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RESEARCH BRIEF # 4

Landtypes of the MacKay River Watershed  
Cariboo Region

by

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TITLE: Landtypes of the Mackay River Watershed,  
Cariboo Region.

Site specific information for forest management  
with recommendations for timber harvesting  
and reforestation.

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1. Introduction

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Everyone agrees that improvements in forest management will come only when we can make decisions on a "site-specific" basis. Reaching this goal, though, requires a great deal of site specific information about the forest resources we wish to manage. Our report represents a small step toward providing this information for the Cariboo Resource Management Region. Its contribution is limited both in terms of area covered - the MacKay River Watershed - and information ~~is~~ provided - a land type classification with attendant interpretations for timber harvesting and reforestation. Nevertheless we expect the report to have application well beyond the area of study. Similar ecological conditions are found throughout the region's Englemann Spruce - Sub Alpine Fir Biogeoclimatic zone which occurs above 4,000 feet in the Quesnel Highlands. Thus it is not unreasonable to expect that our comments on timber management in the MacKay can be transferred to other areas, as long as the reader takes care.

\* \* \* \* \*



Figure 1. Location of Mackay River Valley

## 2. Study Methods

In essence we set out to define the landtypes of the MacKay River.

"Landtypes are the basic units and building blocks for over-all land use study and planning. They are the visually identifiable unit areas resulting from homogeneous geomorphic and climatic processes and having defined patterns of soils and vegetative potentials. Landtypes range in size from about 1/10 to 1 square mile. Their size and composition depend upon the significance of physical characteristics which can be readily interpreted to identify hazards, suitabilities, and productivity potentials that are reliable for area planning purposes. They are areas of land generally managed as an entity and as such identify areas for which zoning and resource allocation decisions can be made. Landtypes delineate the permanent elements of the ecosystem and serve as a logical base and frame of reference for which other elements of the ecosystem can be described.

Landtype delineations and descriptions correspond with what can be readily observed in the field, permitting rapid understanding by land managers, facilitating extrapolation of experience and research to similar areas of land, enhancing continuity of management with changing personnel, and promoting consistent management within organizations. Few inventories of landtypes have been made for wildland areas in the United States. Maps of landtypes are generally made from air photos of 1:20,000 to 1:60,000 scale and printed at about 1:20,000."

(Wertz & Arnold, 1972)

Field investigations were carried out on a central portion of the watershed (Timber Sale Licence A07015) which covers 10% or 3,000 acres of the total area. Soil<sup>1</sup>, vegetation<sup>2</sup>, and timber inventory<sup>3</sup> information were collected in a series of traverses; photo interpretation was used to extend the field information to the remainder of the watershed.

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1. Soil descriptions, proposed classification and terminology follow.
  2. Vegetation was classified using Hitchcock and Cronquist.
  3. Canada Land Inventory.

