2
103	46 1 3 4	6	1	14	JP5,TA3,WS2
104	04 2 3 2	6	1	28	JP8,BS1,TA1

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
105	04 1 3 3	6	1	22	JP9,TA1
106	06 1 3 3	6	1	26	JP7,TA2,BS1
107	06 2 3 2	6	1	35	JP6,BS3,TA1
108	06 1 3 3	6	1	44	JP6,BS2,TA2
109	04 1 3 2	6	1	13	JP9,TA1
110	14 1 3 3	6	1	25	BS6,JP4
111	06 1 3 2	6	1	26	JP7,BS2,TA1
112	06 1 3 4	6	1	18	JP6,WS2,BS1,TA1
113	04 1 3 3	6	1	16	JP9,TA1
114	44 1 3 4	6	1	21	JP7,TA3
115	06 2 3 2	6	1	239	JP7,BS2,TA1
116	46 1 4 3	6	1	52	JP3,TA3,WS2,BS2
117	46 1 4 4	6	1	28	JP5,TA4,BS1
118	46 1 3 3	6	1	32	JP5,TA3,BS2
119	13 1 4 3	6	1	12	BS10
120	13 1 4 3	6	1	17	BS10
121	04 2 3 4	6	1	82	JP9,BS1,TA1
122	04 1 2 4	6	1	134	JP9,TA1
123	11 1 4 3	6	1	10	WS6,PF2,TA2
124	04 2 2 3	6	1	109	JP8,BS1,TA1
125	14 1 3 3	6	1	13	BS7,JP2,TA1
126	13 1 3 4	6	1	18	BS10
127	06 1 2 4	6	1	19	JP8,BS4
128	13 1 3 3	6	1	11	BS10
129	06 1 3 2	6	1	12	JP8,BS4,TL1
130	04 1 3 4	6	1	81	JP8,BS1,TA1
131	04 1 2 4	6	1	88	JP8,BS1,TA1
132	04 1 2 4	6	1	1	JP8,BS1,TA1
133	13 1 3 3	6	1	21	BS10
134	06 1 3 4	6	1	183	JP5,BS3,TA2
135	83 1 4 4	6	1	19	TA6,JP2,BS2
136	15 1 4 3	6	1	377	BS4,PF2,WS1,JP1,TA1
137	15 1 4 3	6	1	96	BS4,PF2,WS1,JP1,TA1
138	06 1 0 0	6	1	409	
139	13 2 3 4	6	1	21	BS8,TL2
140	13 2 2 4	6	1	59	BS8,TL1,JP1
141	06 1 4 4	6	1	9	JP6,BS4
142	51 1 4 4	6	1	40	WS3,TA3,BS2,JP2
143	06 1 4 4	6	1	69	JP6,WS2,BS1,TA1
144	13 2 3 4	6	1	15	BS10
145	13 2 3 3	6	1	29	BS9,TL1
146	06 1 4 4	6	1	13	JP6,WS4
147	04 1 4 4	6	1	7	JP8,WS2
148	06 1 4 4	6	1	69	JP7,WS2,BS1
149	04 1 3 3	6	1	10	JP8,TA2
150	06 1 3 3	6	1	21	JP7,TA2,BS1
151	06 1 3 3	6	1	113	JP6,BS3,TA1
152	13 2 3 4	6	1	27	BS10
153	06 1 3 4	6	1	118	JP7,BS2,TA1
154	13 2 2 4	6	1	29	BS10
155	06 2 3 3	6	1	151	JP7,BS2

STAND	COVER	TYP	STAT	DWN	AREA	SPECIES COMP
156	14 1 3 3		6	1	42	BS6,JP4
157	13 1 3 3		6	1	25	BS10
158	13 2 3 2		6	1	20	BS10
159	06 1 3 2		6	1	20	JP6,BS2,TA2
160	14 1 3 3		6	1	3	BS6,JP4
161	13 1 3 4		6	1	6	BS8,JP2
162	04 2 3 2		6	1	44	JP8,BS2
163	06 1 3 4		6	1	46	JP7,TA3
164	06 1 3 3		6	1	85	JP7,BS3
165	06 1 3 2		6	1	17	JP7,BS3
166	04 1 3 4		6	1	134	JP8,BS2
167	14 1 3 3		6	1	20	BS7,JP3
168	06 2 3 3		6	1	302	JP5,BS4,TA1
169	13 1 3 4		6	1	13	BS8,JP2
170	13 2 3 2		6	1	15	BS8,TL2
171	14 1 3 3		6	1	21	BS6,JP3,TA2
172	06 2 3 2		6	1	73	JP7,BS2,TA1
173	13 2 3 3		6	1	18	BS10
174	06 2 3 2		6	1	182	JP6,BS4
175	14 2 3 3		6	1	18	BS7,JP3
176	06 2 3 4		6	1	172	JP7,BS3
177	13 2 2 3		5	1	27	BS10
178	06 1 4 4		6	1	12	JP6,BS2,TA2
179	13 2 3 2		6	1	10	BS8,JP2
180	13 1 3 4		6	1	6	BS10
181	06 1 3 3		6	1	178	JP6,BS3,TA1
182	13 2 3 3		6	1	32	BS10
183	06 2 3 3		6	1	73	JP7,BS3
184	13 2 3 3		6	1	15	BS8,TL2
185	06 1 3 3		6	1	152	JP6,BS3,TA2
186	13 2 3 2		6	1	32	BS10
187	06 1 3 3		6	1	33	JP7,BS3
188	13 2 3 3		6	1	35	BS9,JP1
189	04 1 3 3		6	1	57	JP8,BS2
190	06 1 3 3		6	1	15	JP6,BS3,TA1
191	06 2 3 3		6	1	24	JP7,BS3
192	06 2 3 2		6	1	15	JP7,BS3
193	14 1 3 4		6	1	29	BS6,JP4
194	04 2 3 3		6	1	13	JP8,BS2
195	14 1 3 4		6	1	8	BS6,JP4
196	06 1 3 3		6	1	3	JP5,BS3,TA2
197	13 2 3 3		6	1	7	BS9,JP1
198	13 2 3 3		6	1	5	BS9,JP1
199	04 2 4 3		6	1	7	JP8,BS1
200	06 1 3 4		6	1	56	JP7,BS3
201	04 1 4 3		6	1	19	JP11
202	13 2 2 3		6	1	12	BS10
203	06 2 3 2		6	1	9	JP6,BS4
204	06 1 4 3		6	1	48	JP7,BS2,TA1
205	14 1 3 3		6	1	5	BS6,JP4
206	13 2 3 2		6	1	50	BS9,JP1,TA1

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
207	94 1 3 4	6	1	43	BS5,TA3,JP2
208	14 1 3 3	6	1	61	BS7,JP3
209	13 2 3 2	6	1	54	BS9,JP1
210	14 3 3 2	6	1	41	BS6,JP4
211	13 2 2 3	6	1	7	BS10
212	06 2 3 3	6	1	37	JP7,BS3
213	06 1 4 3	6	1	29	JP7,BS3
214	04 1 4 3	6	1	285	JP8,BS2
215	06 2 3 2	6	1	6	JP7,BS3
216	46 1 4 4	6	1	29	JP5,TA3,WS2
217	04 1 4 3	6	1	8	JP9,WS1
218	84 1 4 3	6	1	10	TA7,WS2,JP1
219	06 2 3 2	6	1	36	JP7,BS2,TA1
220	84 1 4 4	6	1	22	TA5,BS3,WS1,JP1
221	06 2 4 3	6	1	30	JP5,BS4,TA1
222	46 1 4 4	6	1	95	JP4,TA4,BS1,WS1
223	14 1 4 3	6	1	19	BS7,JP2,TA1
224	06 1 4 4	6	1	249	JP7,TA2,BS1
225	04 1 4 3	6	1	19	JP8,BS1,TA1
226	04 1 4 4	6	1	8	JP9,WS1
227	04 1 4 4	6	1	24	JP8,BS1,TA1
228	06 1 4 3	6	1	26	JP6,BS4
229	14 3 3 2	6	1	73	BS7,JP3
230	13 2 2 3	6	1	10	BS10
231	83 1 4 4	6	1	18	TA5,JP4,WS1
232	06 1 4 4	6	1	44	JP6,TA2,BS1,WS1
233	06 1 4 3	6	1	6	JP7,TA2,BS1
234	13 2 3 4	6	1	10	BS8,TL2
235	06 2 4 3	6	1	34	JP6,BS2,TA2
236	14 1 3 3	6	1	104	BS7,JP3
237	04 1 4 4	6	1	19	JP8,BS2
238	04 1 4 3	6	1	24	JP8,BS2
239	06 2 2 3	6	1	419	JP6,BS3,TA1
240	46 1 3 3	6	1	37	JP5,TA3,BS1,WS1
241	46 1 2 4	6	1	87	JP4,BS3,TA3
242	13 1 3 4	6	1	23	BS10
243	06 1 3 3	6	1	7	JP5,BS5
244	14 1 3 4	6	1	55	BS6,JP4
245	14 2 2 3	6	1	79	BS5,JP4,TA1
246	83 1 4 3	6	1	36	TA6,JP3,BS1
247	06 1 3 3	6	1	46	JP7,BS2,TA1
248	83 1 3 4	6	1	20	TA5,JP4,BS1
249	13 2 3 2	6	1	11	BS10
250	44 1 3 4	6	1	21	JP6,TA3,BS1
251	99 1 3 4	6	1	9	TA8,JP2
252	83 1 3 3	6	1	20	TA6,JP3,BS1
253	13 1 3 4	6	1	6	BS10
254	13 2 3 3	6	1	33	BS10
255	14 2 2 4	6	1	20	BS7,JP3
256	06 2 3 3	6	1	74	JP7,BS3
257	06 1 3 4	6	1	88	JP6,BS4

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
259	13 1 3 4	6	1	41	BS9,WS1,TL1
259	16 1 3 3	6	1	23	BS6,TL3,JP1
260	04 1 3 4	6	1	18	JP9,BS1
261	06 1 3 4	6	1	89	JP7,BS2,TA1
262	13 1 3 4	6	1	12	BS8,TL2
263	14 1 4 3	6	1	59	BS5,JP3,WS2
264	14 1 4 3	6	1	32	JP4,BS4,WS2
265	13 2 3 3	6	1	11	BS9,JP1
266	06 1 3 3	6	1	58	JP5,BS4,TA1
267	13 1 4 3	6	1	21	BS8,JP2
268	13 2 3 4	6	1	12	BS10
269	04 1 3 3	6	1	21	JP8,BS1,TA1
270	46 1 3 3	6	1	197	JP4,TA3,BS2,WS1
271	44 1 3 3	6	1	83	JP6,TA3,BS1
272	14 1 4 3	6	1	70	BS7,JP2,TA1
273	06 2 0 0	6	1	73	
274	06 1 0 0	6	1	54	
275	14 1 4 3	6	1	6	BS7,JP2,TA1
276	13 1 4 3	6	1	21	BS9,JP1,TL1
277	13 2 3 3	6	1	24	BS10
278	06 1 0 0	6	1	13	
279	06 1 0 0	6	1	5	
280	06 1 0 0	6	1	11	
281	13 1 4 3	6	1	51	BS8,JP2
282	06 1 2 4	6	1	28	JP7,BS3
283	83 1 3 3	6	1	32	TA6,JP3,BS1
284	58 1 3 3	6	1	52	BS5,TA4,WS1
285	13 1 4 3	6	1	26	BS8,TL1,TA1
286	46 1 3 3	6	1	36	JP5,TA3,BS2
287	06 1 3 4	6	1	44	JP7,BS2,TA1
288	06 2 3 2	6	1	217	JP7,BS3
289	13 2 3 2	6	1	34	BS9,TL1
290	04 1 3 4	6	1	5	JP8,BS2
291	06 1 3 3	6	1	12	JP6,BS3,TA1
292	14 1 3 3	6	1	18	BS7,JP3
293	14 1 3 3	6	1	4	BS7,JP3
294	06 2 3 2	6	1	1	JP7,BS3
295	46 1 3 4	6	1	8	JP5,TA4,BS1
296	04 1 3 3	6	1	23	JP8,BS1,TA1
297	06 2 3 2	6	1	15	JP7,BS2,TA1
298	06 1 4 3	6	1	53	JP7,TA2,BS1
299	13 2 3 3	6	1	13	BS10
300	13 2 3 3	6	1	10	BS10
301	06 1 4 4	6	1	1	JP6,BS2,TA2
302	13 2 3 3	6	1	8	BS10
303	14 1 3 3	6	1	35	BS6,JP3,TA2
304	04 1 3 3	6	1	18	JP8,BS2
305	32 1 3 3	6	1	7	TA5,JP3,BS2
306	06 1 4 3	6	1	12	JP7,BS2,TA1
307	04 1 4 3	6	1	45	TA7,WS2,JP1
308	04 1 3 4	6	1	11	JP8,BS1,TA1

AREA LISTING FOR [illegible] TOWNSHIP [illegible] RANGE 66 PAGE 24

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
309	04 1 3 4	6	1	5	JP9,BS1
310	14 1 3 4	6	1	15	BS7,JP3
700	00 0 0 0	6	1	1535	
710	00 0 0 0	6	1	1321	
720	00 0 0 0	6	1	101	
730	00 0 0 0	6	1	127	
800	00 0 0 0	6	1	100	
830	00 0 0 0	6	1	579	
900	00 0 0 0	6	1	5311	

TOTAL ACRES 23496

For example, Stand 39 on the map according to the Species Composition column contains JP6 TA3 BS1. Since all stands are calculated on the basis of 100%, the composition is 60% jack pine, 30% trembling aspen and 10% black spruce. Since this stand contains 10% black spruce, which is an indicator species, it falls into category 2. A second example could be Stand 37. Species Composition here is BS8 TL2. Since the total composition of this stand is made up of indicator species (80% black spruce and 20% tamarack) it falls into category 4.

In summary then, the first step of the method involves the categorisation of the specific stands according to their respective species composition. For ease of visual interpretation, to avoid the need for a constant reference to the computer print-out, and to obtain a perspective of the area being categorised, a simple colour-coding has been introduced as part of the first step:

Category 1 (Red) : 0% indicator species.

Category 2 (Orange) : 10-30% indicator species.

Category 3 (Blue) : 40-60% indicator species.

Category 4 (Green) : 70%+ indicator species.

Thus in the examples cited, Stand 39 would be denoted by orange, and Stand 37 by green.

The end result of categorisation is a coloured map representing the different combinations of species. During the colour-coding process one exception is recognised. All pure stands of non-indicator species would not be coloured red as category 1 but would be coloured orange as category 2. Such stands would be noted on the master map by a P (species name). The downgrading of a pure stand recognises

diversity of species along with good site drainage and soundness of species to be a characteristic which should be associated with a recreational site.

At the completion of categorisation the following information would be known:

i. the size in acres of each stand (provided in the computer print-out under the heading, "AREA");

ii. type and diversity of species (determined by the colour codes);

iii. the distance to the nearest access road (determined by visual inspection);

iv. the relative location of sites on the shoreline with the highest potential for recreation (categories 1 and 2);

v. the type of conditions which may have to be crossed to reach each potential site from the nearest road;

vi. the status of the land ownership (shown under "OWN" in the print-out as a code number, with each number representing a type of ownership, e.g. Crown Land, Private Land, Mineral Claim or Right-of-Way);

vii. the diversity of the general lakeshore; and

viii. the number of alternatives available. (The number of sites of categories 1 and 2 along a shoreline).

This information base, which can be gathered quickly in the office, could now be used to establish a field-inspection program. The ability of the system to assist in the formulation of field priorities at an early stage is considered advantageous for the following reasons:

i. it eliminates the need to spend time and money investigating unknowns along a shoreline, (areas may look acceptable from a boat, but may be backed by swamp), and

ii. it assists in reducing the amount of time necessary for field inspection.

These factors are critical as detailed field inventories are costly.

B. Differentiation

The information base provided in the first stage, categorisation, is considered adequate for the establishment of field priorities in limited study areas. However, if the study area involves several lakes or several miles of shoreline and the budget allows for only limited field inspection, it is necessary to add further information to the process to assist in the rationalisation of priorities. This stage of the method introduces three additional variables which can be interpreted objectively and consistently to compare different sites. These variables are

i. moisture regime,[1]
ii. cutting class,[2] and
iii. crown closure.[3]

---

[1]Moisture regime refers to conditions associated with a particular stand according to the forestry inventory.

[2]Cutting class is a forestry term used to denote age.

[3]Crown closure is an indication of density of a stand.

Information related to each of these variables is provided in the computer print-out under the heading "TYPE". Referring back to the previous example, Stand 39 is coded as 133 while Stand 37 is coded as 233. The first digit of this numerical code indicates the moisture regime, the second digit indicates the cutting class, and the third digit indicates crown closure (stand density).

1. Differentiation by Moisture Regime

In the examples given Stand 39 is a moisture regime number 1 site and is composed of JP6 TA3 BS1, while Stand 37 is a moisture regime number 2 site and consists of BS8 TL2.

To determine the moisture ranges in these stands reference is made to the Moisture Regime Chart (Table 8) provided with the field instructions[1] which accompany the forest inventory data.

The Moisture Regime Chart is used to provide a more definitive statement of the actual moisture conditions on the site than would otherwise be extrapolated from the presence or absence of indicator species. For example, black spruce can grow on arid or saturated sites. The Moisture Regime Chart thus indicates actual rather than assumed moisture conditions. The use of this chart thus reduces the need for a subjective assumption as to the moisture conditions on a particular site,

---

Manitoba, Department of Mines, Natural Resources and Environmental Management, Forest Inventory--Field Instructions (Winnipeg: Queen's Printer, 1975) p. 14.

TABLE 8

MOISTURE REGIME

	Arid	Dry	Fresh	Moist	Very Moist	Wet	Saturated
Jack Pine	2	2	1	1			
White Spruce	3	3	1	1			
White Birch		2	1	1			
Ash/Elm/Maple			1	1			
Bur Oak		2	1	1			
Trembling Aspen	3	2	1	1	1		
Balsam Poplar		2	1	1	1		
Cedar				1	1	1	2
Tamarack				1	1	2	
Black Spruce	2	3	1	1	1	1	2
Balsam Fir			2	1	1		

In the case of Stand 39 (Number 1 site JP6 TA3 BS10) the Moisture Regime Chart indicates that moisture conditions in that stand range from fresh to moist, with the possibility of very moist depressions in association with the black spruce. (Because of the dominance of jack pine, in all likelihood the site is dominantly fresh or well-drained). In the case of Stand 37 (Number 2 site BS8 TL2) the Moisture Regime Chart indicates that moisture conditions in that stand range from wet to saturated. To further illustrate the point, if Stand 39 was on a Number 2 site and was composed of the same species (JP6 TA3 BS10) the Moisture Regime Chart would indicate that

moisture conditions range from dry to arid. All other things being equal, if a decision had to be made on which area should be inspected first, this site should receive preference over the Number 1 site JP6 TA3 BS10 as the Number 2 site area is drier.

Differentiation of sites by the Moisture Regime Chart thus assists in the identification of field priorities by providing information on the actual site conditions of the area. This assistance is provided with little or no need for subjective interpretation.

2. Differentiation by Cutting Class

The process of differentiation of tree stands by cutting is based on the principle that a young stand of trees has more vigorous growth and is less susceptible to disease and decay than an older stand. Also, all other things being equal, in an old stand one can expect to be involved with replanting and site management much cooner than in a young stand. Sites with low cutting class (young) numbers are thus considered superior to sites with high cutting class (old) numbers.

The cutting class number of a stand is found next to the moisture regime number in the computer print-out. The examples previously used were:

Stand: 39 133 JP60 TA30 BS10

Stand: 37 233 BS8 TL2

In both stands 39 and 37 the cutting class is 3.

The six cutting classes identified in the Forest Inventory are:

i. Class 0: Forest land not restocked following fire, cutting, windfall or other major disturbances (hence potentially productive land). Some reproduction or scattered residual trees may be present.

ii. Class 1: Stands which have been restocked either naturally or artificially. There may be scattered residual trees present as in cutting class 0. To be in cutting class 1, the average height of the stand must be less than 3.6 metres.

iii. Class 2: Advanced growth of post-size diameter. The average height of the stand must be over 3.6 metres.

iv. Class 3: Immature stands growing at or near their maximum rate. The average height of the stand should be over 7.5 metres and the average diameter should be 8.75 centimetres at breast height.

v. Class 4: Mature stands, which may be cut as they have reached rotation age.

vi. Class 5: Overmature stands, which should be given priority in cutting.

After a review of the cutting class descriptions above it is suggested that cutting classes 2 and 3 appear to be best suited for recreational development for the following reasons:

i. there is vigorous growth;

ii. young species are less susceptible to disease and decay;

iii. they have a longer life potential without management than cutting classes 4 and 5; and

iv. since the stands are young and there is vigorous growth they may be able to withstand site disturbances associated with road

or building construction much more readily than classes 4 and 5.

Although it is suggested that cutting classes 2 and 3 are preferable choices for development (all other things being equal) this does not preclude development in cutting classes 0, 1, 4 or 5. For example cutting classes 0 and 1 may be ideally suited for picnicking and day-use facilities. In these cases open spaces are desirable for field activities or sun-bathing. Cutting classes 4 or 5, on the other hand, may be developed for any type of use as long as it is recognised that site management will have to occur almost immediately. (The campground at Leaf Rapids which will open in 1979 was constructed in an area containing cutting class 4 and 5 species. In this case an alternative site which exhibited a higher developmental suitability was available. However, an additional 4.8 kilometres of access road would have been necessary. The decision was thus made to accept the lower quality site conditions and on-going site management costs for the nearer site. The costs associated with this option were considered significantly less that the costs of additional kilometres of road.)

The process of introducing differentiation by cutting class is to compare the cutting class of one tree stand with the cutting class of other tree stands. This procedure further assists in the identification of field priorities. It is particularly useful in differentiating between similarly categorised sites. For example, given the following two descriptions

Stand X 133 JP6 TA3 BS1

Stand Y 153 JP6 TA3 BS1

it is obvious that Stand X should be given priority over Stand Y.

As has been noted, cutting class 5 contains the oldest trees and are considered overmature. In recognition of the potential problem of windfall, disease and stagnation that could occur, all cutting class 5 sites are downgraded one category during the first stage, categorisation, of the method. A stand containing 0% indicator species would thus be categorised 2 instead of 1 and coloured orange instead of red on the inventory map. Stands downgraded in this manner are identified on the inventory map by 0 (species name).

3. Differentiation by Crown Closure

Crown closure is an indication of the density of a stand. Information related to crown closure is provided in the computer print-out next to the cutting class number. The use of crown closure information is not considered a critical comparative element. However, it has been included since it is an existing source of information. The use of crown closure information is most appropriately applied if it is known what type of recreational activity or development is to occur. For example, a denser crown closure may be more appropriate in a cottage subdivision that in a picnic area. In the case of a subdivision, a dense crown closure, which infers density of trees, would be more appropriate as buffers to increase privacy between lots. Conversely, in a picnic area, open spaces for walking and playing are more important. Hence, crown closure or density of species need not be as high.

Four classes of crown closure have been identified in the Forest Inventory:

i. Class 1: 15%-30% crown closure

ii. Class 2 : 31%-50% crown closure

iii. Class 3 : 51%-70% crown closure

iv. Class 4 : 71%+ crown closure

The procedure employed to introduce differentiation by crown closure into the analysis is to compare the crown closure of one site with that of another. This procedure, although not considered critical, could further assist in the formulation of field priorities.

The information base generated in this second stage of the procedure includes

i. an indication of moisture conditions at specific sites;

ii. an indication of the age, height and life-expectancy of tree species at specific sites; and

iii. an indication of the density of cover at a specific site.

At the conclusion of this second stage of the method the following objective information is available:

i. an indication of the type and diversity of species along a particular lakeshore;

ii. an indication of the type of conditions which would have to be crossed to provide access to each site with potential for development from the nearest access road;

iii. an indication of the diversity of species along the lakeshore;

iv. an indication of the moisture and growing conditions on specific sites;

v. an indication of the age, height and condition of tree species on specific sites;

vi. an indication of the density of cover on specific sites;

vii. an indication of the number of sites with potential for development along the lakeshore being studied;

viii. the relative location of all sites with potential for development on the lakeshore;

ix. the number of alternatives for potential development on a lakeshore;

x. an indication of the size in acres of each potential site; and

xi. the status of the land ownership.

The information generated up to this stage provides an indication of the on-site potential within the study area, a stage at which the field investigations could be initiated. The purpose of the field investigation stage would be to confirm the existence of the site conditions projected in the two earlier stages and to gather other information not provided by the Forest Inventory (Soil Depth and Texture, Topography).

C. The Introduction of Additional Information

At this stage of the method a procedure is outlined to introduce additional information into the analysis to complement that generated in the stages of categorisation and differentiation.

