EVALUATION OF LAND RESOURCE INFORMATION FOR SETTLEMENT SUITABILITY

(WHITEHORSE-CARCROSS-JAKES CORNER REGION)

November 1978

HD
319
.Y8
E93
1978

Evaluation of land resource information for settlement suitability (Whitehorse-Carcross-Jakes Corner region)

EVALUATION OF LAND RESOURCE INFORMATION FOR SETTLEMENT SUITABILITY (WHITEHORSE-CARCROSS-JAKES CORNER REGION)

Maps and Report
prepared by

D.S. Lacate
M.A. Kerr
D.K. Redpath
L.A. Decker

Lands Directorate, Pacific and Yukon Region

and

E.T. Oswald

Pacific Forest Research Centre, Canadian Forestry Service

November 1978

TABLE OF CONTENTS

EVALUATION OF LAND RESOURCE INFORMATION FOR SETTLEMENT SUITABILITY (WHITEHORSE-CARCROSS-JAKES CORNER REGION)

I. INTRODUCTION

At the request of the Land Resources section, Department of Indian Affairs and Northern Development (DIAND), Whitehorse, the Lands Directorate, Pacific and Yukon Region, Department of the Environment, was asked to provide advice and develop interpretations on "suitability for settlement" for lands in the Whitehorse-Carcross-Jakes Corner region. This background information would assist DIAND in the preparation of land-management policies and plans for the region. This report and accompanying orthophoto maps represent the results of the Lands Directorate's work.

II. PROCEDURES

Existing information (e.g. surficial geology maps on open file, the reports and maps on Soil and Soil Suitability Information Series prepared for DIAND) was examined and evaluated prior to field work. The entire area was pre-mapped on airphotos (approximate scale 1:60,000) before any field work was undertaken to: (1) establish preliminary boundaries and legends for the major kinds of land patterns in the area; (2) provide a framework for the design and location of field sampling, and (3) serve as a means for training personnel in the techniques of interpreting and extrapolating information on the land resources.

Field work was then undertaken to verify the location of boundaries, to correct and refine them as required, and to confirm the initial interpretations and extrapolations of the characteristics of the land base (see Part III of this report for description of the units identified). 1977 colour airphotos (approximate scale 1:25,000) were also used during field checking along the major roads.

After the survey on landforms, soils and soil materials was completed, this information was used as a framework for the development of "suitability for settlement ratings" which were based on the more obvious limitations and constraints to potential developments. (See Part IV of this report).

III. SUMMARY OF INFORMATION PRESENTED ON THE ORTHOPHOTOGRAPHS

The following is a description of the kinds of landforms and materials (and texture) which were identified and mapped in the study area to serve as a base for interpretive ratings. The vegetation patterns associated with the major units are also summarized.

A ALLUVIAL: Materials transported and deposited by streams and rivers. This category includes specific land forms such as alluvial fans, braided floodplains, meandering floodplains and areas of slope-wash. Texture of material varies from silts to sands and gravels depending upon stream morphology and season/annual runoff variability; materials are variably sorted. When stable, alluvial fans support lodgepole pine and/or white spruce with an understory of kinnickinnick, willow and grass on coarser textures and feather-moss on finer textures; when active, willows, shrub birch, rose and sometimes aspen dominate. The braided and meandering floodplain units in their early stages support horsetails, followed by willows, then by balsam poplar and white spruce with willow, horsetails, rose and feathermoss in the understory. Lodgepole pine may follow fires but is replaced by white spruce.

A_f - alluvial fan: cone-shaped landform, gentle to moderately steep slopes at the mouths of smaller tributary valleys; surfaces are commonly marked by small distributary channels.

A_b - braided river floodplain: floodplain with multiple channels that are occupied during floods and are constantly shifting within the floodplain; materials are generally coarse textured.

A_m - meandering river floodplain: gently irregular to nearly flat surfaces that include the floodplains of large streams and occasionally inclusions of small features such as stream terraces and alluvial fans; abandoned channels and point bar deposits are common features.

A_s - slope wash: material transported by overland or surface water flow in broadly distributed sheets or small gullies (on steeper slopes).

B BEACHES AND STRAND LINES: Materials deposited by present or former wave action; texture of material is sand and gravel, cobbly in places; long, narrow smoothly curving to straight ridges, often parallel to a present or former shoreline in this study area. These units support open stands of lodgepole pine with kinnickinnick, juniper, rose or grass in the understory. The pine eventually gives way to white spruce and a feathermoss-lichen understory develops.