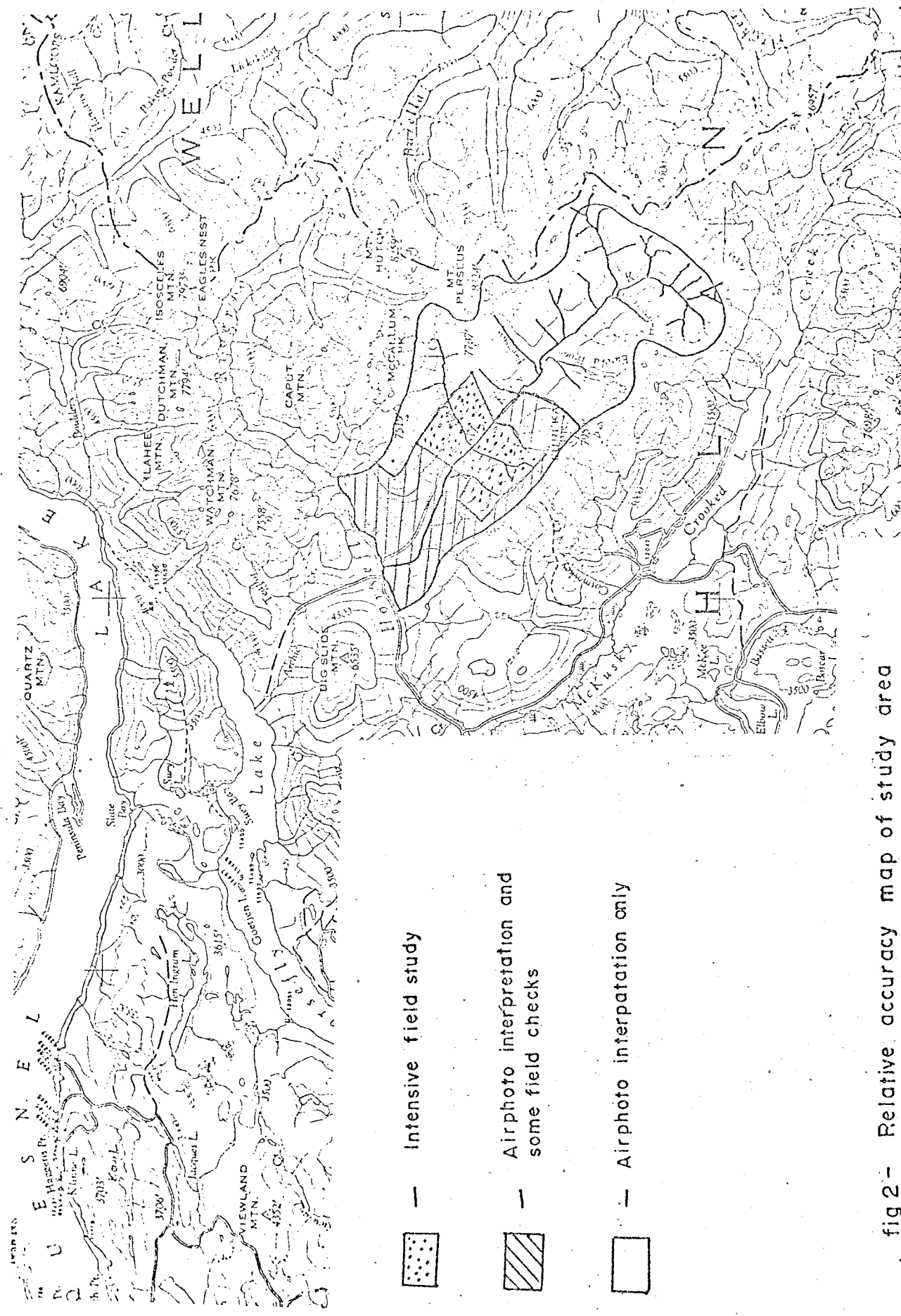


fig 2- Relative accuracy map of study area

### 3. Land Types of the Mackay

#### (a) Timber Management Interpretation

Information gained in the process of land type classification, and observation of timber harvesting in the watershed, has been used to formulate management recommendations for road access, construction, road density, timber extraction to the road, and reforestation. The recommendations are based on current technology, and perhaps more important standard logging practices in the Quesnel Highlands. Thus the road building comments are based on the assumed use of crawler tractors: use of a large backhoe, which from observations causes less soil disturbance than 'cats', would change some comments. Similarly, we have assumed that logs will be skidded to landings unless cable yarding is prescribed. This does not mean that cable yarding should not replace skidding elsewhere, but merely that skidding should not take place in some areas so as to avoid excessive soil disturbance.

Please remember that the recommendations are founded on soils and vegetation examinations well mixed with observations and spiced with inspired (we hope) guesswork. We have tried to provide enough information in each land type description for you to work out the relationship between landtype and proposed practices yourself. The recommendations, therefore, are an initial guide only. We expect that as logging expands in the Quesnel Highlands and experience grows the recommendations will change, and eventually, become obsolete.

A summary of recommendations by landtype is presented in Table 1.

TABLE 1 - SUMMARY OF RECOMMENDATIONS  
BY LANDTYPE

TIMBER MANAGEMENT INTERPRETATIONS

Land-type	S O I L		Vegetation	Road Construction Limitations	Harvesting Method Limitations	Reforestation	Forest Capa.
	Parent Material	Dominant Sub Group					
1	Glacial Fluvial	Orthic Humo-Ferric Podzol	N. Aspect-Valeriana Oakfern S. Aspect-Cornus Moss.	Few Limitations	Few Limitations	Plant Spruce	5
2	Glacial Till	Orthic Humo Ferric Podzol	Valeriana-Oakfern	Moderate Limitations.	Moderate Limitations	Plant Spruce immed. after site prep.	5
3	Colluvium over till	Degraded Dystric Brunisol	Valeriana-Oakfern	Few-moderate limitations	Topographic Limitations	Same as above	5
4	Colluvium	Orthic Dystric Brunisol	Valeriana-Arnica	Moderate Limitations	Topographic Limitations	Plant Spruce, Pine on shallow exposed sites.	5 & 6
5	Colluvium or Till	Gleyed Humo Ferric Podzol	Ladyfern-Devil's Club	Moderate-severe limitations	Topographic & seasonal limitations	Plant immed. after site preparation.	4
6	-	Orthic Humic Gleysol	Senecio-Horsetail	Moderate-severe limitations	Seasonal limitations	Same as above	5
7	Organic	Typic Humisol	Carex Bog	Severe limitations	Non-productive landtype	Non-productive landtype.	7
8	Colluvium and Rock	Orthic Dystric Brunisol	Ladyfern-Devil's Club	Severe Limitations	Non-productive landtype	Non-productive landtype.	7