The information generated earlier refers only to physical conditions of specific sites. This stage introduces information related to other resources and attempts to place that data in a rational framework. It is meant to assist in establishing an overall perspective of the resource base as well as to contribute to the final decision-making process. It is stressed that data gathered during this stage should be recorded as information only. No attempt should be made to interpret the data in terms of its ability or inability to contribute to a recreational experience. In other words, for example, although

data sources may indicate a beach along a shoreline no attempt should be made to suggest it has a high or low capability to sustain recreational activity. The important fact is whether or not a beach exists.

The type of data that is gathered at this stage and is subsequently recorded on the Forest Inventory Map would deal with

i. archaeological sites;
ii. beaches;
iii. wildlife concentrations (range areas summer-winter);
iv. scenic outlooks;
v. fish-spawning areas;
vi. wild rice locations;
vii. historical sites or features (homesteads, old mines,etc.);
viii. unusual geological features;
ix. unique flora concentrations;
x. rare or endangered species' nesting or range areas;
xi. mineral potential; and
xii. forestry potential.

This type of information is readily available from a number of such different sources as

i. Canada Land Inventory;
ii. Government reports;
iii. International Biological Program reports;
iv. Archaeological reports (University and Government);
v. Geological reports;
vi. Aerial photographs;
vii. Canadian Wildlife Service publications;

viii. Ducks Unlimited;

ix. Government Archives; and

x. Personal contact with local residents and first-hand experience.

The above list is not complete. However, it serves to point out that in a large number of cases information of some type is usually available. Therefore these sources should be explored prior to initiating a costly and time-consuming independent inventory.

The procedure to incorporate the data into the method is to establish a check list of features associated with each potential site identified in the stages of categorisation and differentiation. In this manner, comparative advantages between similarly categorised sites can be noted and used as a future rationale for final site selection. The end result of the process would thus be the selection of a site for development (subsequent field investigations) on the basis of its onshore physical characteristics and its comparative advantage with other resource features. The end result of the process is thus consistent with the original intent of the method of land analysis and classification: the determination of the best use to which a particular land area could be put.

TABLE 9

SAMPLE CHECK LIST OF SITE FEATURES

	Beach	Geological Feature	Mineral Potential	Scenic Outlook	Spawning Area	Archaeological Site	Wild Rice
Site X	*	*		*			
Site Y	*		*		*		

Leaf blank to correct

numbering

CHAPTER IV

EVALUATION OF THE METHOD OF LAND ANALYSIS AND CLASSIFICATION FOR THE CANADIAN SHIELD PORTION OF MANITOBA

This thesis began with three objectives that were to be pursued. They were:

i. to identify some primary general characteristics which should be inherent in a method of land analysis and classification.

ii. to outline a method of land analysis and classification for the Canadian Shield portion of Manitoba; and

iii. to evaluate the proposed method of land analysis and classification relative to the primary characteristics which should be inherent in any method of land analysis and classification.

In Chapter I the description and evaluation of three methods of analysing and classifying land sets the framework by outlining several problems common to such methods. Chapters II, on the basis of the data contained in Chapter I and a general literature review, outlines general primary characteristics which should be recognised in a method of land analysis and classification. Chapters I and II were thus devoted to meeting the first objective of this thesis.

Chapter III outlined a method of land analysis and classification for the Canadian Shield portion of Manitoba, and thus met the second objective of this thesis.

The purpose of this Chapter is to meet the third objective of the thesis: to evaluate the method of land analysis and classification outlined in Chapter III relative to the primary desirable characteristics, as outlined in Chapters I and II.

In summary form, and as outlined in Chapter II, the primary desirable characteristics which should be inherent in any method of land analysis and classification are as follows:

i. the method should be easy to apply and make good use of the time of the personnel involved in the analysis;

ii. it should make inventory decisions and recommendations only;

iii. it should gather only the information necessary to make a rational decision;

iv. it should be accurate;

v. it should call for very little personal judgement or subjective interpretation of information;

vi. it should be possible to be duplicated (the conclusions reached by two different study teams working separately on the same area should be the same);

vii. it should recognise other resource uses which could influence the recreational potential in the future;

viii. it should consider the recreational resources in combination;

ix. it should provide realistic and adequate information on actual developmental potential; and

x. it should use existing sources of information to generate new information.

In evaluating the method of land analysis and classification described in Chapter III relative to the primary desirable characteristics outlined, the following observations are made:

i. The system is easy to apply since it can be learned in less than half-an-hour (personal experience) by anyone who can read and colour; and there is a minimum of time required for organisation prior to analysis.

ii. The decision-making process during the application of the system is confined exclusively to the establishment of field priorities for information confirmation. A separate decision-making process determines if, where and what types of development will occur.

iii. The system assembles only that level and type of data required to make a decision.

iv. The system is accurate in so much as it is based on expert aerial photograph interpretation (with random field checks to confirm the accuracy of the interpretation) and on consistent comparative standards.

v. The system calls for little personal judgement throughout the entire process. Some judgement is, however, required when differentiating between similarly classified sites. This could result in minor alterations in field priorities between similar sites (a before b rather than b before a).

vi. The system can be duplicated since it is based on the application of consistent criteria.

vii. The system recognises the possible existence of resource contingencies and allows for these to be documented for consideration in the subsequent decision-making process.

viii. The system considers all recreational resource potentials insomuch as it allows additional data to be added as information at the final stage of the procedure.

ix. The system provides the opportunity to consider the recreational and other resource features in combination as part of the final stage of the procedure.

x. The system provides initial base line data on such factors as distance to nearest access road, and ground conditions to be traversed to gain access to a particular site. This allows the opportunity to formulate realistic cost estimates.

xi. The system can rely exclusively on existing sources of information, and can generate new information from information gathered for other purposes, and

xii. The system can be initiated in the winter and subsequently continued in the summer. This allows the opportunity to take the greatest advantage of the field season.

Thus, these observations suggest that there is some merit in continuing to apply the method of land analysis and classification to the task of identifying potential sites for development in the Canadian Shield portion of the Province of Manitoba.

CHAPTER V

A CRITIQUE OF THE METHOD

Although this thesis has to this point addressed the three stated objectives, it would not be considered complete unless a critique of the method of Land Analysis and Classification for the Canadian Shield Portion of Manitoba was included. This chapter will address itself to a brief critique of the method.

A critique is considered essential for the following reasons:

i. It will ensure that those using the system will be aware of its shortcomings. Hence, the probability of the system being misinterpreted will be reduced.

ii. Through self-criticism it is hoped that further discussions and recommendations for improvement will follow.

Within the context of spurring constructive criticism and positive information-exchange, the following are considered to be problems associated with this method.

i. The method assumes that tree species are evenly distributed throughout a stand.

ii. Topographic diversity is not considered in the first three stages of the method. So, while a site may be theoretically suited for development, site investigation could show topography that may not be conducive to development. This is particularly important when analysis is undertaken in the Canadian Shield. Although this is

a minor point, at times one may sustain a false sense of potential relative to a study area. This point is made to stress the importance of careful field work to accompany the inventory.

iii. The method relies on the accuracy of the forest inventory information.

iv. The method assumes that all sites with over 70% indicator species are not suited for recreational development when, in fact, such areas may have interpretative value or be suited for trail development.

v. Forest inventory maps are extremely bulky and awkward to use in the field.

vi. Canada Land Inventory maps and other information sources are usually produced at different scales so that distortions may result when transferring information. This problem will, of course, resolve itself to some degree with the application of metric scales.

APPENDIX

RECREATIONAL SITE IDENTIFICATION SYSTEM

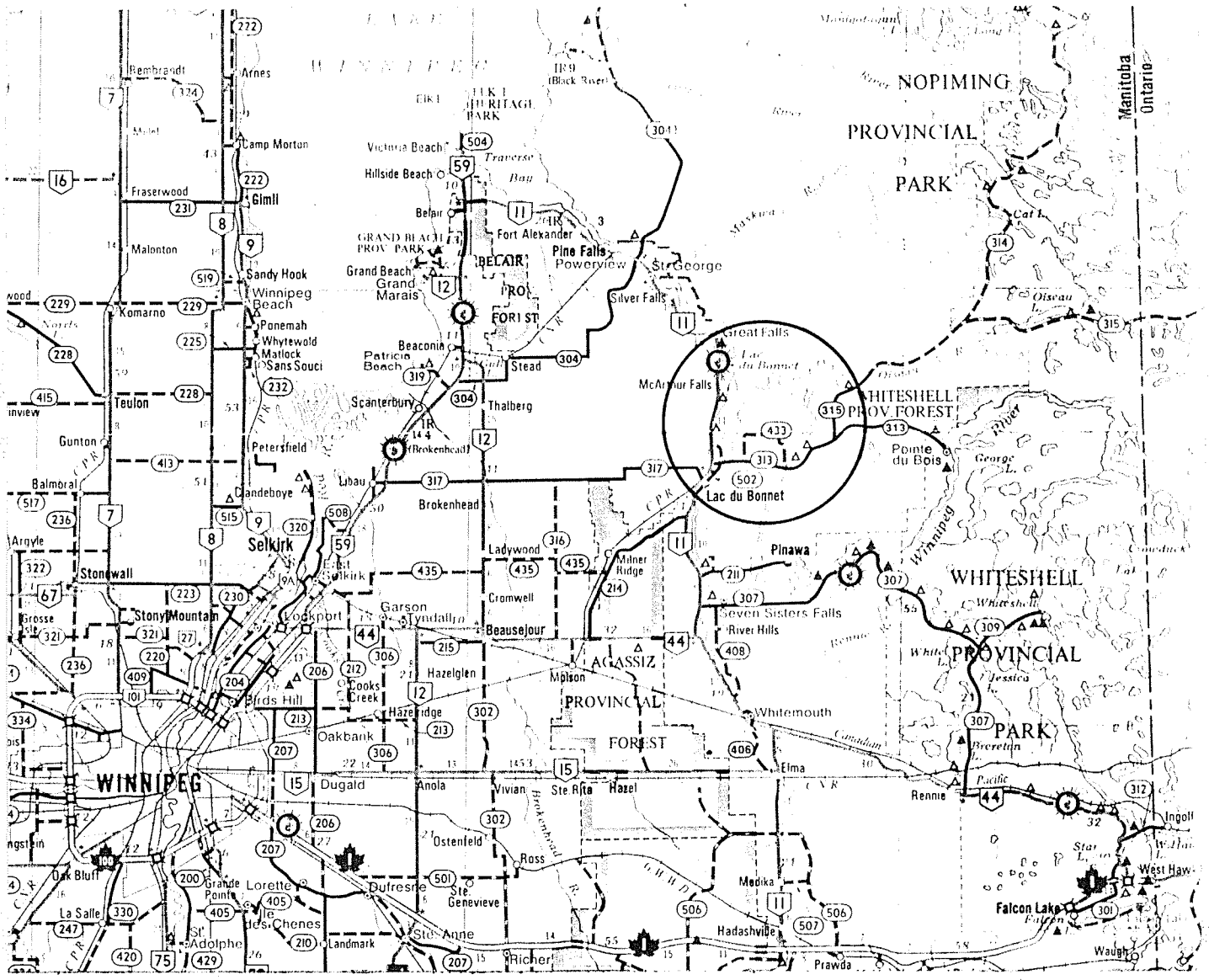
WORKING EXAMPLE: NORTH SHORE OF LAC DU BONNET

This study was undertaken by Mr. T. Merkl, Assistant Planner, Eastern Region, Manitoba Parks Division, during the spring and summer of 1978. The purpose of the study was to determine the developmental potential in general of the north shore of Lac du Bonnet (Map 6).

The example of the north shore of Lac du Bonnet was chosen to demonstrate, firstly, the initial application of the Method of Land Analysis and Classification and, secondly, the process of adding information to the original data base to provide a comprehensive and complete analysis of a specific area.

A. Step I

The objective of this study was to determine the general developmental potential of the north shore of Lac du Bonnet. Hence the first step was to colour-code the applicable forest inventory map. From this, Maps 7-10 resulted. The information obtained from the first step indicated that Category 1 and 2 sites occupied extensive areas of the north shore. Therefore the decision was made to proceed with more detailed analysis. It is pointed out that the procedure would have terminated at this stage as there was sufficient evidence at hand to indicate that the area did have developmental potential. Notwithstanding this preliminary indication of potential, it was recognised that costs for access would be extremely high due to the



MAP 6

LAC DU BONNET REGION

FOREST RESOURCE INVENTORY
Twp. 17, Rge. 12 EPM

MAP 7

DU BONNET

LAC DU BONNET

A22047
A21994

TABLE 10

AREA LISTING FOR MANAGEMENT UNIT 23,

TOWNSHIP 17, RANGE 62

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
1	91 1 4 3	2	1	2358	TA7,WB2,WS1
14	82 1 4 3	2	1	2	TA6,WS4
15	06 2 5 3	2	1	31	JP6,BS4
16	82 1 4 3	2	1	5	TA5,WS4,BF1
17	13 2 3 4	2	1	21	BS10
18	51 1 3 3	2	1	10	WS4,TA4,BF2
19	90 1 4 3	2	1	7	TA8,BF1,BS1
20	82 1 3 4	2	1	12	TA6,BF3,WS1
23	90 1 3 3	2	1	16	TA9,BF1
24	91 1 4 4	2	1	32	TA7,WB3
25	90 1 2 3	2	1	13	TA10
26	90 1 2 3	2	1	8	TA10
27	90 1 4 4	2	1	6	TA10
28	90 1 4 4	2	1	22	TA9,WS1
29	82 1 4 3	2	1	32	TA5,BF3,WS2
30	82 1 3 2	2	1	20	TA6,BF4
31	90 1 3 4	2	1	32	TA9,BF1
32	04 2 0 0	2	1	10	
33	04 2 0 0	2	1	11	
34	13 1 0 0	2	1	37	
35	13 1 3 4	2	1	6	BS10
36	13 1 3 4	2	1	14	BS10
37	82 1 4 3	2	1	19	TA7,BF3
38	90 1 3 2	2	1	18	TA8,BF2
39	90 1 4 3	2	1	48	TA8,WS2
40	90 1 2 2	2	1	10	TA10
41	61 1 4 3	2	1	35	BF4,BS3,TA3
42	90 1 3 4	2	1	32	TA8,WS1,BF1
43	61 1 4 3	2	1	14	BF4,BS3,TA3
44	90 1 3 4	2	1	8	TA8,BS2
45	82 1 4 3	2	1	27	TA7,WS3
46	13 1 4 3	2	1	18	BS10
47	90 1 3 4	2	1	859	TA8,BF1,BS1
48	82 1 3 2	2	1	21	TA5,BF5
49	61 1 3 4	2	1	25	BF5,BS2,TA3
50	13 1 3 4	2	1	39	BS10
51	06 2 2 3	2	1	25	JP7,BS2,TA1
52	51 1 3 3	2	1	18	WS5,TA4,BF1
54	13 1 3 4	2	1	6	BS10
55	13 1 0 0	2	1	6	
56	04 2 4 2	2	1	12	JP9,TA1
57	13 1 0 0	2	1	19	
58	13 2 3 3	2	1	34	BS10
59	82 1 4 2	2	1	10	TA7,BF3
60	82 1 3 2	2	1	12	TA6,BF2,WS2
61	20 1 3 3	2	1	21	BF8,TA2
62	90 1 3 4	2	1	16	TA8,BS2
63	82 1 4 3	2	1	15	TA7,BF3
64	10 1 0 0	2	1	4	
65	82 1 4 3	2	1	3	TA7,BF3
66	90 1 3 3	2	1	5	TA10

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
67	90 1 4 4	2	1	28	TA8,BF2
68	11 1 3 1	2	1	23	WS6,BF2,TA2
69	82 1 4 3	2	1	19	TA7,WS3
70	16 1 3 2	2	1	43	BS7,TL3
71	90 1 3 4	2	1	7	TA8,BS2
72	13 1 4 4	2	1	35	BS10
73	13 1 0 0	2	1	12	
74	13 1 4 4	2	1	17	BS10
75	15 1 4 3	2	1	19	BS6,BF3,TA1
76	04 2 0 0	2	1	4	
77	04 2 0 0	2	1	6	
78	13 1 4 3	2	1	5	BS9,TA1
79	04 1 0 0	2	1	15	
80	56 1 3 2	2	1	7	BS5,TA3,TL2
81	16 1 4 3	2	1	9	BS6,TL4
83	91 1 3 4	2	1	15	TA6,WB3,BF1
84	61 1 4 3	2	1	2	BF4,BS3,TA3
85	82 1 2 3	2	1	3	TA5,BS5
86	16 1 4 3	2	1	1	BS6,TL4
87	44 1 2 4	2	1	11	JP6,TA3,BS1
88	13 2 3 3	2	1	11	BS10
89	90 1 3 4	2	1	1	TA8,BF1,BS1
90	21 1 4 4	2	1	72	BF6,BS2,TA2
91	90 1 3 4	2	1	5	TA10
92	13 1 4 3	2	1	4	BS9,TA1
93	46 1 1 3	2	1	17	JP4,TA4,BS2
94	13 1 3 4	2	1	8	WS7,BS2,TA1
95	13 1 0 0	2	1	16	
96	82 1 4 4	2	1	15	TA7,BF3
97	90 1 4 4	2	1	5	TA9,BS1
98	13 1 3 3	2	1	7	BS9,TL1
99	90 1 4 4	2	1	40	TA8,BF2
100	13 1 4 2	2	1	7	BS10
101	61 1 3 4	2	1	6	BF5,TA3,BS2
102	15 1 4 3	2	1	83	BS5,BF4,TA1
103	81 1 4 3	2	1	3	TA7,JP2,BS1
104	13 1 3 3	2	1	26	BS8,JP1,TA1
105	90 1 3 3	2	1	9	TA10
106	04 2 0 0	2	1	4	
107	04 2 0 0	2	1	2	
108	06 1 4 4	2	1	43	JP7,TA2,BS1
109	13 2 3 4	2	1	67	BS10
110	82 1 4 4	2	1	11	TA7,BS3
111	82 1 4 4	2	1	50	TA7,BS3
112	04 2 0 0	2	1	10	
113	13 2 0 0	2	1	7	
114	14 1 4 4	2	1	15	BS6,JP2,TA2
115	13 2 4 4	2	1	271	BS10
116	82 1 4 3	2	1	8	TA6,BS4
117	82 1 4 4	2	1	10	TA7,BS3
118	13 1 4 4	2	1	6	BS9,TA1

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
119	82 1 2 3	2	1	12	TA7,BS2,WS1
120	10 1 0 0	2	1	19	
121	90 1 3 4	2	1	28	TA9,BF1
122	13 1 3 2	2	1	18	BS10
123	90 1 4 4	2	1	244	TA9,WS1
124	13 2 0 0	2	1	28	
125	90 1 4 4	2	1	21	TA8,BS2
126	13 1 2 3	2	1	20	BS10
127	15 1 4 3	2	1	40	BS5,BF3,TA2
128	82 1 4 4	2	1	76	TA7,BF2,WS1
129	10 1 0 0	2	1	24	
130	82 1 3 3	2	1	18	TA6,WS4
131	13 1 3 4	2	1	7	BS8,TA2
132	90 1 3 2	2	1	53	TA8,BF2
133	10 1 0 0	2	1	43	
134	90 1 1 3	2	1	11	TA10
135	13 1 3 2	2	1	6	BS9,TA1
136	82 1 3 3	2	1	145	TA5,BS3,BF2
137	13 1 4 4	2	1	21	BS10
138	13 1 3 4	2	1	17	BS10
139	90 1 4 4	2	1	7	TA10
140	90 1 4 4	2	1	5	TA10
141	30 1 3 4	2	1	18	TL8,TA2
142	90 1 4 4	2	1	12	TA10
143	10 1 0 0	2	1	62	
144	53 1 3 4	2	1	16	BS6,TA4
145	04 1 0 0	2	1	11	
146	13 1 3 4	2	1	8	BS10
148	13 1 4 3	2	1	19	BS10
149	13 1 4 3	2	1	7	BS9,TA1
150	61 1 3 2	2	1	47	BF5,TA4,BS1
151	13 1 3 1	2	1	4	BS10
152	06 1 5 3	2	1	331	JP5,BS3,TA2
153	13 1 4 4	2	1	12	BS10
154	13 1 4 2	2	1	8	BS8,TL1,TA1
155	82 1 4 2	2	1	62	TA6,BS3,BF1
156	13 1 3 4	2	1	8	BS10
157	82 1 3 3	2	1	21	TA7,BF3
158	13 1 3 2	2	1	7	BS10
159	04 1 0 0	2	1	28	
160	13 1 0 0	2	1	8	
161	82 1 4 2	2	1	10	TA6,WS2,BF2
162	90 1 1 4	2	1	7	TA8,BF2
163	04 2 0 0	2	1	21	
164	90 1 3 2	2	1	37	TA8,BF2
165	13 1 4 3	2	1	8	BS10
166	82 1 4 3	2	1	14	TA5,WS5
167	10 2 3 2	2	1	15	WS8,BF2
168	82 1 4 3	2	1	24	TA7,WS3
171	82 1 4 3	2	1	3	TA7,BF2,BS1
174	13 1 0 0	2	1	4	

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
175	90 1 4 4	2	1	11	TA9,BF1
176	04 2 0 0	2	1	16	
243	31 1 4 4	2	1	26	TL6,BS4
254	06 2 5 3	2	1	8	JP5,BS5
266	90 1 4 4	2	1	1	TA9,BS1
268	06 1 4 4	2	1	67	JP6,BS3,TA1
269	82 1 4 4	2	1	11	TA7,BS3
272	13 1 3 4	2	1	5	BS10
273	13 1 3 4	2	1	9	BS10
274	04 2 0 0	2	1	27	
275	90 1 4 4	2	1	7	TA8,JP2
276	90 1 4 4	2	1	18	TA8,JP2
278	04 2 0 0	2	1	7	
282	13 1 4 2	2	1	10	BS8,TA2
287	04 2 0 0	2	1	1	
288	82 1 4 4	2	1	16	TA6,BS3,JP1
291	90 1 3 3	2	1	42	TA8,BF2
292	13 3 2 3	2	1	9	BS8,TA2
293	13 1 0 0	2	1	14	
294	14 1 4 2	2	1	33	BS4,JP2,BF2,TA2
295	13 1 4 4	2	1	12	BS10
296	82 1 4 3	2	1	5	TA6,BS4
297	30 1 4 4	2	1	42	TL9,BS1
298	90 1 4 3	2	1	5	TA8,BS2
299	81 1 4 3	2	1	3	TA7,JP2,BS1
300	13 2 2 3	2	1	4	BS9,TL1
301	10 2 3 2	2	1	38	BS8,BS1,TA1
302	04 2 0 0	2	1	19	
303	90 1 4 4	2	1	107	TA9,BF1
304	44 2 2 3	2	1	23	JP6,TA4
305	06 2 5 3	2	1	163	JP6,BS4
306	81 2 2 3	2	1	7	TA5,JP5
307	53 1 3 2	2	1	7	BS6,TA4
308	13 1 0 0	2	1	10	
309	90 1 1 2	2	1	10	TA10
310	56 1 3 2	2	1	9	BS4,TA4,TL2
311	81 1 3 4	2	1	12	TA5,JP3,BS2
312	90 1 3 3	2	1	20	TA10
313	04 2 2 3	2	1	11	JP8,BS1,TA1
314	13 1 3 3	2	1	8	BS10
315	82 1 4 4	2	1	12	TA6,BF2,BS2
316	06 2 2 3	2	1	37	JP6,BS3,TA1
317	81 1 4 3	2	1	20	TA7,JP3
319	13 2 3 3	2	1	15	BS10
337	82 1 4 2	2	1	48	TA6,BS3,JP1
343	06 2 3 2	2	1	12	JP6,BS3,TA1
345	44 2 3 2	2	1	21	JP6,TA3,BF1
346	13 1 0 0	2	1	20	
347	82 1 3 4	2	1	34	TA7,BS3
348	90 1 4 2	2	1	14	TA8,BS2
349	90 1 4 4	2	1	34	TA8,BS2

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
350	82 1 4 3	2	1	19	TA7,BS3
351	53 1 3 4	2	1	6	BS6,TA4
352	82 1 4 3	2	1	20	TA5,BS3,JP2
353	04 2 0 0	2	1	19	
354	04 2 0 0	2	1	3	
355	81 1 4 3	2	1	1	TA7,JP2,BS1
356	04 2 0 0	2	1	8	
357	81 1 4 3	2	1	33	TA7,JP2,BS1
358	44 2 1 3	2	1	6	JP6,TA4
359	13 1 3 4	2	1	4	BS5,JP1
360	44 2 1 3	2	1	7	JP6,TA4
361	82 1 4 3	2	1	15	TA6,BS4
362	13 1 3 4	2	1	11	BS10
364	82 1 4 3	2	1	6	TA7,BS3
366	82 1 3 3	2	1	19	TA6,BS4
367	44 2 1 3	2	1	6	JP6,TA4
472	20 1 3 3	2	1	2	BF8,BS1,TA1
473	90 1 3 3	2	1	10	TA10
475	82 1 4 2	2	1	2	TA6,BS3,JP1
700	00 0 0 0	2	1	325	
710	00 0 0 0	2	1	28	
720	00 0 0 0	2	1	796	
730	00 0 0 0	2	1	1	
830	00 0 0 0	2	1	214	
900	00 0 0 0	2	1	1709	