E AEOLIAN: Materials transported and deposited by wind; texture of material, fine to very fine sand; mapped only as dunes in this study area (loess is not common); surface of undulating, low relief. Currently covered with open growing lodgepole pine and an understory of grass, kinnickinnick, soapberry, and lichens when stable, but white spruce regeneration is moderate to common and feathermoss and lichens usually form major constituents under white spruce; when active, the vegetation is virtually non-existent.

G GLACIO-FLUVIAL: Materials deposited by glacial meltwater; texture of materials is sand, sand and gravel, ranging from well sorted and stratified to poorly sorted and stratified; surfaces may vary from nearly flat to irregular terrain marked by kames, eskers and abandoned meltwater channels.

G_t - glacio-fluvial terrace: relatively flat surface which is terminated by an abrupt change in slope on one or more sides; sand, and sand and gravel are the dominant textures in the study area. Lodgepole pine is currently the most prevalent tree species, but white spruce regeneration is often present, and spruce may dominate in older stands. The understory varies from feathermoss under closed canopies to kinnickinnick, lingonberry, grass, lichen under open canopies. Soapberry, shrub birch, willow and rose are common understory species where the moisture regime is favourable.

G_k - kames, kame deltas, kame terraces and pitted deltas; level to strongly irregular hummocks, mounds and terraces often associated with, or adjacent to, valley walls; poorly sorted sands and gravel. South-facing slopes are usually treeless and are covered with prairie wormwood, grass and several forbs; tops of ridges usually with kinnickinnick, juniper and prickly saxifrage; north aspects often have aspen or lodgepole pine, sometimes white spruce, and low shrub and grass understories.

G_e - eskers: irregular, sinuous ridges; poorly sorted sands and gravels. Vegetation patterns are similar to unit above (G_k).

L LACUSTRINE (Glacio-lacustrine): Materials that have settled from suspension in glacial lakes in front of or in contact with ice; well-sorted and well-stratified materials; gently irregular to nearly flat surfaces; texture of materials range from very fine sandy silts to clays. (These map units often include small areas of poorly drained soils and organic terrain). The fine sandy areas support lodgepole pine and white spruce with willow, shrub birch, grass and feathermoss understory. The silts feature mostly white spruce or more commonly shrub birch, willow and grass-sedge vegetation. In areas of fine-textured soils, lodgepole pine and white spruce, with a sparse understory of kinnickinnick, twin flower and feathermoss occur on better drained sites; shrub birch and willow, usually with a few white spruce, and with a grass and sedge understory occur on the more poorly drained level or depressional areas.

M MORAINAL (Till): Materials transported and deposited directly by glacial ice; variable textures; in the study area dominantly gravelly sandy loam; ranging from low hills and ridges (where deposits are deep and they reflect only broad aspects of underlying bedrock) to steep terrain where landscape is controlled by the underlying bedrock; map units on steep slopes and at higher elevations include areas of colluvium (material accumulated on and at the foot of slopes by the various processes of mass movement). Currently, most areas are covered with lodgepole pine following fire, but white spruce regeneration is common and may dominate in older stands, with understory vegetation dependent upon moisture regime. Moist sites have shrub birch and/or willow subtended by feathermoss, mesic sites may have Labrador tea or feathermoss, drier sites have grass, low shrubs and lichens in variable combinations.

MARL: Soft and unconsolidated calcium carbonate material and shells (limited distribution in this study area, primarily around Lewes Lake).

O ORGANIC: Deposits resulting from vegetation growth, accumulation and decay; rate of accumulation exceeds decay; includes bogs and fens; in the study area generally associated with fine-textured lacustrine materials (map units include areas of poorly drained soils). In perpetually wet fens, the vegetation consists mostly of sedge, cottongrass and grass; in somewhat drier conditions willow and shrub birch dominate with ground vegetation consisting of wetland mosses. Bogs commonly are dominated by shrub birch, shrubby cinquefoil, Labrador tea and willow, sometimes white and black spruce, with undergrowth consisting of bilberry, willow and bog mosses. Sphagnum may be present in bog-fen complexes. Lichens often cover tops of hummocks.

R BEDROCK: Rock outcrop and rock covered by a very thin mantle of unconsolidated materials; this map unit also includes smaller areas of talus slopes and colluvial fans in this study area. Within the study area, most of this unit has been burnt and currently supports aspen and willow at higher elevations. Lodgepole pine, white spruce and alpine fir are often present but have patchy distributions. On very thin mantles at lower elevations, the vegetation consists of wormwood, creeping juniper, rose, grass, forbs and lichens. Alpine areas have alpine lichens, prostrate shrubs and few forbs.

TEXTURE OF MATERIALS (CLASSES USED FOR THIS STUDY AREA)

1	sand, sand and gravel, gravel.	COARSE
2	aeolian sand (used only for dune areas)	
3	gravelly sandy loam, sandy loam, loam.	MEDIUM
4	silt loam, silt, very fine sand, very fine sandy loam (used primarily in glacio-lacustrine areas)	
5	clay loam, silty clay loam, clays (used primarily in glacio-lacustrine areas)	FINE
6	variable, often ranging from gravelly sand to silt	VARIABLE

IV. PHYSICAL SUITABILITY FOR SETTLEMENT/DEVELOPMENT

Three classes of "suitability for settlement" (a grouping of land units into three general categories based on the degree and kinds of limitations) were established for this study area. The classes and limitations used are as follows:

DEGREE OF LIMITATIONS

1. None, or a combination of minor, unspecified limitations.
2. Moderate limitations.
3. High limitations.

LIMITING FACTORS

T - topography - slope
E - erosion
A - wind erosion
F - flooding/wetness (including ponding and seepage areas)
U - unstable materials (subject to slumping, slides, subsidence)
R - bedrock and talus

The assumption is that if these general limitations to development are not taken into account in the planning process, activities on lands having moderate to high limitations could require:

(1) expensive maintenance problems over time,
(2) costly programs to rehabilitate and/or stabilize the landscape,
(3) public funds to "bail out" severely damaged developments such as those that might be initiated on active floodplains, or on-or-below areas subject to slumping and stability problems.

It should be noted that the "Suitability for Settlement" ratings do not include or incorporate other additional limitations such as unfavourable climatic conditions, poor access to the area, whether or not a water supply (surface or groundwater) is available, or whether or not the areas in question are suitable for septic tanks or other methods of sewage disposal. An area mapped as class 1 in this present examination of the physical constraints could be, for example, downgraded and could be regarded as having

very severe limitations in terms of its feasibility for development if a water supply were not available. These additional constraints could be the subject of several other supplementary studies that other agencies might wish to undertake in conjunction with present planning concerns.

Another important limitation that must be recognized is that the information presented in this study is only a part of the overall information base required as inputs to the planning process. Biological aspects may be of considerable significance. For example, an area that might be identified as being "suitable for settlement" on the basis of the physical information examined in this study may be "unsuitable" if the area in question is identified through other studies as being an important or critical winter habitat for certain species of wildlife.

V. SENSITIVE AREAS

Highlights of some of the more sensitive areas associated with the valleys and areas of lower elevations can be summarized as follows:

(A) Sand Dunes:

i) Carcross area: These are active dunes and are currently shifting generally to the northeast, except in the southeast where a rock outcrop forms a barrier. Because of the sand movement, the vegetation has great difficulty in becoming established. Early invaders include Equisetum arvense, E. variegatum, Stellaria monantha, Artemisia arctica, Polemonium pulcherrimum, Poa and Carex sp. Plants present in more stabilized areas include lodgepole pine, white spruce, aspen, kinnickinnick, rose, juniper, lupine, pasque flower, grass and lichens. Special attention should be given to preventing vehicular traffic and fires to allow stabilization of the dune areas. The maintenance of a tree cover to the south of the active dune area will aid stabilization by forming a barrier that will reduce wind velocities.

ii) Annie Lake Road: The sand deposits in this area are currently stabilized, although droughty. Vegetation for the most part includes lodgepole pine, kinnickinnick, lingonberry, grass (Festuca, Calamogrostis, Poa and Trisetum), death camas, pasque flower, cinquefoil and lichens. White spruce regeneration, although sporadic, is usually present under the lodgepole pine, and the spruce forms a dominant canopy in a few areas.

Grazing is common in the area and is acceptable as long as over-use does not occur. The tree cover is essential to stability as it reduces wind velocities at ground level. Fires and widespread clearing would be devastating and would result in erosion by wind and water.

iii) Tagish Lake Cottage area: Current vegetation is lodgepole pine with an understory of grass and kinnickinnick. The vegetation, particularly the understory, has been degraded from trampling and trafficking associated with cottage development and utilization.

This is a particularly sensitive area because of the strong winds from across Tagish Lake that gave rise to the dunes in the first place. Every means to maintain a vegetative cover, especially along the shore, should be exercised.

(B) Hummocky Kame Area - Lewes Lake: In this area the steep southerly aspects support Artemisia frigida, grass (Festuca altaica, Poa alpina, Poa spp., Calamogrostis, etc.), Juniperus horizontallis, Saxifraga tricuspidata, Pulsatilla patens ssp. multifida, Pentstemon proceras, P. gormani, Antennaria spp., etc., but the cover is usually thin and discontinuous. Disturbances that disrupt the vegetative cover lead to erosion and slumping. The northerly aspects usually have aspen, white spruce, lodgepole pine and a host of low shrubs and forbs, and is more resilient to disturbance because of the more favourable moisture regime, although still on the droughty side. The effective soil depth is thin on the kames and a cover of top soil would probably be required for revegetation following severe disturbances.

(C) Glacio-Lacustrine Fine Sands and Silts - Lubbock River: These areas are prone to severe gully erosion if disturbed. The fine sands support lodgepole pine and white spruce with willow, shrub birch, grass and feathermoss understories. The silts associated with the fine sand have mostly white spruce or, more commonly, shrub birch-willow with an understory of grass-sedge vegetation.

Attention should be given to preventing the establishment of linear disturbances perpendicular to slopes. Roads, for example, should be built parallel to slopes and drainage must be provided. The area is not suitable for dwelling construction and large-scale clearing of vegetation should be avoided. Any utilization should be of a nature that will maintain the deeper rooted plants (trees and shrubs) wherever possible.

(D) Marl - Lewes Lake: This is virtually an unvegetated area and will remain so unless artificially covered to prevent wind erosion. The only current

vegetation consists of a few species such as willow, grass and sagewort that occur on some rocky areas. The material is highly calcareous and becomes very powdery as weathering occurs; most is blown away. Vehicular access should be curtailed.

(E) Organic Terrain, Bogs and Fens: These poorly drained areas are scattered throughout the study area and occur in flat or depressional topography commonly in morainal and glacio-lacustrine deposits. They currently have a cover of willow-shrub birch with understories of low willow, shrubby cinquefoil, sedge, and bog moss, and with lichens on elevated areas. The wetter portions (fens) have sedge, cottongrass and wetland mosses.

They should be avoided for any type of construction because of their instability and high water table, but they can be used for grazing and wildlife.

(F) Very Shallow Soils over Bedrock (at lower elevations in the valleys): These areas have a vegetation cover similar to the southern aspects of kames, except that rose is often very common and Saskatoon berry may be present. The soils are droughty and the vegetation is not resilient to even moderate utilization.

VI. POINTS OF CLARIFICATION AND LIMITATIONS OF THE INFORMATION PRESENTED

(1) Because a large area was examined in a short time period, the study has been limited to a reconnaissance level survey (and interpretations at a reconnaissance level). The map units and their boundaries, therefore, are generalized and many of the units are complexes or mosaics of two or three different kinds of land that are associated cartographically and cannot be delineated at the reconnaissance level scale of mapping. For site-specific interpretations or ratings for a small individual area (one to several hectares in size), the information as presented may not be adequate and could be misleading because of the many unmappable minor inclusions that could occur within one map unit. In these latter cases field checks, as required on an individual project-by-project basis, are recommended.

(2) Detailed examinations of all the shoreline materials along the major lakes (such as Marsh Lake, Tagish Lake, etc.) were not possible in the time available. If these areas become of critical importance, then site-by-site field

check should be undertaken, or an additional small study aimed at obtaining detailed information only along the shorelines should be initiated.

(3) There are places throughout the study area where permafrost or seasonal ground ice could be a problem. It was not possible to identify all these areas in the time available. These areas could be identified through another short-term study or through field checks on an as-required basis, keeping in mind that these problem areas are frequently associated with north slopes, seepage areas, fine-textured soils and areas where the vegetation cover is moderately dense and has not been disturbed frequently by forest fires. One example is at the north end of Marsh Lake where frost cracks in lacustrine material and associated bog-fen complexes have created problems with highway construction. The elevated areas support white spruce/feathermoss, while the subsided areas have willow, shrub birch, etc. on unsaturated areas and sedge-cottongrass in saturated areas. Black spruce is present, but in some areas white spruce is more prevalent.

VII. AGRICULTURE CAPABILITY RATINGS FROM LITTLE ATLIN LAKE SOUTH TO THE B.C. BORDER

Agricultural Capability ratings were applied to the units mapped along the Atlin Road based on a review of the existing information in the reports on Soil Survey and Land Evaluation in the Yukon Territory.

The already established agricultural ratings which were developed for, and applied to, the landscapes north and west of Atlin Road area were extrapolated to similar landscapes, soils and materials mapped as part of this study. These are presented in a separate series of orthophoto maps (paper prints). In general very similar kinds of soils and landscapes were found in both the previously mapped areas and the newly mapped areas. This facilitated correlation and extrapolation of the ratings for agriculture capability.

VIII. OTHER OBSERVATIONS

(1) Forest capability ratings, in the sense of the National Canada Land Inventory classification, are not high throughout the entire area. The most productive area for forestry would appear to be the very fine sandy and silty glacio-lacustrine deposits between Little Atlin Lake and Atlin

Lake (the "terraces" along to the Lubbock River). It should be noted that this landscape is, however, one of the most sensitive in the study area. Any plans to log or to develop access roads in this area must be carefully examined in light of the high susceptibility of the terrain to severe erosion and slumping following any disturbance of the surface cover.

(2) Fire hazard as a constraint to settlement: Forest fires have been common and frequent throughout the landscapes in the study area and unfortunately many of the best-suited, Class 1, areas for settlements (the well drained sandy and gravelly deposits - glacio fluvial terraces, kame, kame terraces, etc.) are highly susceptible to frequent fires. They are also susceptible to more extensive fire damage over their surfaces due to the absence of natural "conflagration barriers" (streams, gullies, frequent slope breaks and changes or breaks in types of vegetation and fuel types that might be associated with these minor landform breaks). Natural "conflagration barriers" are absent on these kinds of landscapes (because of their mode of deposition and their generally coarse-textured dry soils). Water runs "into", not "over" these land units. On the other hand, for example, the glacio-lacustrine clay areas with surface drainage barriers and changes in vegetation and fuel types provide a less hazardous condition.

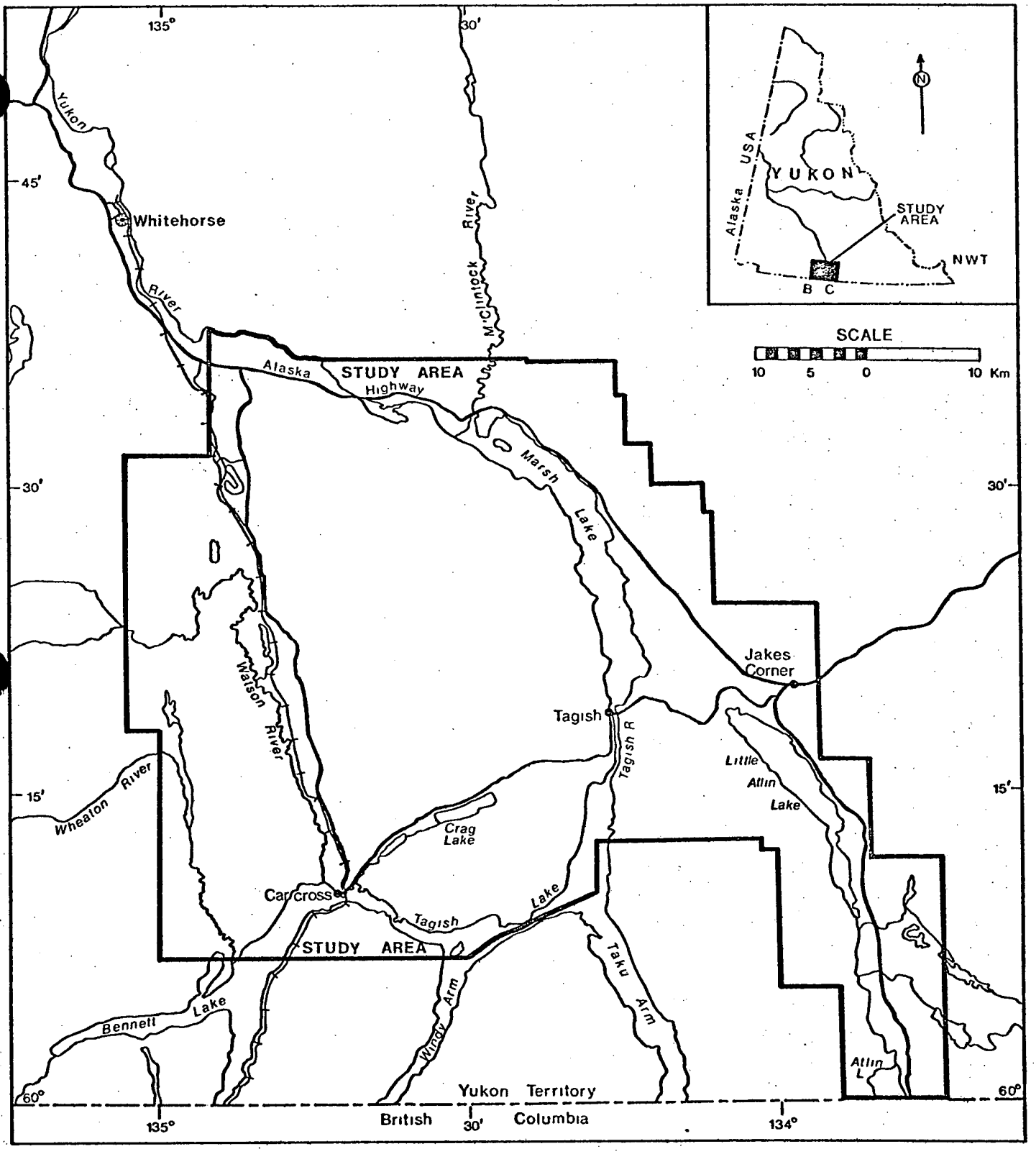
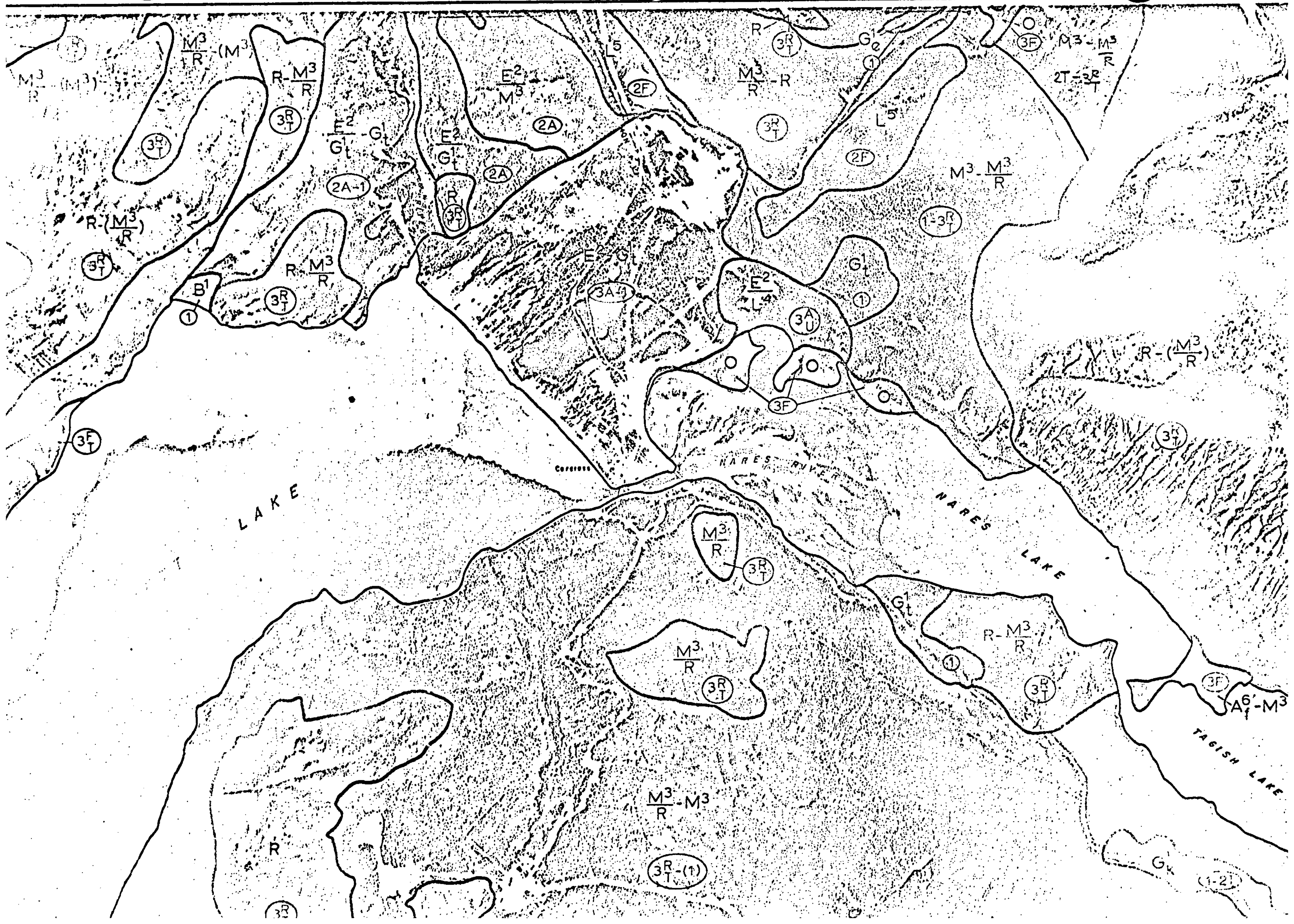


FIGURE 1 Whitehorse – Carcross – Jakes Corner Region of the Yukon Territory


LAKE
NARES RIVER
NARES LAKE
TAGISH LAKE

LEGEND FOR ORTHOPHOTO MAPS

I DESCRIPTION OF LANDFORM AND MATERIAL SYMBOLS

A ALLUVIAL: Materials transported and deposited by streams and rivers. This category includes specific land forms such as alluvial fans, braided floodplains, meandering floodplains and areas of slope wash. Texture of material varies from silts to sands and gravels depending upon stream morphology and season/annual runoff variability; materials are variably sorted. When stable, alluvial fans support lodgepole pine and/or white spruce with an understory of kinnickinnick, willow and grass on coarser textures and feathermoss on finer textures; when active, willows, shrub birch, rose and sometimes aspen dominate. The braided and meandering floodplain units in their early stages support horsetails, followed by willows, then by balsam poplar and white spruce with willow, horsetails, rose and feathermoss in the understory. Lodgepole pine may follow fires but is replaced by white spruce.

- A_f alluvial fan: cone-shaped landform, gentle to moderately steep slopes at the mouths of smaller tributary valleys; surfaces are commonly marked by small distributary channels.
- A_b braided river floodplain: floodplain with multiple channels that are occupied during floods and are constantly shifting within the floodplain; materials are generally coarse textured.
- A_m meandering river floodplain: gently irregular to nearly flat surfaces that include the floodplains of large streams and occasionally inclusions of small features such as stream terraces and alluvial fans; abandoned channels and point bar deposits are common features.
- A_s slope wash: material transported by overland or surface water flow in broadly distributed sheets or small gullies (on steeper slopes).

B BEACHES AND STRAND LINES: Materials deposited by present or former wave action; texture of material is sand and gravel, cobbly in places; long, narrow smoothly curving to straight ridges, often parallel to a present or former shoreline in this study area. These units support open stands of lodgepole pine with kinnickinnick, juniper, rose or grass in the understory. The pine eventually gives way to white spruce and a feathermoss-lichen understory develops.

E AEOLIAN: Materials transported and deposited by wind; texture of material, fine to very fine sand; mapped only as dunes in this study area (loess is not common); surface of undulating, low relief. Currently covered with open growing lodgepole pine and an understory of grass, kinnickinnick, soapberry, and lichens when stable, but white spruce regeneration is moderate to common and feathermoss and lichens usually form major constituents under white spruce; when active the vegetation is virtually non-existent.

G GLACIO-FLUVIAL: Materials deposited by glacial meltwater; texture of materials is sand, sand and gravel, ranging from well sorted and stratified to poorly sorted and stratified; surfaces may vary from nearly flat to irregular terrain marked by kames, eskers and abandoned meltwater channels.

- G_t glacio-fluvial terrace: relatively flat surface which is terminated by an abrupt change in slope on one or more sides; sand, and sand and gravel are the dominant textures in the study area. Lodgepole pine is currently the most prevalent tree species, but white spruce regeneration is often present, and spruce may dominate in older stands. The understory varies from feathermoss under closed canopies to kinnickinnick, lingonberry, grass, lichen under open canopies. Soapberry, shrub birch, willow and rose are common understory species where the moisture regime is favourable.
- G_k kames, kame deltas, kame terraces and pitted deltas: level to strongly irregular hummocks, mounds and terraces often associated with, or adjacent to, valley walls; poorly sorted sands and gravel. South-facing slopes are usually treeless and are covered with prairie wormwood, grass and several forbs; tops of ridges usually with kinnickinnick, juniper and prickly saxifrage; north aspects often have aspen or lodgepole pine, sometimes white spruce, and low shrub and grass understories.
- G_e eskers: irregular, sinuous ridges; poorly sorted sands and gravels. Vegetation patterns are similar to unit above (G_k).

L LACUSTRINE (Glacio-lacustrine): Materials that have settled from suspension in glacial lakes in front of or in contact with ice; well-sorted and well-stratified materials; gently irregular to nearly flat surfaces; texture of materials range from very fine sandy silts to clays. (These map units often include small areas of poorly drained soils and organic terrain). The fine sandy areas support lodgepole pine and white spruce with willow, shrub birch, grass and feathermoss understory. The silts feature mostly white spruce or more commonly shrub birch, willow and grass-sedge vegetation. In areas of fine-textured soils, lodgepole pine and white spruce, with a sparse understory of kinnickinnick, twin flower and feathermoss occur on better drained sites; shrub birch and willow, usually with a few white spruce, and with a grass and sedge understory occur on the more poorly drained level or depressional areas.

M MORAINAL (Till): Materials transported and deposited directly by glacial ice; variable textures; in the study area dominantly gravelly sandy loam; ranging from low hills and ridges (where deposits are deep and they reflect only broad aspects of underlying bedrock) to steep terrain where landscape is controlled by the underlying bedrock; map units on steep slopes and at higher elevations include areas of colluvium (material accumulated on and at the foot of slopes by the various processes of mass movement). Currently, most areas are covered with lodgepole pine following fire, but white spruce regeneration is common and may dominate in older stands, with understory vegetation dependent upon moisture regime. Moist sites have shrub birch and/or willow subtended by feathermoss, mesic sites may have Labrador tea or feathermoss, drier sites have grass, low shrubs and lichens in variable combinations.

MARL: Soft and unconsolidated calcium carbonate material and shells (limited distribution in this study area, primarily around Lower Lake).

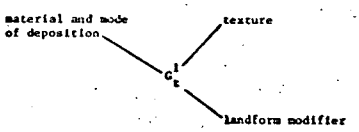
O ORGANIC: Deposits resulting from vegetation growth, accumulation and decay; rate of accumulation exceeds decay; includes bogs and fens; in the study area generally associated with fine-textured lacustrine materials (map units include areas of poorly drained soils). In perpetually wet fens, the vegetation consists mostly of sedge, cottongrass and grass; in somewhat drier conditions willow and shrub birch dominate with ground vegetation consisting of wetland mosses. Bogs commonly are dominated by shrub birch, shrubby cinquefoil, Labrador tea and willow, sometimes white and black spruce, with undergrowth consisting of bilberry, willow and bog mosses. Sphagnum may be present in bog-fen complexes. Lichens often cover tops of hummocks.

R BEDROCK: Rock outcrop and rock covered by a very thin mantle of unconsolidated materials; this map unit also includes smaller areas of talus slopes and colluvial fans in this study area. Within the study area, most of this unit has been burnt and currently supports aspen and willow at higher elevations. Lodgepole pine, white spruce and alpine fir are often present but have patchy distributions. On very thin mantles at lower elevations, the vegetation consists of wormwood, creeping juniper, rose, grass, forbs and lichens. Alpine areas have alpine lichens, prostrate shrubs and few forbs.

TEXTURE OF MATERIALS

1	sand, sand and gravel, gravel	COARSE
2	aeolian sand (used only for dune areas)	COARSE
3	gravelly sandy loam, sandy loam, loam	MEDIUM
4	silt loam, silt, very fine sand, very fine sandy loam (used primarily in glacio-lacustrine areas)	MEDIUM
5	clay loam, silty clay loam, clays (used primarily in glacio-lacustrine areas)	FINE
6	variable, often ranging from gravelly sand to silt	VARIABLE

EXAMPLE OF MAP SYMBOLS



(Indicates Glacio-fluvial terrace, sand and gravel)

Other Symbols Used

Stratigraphic indicator: $\frac{M^3}{R}$ refers to area of morainal (till) material, gravelly sandy loam in texture, overlying bedrock.

Complex area or composite units: M^3-$\frac{M^3}{R}$ (refers to area in which M^3 (deep morainal) deposits are dominant 60%, and M^3/R is the minor component of the mosaic).

Minor but important inclusions: ( ) brackets around a symbol indicate an inclusion in the map unit that occupies 25% of the area, e.g. G_t^1-(E^2) indicates that the Aeolian (E^2) deposits are a minor component scattered throughout the unit.

II LIMITATIONS TO SETTLEMENT/DEVELOPMENT (EXCLUDING A RATING OF EASE OF ACCESS TO THE AREAS MAPPED) (Symbols are enclosed in circles or ellipses)

DEGREE OF LIMITATIONS

1. None, or a combination of minor, unspecified limitations
2. Moderate limitations
3. High limitations

LIMITING FACTORS

- T - topography - slope
- E - erosion
- A - wind erosion
- F - flooding/wetness (including ponding and seepage areas)
- U - unstable materials (subject to slumping, slides, subsidence)
- R - bedrock and talus

SYMBOLS FOR INTERPRETIVE RATINGS

(For areas rated Class 1 the kinds of limitations are not indicated by symbols.

(2T)

(indicates an area with moderate limitations, dominantly steep topography)

(3^R_T)

(indicates an area with severe limitations, dominantly bedrock or shallow soils over bedrock, and steep topography)

Symbols to indicate the components of composite units or units containing minor inclusions are also used as described above.