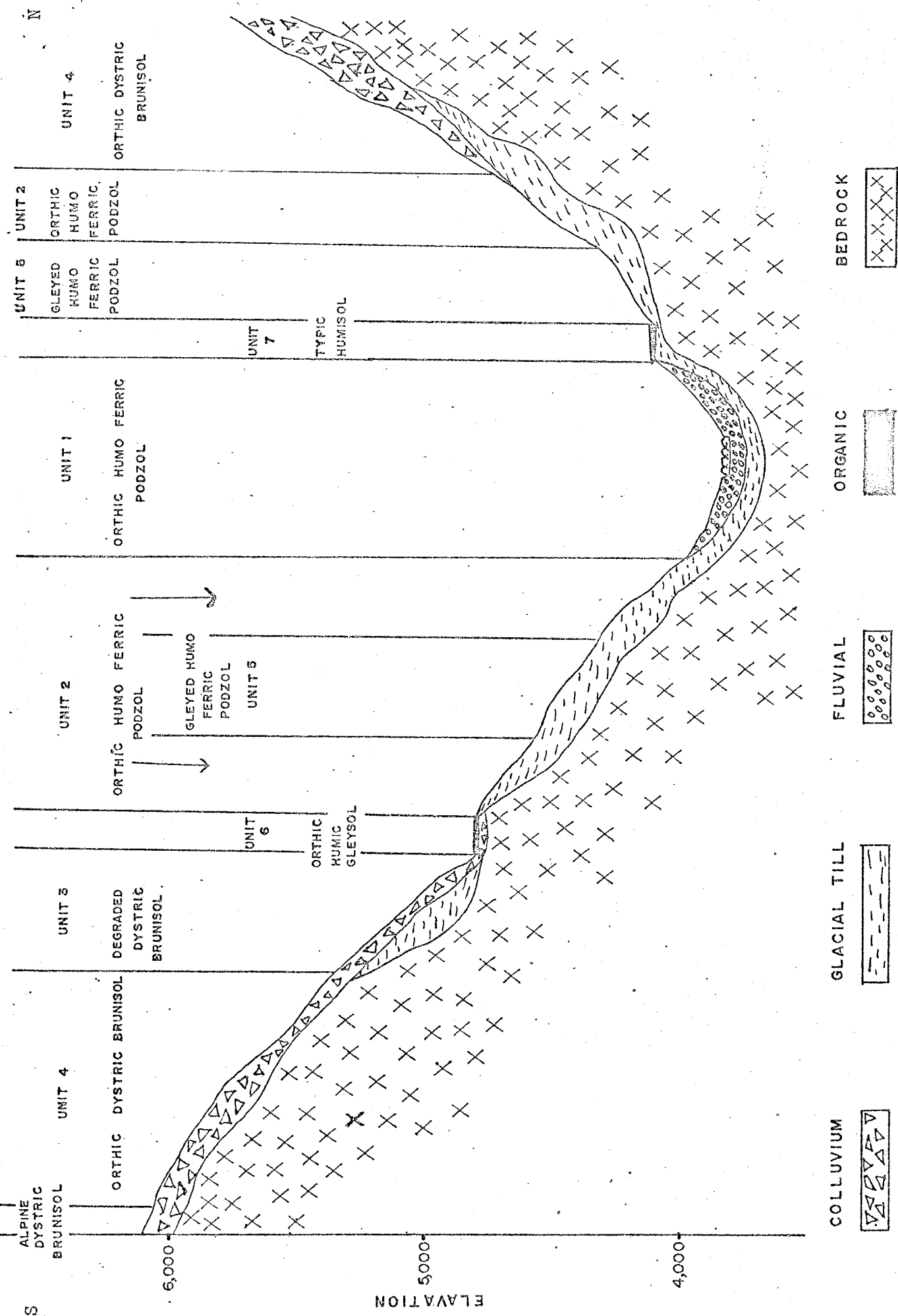


Figure 3. Cross Section of Mackay River Study Area Showing Parent Materials, Soils and Management Units.