TOTAL ACRES 11289

APRIL 18 1974

FOREST RESOURCE INVENTORY
Twp. 17, Rge. 13 EPM

MAP 8

RIVER
BIRD
PR315
Bridge
LOT 1
LOT 2
LOT 3
PAT

FOREST RESOURCE INVENTOR
Twp. 17, Rge. 13 EP

LAC DU BONNET

BIRD

PAT

LOT 1
LOT 2
LOT 3

TABLE 11

AREA LISTING FOR MANAGEMENT UNIT 23,

TOWNSHIP 17, RANGE 63

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
7	61 1 3 2	2	5	2	BF4,WS3,TA3
9	82 1 3 4	2	1	1	TA7,BF2,BS1
9	82 1 3 4	2	5	35	TA7,BF2,BS1
10	61 1 3 2	2	5	8	BF5,TA3,BS2
11	82 1 2 3	2	5	28	TA6,WS2,JP1,BF1
12	90 1 4 3	2	5	40	TA9,BF1
13	81 1 2 3	2	5	43	TA6,JP4
14	82 1 3 4	2	5	7	TA7,WS2,BF1
15	82 1 3 3	2	5	46	TA7,BF3
16	90 1 3 4	2	5	13	TA8,JP1,BS1
17	90 1 3 4	2	5	103	TA8,BF1,BS1
17	90 1 3 4	2	1	192	TA8,BF1,BS1
18	04 1 0 0	2	5	27	
19	13 1 0 0	2	5	7	
19	13 1 0 0	2	1	12	
21	90 1 3 1	2	1	9	TA10
23	90 1 4 4	2	1	23	TA9,WS1
24	04 2 2 4	2	1	7	JP10
26	91 1 4 4	2	1	13	TA6,WB4
26	91 1 4 4	2	5	2	TA6,WB4
28	10 1 0 0	2	1	3	
33	90 1 2 4	2	5	4	TA10
34	90 1 3 3	2	5	26	TA8,BS2
34	90 1 3 3	2	1	1	TA8,BS2
35	04 2 0 0	2	5	8	
36	90 1 3 4	2	5	5	TA9,WS1
37	44 1 1 3	2	5	35	JP7,TA3
37	44 1 1 3	2	1	1	JP7,TA3
38	04 2 0 0	2	5	36	
39	90 1 3 3	2	5	21	TA9,BF1
41	04 2 0 0	2	5	2	
42	14 1 2 3	2	5	28	BS6,JP3,TA1
44	44 2 3 2	2	1	1	JP6,TA3,BS1
44	44 2 3 2	2	5	8	JP6,TA3,BS1
52	90 1 1 4	2	5	14	TA8,JP2
52	90 1 1 4	2	1	4	TA8,JP2
53	06 2 1 4	2	1	38	JP6,BS2,TA2
54	06 2 1 4	2	1	3	JP6,BS2,TA2
56	04 1 0 0	2	1	11	
57	90 1 1 4	2	1	22	TA8,JP2
58	82 1 3 3	2	1	18	TA7,WS3
59	90 1 2 2	2	1	18	TA8,JP2
60	90 1 5 3	2	1	16	TA10
61	04 2 0 0	2	1	23	
61	04 2 0 0	2	5	2	
62	82 1 3 4	2	5	37	TA7,BF3
62	82 1 3 4	2	1	35	TA7,BF3
63	91 1 3 4	2	5	4	TA7,WB3
64	90 1 4 4	2	5	347	TA8,WS1,BS1
64	90 1 4 4	2	1	111	TA8,WS1,BS1
65	10 1 0 0	2	5	26	

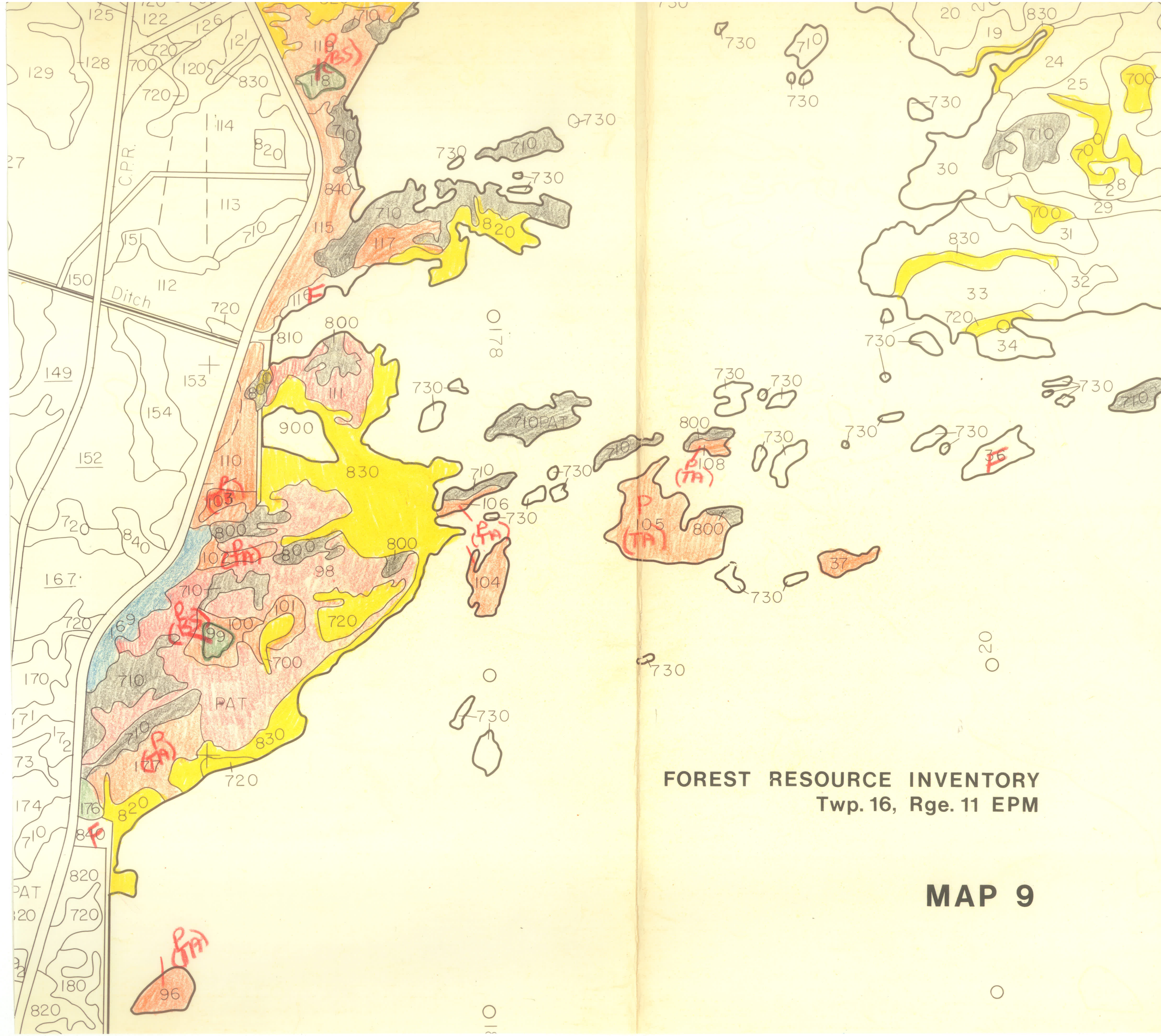
STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
66	90 1 3 4	2	5	38	TA9,JP1
67	90 1 2 4	2	5	10	TA10
73	90 1 4 3	2	5	10	TA8,JP1,BF1
83	90 1 2 4	2	5	60	TA9,JP1
83	90 1 2 4	2	1	1	TA9,JP1
87	04 2 0 0	2	5	23	
88	81 1 2 2	2	5	15	TA7,JP3
89	90 1 3 4	2	5	5	TA8,BF2
90	90 1 4 3	2	5	30	TA8,BF2
91	90 1 4 3	2	1	40	TA7,BA2,WS1
92	82 1 4 4	2	5	10	TA5,BF4,WS1
92	82 1 4 4	2	1	28	TA5,BF4,WS1
95	90 1 2 4	2	1	8	TA10
95	90 1 2 4	2	5	10	TA10
96	82 1 3 4	2	1	1	TA7,WS3
96	82 1 3 4	2	5	1	TA7,WS3
97	90 1 2 3	2	5	43	TA8,JP2
98	90 1 2 4	2	5	11	TA10
99	04 2 0 0	2	1	1	
99	04 2 0 0	2	5	10	
100	61 1 3 4	2	5	1	BF5,TA3,BS2
101	90 1 3 4	2	5	47	TA6,WB2,BS2
101	90 1 3 4	2	1	15	TA6,WB2,BS2
102	90 1 4 3	2	5	18	TA9,WS1
104	04 1 0 0	2	1	7	
104	04 1 0 0	2	5	6	
105	04 2 0 0	2	5	10	
114	04 2 0 0	2	1	6	
115	53 1 3 2	2	1	7	BS7,TA3
116	90 1 2 2	2	1	12	TA8,JP2
117	04 2 0 0	2	1	13	
117	04 2 0 0	2	5	4	
118	44 2 2 3	2	1	5	JP6,TA4
119	91 1 4 3	2	1	1	TA7,WB2,WS1
120	91 1 3 4	2	1	22	TA7,WB3
122	10 1 0 0	2	1	2	
123	91 1 4 3	2	1	46	TA7,WB2,WS1
124	90 1 2 4	2	1	5	TA10
151	90 1 2 4	2	1	1	TA8,JP2
152	04 2 0 0	2	1	10	
154	82 1 3 4	2	1	10	TA7,WS3
155	90 1 2 3	2	1	29	TA8,JP2
156	90 1 4 4	2	1	2	TA9,BF1
210	90 1 4 4	2	5	14	TA8,JP1,BF1
217	90 1 1 4	2	1	7	TA10
219	90 1 3 2	2	1	4	TA9,JP1
220	90 1 1 4	2	1	11	TA10
221	90 1 2 3	2	1	8	TA10
223	90 1 1 4	2	1	1	TA10
560	91 1 4 3	2	1	11	TA7,WB2,WS1
568	90 1 3 4	2	1	2	TA6,WB2,BS2

AREA LISTING FOR MU 23 TOWNSHIP 17 RANGE 63 PAGE 177

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
569	90 1 3 4	2	1	2	TA6,WB2,BS2
570	90 1 3 4	2	1	1	TA6,WB2,BS2
571	90 1 2 2	2	1	1	TA10
573	04 1 0 0	2	5	2	
710	00 0 0 0	2	5	57	
710	00 0 0 0	2	1	27	
720	00 0 0 0	2	1	12	
720	00 0 0 0	2	5	11	
730	00 0 0 0	2	1	8	
730	00 0 0 0	2	5	2	
810	00 0 0 0	2	1	2	
810	00 0 0 0	2	5	212	
820	00 0 0 0	2	5	11	
830	00 0 0 0	2	5	42	
840	00 0 0 0	2	1	39	
840	00 0 0 0	2	5	53	
840	00 0 0 0	2	5	43	
840	00 0 0 0	2	1	38	
900	00 0 0 0	2	1	1946	

TOTAL ACRES 4732

APRIL 18 1974



C.P.R.
Ditch
FOREST RESOURCE INVENTORY
Twp. 16, Rge. 11 EPM
MAP 9

TABLE 12

AREA LISTING FOR MANAGEMENT UNIT 23,

TOWNSHIP 16, RANGE 61

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
1	13 1 0 0	9	5	1	
2	90 1 4 4	9	5	1	TA9,BS1
5	90 1 4 4	9	5	14	TA9,BF1
6	82 1 3 4	9	1	5	TA7,BS3
7	90 1 2 3	9	1	1	TA8,JP2
9	82 1 3 4	9	1	2	TA7,BS3
10	90 1 2 4	9	1	3	TA9,BS1
11	82 1 3 4	9	1	13	TA7,BF3
12	82 1 3 4	9	1	1	TA7,BF3
13	90 1 2 4	9	1	2	TA9,BS1
14	90 1 3 4	9	1	2	TA10
36	04 2 0 0	2	1	9	
37	90 1 3 1	2	5	3	TA8,BF2
37	90 1 3 1	2	1	2	TA8,BF2
38	90 1 2 4	9	1	28	TA9,BS1
39	90 1 3 4	9	1	16	TA9,BF1
40	90 1 2 3	9	1	20	TA10
41	90 1 1 4	9	1	21	TA10
42	90 1 3 4	9	1	12	TA10
43	10 1 0 0	9	1	3	
44	81 1 3 3	9	1	27	TA7,JP3
45	90 1 3 3	9	1	76	TA10
46	90 1 2 4	9	1	6	TA10
47	90 1 2 4	9	1	4	TA10
48	82 1 3 3	9	1	6	TA7,BF3
49	91 1 3 3	9	1	8	TA5,WB3,BF2
50	13 2 0 0	9	1	78	
51	81 1 2 3	9	1	8	TA7,JP3
52	82 1 3 4	9	5	255	TA6,BS3,JP1
52	82 1 3 4	9	1	77	TA6,BS3,JP1
53	13 1 0 0	9	1	2	
54	90 1 3 2	9	5	45	TA9,JP1
54	90 1 3 2	9	1	12	TA9,JP1
56	90 1 2 3	9	1	14	TA8,BS2
57	90 1 2 4	9	1	15	TA10
58	90 1 2 3	9	1	4	TA10
59	90 1 3 3	9	5	98	TA7,BF2,JP1
59	90 1 3 3	9	1	38	TA7,BF2,JP1
60	90 1 3 3	9	5	3	TA10
61	90 1 3 4	9	5	5	TA9,WS1
62	82 1 3 3	9	5	44	TA5,BF3,BA2
63	90 1 4 3	9	5	13	TA8,JP2
64	90 1 1 3	9	5	27	TA10
65	90 1 2 4	9	5	125	TA10
67	90 1 2 4	9	5	11	TA9,BS1
68	90 1 3 3	9	5	14	TA7,WB2,JP1
69	90 1 3 3	9	5	3	TA10
70	90 1 2 4	9	5	47	TA8,JP1,BS1
71	90 1 3 4	9	5	10	TA8,JP1,BF1
72	90 1 3 3	9	5	8	TA10
73	98 1 4 4	9	5	4	BA8,TA2

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
74	90 1 4 4	9	1	1	TA6,AS2,BF2
74	90 1 4 4	9	5	5	TA6,AS2,BF2
75	90 1 1 2	9	1	1	TA10
75	90 1 1 2	9	5	17	TA10
76	90 1 3 4	9	1	1	TA9,BF1
76	90 1 3 4	9	5	30	TA9,BF1
77	81 1 3 2	9	5	8	TA6,JP2,BF2
78	90 1 4 4	9	5	43	TA10
78	90 1 4 4	9	1	1	TA10
79	90 1 1 4	9	5	19	TA10
79	90 1 1 4	9	1	2	TA10
80	90 1 3 3	9	5	45	TA8,WB2
80	90 1 3 3	9	1	2	TA8,WB2
81	90 1 1 4	9	5	12	TA10
82	90 1 3 3	9	1	1	TA9,JP1
82	90 1 3 3	9	5	5	TA9,JP1
84	13 2 0 0	9	5	1	
85	13 2 3 4	9	5	11	BS10
85	13 2 3 4	9	1	1	BS10
86	90 1 1 2	9	5	1	TA10
87	90 1 2 4	9	1	2	TA10
88	90 1 2 4	9	1	4	TA10
89	90 1 3 4	9	5	8	TA10
90	90 1 2 4	9	1	8	TA10
91	90 1 2 4	9	1	9	TA10
92	90 1 3 2	9	1	37	TA7,BA3
93	90 1 3 2	9	1	20	TA8,BA2
93	90 1 3 2	9	5	1	TA8,BA2
94	91 1 4 4	9	5	2	TA7,WB3
94	91 1 4 4	9	1	20	TA7,WB3
95	98 1 3 3	2	1	2	BA8,TA2
95	98 1 3 3	2	5	5	BA8,TA2
96	90 1 3 3	2	1	8	TA10
98	90 1 3 3	9	1	6	TA8,JP2
98	90 1 3 3	2	5	1	TA8,JP2
98	90 1 3 3	9	5	61	TA8,JP2
98	90 1 3 3	2	1	49	TA8,JP2
99	13 2 3 4	9	5	2	BS10
100	90 1 2 4	9	1	1	TA9,BS1
100	90 1 2 4	9	5	7	TA9,BS1
100	90 1 2 4	2	1	5	TA9,BS1
101	82 1 2 4	9	5	8	TA6,BS4
102	90 1 1 4	2	1	3	TA10
102	90 1 1 4	9	5	1	TA10
103	90 1 1 3	2	1	4	TA10
104	90 1 2 2	2	1	8	TA10
105	90 1 4 3	2	5	34	TA10
106	90 1 2 3	2	5	4	TA10
108	90 1 2 4	2	5	3	TA10
110	90 1 3 2	2	1	21	TA8,BS2
111	81 1 2 4	2	1	18	TA7,JP3

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
112	90 1 3 3	2	1	44	TA8,BS2
113	13 2 3 3	2	1	44	BS9,TA1
114	13 2 3 4	2	1	63	BS10
115	81 1 2 3	2	1	25	TA7,JP2,BS1
116	04 1 0 0	2	1	7	
117	90 1 2 3	2	1	9	TA9,BS1
118	13 1 2 3	2	1	5	BS10
119	90 1 2 4	2	1	24	TA8,BS1,JP1
120	90 1 3 4	2	1	21	TA8,BS2
121	81 1 2 3	2	1	4	TA7,JP3
122	90 1 3 3	2	1	11	TA10
124	90 1 3 4	2	1	2	TA9,BS1
125	13 2 0 0	2	1	3	
126	90 1 3 4	2	1	4	TA7,BA2,BS1
127	13 2 3 4	2	1	123	BS8,TL2
128	13 2 0 0	2	1	4	
129	90 1 3 3	2	1	44	TA9,BS1
130	90 1 3 4	2	1	2	TA9,BS1
131	13 2 3 4	2	1	1	BS8,TL2
132	13 1 3 4	2	1	60	BS10
133	13 2 0 0	2	1	13	
134	90 1 3 2	2	1	161	TA10
135	82 1 2 3	2	1	12	TA7,TL2,BS1
139	90 1 2 4	2	1	56	TA9,BS1
140	90 1 2 4	2	1	1	TA9,BS1
141	90 1 1 2	2	1	42	TA10
142	16 2 3 3	2	1	78	BS6,TL4
143	90 1 2 4	2	1	29	TA8,BS2
144	13 2 3 4	2	1	152	BS8,TL2
145	31 2 3 3	2	1	135	TL7,BS3
145	31 2 3 3	9	1	1	TL7,BS3
146	90 1 3 2	2	1	13	TA10
147	90 1 1 3	2	1	28	TA10
148	90 1 2 4	2	1	68	TA9,BS1
149	90 1 3 2	2	1	34	TA6,WB2,BA2
150	53 1 3 2	2	1	5	BS6,TA4
151	13 1 0 0	2	1	8	
152	90 1 3 4	2	1	60	TA5,BA3,WB2
153	13 2 0 0	2	1	40	
154	13 2 3 4	2	1	25	BS10
155	90 1 1 3	9	5	26	TA10
155	90 1 1 3	2	1	145	TA10
156	13 1 3 4	2	1	12	BS10
158	13 1 0 0	2	1	19	
158	13 1 0 0	9	5	34	
159	90 1 3 3	9	1	1	TA10
159	90 1 3 3	9	5	207	TA10
159	90 1 3 3	2	1	140	TA10
160	90 1 2 3	2	1	22	TA8,BS2
161	13 2 3 3	9	5	5	BS10
161	13 2 3 3	2	1	51	BS10

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
162	13 2 3 3	2	1	6	BS10
163	90 1 2 4	2	1	34	TA10
164	90 1 2 4	2	1	4	TA8,BS2
165	90 1 2 3	2	1	73	TA10
166	13 1 3 3	2	1	14	BS10
167	90 1 3 3	2	1	33	TA6,WB2,BA1,WS1
169	82 1 3 2	2	1	19	TA6,BS4
170	90 1 3 4	2	1	17	TA8,BS2
171	82 1 2 3	2	1	8	TA7,BS3
172	82 1 3 4	9	5	1	TA6,BF4
172	82 1 3 4	2	1	8	TA6,BF4
173	90 1 3 1	2	1	3	TA8,BS2
173	90 1 3 1	2	5	3	TA8,BS2
173	90 1 3 1	9	5	4	TA8,BS2
174	53 1 2 3	2	5	4	BS7,TA3
174	53 1 2 3	9	5	10	BS7,TA3
176	13 1 3 3	9	5	2	BS8,TA2
177	90 1 2 4	9	5	13	TA10
177	90 1 2 4	2	1	12	TA10
180	90 1 3 3	9	5	13	TA9,BS1
181	90 1 1 2	9	5	25	TA10
182	90 1 2 3	9	5	8	TA10
182	90 1 2 3	9	1	2	TA10
183	90 1 3 3	9	5	14	TA10
184	90 1 3 4	9	5	3	TA10
185	90 1 3 4	9	5	3	TA10
186	90 1 2 2	9	5	10	TA10
187	90 1 2 4	9	5	41	TA9,JP1
188	13 1 0 0	9	5	12	
189	13 1 0 0	9	5	16	
189	13 1 0 0	2	1	18	
189	13 1 0 0	9	1	1	
190	90 1 3 3	2	1	1	TA7,BF3
190	90 1 3 3	9	5	15	TA7,BF3
191	90 1 2 3	2	1	5	TA10
192	90 1 3 4	9	5	3	TA10
193	90 1 3 3	9	5	9	TA8,BF2
194	90 1 1 2	9	5	4	TA10
194	90 1 1 2	9	1	29	TA10
196	31 2 3 4	9	5	6	TL7,BS3
197	13 2 3 4	9	5	13	BS10
198	13 2 3 4	9	5	4	BS10
199	31 1 4 4	9	5	53	TL7,BS3
200	13 1 0 0	9	5	22	
202	90 1 2 2	9	5	44	TA10
203	90 1 3 3	9	5	4	TA10
204	90 1 3 4	9	5	32	TA10
204	90 1 3 4	9	1	1	TA10
205	90 1 4 3	9	5	47	TA10
206	90 1 4 4	9	5	13	TA9,E1
207	90 1 3 4	9	1	6	TA8,E2

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
208	90 1 3 3	9	1	9	TA10
208	90 1 3 3	9	5	1	TA10
209	30 1 3 2	9	1	18	TL8,BS2
210	90 1 2 4	9	1	11	TA10
212	90 1 2 4	9	1	5	TA10
213	90 1 2 3	9	1	6	TA10
214	90 1 1 3	9	1	22	TA10
215	90 1 3 3	9	1	19	TA9,BS1
215	90 1 3 3	9	5	30	TA9,BS1
217	90 1 2 2	9	5	10	TA10
218	90 1 1 2	9	5	30	TA10
219	90 1 1 4	9	5	28	TA10
221	13 2 0 0	9	1	1	
221	13 2 0 0	9	5	77	
222	90 1 2 2	9	5	25	TA10
222	90 1 2 2	9	1	1	TA10
223	13 1 0 0	9	5	7	
224	90 1 2 4	9	5	2	TA10
225	90 1 2 3	9	1	4	TA10
226	90 1 1 2	9	1	13	TA10
227	13 2 0 0	9	1	40	
228	13 1 0 0	9	1	18	
229	90 1 2 3	9	1	15	TA10
230	13 1 0 0	9	1	110	
231	13 2 0 0	9	5	30	
232	81 1 3 3	9	5	12	TA7,JP3
233	13 1 0 0	9	5	8	
233	13 1 0 0	9	1	2	
234	30 2 3 4	9	1	3	TL10
234	30 2 3 4	9	5	7	TL10
235	81 1 2 3	9	5	8	TA6,JP4
236	81 1 3 3	9	5	2	TA7,JP3
237	90 1 2 4	9	5	6	TA10
238	90 1 1 4	9	5	18	TA10
239	90 1 3 3	9	5	9	TA10
239	90 1 3 3	9	1	1	TA10
240	90 1 2 3	9	1	11	TA10
241	90 1 2 2	9	1	5	TA10
242	90 1 2 2	9	1	1	TA10
244	31 2 3 3	2	1	27	TL7,BS3
244	31 2 3 3	9	1	4	TL7,BS3
245	13 1 0 0	9	1	2	
245	13 1 0 0	2	1	37	
246	90 1 2 2	2	1	20	TA10
247	90 1 2 3	2	1	97	TA8,BS2
248	13 1 0 0	2	1	6	
249	31 2 3 3	2	1	19	TL5,BS5
250	13 1 3 1	2	1	26	BS8,TL2
252	82 1 4 3	2	1	10	TA7,BS3
253	13 1 3 3	2	1	10	BS9,TA1
254	30 2 3 4	2	1	4	TL10