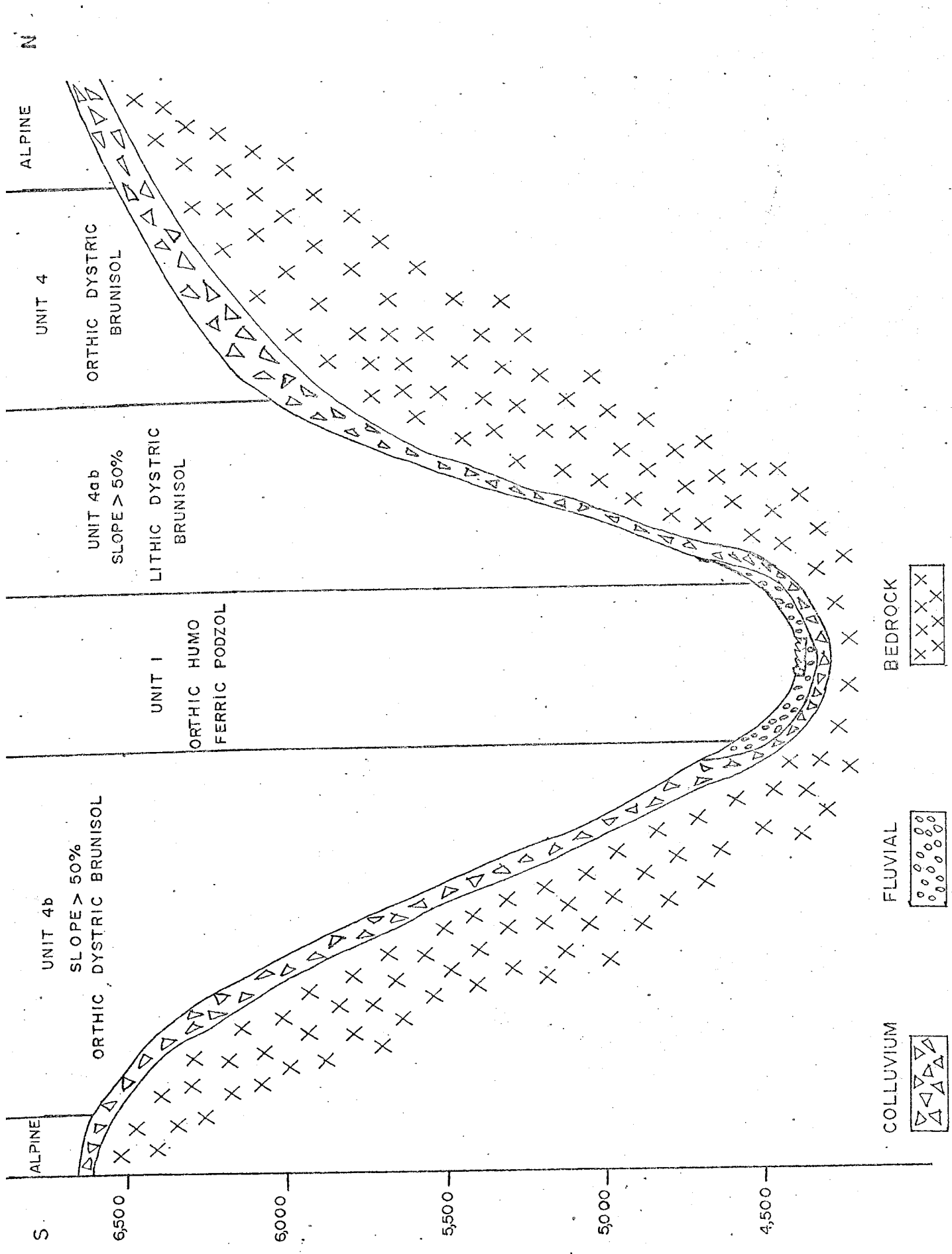


Fig. 4 Cross section of Mackay River head waters, showing parent material and associated landtypes.

(b) Landtype Descriptions and Management Interpretations

Unit: Landtype 1.

I. Description

This landtype is found at the bottom of the valley between the elevation of 3,800 and 4,200 feet. It has developed on well sorted glacio-fluvial and fluvial (outwash, alluvium, alluvial fans) deposits ranging in texture from gravelly sand to sandy loam. The topography is undulating to moderately rolling (0-15%) with a few steeper sloped run-off gullies on the north side of the unit. There is no lateral subsurface flow. In the cool mountain climate, subhumid moisture conditions, and well drained parent materials, rapid leaching has taken place.

The soil is classified as an Orthic Humo-Ferric Podzol. Humic acids from decomposition of coniferous forest litter have removed the sesquioxides (iron and aluminum oxides) from the upper soil horizon leaving a characteristic bleached zone, and the leachates have been deposited lower in the soil profile.

Two vegetation types have developed on this land unit. On northern aspects, where moisture is adequate and exposure is limited, the mesic Valeriana-Oakfern vegetation site is found. Spruce is the dominant tree species and both spruce and Abies are found beneath the main canopy. Beneath the tree layer the cover of herbs and shrub species is extensive and species diversity is high. Stand density is medium to high.

On the southern aspects, conditions are drier and the Cornus-Moss association has developed. Lodgepole Pine is found in the main canopy with Spruce, while suppressed Abies are found below. Spruce regeneration is rare. Stand density and merchantable values are lower because of drier conditions. The herb and shrub layer is less well developed than the moister north aspect. Much of the tree canopy is open. Rhododendron can have extensive cover.

II. Timber Management Interpretations.

A. Road Construction

The soil parent materials in this landtype present few engineering limitations to road development (Table 2). The material is very pervious, has a good saturated shear strength and almost no compressibility or expansion when saturated. Slump and slide hazard is low because the material has a single grain structure, it lacks cohesion and it is susceptible to erosion by running water. Slopes should be cross drained at the top to prevent intercepted water causing erosion. Road cuts greater than 70% on the natural angle of repose will ravel. A few small wet depressions occur locally within the landtype and should be avoided.