AREA LISTING FOR MU 23 TOWNSHIP 16 RANGE 61 PAGE 118

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
255	30 2 3 4	2	1	22	TL10
256	13 2 0 0	2	1	4	
257	90 1 4 4	9	5	4	TA10
700	00 0 0 0	9	5	3	
700	00 0 0 0	2	1	337	
700	00 0 0 0	9	1	3	
710	00 0 0 0	2	5	9	
710	00 0 0 0	9	5	125	
710	00 0 0 0	2	1	147	
710	00 0 0 0	9	1	9	
720	00 0 0 0	9	5	973	
720	00 0 0 0	2	1	432	
720	00 0 0 0	9	1	751	
730	00 0 0 0	2	5	17	
730	00 0 0 0	2	1	52	
800	00 0 0 0	2	5	7	
800	00 0 0 0	9	5	17	
800	00 0 0 0	2	1	20	
800	00 0 0 0	9	1	3	
810	00 0 0 0	9	5	1677	
810	00 0 0 0	2	1	1	
810	00 0 0 0	9	1	240	
815	00 0 0 0	9	5	245	
815	00 0 0 0	9	1	34	
820	00 0 0 0	2	5	5	
820	00 0 0 0	9	5	507	
820	00 0 0 0	2	1	45	
820	00 0 0 0	9	1	89	
830	00 0 0 0	2	5	19	
830	00 0 0 0	9	5	388	
830	00 0 0 0	2	1	184	
830	00 0 0 0	9	1	560	
840	00 0 0 0	2	5	34	
840	00 0 0 0	2	5	3	
840	00 0 0 0	9	5	73	
840	00 0 0 0	9	5	40	
840	00 0 0 0	9	5	27	
840	00 0 0 0	9	5	36	
840	00 0 0 0	2	1	94	
840	00 0 0 0	9	1	278	
900	00 0 0 0	2	1	8189	
900	00 0 0 0	9	1	5	

TOTAL ACRES 21278

APRIL 18 1974

FOREST RESOURCE INVENTORY
Twp. 16, Rge. 12 EPM

MAP 10

LAC DU BONNET

FOREST RESOURCE INVENTOR
Twp. 16, Rge. 12 EPI

MAP 10

LAC DU BONNET

TABLE 13

AREA LISTING FOR MANAGEMENT UNIT 23,

TOWNSHIP 16, RANGE 62

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
1	90 1 3 4	9	5	2	TA8,WB2
4	90 1 3 3	9	5	10	TA10
5	90 1 3 3	9	1	21	TA6,WB2,JP1,BS1
5	90 1 3 3	9	5	41	TA6,WB2,JP1,BS1
6	04 2 2 2	9	1	22	JP8,TA2
6	04 2 2 2	9	5	3	JP8,TA2
7	91 1 3 4	9	1	63	TA7,WB3
7	91 1 3 4	9	5	6	TA7,WB3
8	04 2 2 2	9	1	25	JP8,TA2
9	90 1 3 4	9	1	20	TA10
10	91 1 3 4	9	1	15	TA7,WB3
11	91 1 3 4	9	1	1	TA7,WB3
15	91 1 3 4	9	1	61	TA6,WB4
15	91 1 3 4	9	5	11	TA6,WB4
17	90 1 1 2	9	1	4	TA10
17	90 1 1 2	9	5	7	TA10
18	91 1 4 4	9	5	58	TA7,WB3
19	90 1 4 3	9	1	4	TA9,BF1
19	90 1 4 3	9	5	6	TA9,BF1
20	90 1 4 3	9	1	2	TA10
20	90 1 4 3	9	5	3	TA10
21	04 2 0 0	9	5	12	
22	91 1 4 4	9	1	1	
22	91 1 4 4	9	5	12	TA7,WB3
23	90 1 3 4	9	1	32	TA9,JP1
23	90 1 3 4	9	5	1	TA9,JP1
24	90 1 2 2	9	5	5	TA8,JP2
25	92 1 4 4	9	5	6	WB8,TA2
26	82 1 3 4	9	5	5	TA7,BF3
27	04 1 0 0	2	1	72	
28	90 1 1 4	2	1	46	TA10
29	90 1 3 4	9	1	17	TA6,WB2,BF2
30	90 1 3 3	2	1	3	TA10
30	90 1 3 3	9	1	6	TA10
31	90 1 3 4	9	1	18	TA8,BS1,JP1
32	90 1 1 4	9	1	15	TA10
34	82 1 3 4	2	1	119	TA7,BF2,JP1
34	82 1 3 4	9	1	8	TA7,BF2,JP1
36	13 1 0 0	2	1	5	
37	82 1 3 4	2	1	14	TA6,BF2,BS2
38	44 1 3 1	2	1	110	JP6,TA4
39	90 1 3 3	2	1	51	TA10
40	90 1 2 3	2	1	27	TA10
41	90 1 3 4	2	1	20	TA10
43	91 1 3 4	2	1	121	TA6,WB3,BF1
44	04 2 2 3	2	1	8	JP8,TA2
49	91 1 3 4	2	1	170	TA6,WB4
50	06 2 2 3	2	1	78	JP5,BS3,TA2
51	90 1 2 4	2	1	12	TA10
52	91 1 3 4	2	1	91	TA5,WB4,BF1
53	90 1 1 4	2	1	49	TA10

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
54	90 1 2 4	2	1	142	TA10
54	90 1 2 4	2	5	13	TA10
55	90 1 3 4	2	1	9	TA10
57	91 1 2 4	2	1	1	TA6,WB3,BS1
58	91 1 2 4	2	1	26	TA6,WB3,BS1
59	06 2 2 4	2	1	7	JP5,BS3,TA2
60	06 2 2 4	2	1	1	JP5,BS3,TA2
61	06 2 2 4	2	1	3	JP5,BS3,TA2
63	91 1 3 4	2	1	8	TA7,WB3
67	90 1 3 4	2	5	120	TA6,WB2,JP1,BF1
67	90 1 3 4	2	1	22	TA6,WB2,JP1,BF1
69	90 1 3 4	2	1	28	TA6,WB2,BF2
70	91 1 2 4	2	1	4	TA7,WB3
71	90 1 2 4	2	1	4	TA10
72	90 1 3 2	2	5	5	TA10
72	90 1 3 2	2	1	5	TA10
73	90 1 3 3	2	1	63	TA10
74	90 1 1 4	2	1	27	TA10
75	90 1 3 3	2	1	37	TA8,WB2
77	90 1 3 4	2	5	4	TA8,BA2
77	90 1 3 4	2	1	72	TA8,BA2
78	90 1 3 3	2	1	28	TA10
79	90 1 2 3	2	1	13	TA10
80	90 1 2 2	2	1	9	TA10
81	13 2 3 3	2	1	26	BS10
82	13 2 0 0	2	1	11	
83	90 1 3 3	2	1	27	TA9,BS1
84	90 1 1 4	2	1	16	TA10
85	90 1 3 3	2	1	41	TA9,BA1
86	90 1 1 4	2	1	8	TA10
87	13 2 3 4	2	1	12	BS9,TL1
88	13 1 3 1	2	1	21	BS8,TL2
90	90 1 1 2	2	1	76	TA10
90	90 1 1 2	2	5	26	TA10
93	90 1 3 1	2	1	32	TA9,WB1
95	13 2 3 3	2	1	24	BS10
96	90 1 1 2	2	1	282	TA10
96	90 1 1 2	2	5	32	TA10
97	13 1 0 0	2	1	10	
98	90 1 1 4	2	1	11	TA10
99	90 1 1 3	2	1	13	TA10
100	13 1 0 0	2	1	7	
101	90 1 4 3	2	1	9	TA10
102	90 1 4 3	2	1	7	TA10
104	44 2 4 2	2	1	11	JP7,TA3
104	44 2 4 2	2	5	30	JP7,TA3
105	13 2 2 2	2	5	8	BS8,TA2
106	90 1 3 4	2	5	42	TA8,WB1,JP1
106	90 1 3 4	9	5	52	TA8,WB1,JP1
106	90 1 3 4	9	1	143	TA8,WB1,JP1
106	90 1 3 4	2	1	343	TA8,WB1,JP1

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
107	13 2 3 4	2	1	14	BS10
108	04 1 0 0	9	1	6	
108	04 1 0 0	2	1	69	
109	13 1 0 0	2	1	10	
110	90 1 1 4	2	1	47	TA10
111	13 1 3 3	9	1	5	BS10
111	13 1 3 3	2	1	6	BS10
112	90 1 3 4	2	1	4	TA8,BS2
112	90 1 3 4	2	5	1	TA8,BS2
113	13 2 3 3	2	1	116	BS8,TL2
113	13 2 3 3	2	5	2	BS8,TL2
118	90 1 2 2	9	5	12	TA10
121	13 2 0 0	2	1	22	
122	90 1 3 4	2	1	7	TA10
122	90 1 3 4	9	5	9	TA10
124	90 1 3 3	9	5	6	TA10
124	90 1 3 3	2	1	1	TA10
124	90 1 3 3	2	5	4	TA10
125	90 1 3 3	9	5	5	TA10
126	90 1 3 4	9	5	3	TA7,BA3
128	90 1 3 3	9	5	6	TA10
128	90 1 3 3	2	1	1	TA10
130	90 1 3 4	9	1	96	TA8,WB2
131	90 1 1 4	9	1	2	TA10
133	90 1 1 4	9	1	2	TA10
135	90 1 3 4	9	1	1	TA8,WB2
136	90 1 4 4	9	5	22	TA8,BA2
137	90 1 3 3	9	5	1	TA10
139	90 1 3 3	9	5	2	TA9,JP1
139	90 1 3 3	2	1	39	TA9,JP1
140	90 1 3 3	2	1	1	TA9,JP1
143	98 1 3 3	9	5	4	BA8,TA2
146	13 2 2 4	9	5	11	BS10
147	90 1 3 3	9	5	18	TA10
148	90 1 1 3	9	5	22	TA10
148	90 1 1 3	2	1	48	TA10
149	90 1 1 3	2	1	11	TA10
151	90 1 2 3	2	1	40	TA10
153	13 2 3 3	9	5	12	BS10
154	13 2 2 3	2	1	7	BS10
155	13 1 0 0	2	1	3	
156	04 1 0 0	2	1	50	
157	90 1 3 3	9	5	3	TA10
157	90 1 3 3	2	1	3	TA10
158	90 1 3 2	2	1	1	TA10
158	90 1 3 2	9	5	31	TA10
159	90 1 2 2	2	1	15	TA10
160	13 2 3 3	2	1	26	BS10
163	90 1 1 4	2	1	17	TA10
164	81 2 2 3	2	1	16	TA7,JP3
165	90 1 1 3	2	5	5	TA10

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
165	90 1 1 3	2	1	28	TA10
166	90 1 3 4	2	1	5	TA10
167	90 1 3 4	2	5	18	TA8,BA2
167	90 1 3 4	2	1	44	TA8,BA2
168	90 1 1 2	2	1	6	TA8,JP2
169	90 1 3 4	2	1	334	TA9,JP1
169	90 1 3 4	2	5	148	TA9,JP1
170	90 1 3 2	2	1	5	TA6,BA4
171	81 2 2 3	2	1	31	TA7,JP3
172	13 1 3 3	2	1	7	BS10
172	13 1 3 3	2	5	11	BS10
173	90 1 3 2	2	5	12	TA10
173	90 1 3 2	2	1	1	TA10
174	90 1 3 4	2	1	4	TA10
174	90 1 3 4	2	5	6	TA10
175	90 1 3 3	2	5	6	TA10
175	90 1 3 3	2	1	4	TA10
176	90 1 2 4	2	1	2	TA10
176	90 1 2 4	2	5	6	TA10
177	90 1 1 3	2	5	3	TA10
178	90 1 2 4	2	5	7	TA10
179	90 1 3 2	2	1	3	TA10
180	13 2 3 4	2	1	13	BS10
181	53 1 2 4	2	1	8	BS6,TA4
182	90 1 4 3	2	1	55	TA6,AS2,BF2
183	44 2 2 3	2	1	70	JP7,TA3
184	90 1 3 4	2	1	84	TA8,JP2
185	44 2 2 3	2	1	19	JP7,TA3
187	81 1 2 4	2	1	17	TA6,JP4
189	91 1 3 3	2	1	4	TA6,WB4
190	91 1 3 4	2	1	17	TA6,WB4
191	90 1 3 4	2	5	8	TA10
191	90 1 3 4	2	1	110	TA10
192	10 1 0 0	2	1	13	
193	90 1 3 4	2	1	24	TA10
194	90 2 2 2	2	5	13	TA10
196	92 1 3 3	2	1	9	WB8,TA2
197	92 1 4 4	2	5	12	WB6,TA2,BF2
197	92 1 4 4	2	1	2	WB6,TA2,BF2
199	90 1 3 3	2	5	61	TA6,WB2,JP2
202	90 1 3 4	2	5	18	TA8,BS2
206	82 1 4 3	2	1	1	TA5,WB2,BF3
206	82 1 4 3	2	5	34	TA5,BF3,WB2
210	90 1 2 2	2	5	2	TA10
211	53 1 3 4	2	5	3	BS7,TA3
215	90 1 3 4	2	1	5	TA10
215	90 1 3 4	2	5	18	TA10
217	90 1 2 4	2	5	8	TA9,BS1
217	90 1 2 4	2	1	97	TA9,BS1
219	90 1 3 2	2	1	5	TA10
220	82 1 3 4	2	1	4	TA7,BF3

STAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
220	82 1 3 4	2	5	1	TA7,BF3
222	82 1 3 4	2	1	11	TA7,BS3
223	90 1 2 4	2	1	1	TA9,BS1
224	90 1 2 3	2	1	16	TA10
225	90 1 3 4	2	1	7	TA10
226	90 1 4 3	2	5	12	TA10
227	90 1 1 4	2	5	4	TA10
229	90 1 1 4	2	1	1	TA10
232	90 1 2 3	2	1	8	TA8,JP2
233	90 1 3 3	2	1	2	TA10
234	82 1 3 4	2	1	4	TA7,BS3
235	90 1 2 4	2	1	1	TA10
236	90 1 2 4	2	1	9	TA9,JP1
238	90 1 2 4	2	1	2	TA10
239	90 1 3 4	2	5	15	TA8,JP2
241	90 1 2 3	2	1	9	TA10
241	90 1 2 3	2	5	2	TA10
242	90 1 3 4	2	1	9	TA10
243	90 1 3 4	2	5	1	TA8,BS2
244	90 1 3 4	2	5	7	TA10
245	90 1 3 4	2	5	205	TA9,JP1
245	90 1 3 4	2	1	106	TA9,JP1
246	90 1 1 2	2	1	1	TA10
246	90 1 1 2	2	5	24	TA10
249	90 1 1 4	2	5	1	TA10
249	90 1 1 4	2	1	15	TA10
250	90 1 1 4	2	1	2	TA10
250	90 1 1 4	2	5	6	TA10
251	13 1 0 0	2	1	54	
252	90 1 1 1	2	1	4	TA10
253	13 1 0 0	2	1	8	
253	13 1 0 0	2	5	1	
256	90 1 4 4	2	5	1	TA9,BF1
256	90 1 4 4	9	1	32	TA9,BF1
257	90 1 2 3	9	1	3	TA10
259	82 1 2 3	9	1	54	TA7,BS3
259	82 1 2 3	2	1	10	TA7,BS3
261	90 1 3 4	2	5	12	TA8,BS2
261	90 1 3 4	9	1	6	TA8,BS2
262	90 1 3 3	2	1	5	TA9,BS1
263	90 1 4 4	2	1	146	TA9,BS1
263	90 1 4 4	2	5	1	TA9,BS1
263	90 1 4 4	9	1	40	TA9,BS1
264	13 1 3 3	2	1	5	BS8,TA2
265	82 1 3 4	2	1	30	TA7,BS3
266	31 2 2 4	2	1	177	TL6,BS4
266	31 2 2 4	9	1	1	TL6,BS4
267	13 1 0 0	2	1	27	
268	15 2 3 2	9	5	82	BS6,TL4
268	16 2 3 2	2	1	89	BS6,TL4
269	90 1 4 4	2	1	17	TA9,BS1

LAND	COVER TYPE	STAT	OWN	AREA	SPECIES COMP
270	90 1 3 4	2	1	21	TA8,BF1,BS1
271	90 1 2 3	9	1	5	TA10
273	13 1 0 0	2	1	32	
274	13 2 3 4	2	1	30	BS10
275	13 2 3 4	2	1	1	BS10
276	82 1 3 4	2	1	10	TA7,BS3
277	13 2 3 3	2	1	36	BS8,TL2
278	16 2 3 3	2	1	4	BS6,TL4
280	90 1 2 4	2	1	6	TA10
700	00 0 0 0	2	1	511	
700	00 0 0 0	2	5	62	
700	00 0 0 0	9	5	103	
700	00 0 0 0	9	1	3	
710	00 0 0 0	2	1	179	
710	00 0 0 0	2	5	24	
710	00 0 0 0	9	5	28	
710	00 0 0 0	9	1	80	
720	00 0 0 0	2	1	944	
720	00 0 0 0	2	5	68	
720	00 0 0 0	9	5	61	
720	00 0 0 0	9	1	10	
730	00 0 0 0	2	5	12	
730	00 0 0 0	2	1	23	
800	00 0 0 0	2	1	110	
800	00 0 0 0	2	5	99	
800	00 0 0 0	9	5	6	
800	00 0 0 0	9	1	5	
810	00 0 0 0	2	1	108	
810	00 0 0 0	2	5	63	
810	00 0 0 0	9	5	864	
810	00 0 0 0	9	1	146	
820	00 0 0 0	9	1	31	
820	00 0 0 0	2	1	160	
820	00 0 0 0	9	5	413	
820	00 0 0 0	2	5	406	
830	00 0 0 0	2	5	61	
830	00 0 0 0	9	5	20	
830	00 0 0 0	9	1	45	
830	00 0 0 0	2	1	688	
840	00 0 0 0	2	5	42	
840	00 0 0 0	9	5	40	
840	00 0 0 0	9	1	137	
840	00 0 0 0	2	1	161	
900	00 0 0 0	2	1	9691	

TOTAL ACRES 22616

APRIL 18 1974

length of road required. Hence it was necessary to obtain additional base line data relevant to actual physical potential.

B. Step II

Following on the decision to proceed with a more detailed analysis of the north shore of Lac du Bonnet, the in-office analysis concentrated on securing readily available data on

i. Climate;

ii. Fish;

iii. Wildlife (ungulates);

iv. Registered traplines;

v. Archaeological sites;

vi. Land tenure and land use:

(a) Dwellings,

(b) Water licensing area,

(c) Timber berth,

(d) Wild rice cultivation;

vii. Water quality:

(a) Turbidity,

(b) Drainage patterns,

(c) Wave patterns

(d) Movement of water;

viii. Canada Land Inventory Recreation Capability Map;

ix. Soils:

(a) General description,

(b) Soil capability for agriculture;

x. Calculations of the developmental capability of the water Area:

(a) Boat-limit system; and

xi. Canada Land Inventory Water Fowl Capability Map.

1. Climate

The area has subhumid temperature climate, characterised by warm summers and cold winters. The mean monthly temperatures along the Winnipeg River range from -17°C in January to 20°C in July. The transition between seasons is short with April being the month when the change from winter to summer occurs, while October holds the change from summer to winter. Wind velocity varies greatly, however, due to the size of the lake. Wind forces of 20 k.p.h. to 25 k.p.h. are common with 60 k.p.h. gales during storms. Temperatures are particularly variable in the spring and fall when the area is affected by frequent frontal disturbances between cold air from the north and warm dry air from the south. The average frost-free period ranges between 111 and 127 days with the average being 114. The precipitation is about 50 centimetres. Rainfall has fluctuated from 11 centimetres in June 1949 to 25.3 centimetres in June 1961. Total yearly precipitation has ranged from 31.3 centimetres in 1961 to 67.3 centimetres in 1950.

2. Fish

Due to its size, Lac du Bonnet supports a large variety of fish. Major species are

i. Walleyed Pike

ii. Sauger

iii. Mooneye

iv. Northern Pike

v. White Bass

vi. Goldeye

vii. Whitefish

viii. Perch

ix. Bullhead

x. Sturgeon

Of these, walleyed pike, northern pike and perch are the most sought after game fish.

3. Wildlife (Ungulates)

Development of the north shore of Lac du Bonnet presents a series of factors with a direct impact on ungulates. Both moose and deer are greatly affected by access roads and shoreline accessibility. Moose concentrate in the more northern and eastern areas, around Anson Lake. They are scattered throughout the region and, depending on the severity of the winters,range widely in order to browse. Since development would be restricted to the shoreline, a direct impact through development should be minimal. However, with improved access, hunting pressure will increase. Deer have a fairly high concentration along the ash swamps. This apparently is the best wintering area for the white-tailed deer. Increased hunting pressure due to development will have an effect on the deer.

Moose are not tolerant of Man, especially in feeding zones. In order to deal with this problem, habitat areas should be recognised and thus avoided. Populations are concentrated in and about the Anson

Lake area. Deer are well adapted to the presence of Man. However, development does reduce the amount of range and also permits a higher success rate during the hunting season. Proper management should ensure a constant deer population due to the extreme adaptability of this animal. A study should be made to identify yarding areas and prime browsing zones. Development should avoid these areas.

According to the C.L.I. Land Capability for Wildlife this area is classified as having very slight to slight limitations on the production of ungulates (Map 11).

The only limiting factors suggested are

i. Climate : severe climate reduced habitat for production and survival of ungulates.

ii. Fertility : lack of nutrients in the soil for optimum plant growth.

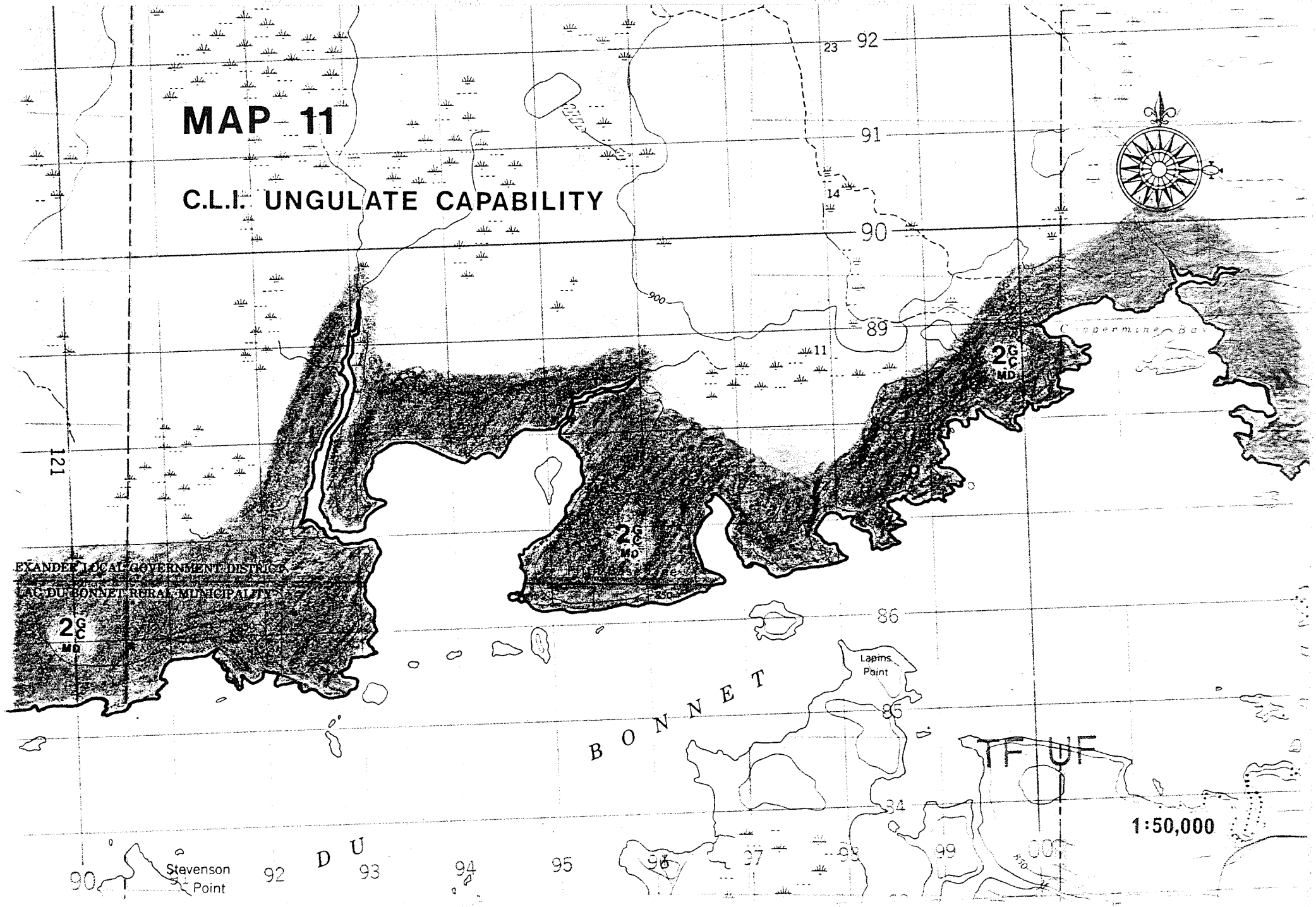
iii. Land Form : poor distribution of landforms for optimum ungulate habitat. It can be seen,accordingly, that the area itself is not prime for moose and deer capability, but it is very definitely close to the prime habitat in the general vicinity of Anson Lake. Thus, proper care must be taken to avoid disturbing any migration that may occur.

4. Registered Traplines

The number of fur crops reported in the Fur and Game Crop Census and General Report [1] is inaccurate in its assessment of the actual

---

[1]Personal Communication from Mr. R. Carmichael, Fur Program Co-ordinator, Wildlife Section, Manitoba Department of Mines, Natural Resources and Environment.


MAP 11
C.L.I. UNGULATE CAPABILITY
92
91
90
89
86
85
84
121
2 GC MD
2 GC MD
2 GC MD
EXANDER LOCAL GOVERNMENT DISTRICT
AC DU BONNET RURAL MUNICIPALITY
Lapins Point
BONNET
TF UF
1:50,000
Stevenson Point
90
92
93
94
95
96
97
99
D U

number of fur bearers in the area. Many variables are involved. Weather conditions affecting the wildlife would limit food supplies. This would vary seasonally, but would help determine whether trapping efforts would be successful.

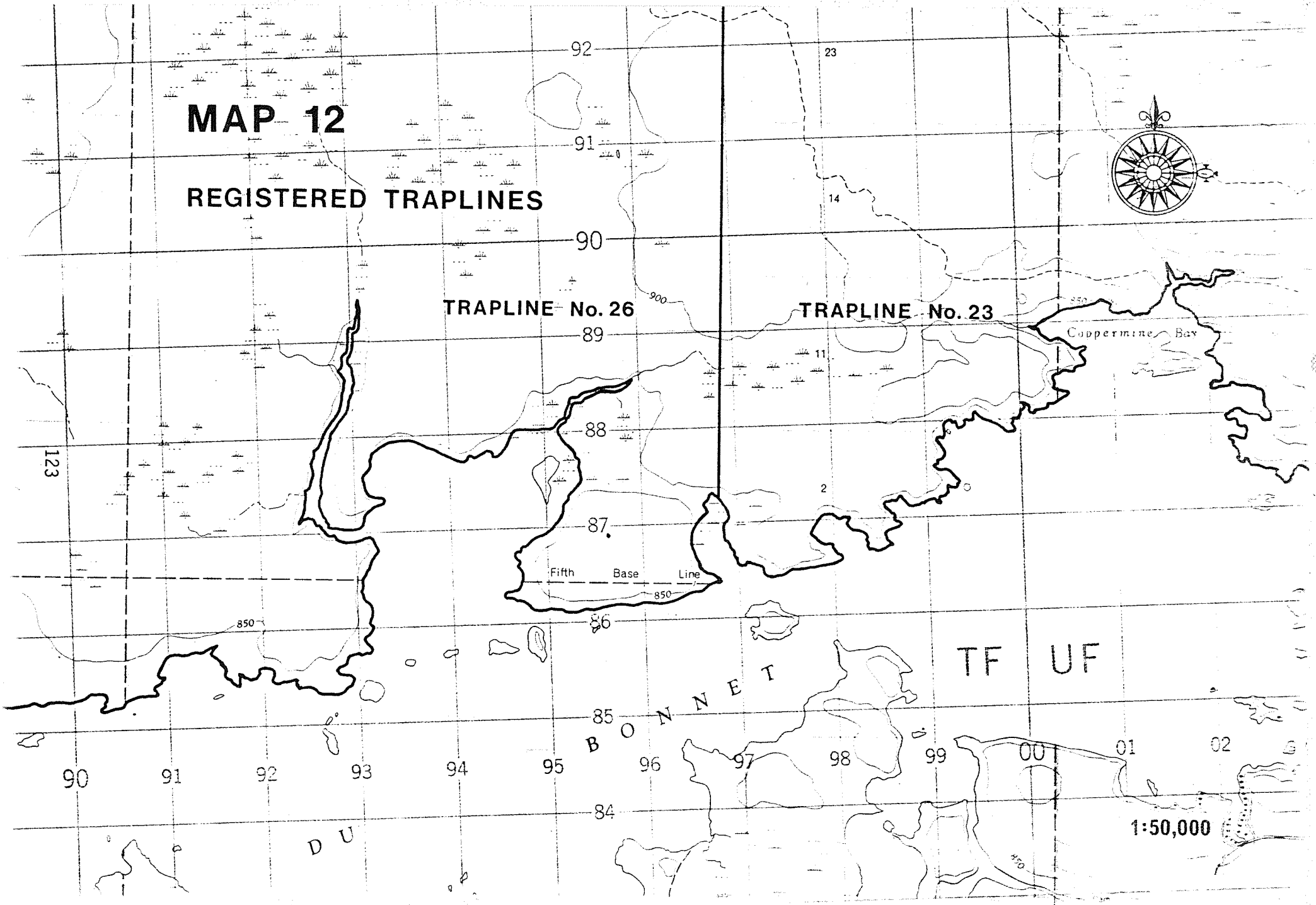
There are two Registered Traplines that reach the north shore area and which, in total, include a total of 26 trappers (Map 12).

Registered trapline # 23, run by one individual, and trapline # 26, run by 25 individuals (with approximately 40 trappers using it).

TABLE 14

FUR CROPS OF REGISTERED TRAPLINES, 1976-77

Fur Crops	Trapline # 23	Trapline # 26
Beaver		448
Coyote		18
Ermine		119
Fisher	1	16
Fox Cross		1
Fox Red		3
Lynx		3
Mink	2	101
Muskrat	1	90
Otter		34
Racoon		1
Squirrel	9	274
Wolf		5
Value	$ 146.99	$ 18,645.62


MAP 12
REGISTERED TRAPLINES
TRAPLINE No. 26
TRAPLINE No. 23
Coppermine Bay
Fifth Base Line
BONNET
TF
UF
DU
1:50,000
92
91
90
89
88
87
86
85
84
123
90
91
92
93
94
95
96
97
98
99
00
01
02
23
14
11
2
900
850

It can be seen from Table 14 that the community trapline was very active resulting in production amounting to over $18,000 for the 1976/77 trapping season. If development is decided on it is recommended that migration and habitat studies be undertaken before implementation of the development. Registered Trapline owners and wildlife program co-ordinators should be contacted for comments.

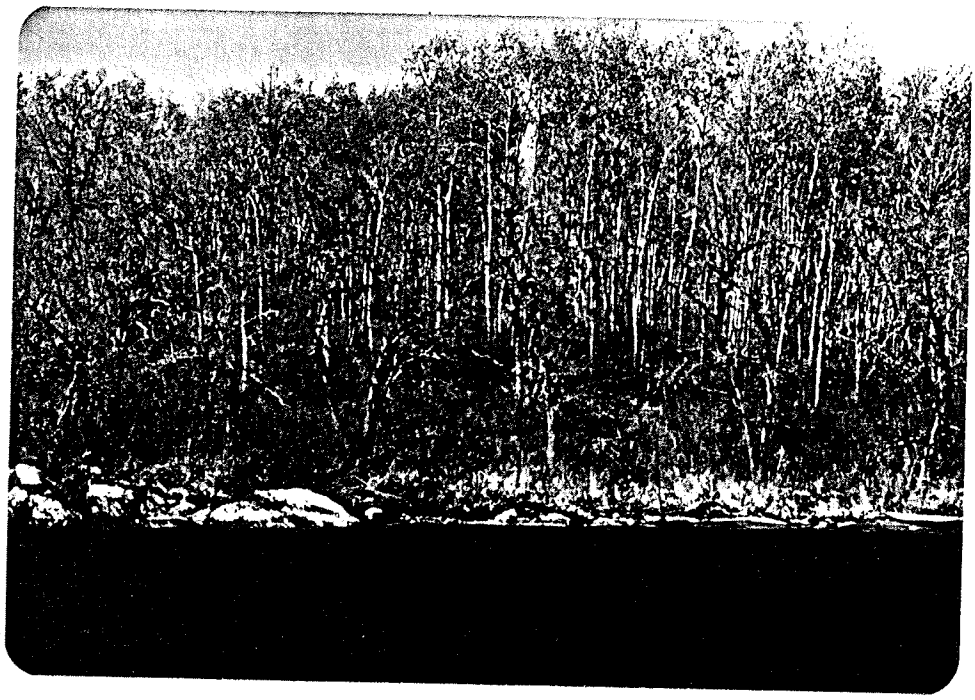


PHOTO 10

TYPICAL SHORELINE

5. Archaeological Sites

Two sites have been inventoried to date according to Leo Pettipas, Staff Archaeologist, Manitoba Historic Resources Branch. One site is immediately west of the McArthur Falls Dam along the west shore of the bay, and the second site is along the north bank of the mouth of the

Bird River. It is Mr. Pettipas's prediction that a considerable number of archaeological sites would be found along the shoreline if a concerted attempt was made to find them. The recorded number of sites at this time should in no way be considered reflective of what is actually there. It is recommended that a field study be undertaken in the area to ascertain the whereabouts and distribution of archaeological sites to assist in determining where cottage subdivisions and other recreational facilities should be developed.

PHOTO 11

TYPICAL SHORELINE SHOWING SLOPES, DRAINAGE AND VEGETATION ARE COMPATIBLE WITH DEVELOPMENT

6. Land Tenure and Land Use

a. Dwellings: There are a number of summer homes and private lands where recreational activities take place. A number of cabins exist along the north shore of Lac du Bonnet which are reported to be in good condition. They are located on private land and in areas occupied by summer house permit-holders. There are also a few trapping cabins located in this study area.

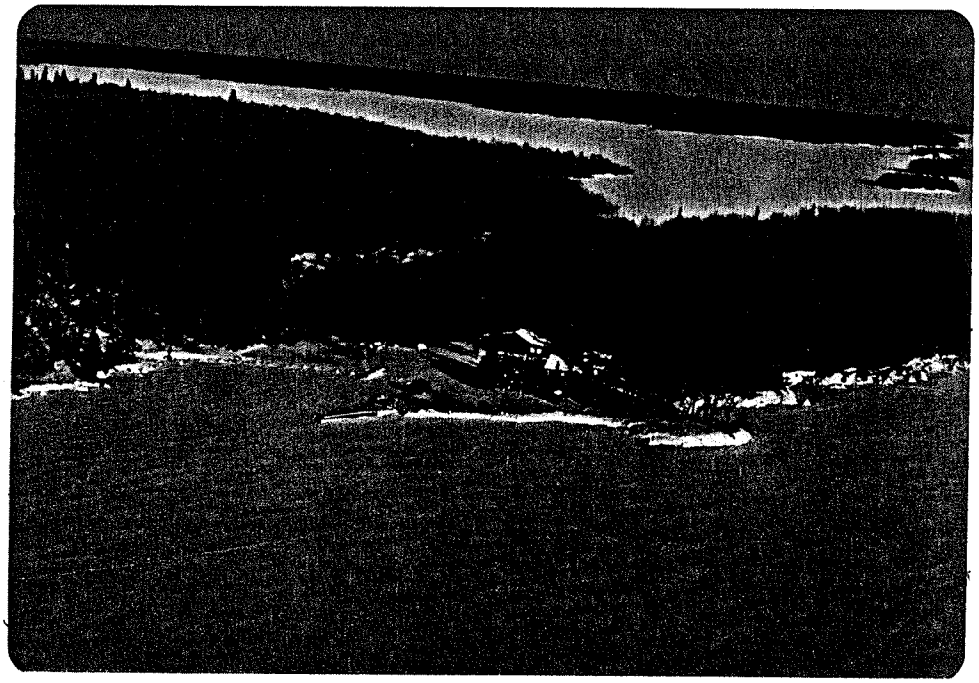


PHOTO 12

NORTH SHORE, LAC DU BONNET

b. Water Licencing Area: In association with the dams along the Winnipeg River system, water power on water licencing areas have been designated for the Lac du Bonnet area. The McArthur Falls licence area

affects Lac du Bonnet. Development within a water licencing area or water power reserve must be evaluated by the Manitoba Water Resources Division and by Manitoba Hydro.

c. Timber Berth: The study area is within Abitibi's cutting berth A. It is an area considered for future timber operations. The area also has some forestry roads and bush trails. The condition of these trails is poor. Further development must consider the resultant impact on the forestry resource.

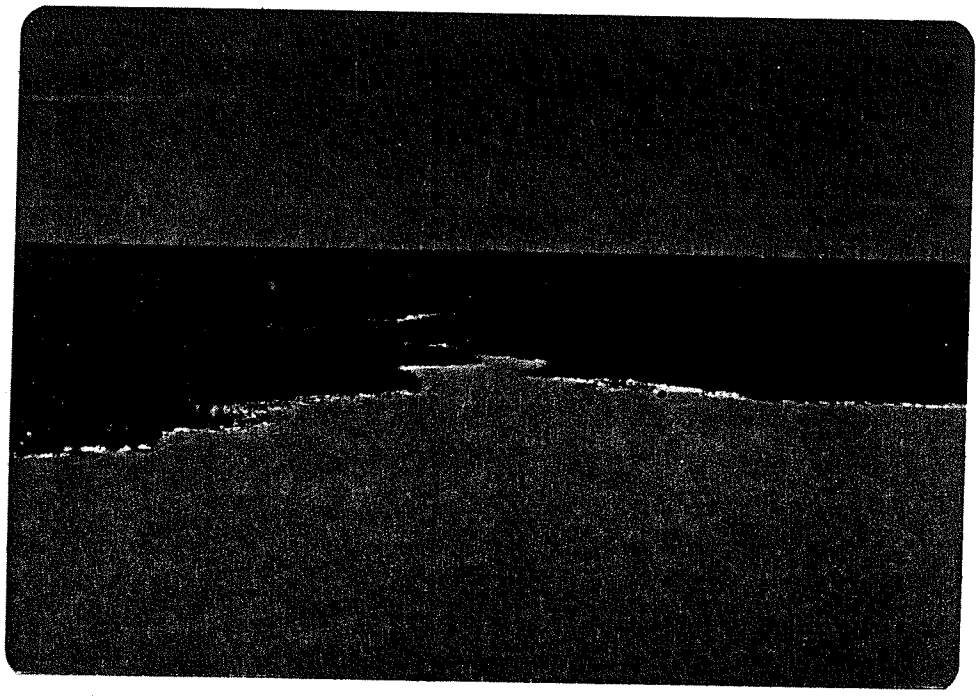


PHOTO 13

TYPICAL BAY WHERE WILD RICE COULD BE EXPECTED TO GROW IN SHALLOW WATER. THE STREAM-MOUTH IS ALSO A FISH SPAWNING AREA AND, AS SUCH, DEVELOPMENT SHOULD NOT DISRUPT THIS AREA

d. Wild Rice Cultivation: Wild rice cultivation does take place within the study area. In the vicinity of Hay Bay lies wild rice number 106. Future development must avoid wild rice bays.

7. Water Characteristics

a. Turbidity: Lac du Bonnet has a low to moderate turbidity rate, indicating a slow flushing effect. Turbidity has a psychological effect which may decrease the aesthetic value of the lake. In areas where bank erosion is evident, silt became a problem because of the slow flushing quality.

PHOTO 14

WATER COLOUR IS INFLUENCED BY TURBIDITY

b. Drainage Patterns: Most of the small streams located on the north shore flow north to south and are dry in the fall and active during spring runoff. These streams serve as drainage points for several large swamps immediately north of the study area.

c. Wave Patterns and Navigability: Lac du Bonnet is susceptible to the prevailing north-west winds. It is significant to note that this presents a potential hazard to small craft, particularly canoes. Lac du Bonnet is a shallow lake averaging six metres in depth. However, sunken islands and reefs are present along the north shore, especially in and around existing islands.

d. Movement of Water: Lac du Bonnet, due to its slow flushing action, has a minimal amount of current. Major danger areas are in the vicinity of McArthur Falls.

As part of a large drainage network, Lac du Bonnet's large size tends to dilute the physical and chemical effluents. As such, continuous monitoring may be required. Fish populations can and do disperse in response to toxic or disagreeable substances. Thus, only benthic organisms with a specific habitat preference and limited mobility are continuously affected by substances entering their environment. As such, these organisms act as "biological indicators" and reflect, by their presence and densities, both past and present conditions in water quality.

Along the south shore of Lac du Bonnet there are approximately 200 summer residences. This does not include campground and trailer village sites, or include Lac du Bonnet townsite. If these factors are considered, the number of dwellings, both winter and summer occupancy,

would rise to 1,300 units. In many of these instances the additional pressures of campers and cottagers could be a source of concern with regard to water quality. Also, farms in the vicinity, particularly cattle operations (be it dairy or beef) also contribute to ground water pollution which in turn affects the entire water source.

It is recommended that a complete study of existing treatment facilities be done, including a comprehensive study of seasonal homes and farms. Strict regulations should be enforced to prevent changes in existing development that do not meet standards, while similar regulations should be made mandatory for new development.

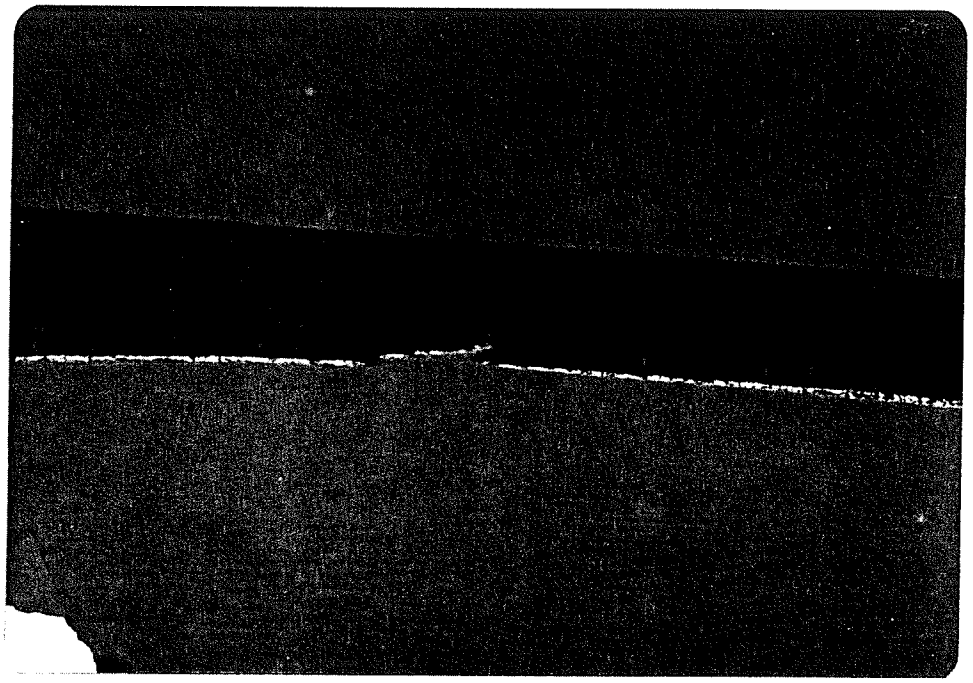


PHOTO 15

INTERMITTENT STREAM, ENTERING THE LAKE,

WHICH PROVIDES DRAINAGE TO THE BACK SHORE

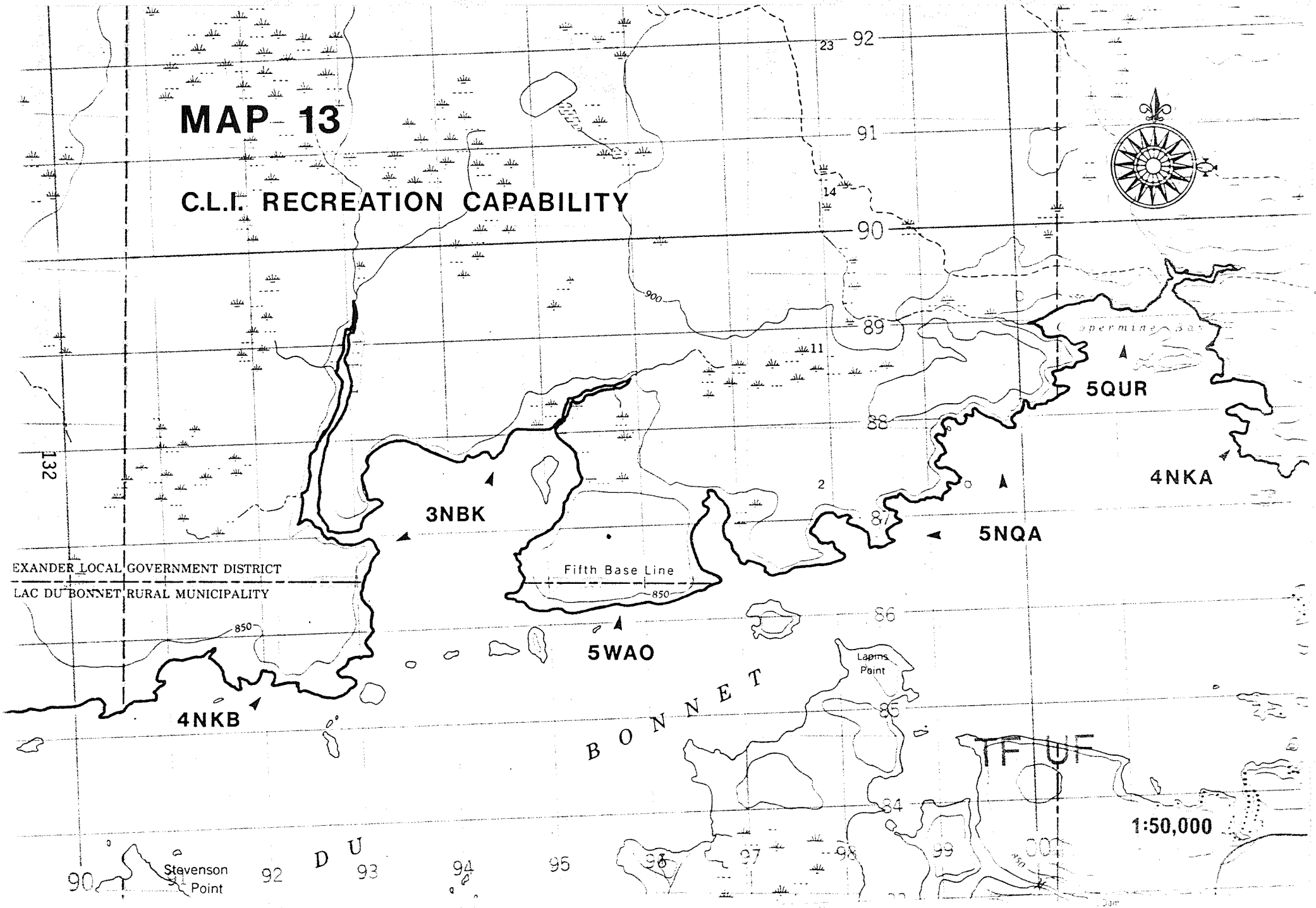
TABLE 15

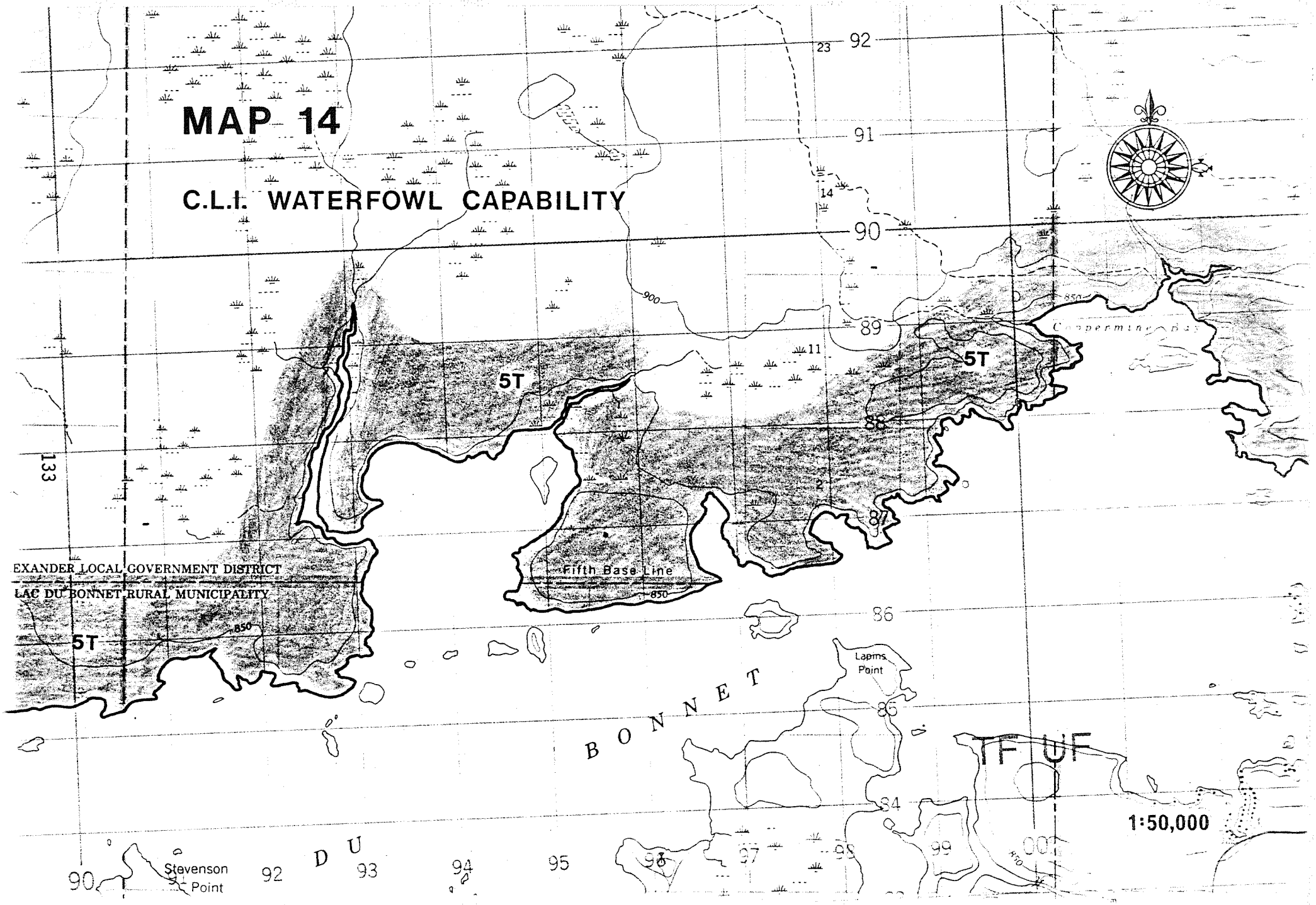
GUIDE TO THE CANADA LAND INVENTORY MAP LEGEND:

RECREATION FEATURES

A. Angling	N. Lodging
B. Beach	O. Upland Wildlife
C. Canoeing	P. Cultural Landscape Pattern
D. Deep Inshore Water	Q. Topographic Pattern
E. Vegetation	R. Rock Formations
F. Waterfalls and Rapids	S. Skiing Area
G. Glaciers	T. Thermal Springs
H. Historic Sites	U. Deep Water Boating
J. Gathering and Collecting	V. Viewing
K. Organized Camping	W. Wetland Wildlife
L. Landforms	Y. Family Boating
M. Small Surface Waters	Z. Man-made Features

1. Very high capability to attract and sustain intensive recreational use.
2. High capability to attract and sustain intensive recreational use.
3. Moderate capability to attract and sustain intensive recreational use.
4. Moderate capability to attract and sustain intensive recreational use.
5. Moderately low capability to attract and sustain intensive recreational use.
6. Low capability to attract and sustain intensive recreational use.
7. Very low capability to attract and sustain intensive recreational use.