TABLE 2 - INFERRED ENGINEERING CAPABILITY\*

Land Unit	Unified System	Permeability	Shear Strength (saturated)	Compressibility & Expansion (saturated)	Slump & Slide Hazard	Potential Frost Action	Workability as a Construction Material.	Pedological Drainage Class
1	GP	Very pervious	Good	Almost none	Low	None to very slight.	Good	Rapid to well.
2	ML	semipervious to pervious	Fair	Slight to medium.	Mod. to high.	Medium to very high.	Fair	Well to mod. well
3	SP/ML	Pervious.	Good to Fair.	Almost None/Slight to medium.	Mod./High.	Very slight to high.	Good to Fair.	Well to moderately well.
4	SP(GC, SM)	Pervious (variable)	Good to fair.	None to slight.	Mod. to low.	None to slight. (occas. very high.)	Good to Fair.	Moderately well.
5	MH	Semipervious	Fair to Poor.	High	High to moderate.	Medium to high.	Poor	Imperfect to poor.
6	MH	Semipervious	Poor to Fair.	High	Moderate to high.	Medium to high.	Poor	Imperfect to poor.
7	PT	Pervious	N.A.	Very High.	-	Slight	-	Poor to very poor.

\* Engineering characteristics are general guidelines and relative ratings and are not intended to replace site specific engineering investigation.

## B. Harvesting Method

Full tree skidding with rubber tired skidders is acceptable. The gentle topography and physically resilient soil make this method suitable. Skid trails should be designed to minimize displacement of the shallow organic litter layer in the site. Although the litter layer is shallow, it contains a large proportion of the soil's nutrients. This disturbance should be kept to a minimum.

Skidding should not occur in stream beds or gully bottoms. High volumes of spring runoff are channeled through the gullies and will erode exposed mineral soil. Skid roads and trails should avoid the occasional slopes which exceed 30%.

## C. Recommended Harvesting Method:

Summer: Rubber tired skidders, restricted to identified skid trails.

Winter: Same as above.

N.B. (All slopes < 30%)

## III. Reforestation

Site conditions are moist enough for successful natural regeneration of Spruce on both N. and S. aspects in the unit. However, planting is recommended because of uncertain seed years and the risk of brush competition, particularly from Rhododendron on the N. aspect. Litter layers are not thick enough to justify special scarification experiments for planting although some soil disturbance would encourage early growth through increased soil temperatures, especially on the north aspect. For this reason careful summer logging is preferred.

Broadcast burning for slash disposal is not recommended because of the danger of destroying a high proportion of soil organic matter and thus releasing much of the site's nutrients into the air or runoff water. In addition, once the surface mat of organic material is removed, the underlying mineral soil and its single grain structure is subject to rapid erosion.

Unit: Landtype 2

I. Description

This landtype is situated on the lower slopes on the valley walls from 4,200 to 4,500 feet. It has developed on sandy loam to loam basal till, on steeply sloping (15-30%) topography. This is a seepage receiving area, with localized lateral sub-surface flow. The soils are moderately well drained to imperfectly drained. Water is removed from the soil somewhat slowly in relation to supply. There are no significant moisture deficits in the growing season; the unit has a perhumid moisture subclass.

In areas of coarser textures (sandy loam) and good drainage, rapid leaching has taken place, leading to the development of an Orthic Humo-Ferric Podzol. Where the soil is finer (loamy) and drainage is impeded, as in areas of seepage, leaching is not significant. The morphology of the B horizon of the soils in this area indicate that the soil be classified as a Degraded Dystric Brunisol.

Both north and south aspects in the unit support the Valeriana-Oakfern vegetation type, which develops on mesic sites throughout the study area, usually below 5,500 feet. The tree layer has medium to high density and is dominated by Spruce. Codominants are equally divided between Spruce and Abies. The shrub layer is moderately developed with good species diversity. The herb layer is well developed and characterized by the abundant cover of Oakfern.

II. Timber Management Interpretations:

A. Road Development

The glacial till parent materials in this landtype present moderate engineering limitations to road development (Table 2). When saturated the material has a fair sheer strength and slight to medium compressibility and expansion. Slump and slide hazard is moderate to high - the highest hazard being on steeper topography and having abundant groundwater. Potential frost action is medium to very high. For construction the material has a fair workability.

At the time of construction, care should be taken to maintain the driest possible conditions by providing immediate drainage facilities. The materials workability will be enhanced when in the unsaturated state.

B. Harvesting Methods

Full tree yarding is acceptable. On slopes less than 30% full tree skidding on compact snow is also acceptable. The normally moist soil conditions make the soil susceptible to damage. Soil compaction with subsequent drying will leave it in a cement like condition. Soil disturbance which exposes bare mineral soil can lead to loss of the soil resource through erosion. Where runoff is channelled and streams redirected erosion will be high.

The soil is most susceptible to damage when moisture levels are high.

C. Recommended Harvesting Method

	<u>Slope &lt; 30%</u>	<u>Slope &gt; 30%</u>
Winter	Rubber Tired Skidder	Cable
Summer	Cable	Cable

(do not log when moisture levels are high).

III. Regeneration

Site conditions are moist enough to favour spruce regeneration on both north and south aspects. If natural regeneration is sought after competition will be moderate from Rhododendron. The competition will be high in seepage areas.