MAP 13
C.L.I. RECREATION CAPABILITY
5QUR
4NKA
3NBK
5NQA
5WAO
4NKB
Fifth Base Line
EXANDER LOCAL GOVERNMENT DISTRICT
LAC DU BONNET RURAL MUNICIPALITY
BONNET
Lapins Point
Stevenson Point
1:50,000


MAP 14
C.L.I. WATERFOWL CAPABILITY
5T
5T
5T
Fifth Base Line
EXANDER LOCAL GOVERNMENT DISTRICT
LAC DU BONNET RURAL MUNICIPALITY
Lapins Point
Stevenson Point
BONNET
1:50,000

8. Soils

a. General Description: The north shore occupies a general soil type referred to as Indian Bay Complex. This general soil area occurs in the Precambrian Drift Plain and occupies about twelve per cent of the area. This strongly glaciated area is recognised by its characteristic outcrops of granite and the marked local relief with trees, ringed lakes or tree-covered organic soils in the depression. Associated with the rock outcrops are a complex of podzolic, ilysilic and organic soils developed on drift and peat deposits. Soils are variable as to mode of deposition, mineralogical composition, drainage

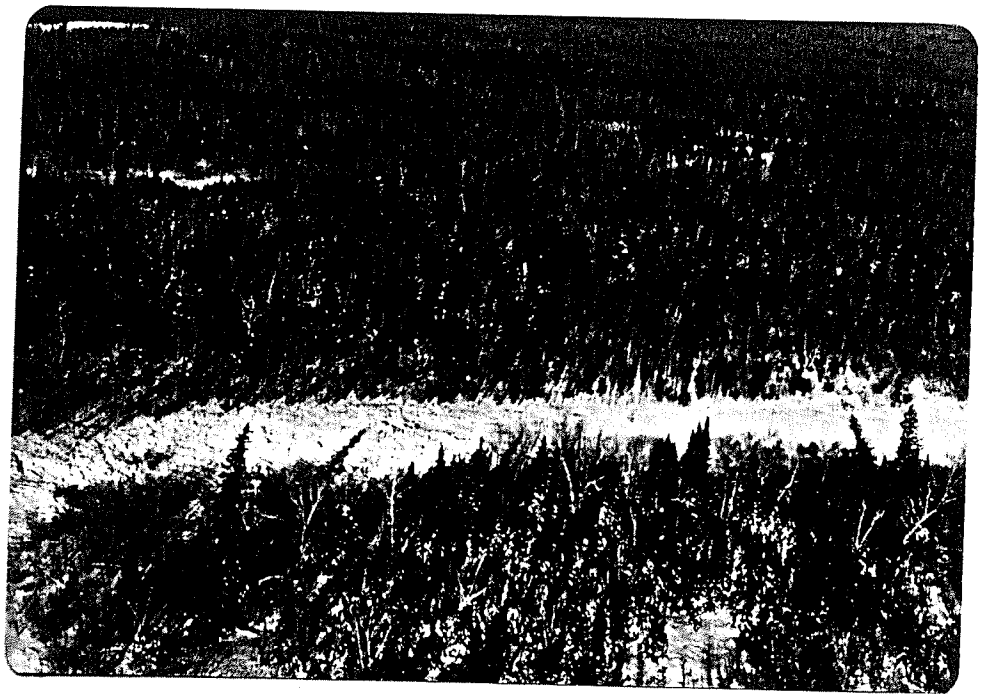


PHOTO 16

BLACK SPRUCE AND TAMARACK

ON POORLY DRAINED SOILS (ORGANIC)

and stoniness. Native vegetation is chiefly mixed boreal forest on better-drained sites, while black spruce and tamarack occur on organic soils.

The Indian Bay Complex consists of approximately 75% granitoid rock outcrop, 10% of well- to imperfectly-drained grey wooded and podzol soils and 15% of very poorly-drained humic gleysol, gleysol, eluviated gleysol, shallow and deep peat soils. Most of the mineral soils in this complex have been developed on lacustrine clay deposits and thin lacustrine clay over a stony till. Some have been derived from acidic granitoid rocks and are extremely stony. The topography varies from irregular gently sloping to steeply sloping. The native vegetation varies mainly with drainage and consists of jack pine on the rocky knolls; mixed stands of aspen, jack pine, white spruce, balsam fir and white birch on the more moist mineral soil sites; and black spruce and tamarack on wet organic soils. Soil series in this complex include Lettonia, Arborg, Thalberg, Peguis till substrate phase, Pine Valley till substrate phase, Fyala, Fyala till substrate phase and Telford soils.[1]

b. Soil Capability for Agriculture: The north shore is dominated by two basic classifications, as will be mentioned later. The study area has undergone severe glaciation resulting in base rock outcrops and shallow depression, and thus poor soils for agriculture. As such, the soil in the area has no capability for arable culture or permanent pasture.

---

[1] R.E. Smith, W.A. Ehrlich and S.C. Zoltai, Soils of the Lac du Bonnet Area. Manitoba Soil Survey. Soils Report No. 15. (Winnipeg: Manitoba, Department of Agriculture, 1967), p.54.

As in the second large bay west of Coppermine Bay (generally known as Hay Bay), the area of study is dominated by $_7 \frac{2}{\frac{P}{R}}$ classification.[1]

A variable class description for the area is given for its potential. The area has no capability, with bare rock and stones interfacing with tillage, planting and harvesting. The area is shallow with solid bedrock less than one metre from the surface. The area around Coppermine Bay is classified as being $7 \frac{R}{W}$.

10. Calculations of the Developmental Capability of the Water Area

The criteria used for calculating capacity used variables such as shoreline, surface area and outlay of the lake island. Since the north shore has many bays and inlets which are sheltered from the prevailing north-westerly wind, a greater number of boats could be sustained here than along a smooth lake shore.

To calculate the approximate number of cottage sites the north shore could assume, the Ontario Lake Alert System[2] as it pertains to

---

[1]This classification is given by the C.L.I. for agriculture capability.

7 - soils have no capability for arable culture or permanent pasture.

2 - soils have moderate limitations that restrict the range of crops or require special conservative practices.

P - stoniness - stones interfere with tillage, planting and harvesting.

R - shallowness to solid bedrock - solid bedrock is less than three feet from the surface.

W - excess water - other than from flooding limits use for agriculture; may be due to poor drainage, a high water table, seepage or runoff.

[2]The Lake Alert System is a methodology used by the Province of Ontario to determine developmental capability for specific lakes. The procedure is based on subjective values. However, those values are applied consistently. It is a guideline approach and in no way should be regarded as a definitive scientific method.

PHOTO 17

SOIL PROFILE

boat limits was used. The procedure and results follow.

a. Capacity Calculations

i. Boat limit system

Calculations based on the Lake Alert System

North shoreline (approximately, within a mile)	:	21.5 miles long.
Islands' shoreline	:	7.0 miles approx.
Total shoreline	:	28,5 miles

ii. Calculate the net acreage

(a) Using 200-foot band around the shore.

5,280 x 21.5 = 113,520

113,520 x 200 band = 22,704,000 sq.ft.

(b) Using 100-foot band around all non-subdivided islands.

5,280 x 7 = 36,960

36,960 x 100 band = 3,696,000 sq. ft.

(c) 22,704,000 sq. feet
3,696,000 sq. feet

26,400,000 sq.feet

(d) 1 acre = 43,360 sq. feet
Lac du Bonnet = 23,296 acres

$43\overline{)26400000}$ 608 acres (approximate within 1 acre)

(e) 23,296 gross acreage
-608 acres
22,688 net acreage

(f) The instantaneous boat capacity.

$$\frac{22688 \text{ net acreage}}{10 \text{ acres per boat}}$$

(g) 2,268 boats (maximum)

(h) The capacity in cottages

$$\frac{2{,}268}{2 \text{ boats per cottage}} = 1{,}134 \text{ cottages maximum, including all islands and all shoreline, north shore.}$$

C. Step III

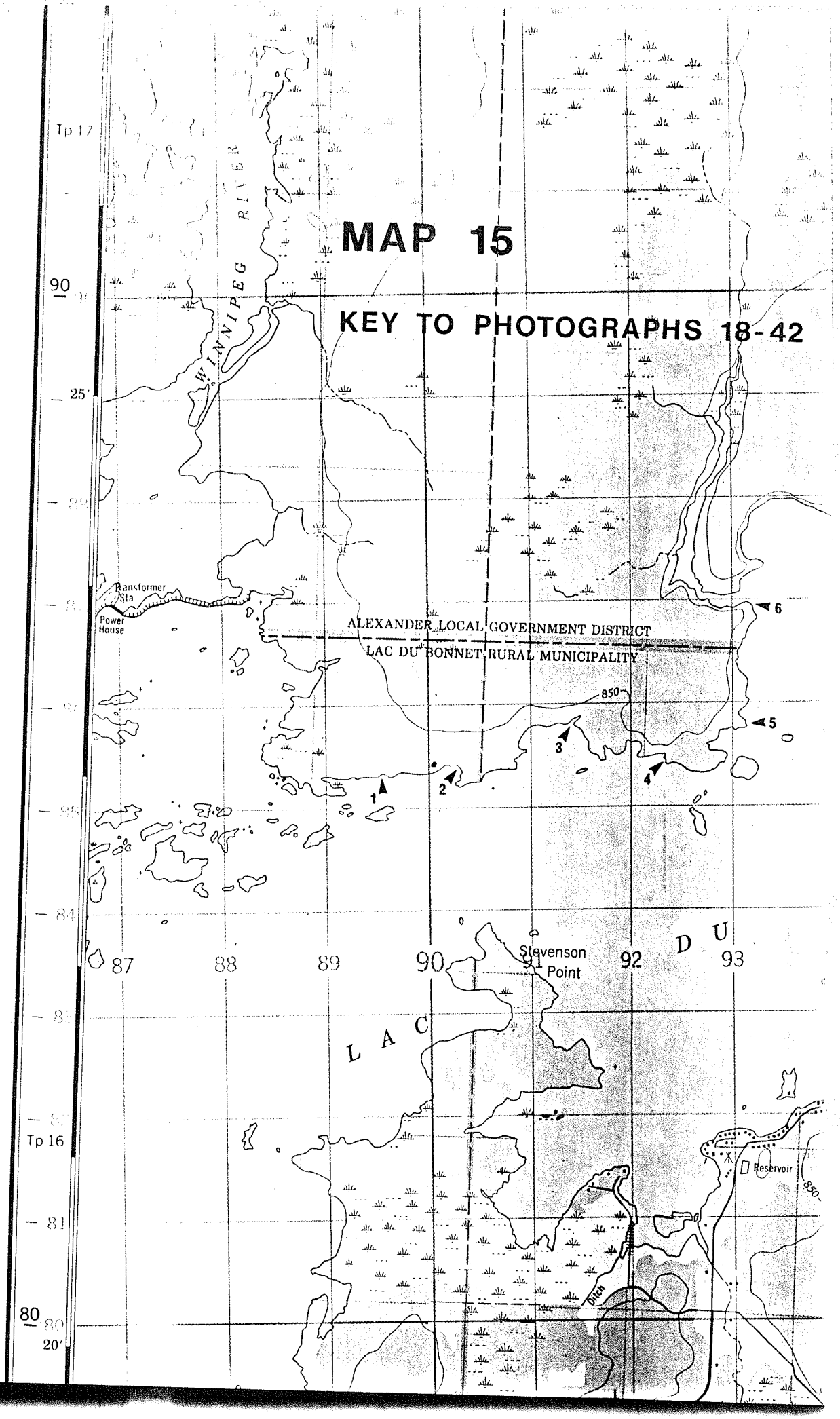
The information generated up to this stage confirms the original indications of Step I, that the north shore of Lac du Bonnet has developmental potential. Although the analysis would stop here, pending a decision to proceed with development, it was decided to undertake a brief field check of the area. The purpose of the field check was

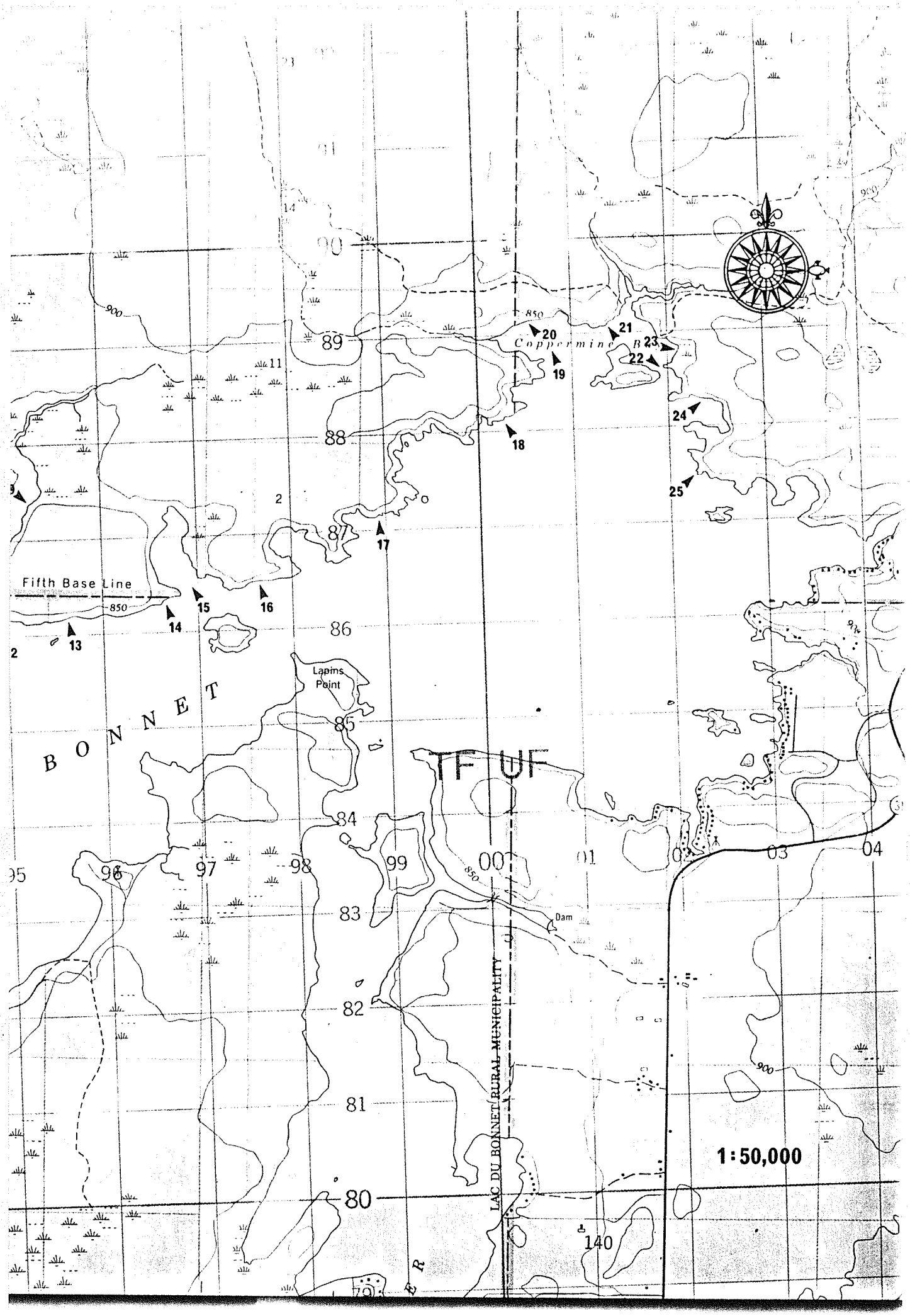
i. to obtain a photographic reference for the area, and

ii. to provide the reader of this report with a general perception of actual site conditions.

D. Conclusions

The application of the Method of Land Analysis and Classification clearly indicates that the north shore of Lac du Bonnet has potential for development. The subsequent in-office analysis confirms this developmental potential and introduces a number of factors which must be considered should the decision to proceed with development occur. These factors are listed as follows.


MAP 15
KEY TO PHOTOGRAPHS 18-42
WINNIPEG RIVER
Tp 17
90
25'
Transformer Sta
Power House
ALEXANDER LOCAL GOVERNMENT DISTRICT
LAC DU BONNET RURAL MUNICIPALITY
850
1
2
3
4
5
6
87
88
89
90
91
92
93
Stevenson Point
L A C
D U
Tp 16
Reservoir
Ditch
80
20'


Fifth Base Line
Lapins Point
Dam
LAC DU BONNET RURAL MUNICIPALITY
1:50,000

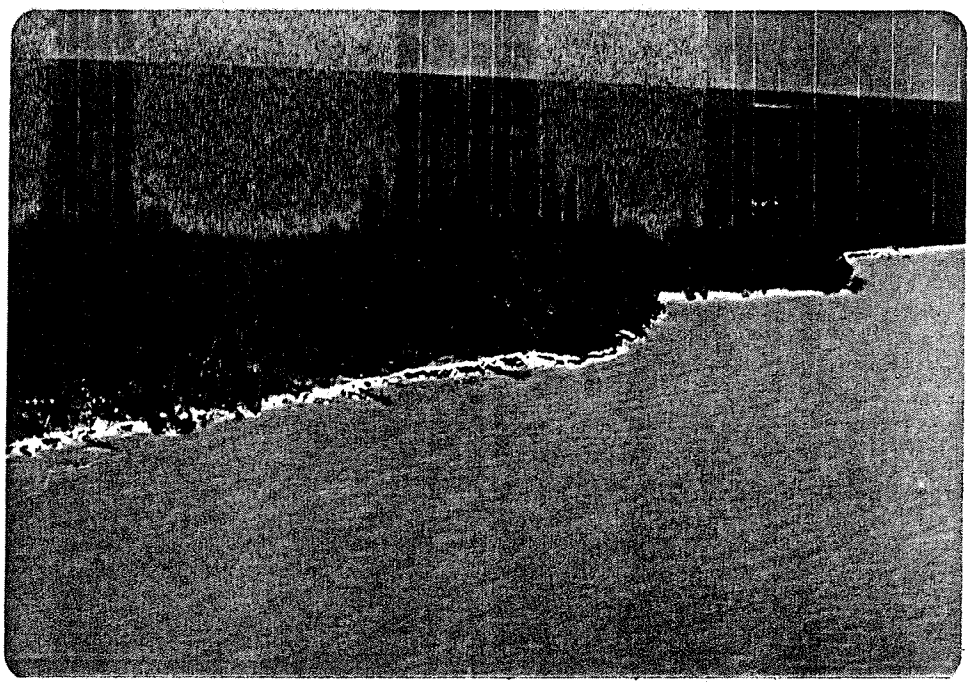


PHOTO 18

NORTH SHORE OF LAC DU BONNET, PROSPECT 1

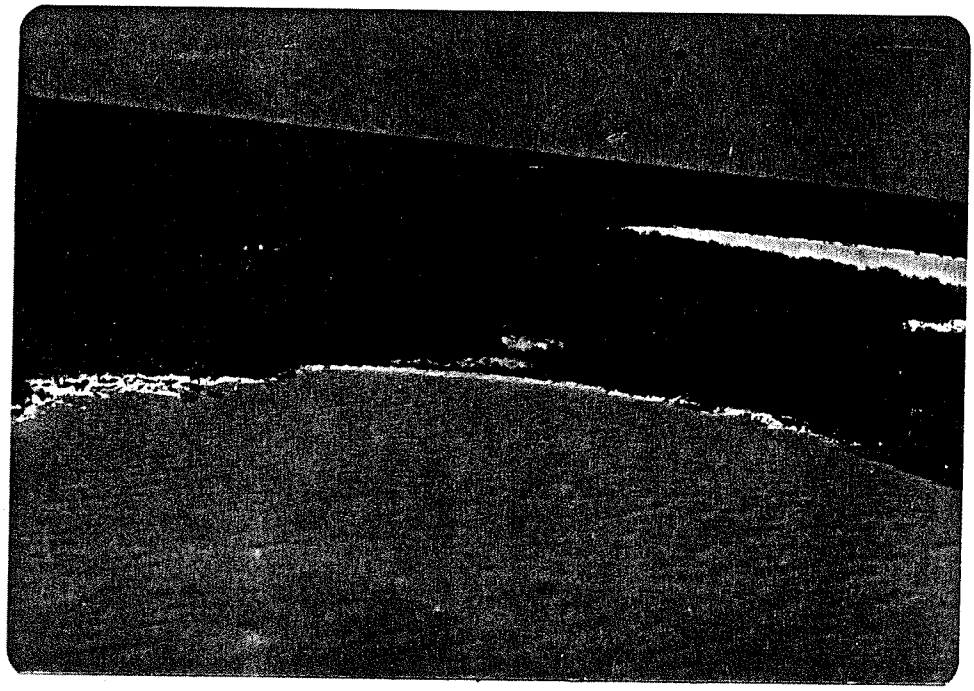


PHOTO 19

NORTH SHORE OF LAC DU BONNET, PROSPECT 2

i. Photograph 18

Vegetation	:	Deciduous-conifer mix
Topography	:	Medium gradient
Recommendation	:	Medium-density development

ii. Photograph 19

Vegetation	:	Deciduous-conifer mix
Topography	:	Low, slight gradient
Recommendation	:	Low-density development

iii. Photograph 20

Vegetation	:	Deciduous
Topography	:	Medium gradient
Recommendation	:	Medium-density development

iv. Photograph 21

Vegetation	:	Deciduous
Topography	:	Medium gradient
Recommendation	:	High-density development

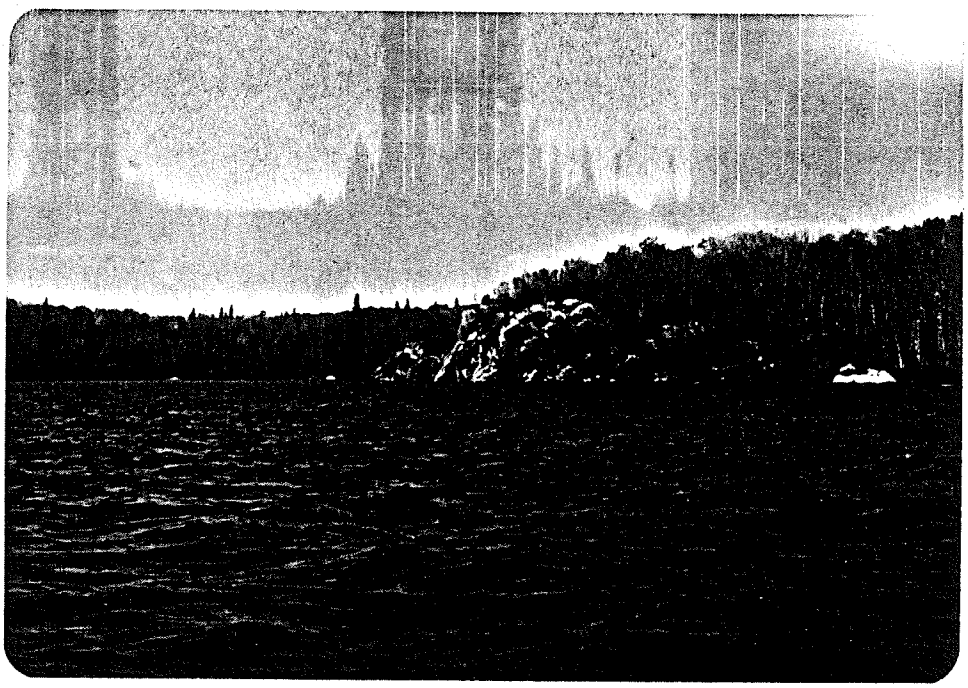


PHOTO 20

NORTH SHORE OF LAC DU BONNET, PROSPECT 3

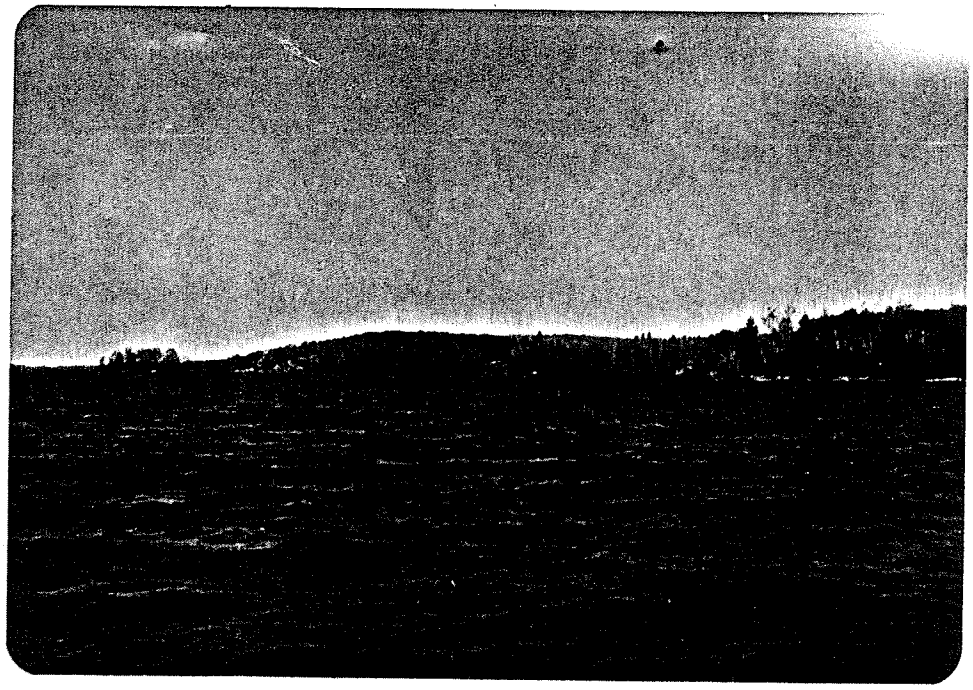


PHOTO 21

NORTH SHORE OF LACK DU BONNET, PROSPECT 4

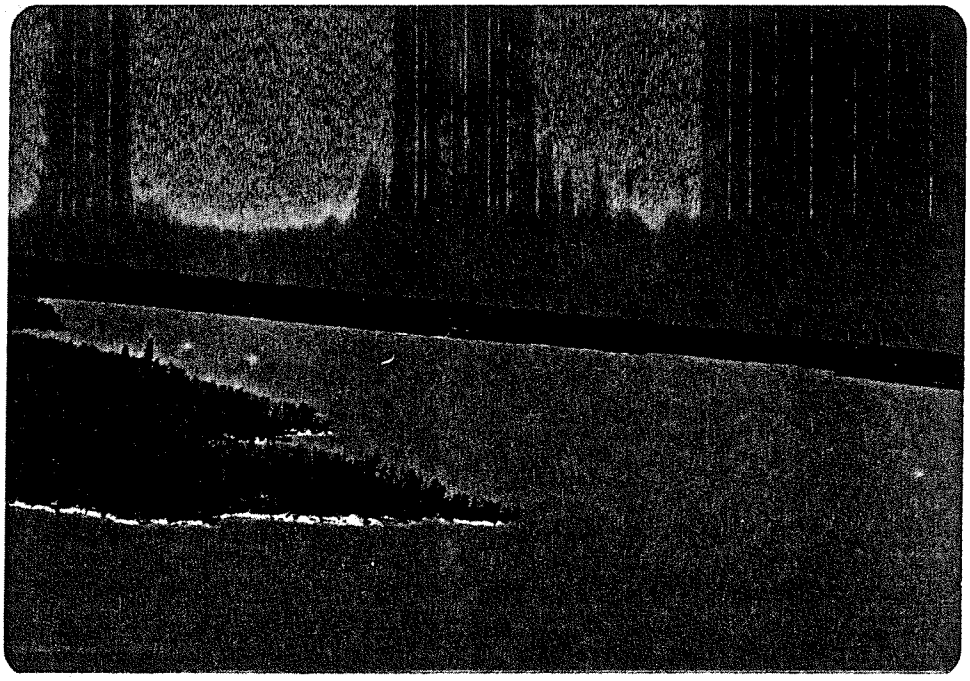


PHOTO 22

NORTH SHORE OF LAC DU BONNET, PROSPECT 5

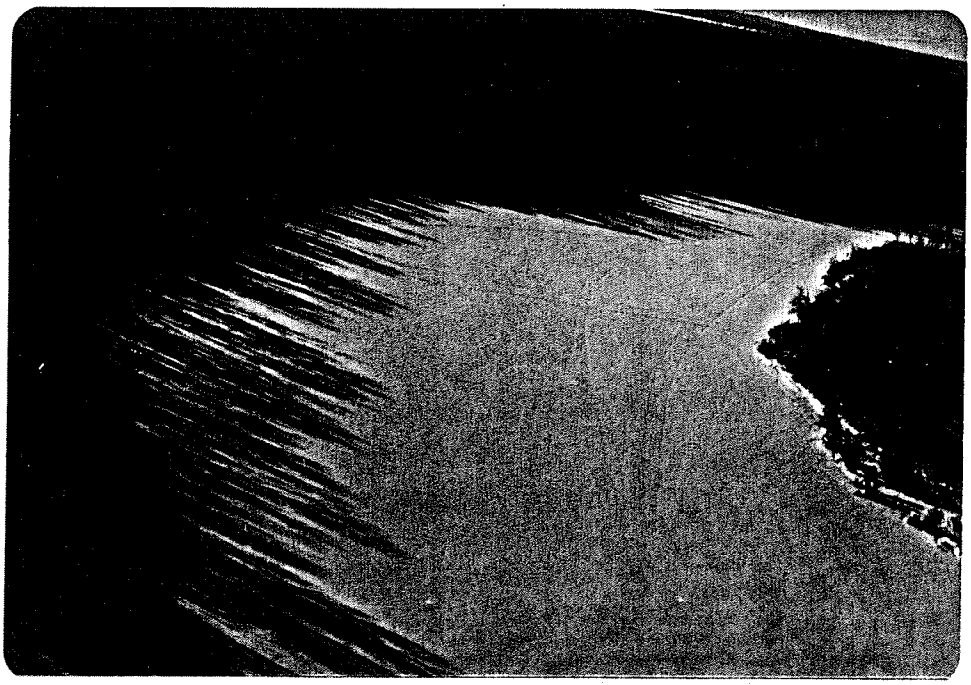


PHOTO 23

NORTH SHORE OF LAC DU BONNET, PROSPECT 6

v. Photograph 22

Vegetation	:	Deciduous
Topography	:	Medium gradient
Recommendation	:	High-density development

vi. Photograph 23

Vegetation	:	Deciduous
Topography	:	Low gradient
Recommendations	:	Wilderness corridor

vii. Photograph 24

Vegetation	:	Deciduous
Topography	:	Medium gradient
Recommendation	:	High-density development

Viii. Photograph 25

Vegetation	:	Deciduous-conifer mix
Topography	:	Low gradient
Recommendation	:	Low-density development

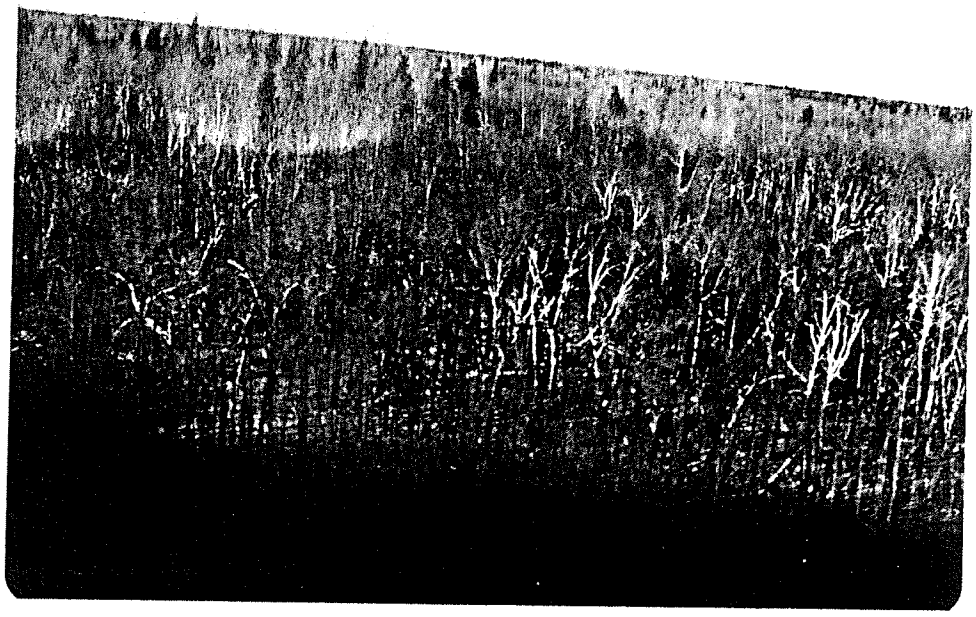


PHOTO 24

NORTH SHORE OF LAC DU BONNET, PROSPECT 7

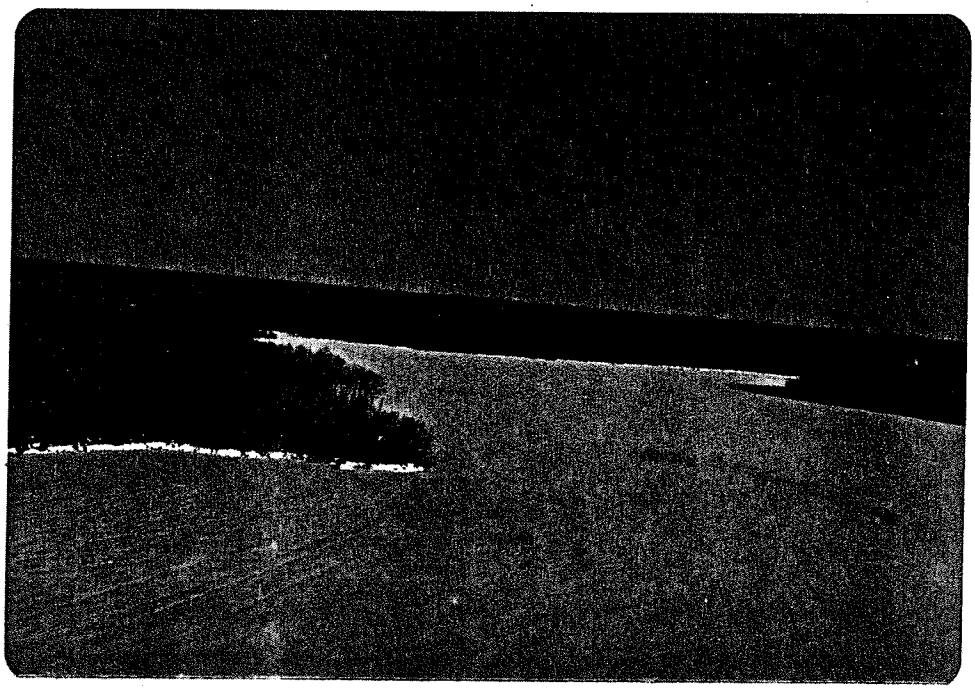


PHOTO 25

NORTH SHORE OF LAC DU BONNET, PROSPECT 8

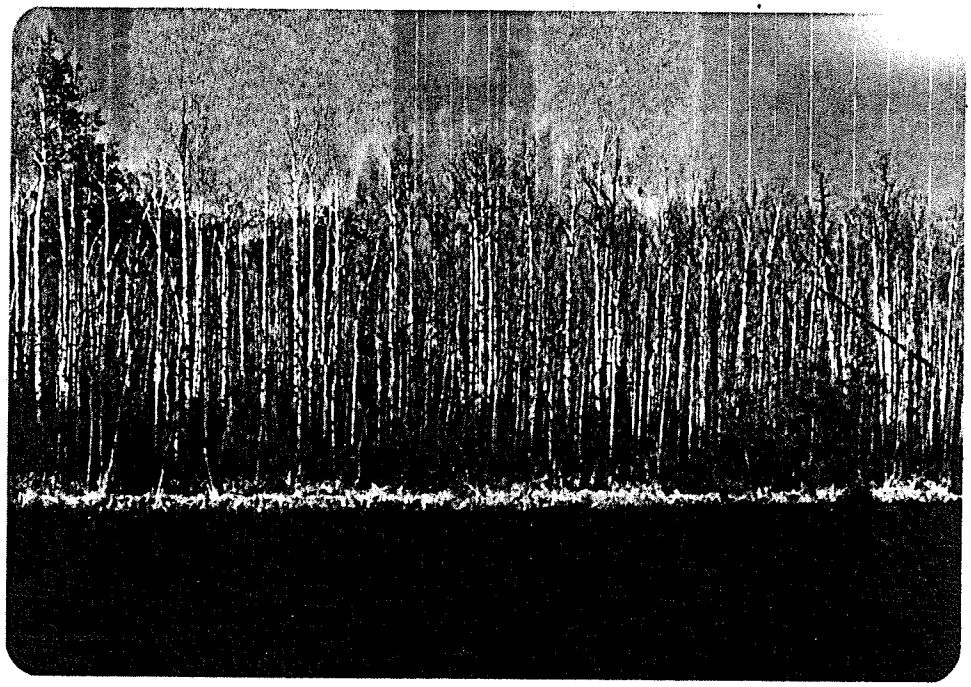


PHOTO 26

NORTH SHORE OF LAC DU BONNET, PROSPECT 9

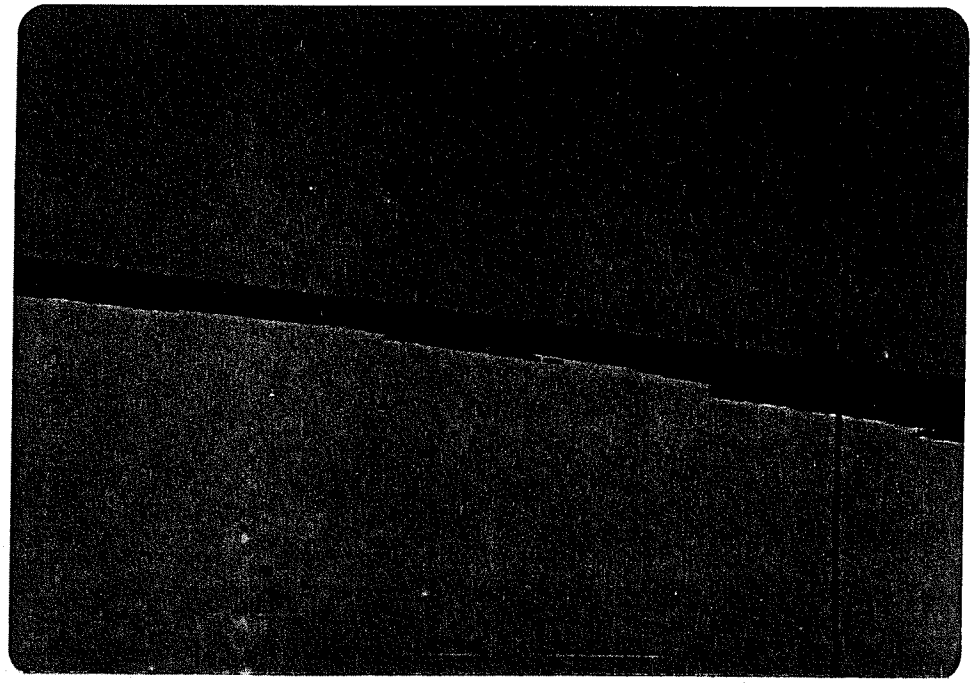


PHOTO 27

NORTH SHORE OF LAC DU BONNET, PROSPECT 10

ix. Photograph 26

Vegetation	:	Deciduous-conifer mix
Topography	:	Low gradient
Recommendation	:	No development

x. Photograph 27

Vegetation	:	Deciduous
Topography	:	Medium-gradient
Recommendation	:	High-density development

xi. Photograph 28

Vegetation	:	Deciduous-conifer mix
Topography	:	Low gradient
Recommendation	:	Low-density development

xii. Photograph 29

Vegetation	:	Deciduous-conifer mix
Topography	:	Low gradient
Recommendations	:	No development

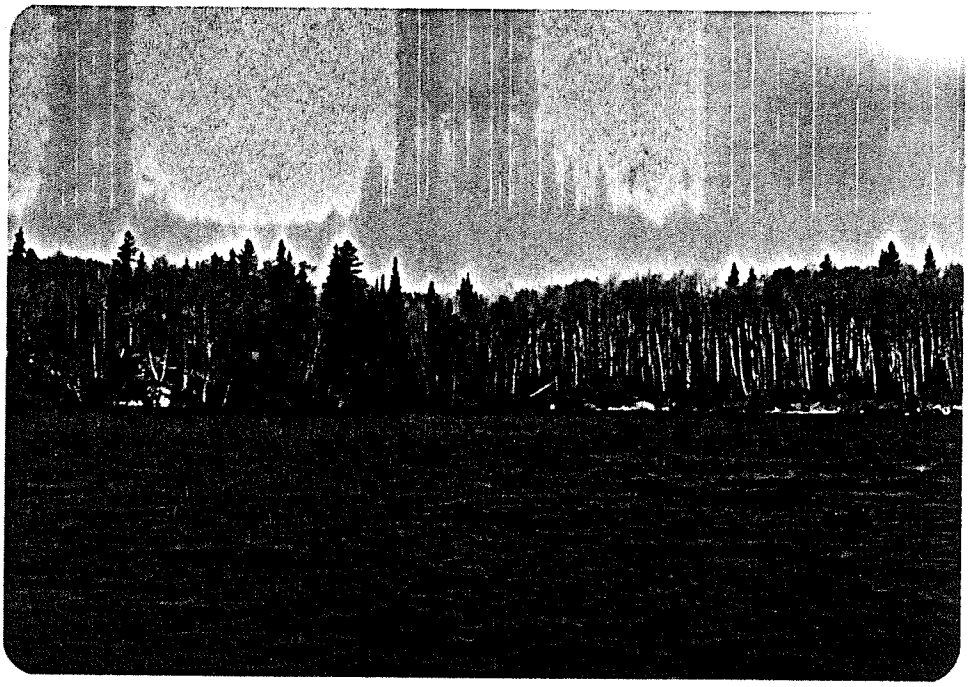


PHOTO 28

NORTH SHORE OF LAC DU BONNET, PROSPECT 11

PHOTO 29

NORTH SHORE OF LAC DU BONNET, PROSPECT 12

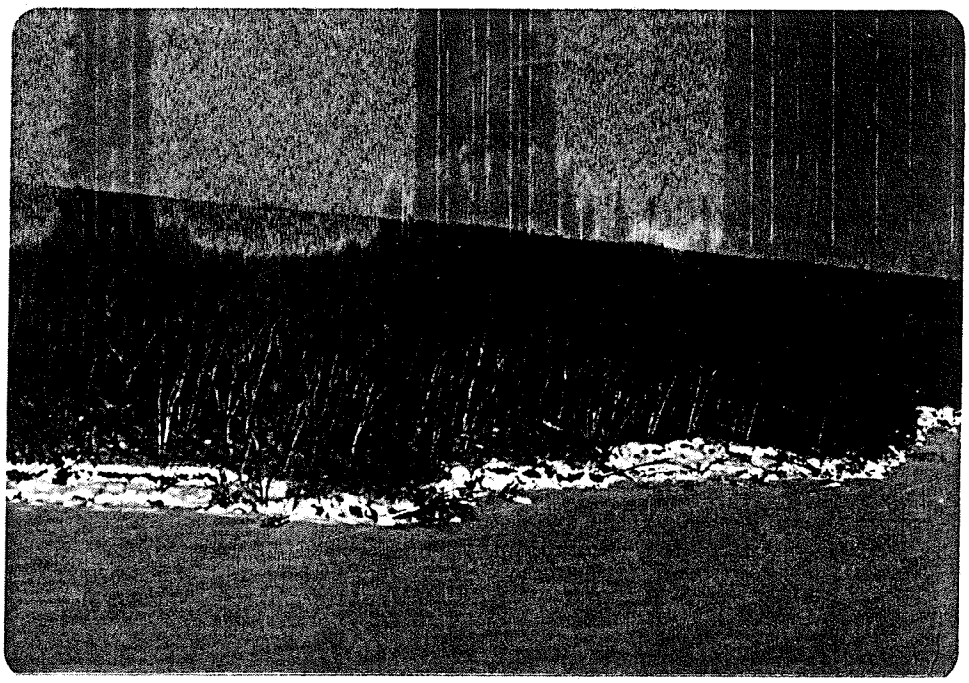


PHOTO 30

NORTH SHORE OF LAC DU BONNET, PROSPECT 13

xiii. Photograph 30

Vegetation	:	Deciduous
Topography	:	Medium gradient
Recommendation	:	High-density development

PHOTO 31

NORTH SHORE OF LAC DU BONNET, PROSPECT 14

xiv. Photograph 31

Vegetation	:	Deciduous-conifer mix
Topography	:	Medium gradient
Recommendation	:	High-density development