Planting of Spruce immediately after logging will avoid competition and the problem of uncertain seed years. Screefing at the time of planting should be sufficient scarification.

Scarification by ripping of landings to break up the easily compacted parent material will be necessary to return them to timber production areas.

Slash burning is not recommended on the steeper slopes because of the danger of surface erosion after a hot burn.

Unit: Landtype 3

I. Description

This landtype is found on the middle slopes, on north and north west aspects, between the elevations of 4,500 and 5,000 feet. The soils are developed on till, covered with a gravelly sandy loam to loam colluvial veneer (about 1 meter thick) on very steeply sloping to hilly (30-60% slope) topography. There is some lateral sub-surface flow; the unit is a transmitting zone of moisture from the receiving areas above to the lower elevations below.

The relatively cooler climate and perhumid moisture conditions have led to the development of a Degraded Dystric Brunisol. These are soils which undergo the same leaching process as podzolic profiles but the B horizon contains insufficient illuviated material to be classified as podzolic. Orthic Dystric Brunisol inclusions are also found. They are formed in the same manner as the Degraded Dystric Brunisol but less leaching has taken place. Lithic subgroups occur where the colluvial veneer thins to less than 50 cm. in thickness.

The Valeriana-Oakfern association is found on this landtype. The tree layer has medium to high density and is dominated by spruce. Codominants are equally divided between spruce and Abies. The shrub layer is moderately developed and has good species diversity. The herb layer is well developed and is characterized by the very abundant cover of Oakfern. In moister areas Valeriana has extensive ground cover.

II. Timber Management Interpretations.

A. Road Development

The colluvium veneer presents few engineering limitations but the underlying glacial till presents moderate engineering limitations. (Table 2). The most limiting situation is the combination of glacial till, steep topography, and seepage. Most cuts will involve working in the glacial till. In addition, bedrock may be near the surface locally. The slump and slide hazard is moderate to high. On the 30 to 60% slopes many cuts and fills will be required and will produce over steepened areas susceptible to slumping and erosion.

## B. Harvesting Methods

Full tree skidding is considered acceptable on slopes less than 30% during winter and drier conditions in the summer. Cable yarding should be practised on slopes greater than 30%. On gentler slopes skid road construction will occur in the colluvium which has few limitations. On steeper (>30%) slopes excessive soil disturbance including cutting through the colluvium and into the till is predicted. Adequate culverting is required to dispose of intercepted surface and subsurface water flow and protect the bare mineral soil from excessive erosion and subsequent sedimentation.

The adverse topography is the major contributor to the limitation of ground skidding on these parent materials.

## C. Recommended Harvesting

	<u>Slopes &lt; 30%</u>	<u>&gt; 30%</u>
Winter	Rubber Tired Skidder	Cable
Summer	Rubber Tired Skidder	Cable

## III. Regeneration

Spruce should be favoured, and because of vegetation competition and uncertain seed years, planting immediately after logging is recommended. Site preparation, other than soil disturbance during logging, will not be necessary.

Prescribed burning of slash should be avoided unless the soil litter layer can be retained.

Unit: Landtype 4

I. Landtype

This landtype is found on both sides of the valley between 5,000 - 6,000 feet. The parent material is gravelly, sandy loam to gravelly loam colluvium, less than two meters thick overlying bedrock on very steeply sloping (30-80%) topography. It is moderately well drained and a runoff shedding position with little sub-surface flow.

As this unit is situated at high elevations, it is subject to a cold climate and is strongly influenced by cold air drainage from the cirque valleys above it. The cold climate, perhumid moisture regime have led to the formation of an Orthic Dystric Brunisol; on areas shallow to bedrock, the soils are classified as Lithic Dystric Brunisols. These soils have a surface litter and humus layer over a weakly illuviated B horizon. There has been very little translocation of minerals within the profile. The parent material is acidic and made up of rock fragments eroded from the mountain faces above.

While the upper slopes have all developed much the same soil profile the vegetation is quite varied within this unit. Vegetation types that have formed are a result of aspect, depth of soil and the presence of cold air drainage. On the northern aspects the Valeriana-Arnica extends down to 5,000 feet in the hanging valleys.

The tree layer has a medium density with Spruce and Abies dominating. The shrub layer varies in its degree of development depending on canopy closure. Shrub species diversity however is poor, with Rhododendron and Vaccinium being the principal components.

The Valeriana-Arnica vegetation type is also found on the southern aspects at the maximum elevation of the landtype. On the xeric southerly sites, the Lichen-Moss association is found while on subxeric sites the Cornus-Moss association prevails. The tree layer is of low to medium density and characterized by Spruce and occasional Lodgepole Pine. Abies mortality is high, resulting in frequent snags and deadfalls. (Rhododendron is abundant and extremely vigorous in the Lichen-Moss association, while it is less abundant in the Cornus-Moss association.) The herb layers are poorly to moderately developed in both types, with rare xerophytic species occurring in the Lichen-Moss association.

## II. Timber Management Interpretations

### A. Road Construction

The soil parent materials present moderate limitations to road construction. The major limitations are adverse topography and variability of the materials. The material is pervious and has a good to fair saturated shear strength. Due to steep topography it will require excessive cut and fill slopes to attain an adequate cut bank or side cast slope. The slump and slide hazard is moderate to low but creep of the surface soil will occur if exposed.

### B. Harvesting Methods

Harvesting should be accomplished with a minimum of road construction. Ground skidding methods are not acceptable. Soil disturbance of the relatively nutrient rich upper soil horizons should be minimized. Probability of a major slope failure increases in proportion to road density.

The sensitive subalpine environment dictates that disturbances due to logging be minimized.

### C. Recommended Harvesting Method

Cable yarding with a minimum of road construction (as with Skyline Systems) will keep soil disturbance to an acceptable minimum.

## III. Regeneration

Removal of tree cover will intensify the near alpine climate of the unit. Accordingly, regeneration problems, inferred by lack of regeneration, which are already evident in the mature stands, will worsen. It is possible that planting could augment the existing layer of Abies advanced regeneration, but the outlook for success is not favourable. For this reason we may have to conduct the logging as a timber mining operation removing the surprisingly high volumes of large diameter, very old spruce trees found as scattered blocks over the unit, without thought of future operations. Alternately, the unit could be established as an environmental protection forest area.

If planting takes place severe brush competition from Rhododendron can be expected on the Cornus-Moss types and spruce should be planted immediately after logging. Spruce should also be planted on the

less troublesome Valeriana-Arnica Type. Pine is preferred for the drier Lichen-Moss type.

Any form of additional soil disturbance for site preparation should be avoided on this land type.

Unit: Landtype 5

I. Description

This landtype is found on lower and middle elevation slopes which receive seepage. The parent material is a loam to silty loam basal till greater than two meters thick on moderately to steeply sloping (10-40%) topography. It is a poorly drained area of common lateral subsurface flow. The landtype is typified by its excessive moisture conditions.

As these soils are wet most of the year, they undergo intense reduction, causing duller colours, mottling, and a higher organic matter content in the A horizon. This wetness and resultant reduction also tends to diffuse soil horizon boundaries, making the transition from one to the other difficult to see. The oxidation reduction process is called gleying and the soil in this unit is classified as a Gleyed Humo-Ferric Podzol. Because this soil is saturated for long periods of time, it is placed in the peraquic moisture subclass.

The vegetation also reflects the moist environment which results in an increase in hydrophilous species.

The tree layer has medium to poor density and is dominated by large widely spaced spruce. Abies predominates over spruce in the co-dominant and suppressed categories as well as the advanced regeneration class. Alder is abundant and usually forms pure stands which excludes any conifer regeneration. The shrub layer is well developed and characterized by various sized patches of Devil's Club. The herb layer is also well developed and diverse in species.

II. Timber Management Interpretations

A. The glacial till parent materials of this landtype present moderate to severe engineering limitations. The semipervious material has a fair to poor saturated shear strength and has high compressibility and expansion when saturated. Slump and slide hazard is high to moderate. Potential frost action is medium to high. Workability as a construction material is poor. The abundance of water in the material throughout the year contributes to its adverse engineering limitations. Slope measurements of cut bank and side cast failures in this landtype are between 20 and 30%. Due to these engineering limitations this land type should be by-passed in road development wherever possible.

B. Harvesting Method

Full tree skidding is acceptable on slopes less than 30% when done on snow to minimize ground disturbance. Skidding is not acceptable during summer or on slopes greater than 30% due to excessive soil disturbance by skid road construction and logging. Cable logging methods are strongly recommended for this productive landtype.

C. Recommended Harvesting Method

	<u>Slope &lt; 30%</u>	<u>&gt; 30%</u>
Summer	cable	cable
Winter	Rubber tired skidder	cable

III. Regeneration

Excessive moisture and heavy brush competition create regeneration problems within this unit. Alder is naturally quite abundant and will perpetuate itself in this highly productive site. Natural regeneration is poor due to brush competition from Alder and shrub species.

Prescribed burning is recommended because the moist upper soil horizons will not be damaged and planting costs will be reduced. Planting of spruce should take place immediately after preparation. This should be restricted to micro sites suitable to the spruce seedlings, alder thickets should be avoided.

Unit: Landtype 6

I. Description

This land type develops at the base of slopes, flat areas, and depressions that collect seepage water. The parent material varies from silt loam basal till to gravelly loam colluvium according to the elevation and location on the valley walls. These areas are imperfectly to poorly drained and consequently the ground is saturated throughout the growing season; the unit has a peraquic moisture subclass.

The soils vary widely in profile development, some being classified as Gleysolic and others as Organic where water has ponded in depressions. In both cases, the cold, wet conditions have retarded plant residue decomposition resulting in an organic accumulation in the surface horizon. The land type unit has grouped these soils together for management purposes.

The mineral soil which predominates in this unit has been classified as Orthic Humic Gleysol. As a result of reducing conditions, mottling (the localised oxidation of ferrous iron and deposition of hydrated ferric oxides) occurs in the profile below the organic surface layer. This layer ranges up to 30 cms. deep. The organic soils, which are scattered in small patches through the unit are classified as Typic Humisols, the organic soils extending down greater than two meters.

The unit has a generally neutral aspect, and on some of the higher elevation sites, is influenced by cold air drainage. Its range is defined by the Senecio-Horsetail plant association, a hygic vegetation site type. The tree layer has low to medium density which is dominated by spruce and an occasional lodgepole pine. Abies share dominance with spruce in the co-dominant tree class but is the most frequent species in the suppressed class. Alder is a frequent component but doesn't attain the vigor or distribution found in the ladyfern - Devil's Club type.

The shrub layer under open canopy conditions is dominated by Rhododendron; Lonicera is the only other commonly occurring shrub.

The herb layer is considered floristically rich and contains many hydrophilous and bog species, the Lichen-Bryophyte layer is also well developed.

## II. Timber Management Interpretations.

### A. Road Construction

The parent materials of this landtype present moderately severe engineering limitations for road construction. The semipervious material is saturated with water for a significant time of the year. The saturated shear strength is poor to fair and compressibility and expansion when saturated is high. The slump and slide hazard is moderate to high but if left undisturbed the material is on such gentle topography no instability will be evident. The shallow organic layer is not suitable for road construction and must be wasted. Lithic soils also occur presenting a difficult combination of materials to cope with. Due to depressional topography, there will be difficulties in providing adequate drainage.

### B. Harvesting Method

Full tree yarding is acceptable if the landing is located off this landtype. Cable yarding is recommended but winter skidding is acceptable. The soil is sensitive to damage by compaction, disruption of drainage, and loss of soil structure.

### C. Recommended Harvesting Method

Summer	-	Do not log.
Winter	-	Rubber tired skidders.

## III. Regeneration

Regeneration will be difficult due to the thick surface litter and excessive moisture. Site preparation, in the form of a broadcast burn could be used to remove much of the slash, however preparation of a seed bed for natural regeneration will be more of a problem. Brush will spread rapidly after the fire and spruce regeneration will be slow unless spruce seedlings are planted immediately.

## Unit Landtype 7

### I. Description

This unit is found on level and depressional topography. Sandy loam to loam till or bedrock is overlain by well and semi-decomposed organic matter, two to three meters thick. Drainage is very poor and the soil is saturated throughout the year. The water table lies on or near the surface, giving a hydric vegetation site classified as Carex bogs.

The soils are all organic and are classified according to the degree of decomposition of the organic matter. The dominant subgroup found is Typic Humisol, a soil which is made up entirely of well decomposed organic matter. Significant inclusion of Mesic Humisol (a soil with well decomposed organic matter underlain by semi-decomposed material) and Mesic Fibri sol (a soil made up of poorly and semi-decomposed material) is also found.

The vegetation is made up of various bog sedges, while all tree species are absent.

### II. Timber Management Interpretation

#### A. Road Construction

The organic materials in this landtype present severe engineering limitations to road construction. The material has very high compressibility and expansion when saturated which makes it unsuitable for road construction purposes. It is recommended that roads are not constructed on this landtype.

#### B. Harvesting Method

This landtype does not support a commercial forest so no harvesting will take place on this landtype.

#### C. Recommended Harvesting Method

This unit provides no commercial timber and therefore there will be no logging operations in these areas. These organic soils are also unsuitable for road construction (see Unit 6) due to physical properties, and should be avoided.

### III. Regeneration

Area not suited to production of tree species.

Unit: Landtype 8

### I. Description

This landtype occurs on steep pitches with slopes usually greater than 40%. The landtype generally runs as a narrow strip running from the alpine down to the river. It occurs throughout the watershed along steep valley walls, and acts as a channel for the downward movement of snow and debris.

During the summer months the unit provides a natural stream channel. As a result of the abundant moisture, generally the Ladyfern-Devil's Club vegetation association results. Soil profile varies according to elevation, however they are generally Orthic or Lithic Dystric Brunisols. The downward movement of snow and debris prohibits the maturation of commercial tree species.

### II. Timber Management Interpretations

#### A. Road Construction

This landtype presents severe engineering limitations to road construction. The physical characteristics of the material may be suitable but the location in the landscape is the overriding factor. The unstable snow and landform conditions upslope would affect maintenance and servicability of the road.

#### B. Harvesting Method

Due to unstable conditions trees do not reach a merchantable size on this landtype and by definition of the landtype no harvesting will occur on this type. It is recommended that landtypes next to this one allow for a buffer strip along the boundary as a safety measure.

### III. Reforestation

This landtype is a non-productive unit in terms of commercial tree species, and due to the adverse physical characteristics of the unit any attempts in forestation would prove fruitless.

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