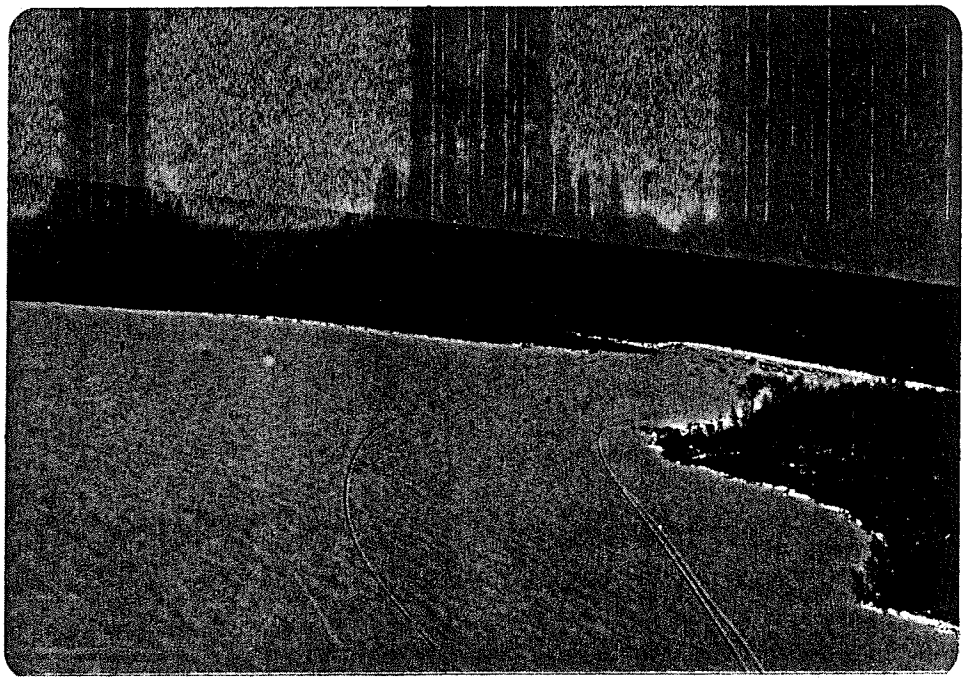


PHOTO 32

NORTH SHORE OF LAC DU BONNET, PROSPECT 15

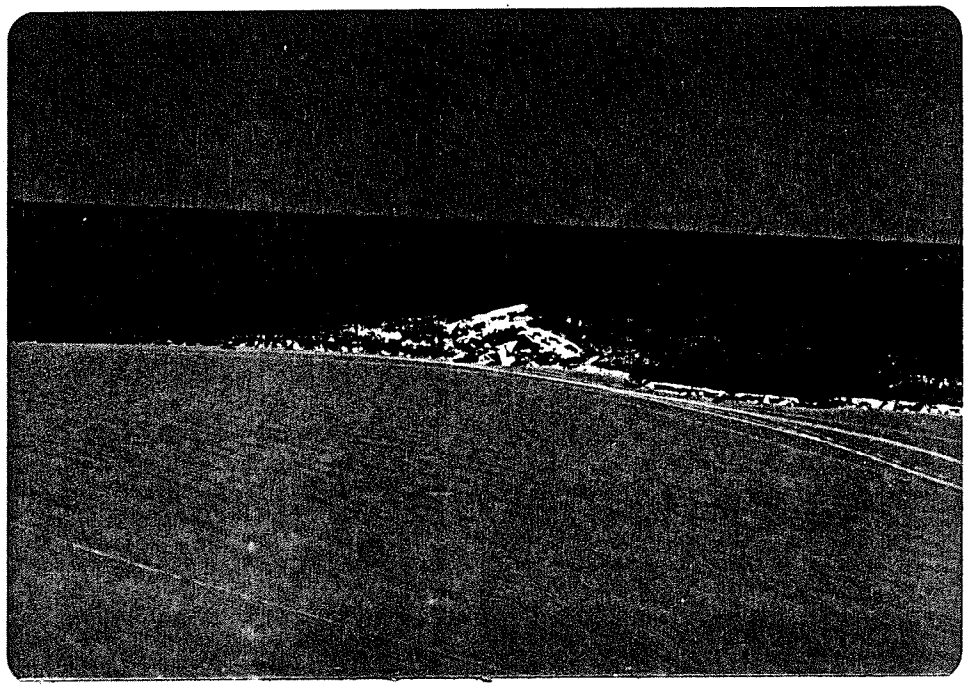


PHOTO 33

NORTH SHORE OF LAC DU BONNET, PROSPECT 16

xv. Photograph 32

Vegetation	:	Deciduous-conifer mix
Topography	:	Low gradient
Recommendation	:	Low-density development

xvi. Photograph 33

Vegetation	:	Deciduous-conifer mix
Topography	:	Steep gradient
Recommendation	:	Medium-density development

xvii. Photograph 34

Vegetation	:	Deciduous-conifer mix
Topography	:	Very steep gradient
Recommendation	:	No development

xviii. Photograph 35

Vegetation	:	Deciduous-conifer mix
Topography	:	Very steep gradient
Recommendation	:	No development

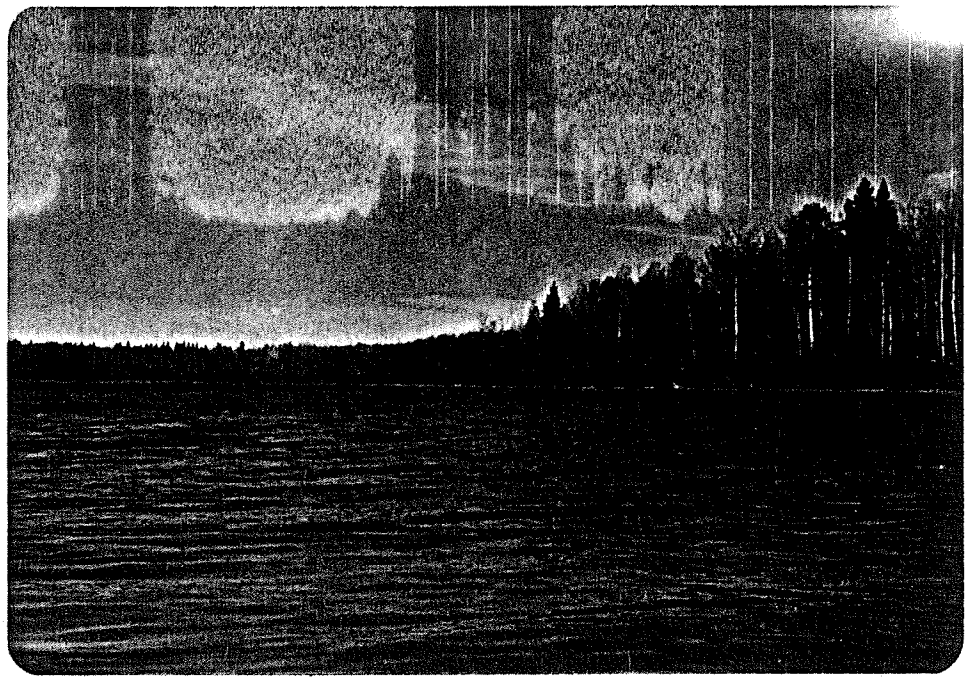


PHOTO 34

NORTH SHORE OF LAC DU BONNET, PROSPECT 17

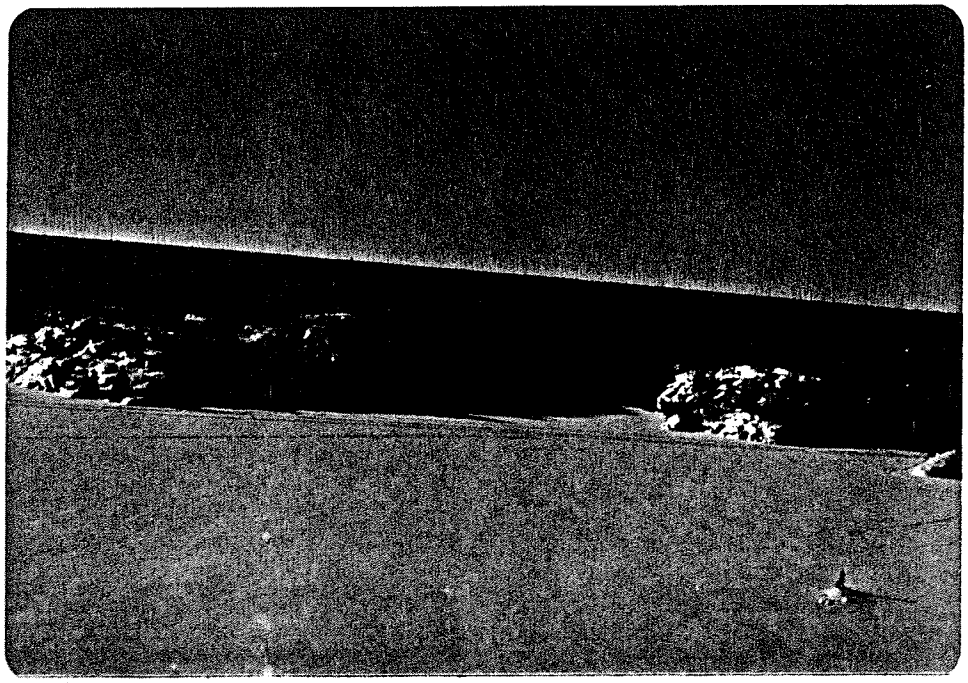


PHOTO 35

NORTH SHORE OF LAC DU BONNET, PROSPECT 18

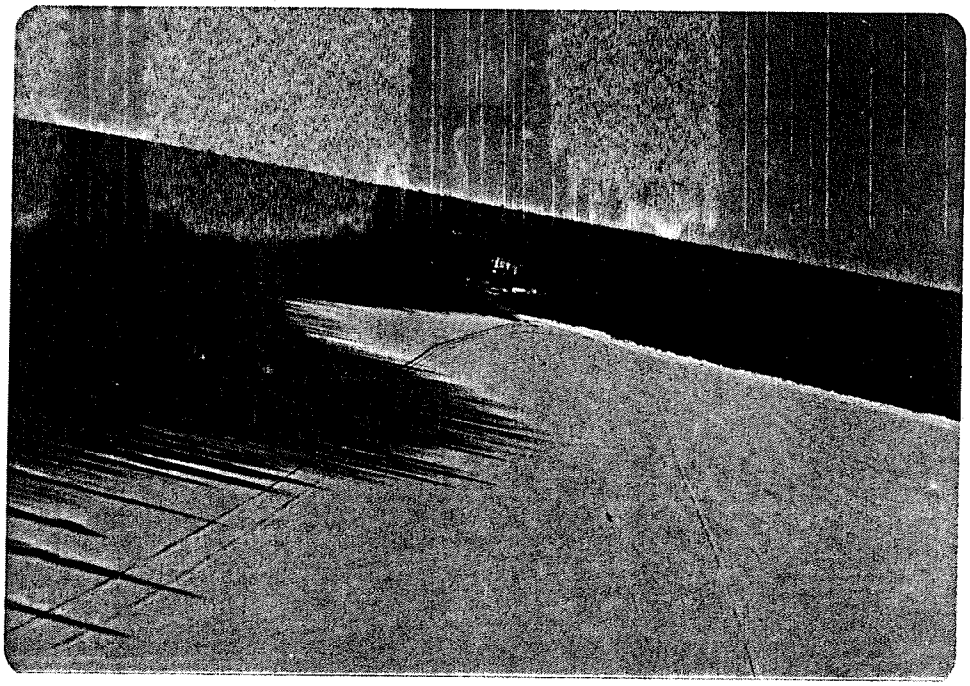


PHOTO 36

NORTH SHORE OF LAC DU BONNET, PROSPECT 19

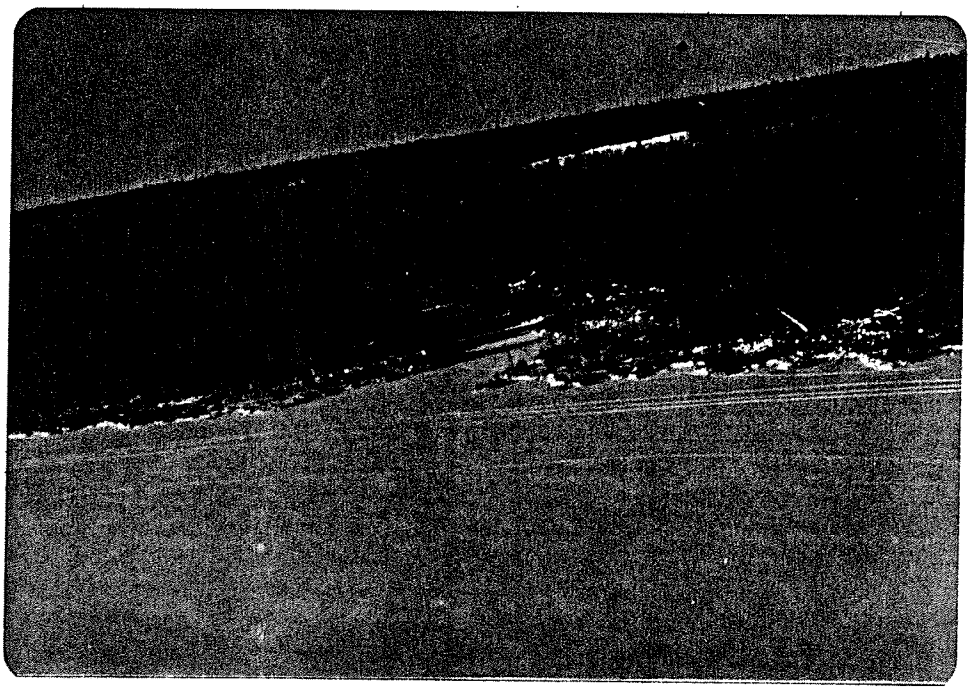


PHOTO 37

NORTH SHORE OF LAC DU BONNET, PROSPECT 20

xix. Photograph 36

Vegetation	:	Deciduous
Topography	:	Medium gradient
Recommendation	:	High-density development

xx. Photograph 37

Vegetation	:	Deciduous-conifer mix
Topography	:	Medium gradient
Recommendation	:	Medium-density development

xxi. Photograph 38

Vegetation	:	Deciduous
Topography	:	Steep gradient
Recommendation	:	Low-density development

xxii. Photograph 39

Vegetation	:	Deciduous-conifer mix
Topography	:	Medium gradient
Recommendation	:	High-density development

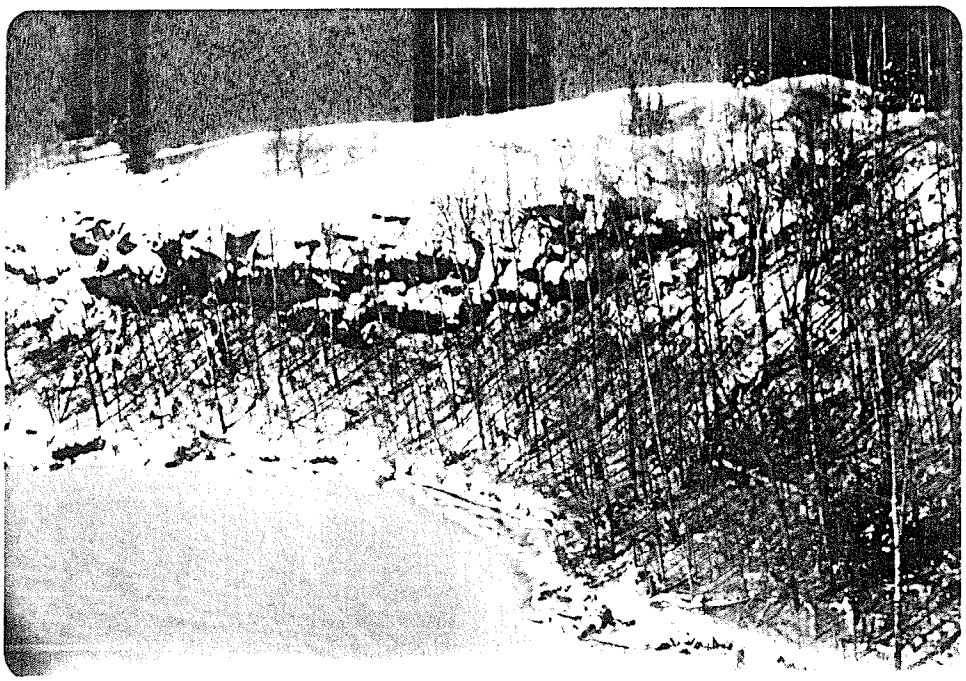


PHOTO 38

NORTH SHORE OF LAC DU BONNET, PROSPECT 21

PHOTO 39

NORTH SHORE OF LAC DU BONNET, PROSPECT 22

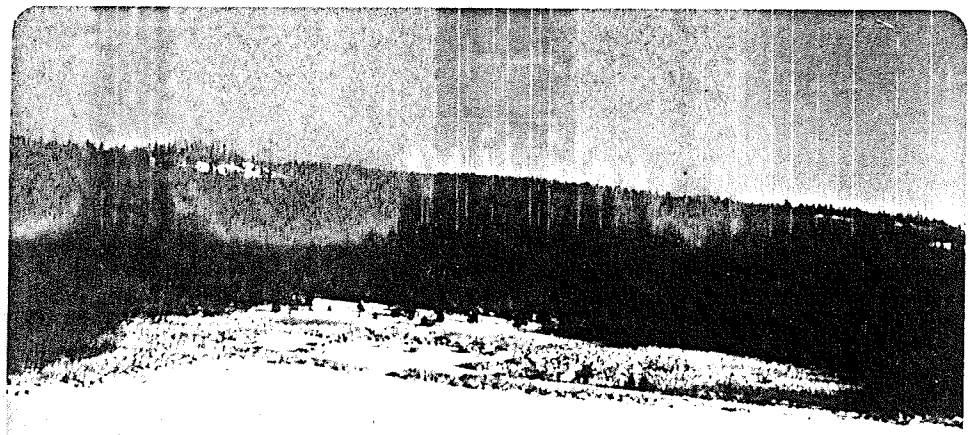


PHOTO 40

NORTH SHORE OF LAC DU BONNET, PROSPECT 23

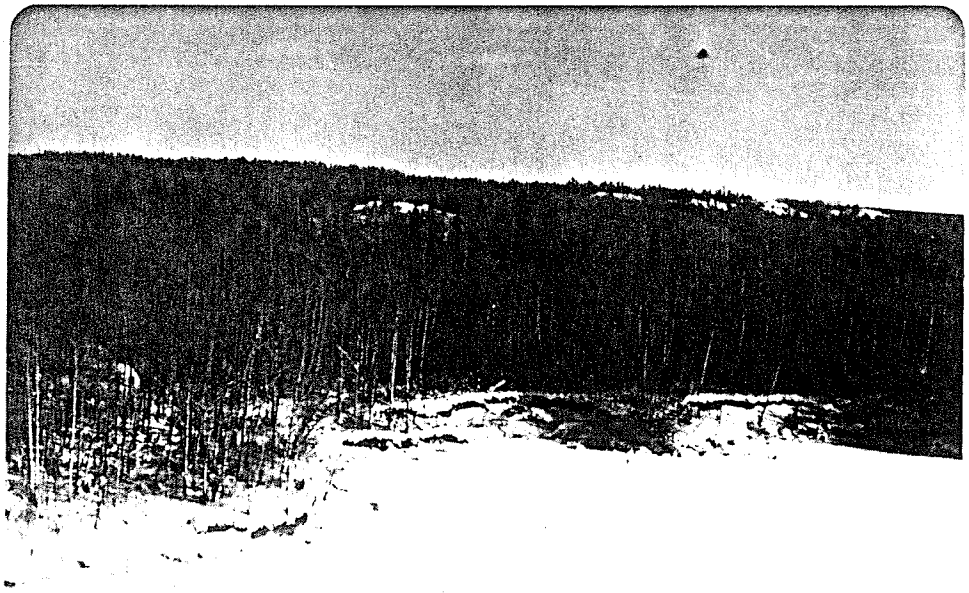


PHOTO 41

NORTH SHORE OF LAC DU BONNET, PROSPECT 24

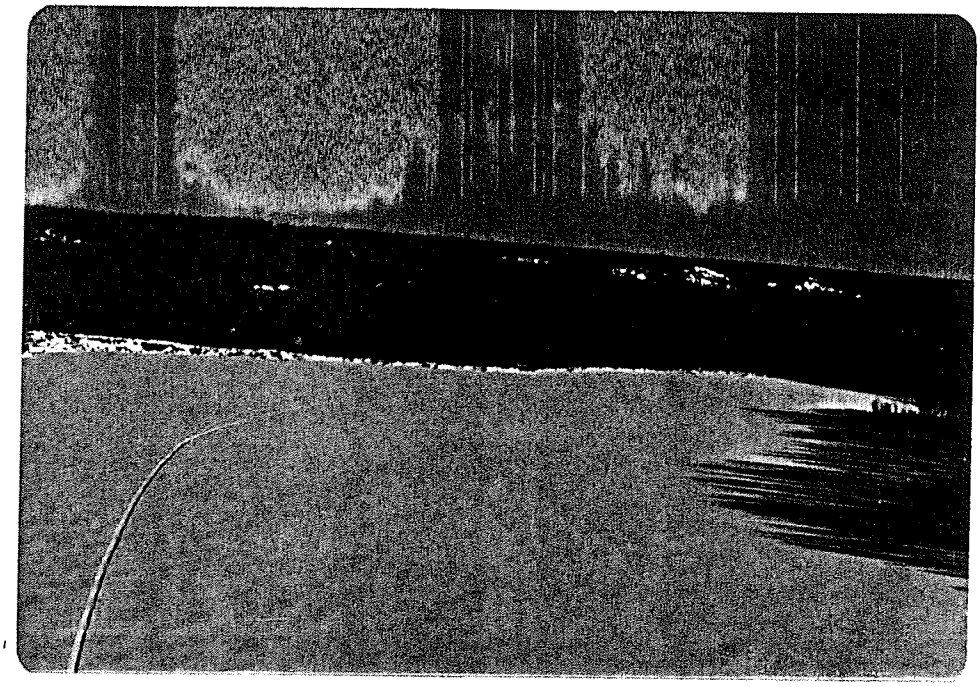


PHOTO 42

NORTH SHORE OF LAC DU BONNET, PROSPECT 25

xxii. Photograph 40

Vegetation	:	Deciduous-conifer mix
Topography	:	Low gradient
Recommendation	:	No development

xxiv. Photograph 41

Vegetation	:	Deciduous-conifer mix
Topography	:	Medium gradient
Recommendation	:	High-density development

xxv. Photograph 42

Vegetation	:	Deciduous-conifer mix
Topography	:	Medium gradient
Recommendation	:	High-density development

i. Care must be taken to avoid disrupting fish-spawning areas. In this instance development should not be placed in shallow bays or in association with stream entrances. Stream crossings should be constructed to allow the movement of spawning fish, and stream crossings should be constructed to minimise siltation by runoff.

ii. Care should be taken to avoid disrupting major wildlife concentrations, particularly those areas used for winter range or calving.

iii. Prior to development detailed archaeological investigations should be undertaken to determine if there are areas of archaeological value. Development should avoid those sites until such time as they are fully researched.

iv. Developmental plans should avoid areas covered by the Water Licence.

v. Shoreline developments should be carefully controlled to avoid bank slumping and increased siltation.

vi. Wild rice production areas should be avoided.

vii. Developmental plans should recognise the possibility of future timber operations.

viii. Provisions should be made in any detailed developmental plan to control effluent discharge into the lake; and

ix. Given the information at hand preliminary figures should be generated to provide a general indication of cost per unit of potential development.

SELECTED BIBLIOGRAPHY

Allison, R.C. and Leighton, R.S. Evaluating Forest Campground Sites. Burlington, Vermont: University of Vermont, 1965.

Canada. Department of the Environment. A Preliminary Site Capability Rating System for Campground Use in Alberta, by G.L. Leskko. Edmonton: Northern Forest Research Centre, 1973.

Canada. Department of Fisheries and Forestry. Canadian Forestry Service. Native Trees of Canada, by R.C. Hosie. 7th ed. Ottawa: Queen's Printer, 1969.

Clark, S.B.K. "Landscape Survey and Analysis on a National Basis." Planning Outlook, Vol. 4 (Spring 1968), 15-29.

Clawson, Marion and Knetsch, Jack L. Economics of Outdoor Recreation. Baltimore, Maryland: The John Hopkins Press, 1966.

Createplan Ltd. "Recreation Classification and Development Implications, Riding Mountain National Park." Report prepared for Canada, Department of Indian Affairs and Northern Development, National and Historic Parks Branch, Winnipeg, 1971.

Ditton, Robert B., and Goodale, Thomas I. Environmental Impact Analysis: Philosophy and Methods. Proceedings of the Conference on Environmental Impact Analysis, Green Bay, Wisconsin, January 4-5, 1972. Madison: University of Wisconsin, 1972.

Dooling, Dr. Peter T. "Perspectives on Alternative Approaches to an Evaluation Criteria of Recreation-Resource Inventory and Assessment System for Provincial, Regional and Site Plans." Paper submitted to the Wildlands Recreation Conference, Banff, Alberta, February 28-March 3, 1977.

Frissel, S.S., and Duncan, D.P. "Campsite Preference and Deterioration in the Quetico-Superior Canoe Country." Journal of Forestry, Vol. 4 (1975), 256-260.

Heinselman, M.L. "Vegetative Management in Wilderness Areas and Primitive Parks." Journal of Forestry, Vol. 63, No. 6 (June,1965).

Heming, S.E. Development of the Recreational Resource Base in the Tweed Region. Toronto: Department of Geography, York University, 1968.

Herfindal, Orris C., and Kneese, Allan V. Quality of the Environment: An Economic Approach to Some Problems in Using Land, Water and Air. Baltimore, Maryland: The John Hopkins Press, 1967.

McCutcheon, R. Problems and Techniques of Recreational Capability Classification. London, Ontario: Department of Geography, University of Western Ontario, 1966.

Malinski, R.M. Recreation Capability of North Gwillembury Township. Toronto: Department of Geography, York University, 1967.

Merriam, L.C., et al. Newly Developed Campsites in the Boundary Waters Canoe Area: A Study of Five Years Use. St. Paul: Agricultural Experiment Station, University of Minnesota, 1973.

Ontario. Ministry of Natural Resources. Methodology for Ontario Recreation Land Inventory. Toronto: Queen's Printer, 1971.

Redpath, D.K. Policy Implications for Shoreland Recreation: A Pilot Study in New Brunswick and Nova Scotia. Waterloo: Department of Regional Planning and Resource Development, University of Waterloo, 1971.

Searth, Thomas S. "Land Classification for Outdoor Recreation." Unpublished M.A. thesis, University of Calgary, 1970.

Spurr, Stephen R. Forest Ecology. New York: Ronald Press, 1964.

U.S. Department of Agriculture. Soil Conservation Service. Guide to Making Appraisals of Potentials for Outdoor Recreational Developments. Washington, D.C.: