LAND PROTECTION DIVISION

Technical Report No. 2

# Nicholson River
# Water Supply Catchment

## Report on a Proposed
## Land Use Determination

June 1990

# Report on a Proposed Land Use Determination For the Nicholson River Water Supply Catchment

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# Foreword

This report was prepared in 1984 following an investigation of the catchment the previous year. Since that date review of information has been made only to reflect major differences in the catchment situation since 1983/84. The Determination of Land Use, the main focus of the study, remains unaffected.

In June 1989 the Director-General of the former Department of Conservation, Forests and Lands made the Determination for the catchment.

# INTRODUCTION

The Nicholson River Water Supply Catchment was proclaimed as a water supply catchment under the *Soil Conservation and Land Utilization Act* in 1975 following a request for proclamation by the (then) Lakes Entrance Waterworks Trust. The responsible water supply authority is now the Tambo Water Board. The area covered by the proclamation is the catchment to the offtake weir constructed on the Nicholson River. The storage dam which was proposed at the time of proclamation was completed in 1976. It is some 5 km upstream of the offtake.

Proclamation was made because of the Trust's concern about accelerated development of land in the Catchment (Soil Conservation Authority, 1975). Indeed, during the last decade there has been a considerable number of land use changes, for example, from bushland to agriculture or hobby farms. There is also increasing pressure for hobby farming, residential use and recreation, all of which are already present in the Catchment.

The quality of the harvested water is strongly influenced by the type of land use in the catchment. Provided that land use within the catchment is managed satisfactorily and located appropriately, deterioration in water quality should not be significant in the long term. Where a land poses a threat to water quality, by virtue either of its nature, its location or where management input is insufficient, regulatory measures may be needed in addition to technical advice.

This report describes the present state of the Catchment and recommends the most suitable use of land in order to maintain an adequate level of water quality and yield. An investigation of the Catchment has been made to identify and describe the types of land, their limiting characteristics and the general condition of the land under present management. The freehold land has been investigated and mapped in more detail because this land has a wide range of uses, it is more intensively used and is in close proximity to water supply offtake.

# DESCRIPTION OF THE CATCHMENT

## *Locality*

The Nicholson River Water Supply Catchment is located in East Gippsland. The Catchment extends from the off-take weir 13 km north-east of Bairnsdale and 4 km north-west of Sarsfield, to Mt Baldhead in the Gippsland Highlands. The Catchment is situated within the Shires of Bairnsdale, Tambo and Omeo and has an area of about 450 $km^2$. The Catchment is bordered by a number of roads (refer Figure 1).

## *Physiogrpahy and Geology*

The Nicholson River Water Supply Catchment forms part of the eastern uplands. Mature and diverse topography are outstanding features of the Catchment. The elevation ranges from 100 m in the lowlands at the off-take to 1200 m at Mt Baldhead. Other main peaks are Mt Dow (960 m), Mt Sugarloaf (884 m) and Mt Welcome (579 m) on the eastern ridge at Mt Hoad (579 m) and the Two Sisters (579 m) on the western ridge. The Catchment is characterised by low rolling hills and gentle slopes in the south and by gorge-like valleys in the northern uplands.

Most of the Catchment is comprised of sedimentary rocks of Ordovician age with outcrops of granite and granodiorite around Mt Baldhead. Tertiary deposits and a few alluvial deposits are found in the gently sloping ares in the south of the Catchment and along the Nicholson River.

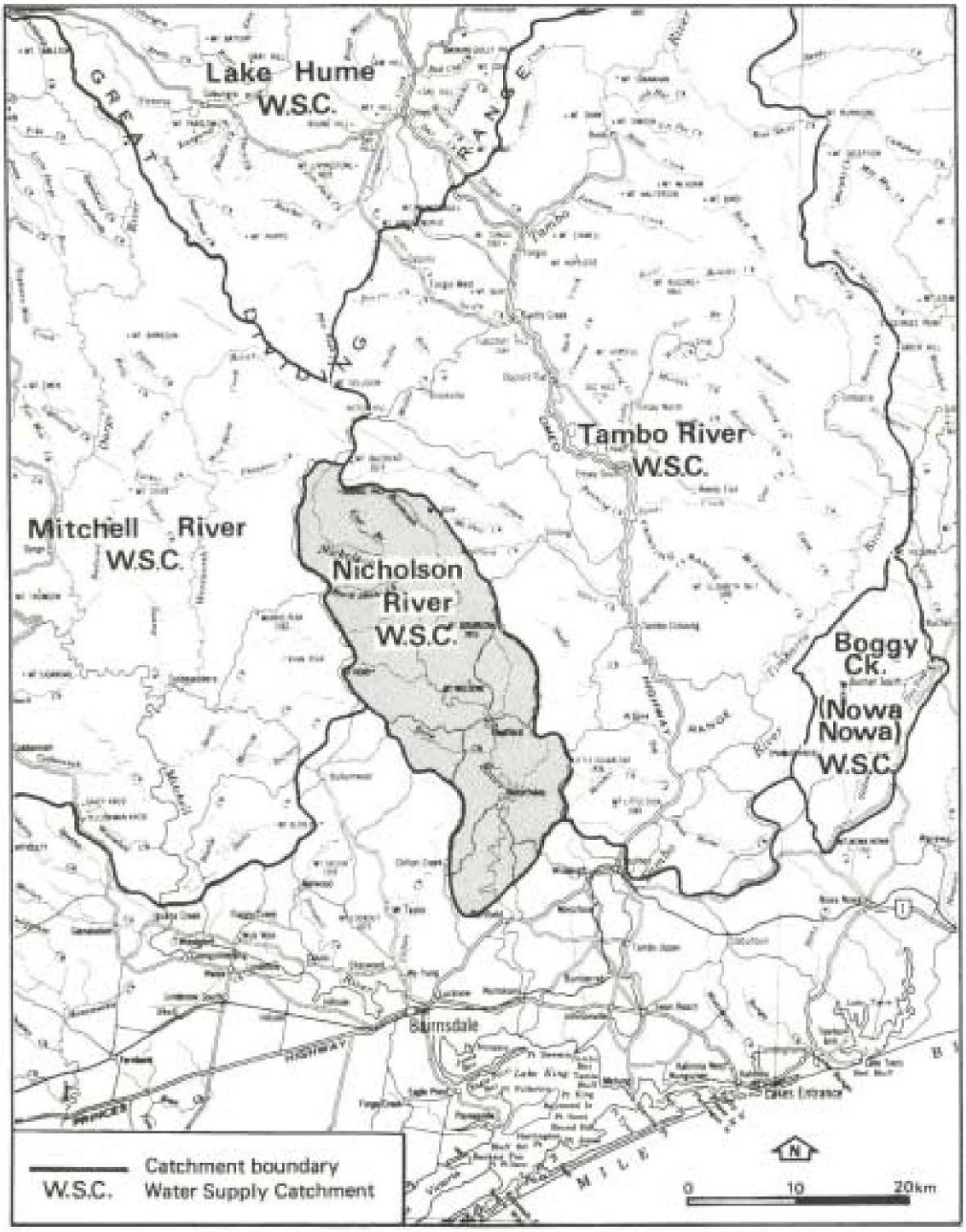
## *Soils*

A brief study of the land was made, concentrating on the freehold land area of the Catchment. for the purposes of Determination a similar study of the public land area was not necessary. The purpose of the study was to provide information on soil and site characteristics and, in particular, to identify limiting characteristics relevant to the present or potential use of land within the area.

Parent material has been the dominant influence in the development of soils throughout the Catchment; consequently this has been the basis for the identification and grouping of soils in the area.

The land consists mostly of soils developed from Ordovician sediments. Tertiary sediments and small areas of recent alluvium and colluvium comprise the remaining parent material. Soils developed from Ordovician sediments also predominate on public land, with the exception of a small area around Mt Baldhead where soils are derived from granite.

*Figure 1 - Catchment Locality Plan*



The technical details of soil types identified in the freehold area are contained in Appendix A. A brief description is given below.

### *Soils Developed on Ordovician Sediments*

These soils cover approximately 85% of the freehold area and consist of two basis groups: yellow duplex soils and red stony soils.

These groups are represented with some variations across all slope ranges.

The soils vary in depth from 30 cm on the slopes to in excess of 200 cm in the drainage lines. They have moderate permeability and are prone to varying degrees of sheet, tunnel and gully erosion. The yellow duplex soils are particularly susceptible to tunnel and gully erosion; the red stony types may suffer from extensive erosion.

### *Soils Developed on Tertiary Sediments*

Soils formed on Tertiary sediments cover approximately 10% of the freehold land area.

The soils occurring on crests and gentle slopes have depths of up to 120 cm and a texture varying from pale to gravelly sand to light red clay depending on the position they occupy in the landscape. Permeability is moderate to high.

On sideslopes of low hills and steeper hill slopes, soils are shallow with a depth of about 60-70 cm. The topsoil is grey sandy loam overlying a variety of subsoil layers. These soils have moderate permeability.

Soils of the drainage lines are often sandy at the surface with clay at depth.

All these soils readily erode if cleared of vegetation or otherwise disturbed and left unprotected. However, they are more stable than the Ordovician soils given similar management.

### *Soils Developed on River Alluviums*

Approximately 5% of the freehold land area is covered by alluvial soil developed on narrow flood plains along major creeks or on alluvial flats associated with the Nicholson River. These soils generally have a surface texture of fine sand with loam to clay loam at depth. They are usually deep with moderate to high permeability. Waterlogging may occur in the Morgans Creek sub-catchment.

## ***Vegetation***

The vegetation in the Catchment varies with the topography, the elevation and the climatic conditions as described below.

On lower foothills in the drier south, white stringybark is dominant in open forest type on gentle slopes of Tertiary and Ordovician soils. Other species include yertchuk on the poorer drier soils and mountain grey gum and red box in drainage lines. The understorey in these lower-lying areas is an association of cassinia, bracken, spiked wattle, black wattle, spring headed matruch, prickly broom heath and tussock poa.

With the increase in elevation towards the north of the Catchment, silver wattle, blackwood, varnish wattle, nodding blue lily and hop goodenia are found amongst the understorey species. Further north on the steeper Ordovician country at elevation up to 600 m the white stringybark forest occurs in association with red stringybark and red ironbark, mountain grey gum an occasional blue gum, with narrow leaf wattle and hickory wattle in the understorey.

Silvertop usually appears in association with white, red and brown stringybark, mountain grey gum and red box at elevation above 400 m. In some areas, between 400 m and 800 m elevation, it appears in almost pure stands. In the higher and wetter areas messmate and peppermint are dominant species in association with silvertop.

Silvertop and brown stringybark often occur on exposed slopes with northern aspects while mountain grey gum, messmate and peppermint are usually found on sheltered southern slopes. Understorey species at higher

altitudes are bracken, common heath, dogwood, bedfordia, juniper wattle, varnish wattle, lomatia, persoonia, silverwattle, sunshine wattle, nodding blue lily and native grasses.

At the highest elevations mountain ash and alpine ash are dominant in association with messmate, peppermint and some silvertop, with a denser understorey typical of higher rainfall areas.

### *Climate*

There are no climatic data available specifically for the Catchment area. The following information is extrapolated from the records of nearby weather stations and from comments made by local landholders and officers of the Department of Conservation, Forests and Lands.

#### *Rainfall*

The rainfall increases from south to north. In the south expected annual rainfall is about 800 mm, whereas the annual rainfall at the foothills of Mt Baldhead increases to 1000 mm and up to 1500 mm at still higher elevations. The incidence of snowfall increases similarly from the south to the north.

Available data from nearby weather stations indicate a fairly even distribution of rainfall throughout the year. Seasonal maximums occur in spring and early summer and high intensity events are frequent.

#### *Temperature*

Temperature in the Catchment decreases from the south to the north with increasing elevation. In the south the number of days with frost is between 10 and 20, mostly during July-August. In the north and in the higher elevations the number of days with frost increases to between 50 and 100.

## WATER SUPPLY

### *The Water Supply System*

The water supply headworks consist of a reservoir of 636 megalitres capacity on the Nicholson River and an offtake weir some 5 km downstream. Flow to the offtake is augmented by releases from the reservoir. Water is pumped to a service storage near Sarsfield for reticulation.

The Tambo Water Board supplies from this Catchment over 2500 consumers in Lakes Entrance, Lake Tyers, Lake Bunga, Kalimna, Swan Reach, Johnsonville, Nicholson, Metung, Sarsfield and a number of rural households along the supply network.

There are two major features of the Catchment and supply system that can have significant impact on the quality of the water in the reticulation. The first is catchment related and concerns the high risk of deterioration of water quality between the reservoir and the offtake where the majority of farms and subdivisions in the Catchment are located (refer Figure 2). Morgans Creek drains this area, carrying with it sediment and pollution to the river above the offtake. Unfortunately, this arrangement of headworks cannot take advantage of the full benefits of sediment settling and bacterial die-off potentially provided by detention in the reservoir.

Piping the system directly from the reservoir would avoid the pollution added downstream and provide the benefit of water retention in the reservoir. However the cost of such an undertaking is high and does not compare favourably, in cost, with the proposed strategy of constructing large offstream storages including service reservoirs. This will allow selective pumping from the river and provide both security of supply over summer when river flows are low and primary treatment with detention in storages.

The second problem arises not from within the Catchment but from the open storage reservoirs in the supply system. Ducks and other water birds find these attractive and their presence contributes to the bacteriological contamination of the water. Roofing of some reservoirs, which should reduce the contamination problem, has commenced.

*Figure 2 - Location of Headworks and Water Supply System*

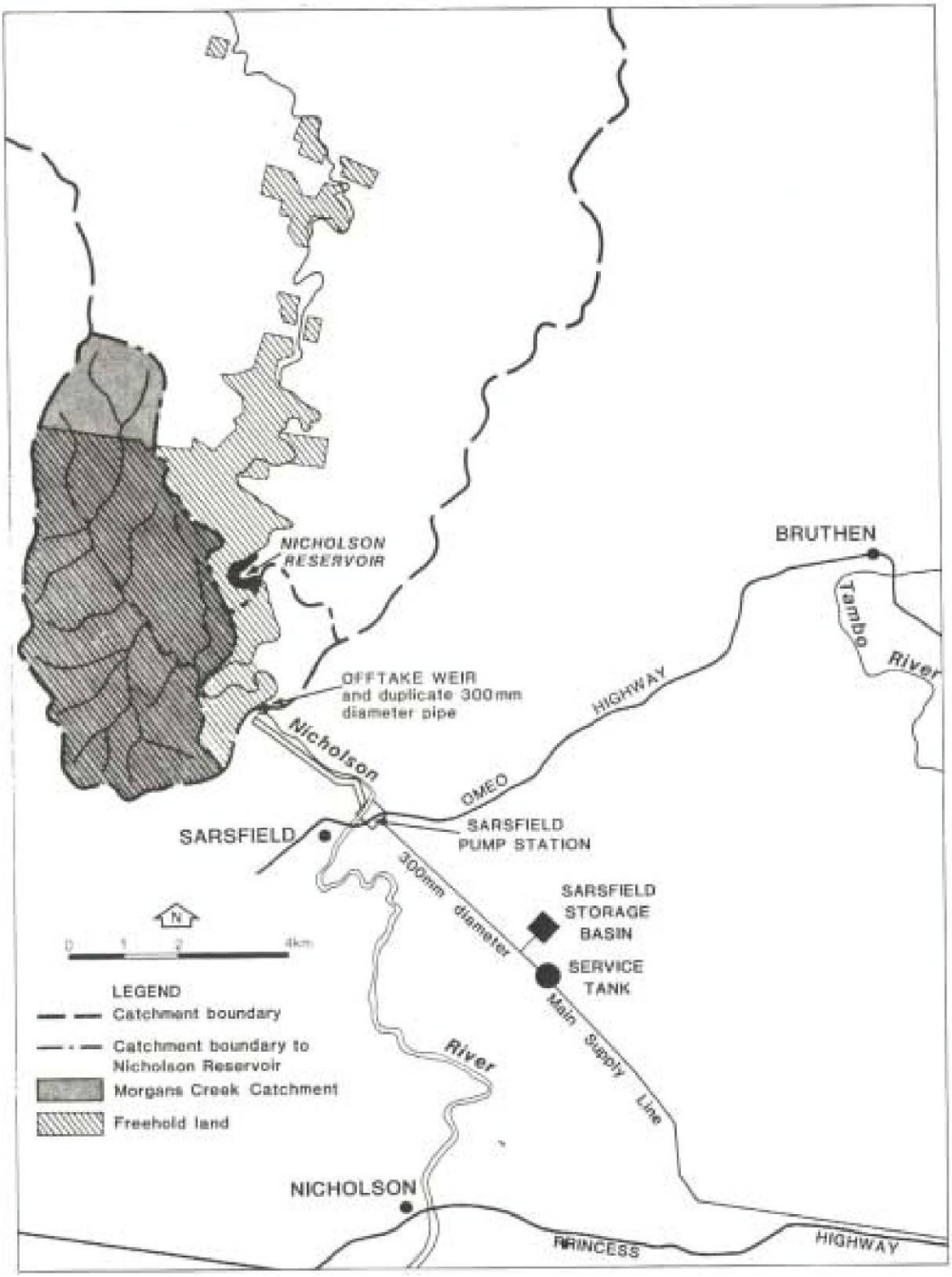


***Table 1 - Summary of water quality data for the supply and the distribution system (results from 4/5/81 to 8/8/83)***

| | River | | | Service Storages | | | | Objective | |
|---|---|---|---|---|---|---|---|---|---|
| | Off-take | Sarsfield Pumping Station | | Sarsfield Reservoir | | Sunlake Storage Reservoir | | NH&MRC* Desirable Current Criterion | NH&MRC* Long Term Objective |
| **Indicator** | | **Value** | **Median** | **Value** | **Median** | **Value** | **Median** | **Value** | **Value** |
| **Bacteriological** | | | | | | | | | |
| *E. coli* | | 0-3000 | 10 | 0-50 | 8 | 0-92 | 2 | 90%<2 per 100 ml | None per 100 ml |
| Total Coliforms | | | | 2-250 | 44 | 0-340 | 20 | 90%<20 per 100 ml | 95% none per 100 ml |
| **Physical and Chemical** | | | | | | | | | |
| | 2.5km downstream of Nicholson Res. | | | | | | | | |
| pH | 6.8-7.3 | 7.3 | | 7.5 | | 7.4-7.7 | 7.5 | 6.5-9.2 | 7.0-8.5 |
| Elec. Cond. (MS/M) | 9.8 | 16.1 | | 10.2 | | 10.8-11.2 | 11.0 | | |
| T. Diss. Solids | 6.6 | 100 | | 65 | | 70 | | | |
| Iron Total | | 1.0 | | | | | | 1.0 | 0.1 |
| Iron, Dissolved | | 0.8 | | | | | | | |
| Manganese Total | | <0.05 | | | | | | 0.5 | 0.05 |
| Colour (Pt-Co) | 300 | | | 320 | | 130-180 | | 50 | 5 |
| Turbidity (NTU) | 12 | | | 12 | | 11-13 | | 25 | 5 |
| Diss. Oxygen | 7.35 | 6.6 | | 6.65 | | 6.85 | | | |

* "Desirable Quality for Dinking Water in Australia" National Health and Medical Research Council 1980.

### *Water Quality*

Samples for bacteriological analysis are taken from Sarsfield pumping station and a number of points within the reticulation system at monthly intervals. Physical and chemical indicators are measured at approximately quarterly intervals from the Nicholson River at Sarsfield downstream of the reservoir and several points in the reticulation system.

On the basis of available bacteriological data and comments made by the analysts, bacterial levels in the reticulation system have often reached undesirable levels. In some cases the Board has recommended that water be boiled before drinking.

Bacteriological test results over the period 1981 to 1983 indicate that, on average, both Coliform and *E. coli* counts are higher in both the raw water and the reticulation system than the NH&MRC desirable criteria (Table 1).

On the basis of the limited data available the following comments may be a useful guide for the physical and chemical qualities of the water.

**pH** levels of 6.8-7.8 are within the desirable current criterion of the NH&MRC which is 6.5-9.2.

**Turbidity** is lower than the desirable current criterion of 25 units but higher than the long term objective of 5 units. Despite this, turbidity is regarded as a problem because of its potential to interfere with the effective sterilisation of the water. Turbidity is observed to be high following rainfall events, so this may not be adequately reflected in the monitoring data which generally reflect baseline levels.

**Colour levels** vary from the off-take to various points in the supply system but the variation is not great. The levels are much higher than the desirable current criterion of 50 units. Usually leaves and litter are the main sources of colour in water and there is very little that can be done in the Catchment to reduce the colour levels. Litter, comprising leaves, plant and other organic material is a natural and an important component of a forested catchment. However, run-off from bare soil, especially from Morgans Creek catchment area, may also contribute towards the high colour of the water.

All the other quality indicators are within the desirable current criteria recommended by the NH&MRC.

In conclusion, the high bacterial and colour levels are causes for concern in the raw water. From observations made, turbidity is regarded as a problem, particularly following storm events. These problems are reflected rarely in monthly monitoring values. It is likely that water treatment (clarification and chlorination) will need to be introduced to improve the quality of the water and overcome the problems that have been encountered.

## LAND TENURE AND LAND USE

The Catchment area, 451 $km^2$, is predominantly public land. Only a small portion, in the south-west, is freehold. The breakdown of tenure is:

| | | |
|---|---|---|
| Public Land | 424 $km^2$ | (94%) |
| Freehold Land | 27 $km^2$ | ( 6%) |

### *Land Use on Public Land*

The Catchment contains 13,000 ha of merchantable forest and 29,000 ha of lower quality stringybark forest.

The merchantable forest is mainly messmate/stringybark mixed species forest, with small areas of alpine ash and mountain ash occurring in the higher elevations of the Catchment.

The average area logged each year is currently less than 150 ha.

### *Land Use on Freehold Land*

About half the area of freehold land has been cleared for agriculture. In 1983 the total area was held in 64 individual properties. The size of holdings varies from just under one hectare to a maximum of 140 ha. The

majority of these are 50 ha or greater. Holdings 10 ha or smaller are located mainly along the south-western ridge road.

The land is used primarily for grazing, mostly of cattle. There are four dairy properties within the Catchment. Some of the land owners hold land elsewhere with their dairy sheds and dwellings located outside the Catchment area. There are only four or five properties on which fodder cropping is carried out.

Most of the properties less than 20 ha in area are used for rural residential purposes or hobby farming.

Two or three farms have a small portion of the land (up to 1 ha) under horticulture for growing berry fruits or flowers for commercial purposes.

## *Land Use Trends*

To provide information on land use trend and possible development pressures, 30 of the 34 landholders who live in the Catchment were interviewed in 1984 and the results of the interviews are summarised below:

- 7% of the land owners plan to subdivide their land; these were owners with a holding larger than 100 ha;

- 27% of land owners plan to build a house, mostly owners of small

holdings;- 17% of land owners plan to clear more land.

These results indicate that there is a desired trend amongst residents in the Catchment towards land development, by building a house and/or clearing more land.

Most of the absentee owners live in the vicinity of the Catchment and use their land for grazing as part of their overall farming property and wish to continue to use the land in this way. The owners who live further away from the Catchment plan to use their land as a retreat and some are now in the process of building a house. There is one holding with several log cabins which is being used as a commercial holiday retreat.

The freehold land in the Catchment is equally attractive to the farming community and to those interested in hobby farms, holiday farms or residential retreats. Other factors which make living in the Catchment attractive are its natural beauty and proximity to Bairnsdale and other business and tourist centres in East Gippsland.

## *Statutory Planning Controls in the Catchment*

The Catchment area is located within the Shires of Bairnsdale, Tambo and Omeo. Most of the freehold land is located within the Shire of Bairnsdale.

All shires administer planning control through planning schemes.

The area of the Catchment within the Shire of Bairnsdale is zoned rural A. The purpose of this zone is to preserve the rural use, character and appearance of the area within the zone and specifically to:

- encourage the use of land for agriculture, protect agricultural land,

- prevent unnecessary fragmentation of land by subdivision,

- prevent residential or other development likely to be incompatible with farming and other related purposes,

- maintain aesthetic qualities of the landscape and protect the environment of the zone, and

- discourage buildings or works likely to detract from the visual beauty of major roads and inland water frontages in the zone.

Subdivision of land in this zone is limited to a 30 ha minimum lot size. However, provisions of the planning scheme permit small subdivisions to be made under certain circumstances. A further provision is that

buildings or works (other than a fence) shall not be constructed at a distance of less than 40 m from the mean water mark of any inland waterway or watercourse.

Land of the Catchment in the Tambo Shire is also within a Rural A zone. Here the purpose of the Rural A zone is:

- to promote the use of land for farming,

- to limit the unnecessary fragmentation of farming lands,

- to permit limited expansion of the sawmilling industry and other similar industries,

- to preserve the physical environment and retain the rural amenity of land within the zone, and

- to regulate use, development and subdivision which may limit the range of practicable future uses of land within the zone.

In this zone the land may be subdivided to a minimum size of 2 ha, provided that the overall density of allotments does not exceed one allotment for every 30 ha within a specified parcel of land.

The planning scheme also provides for the control of development along the streams; and, in the case of the Nicholson River, land within 250 m is identified as an area of natural beauty and interest where any building or works (other than a fence) shall not be constructed without the consent of the Shire. Applications for subdivision of land are considered in relation to adjacent waterways and the need for the preservation of fauna, wildlife, fish and other aquatic life.

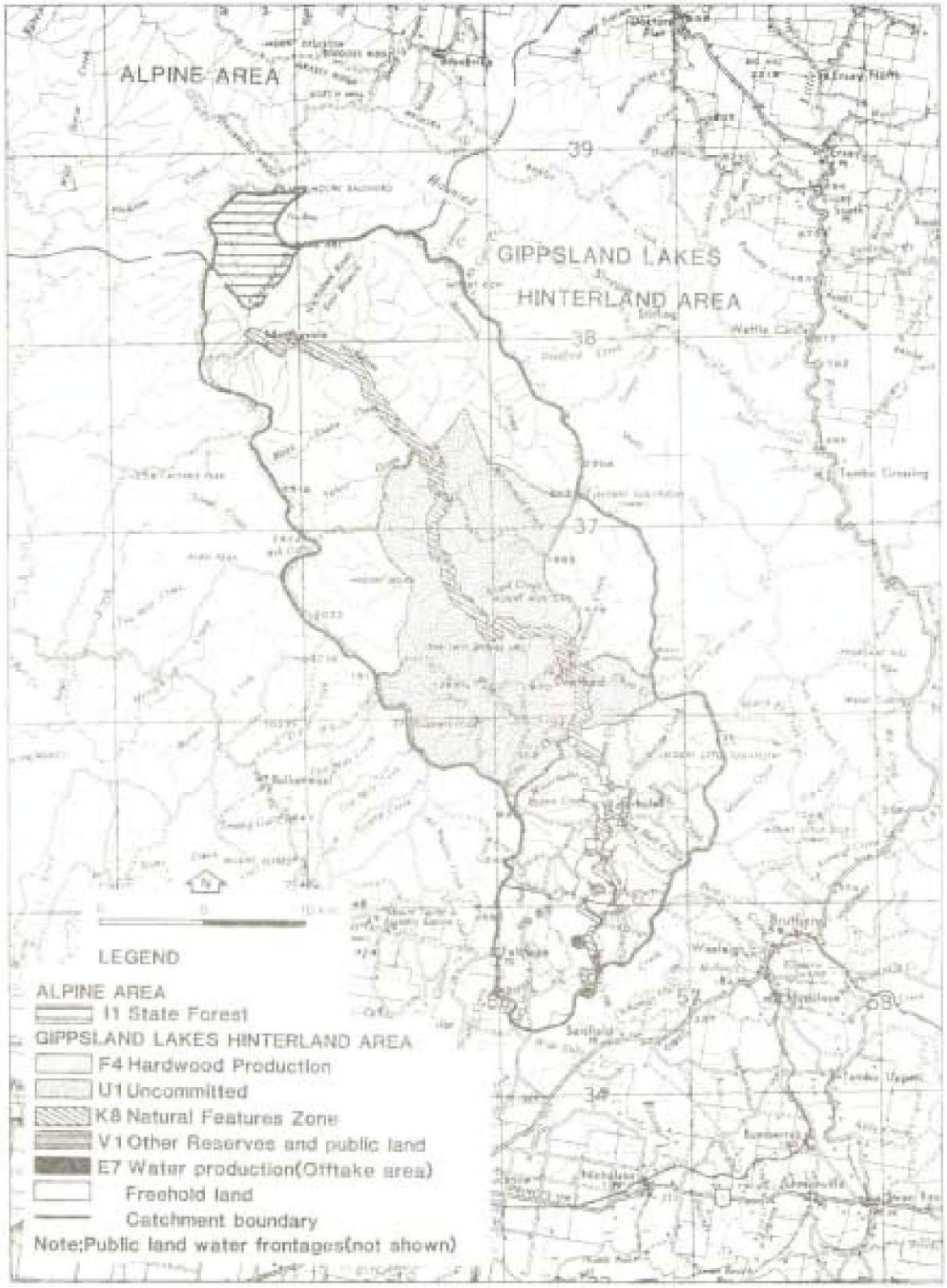
The Shire of Omeo has a "blanket" type of planning scheme. The Scheme provides that, except for the development of public utilities, no person can use or develop land without the consent of the Shire.

### *Land Conservation Council Recommendations*

Final Recommendations for the Gippsland Lakes Hinterland Area (Land Conservation Council 1983) cover most of the public land in the Catchment area. A small area in the north-west is covered by the Final Recommendations for the Alpine Area (Special Investigation) (Land Conservation Council 1983).

Figure 3 shows the boundaries and the extent of the relevant Recommendations. Further detail is contained in Appendix B and should be referred to closely since the Land Use Determination is aimed partly at assisting in the implementation of these Recommendations which have all received Government approval.

***Figure 3 - Approved Public land uses recommended by LCC***



## HAZARDS TO THE WATER SUPPLY

The inherent characteristics of the land and soil types in the freehold part of the Catchment were the subject of the land inventory reported in Appendix A and referred to in section 2.3.

Section C of Appendix A is worthy of close study since it contains an assessment of the likely hazards, in terms of on-site erosion and terms of off-site water quality impacts, to be faced when each particular land type is developed or managed in a number of ways, for example, clearing or cropping. This information forms the basis of the categorisation of land for the purposes of the Land Use Determination.

The remainder of the section consists of a general discussion of hazards to water supply and broad approaches to overcoming them.

While water consumers are interested in receiving high quality water from the Catchment, other needs of the community are being met by using the land for the production of food etc. Changes to the pattern of land use and to the management of land in a catchment can adversely affect both the soil and the water. Nevertheless, if changes are made with care and erosion prevention measures are observed, hazards to the soil and water may be reduced to within tolerable levels.

The Nicholson River Catchment is a multiple-use catchment where existing and potential hazards to the supply are present and result from the various land uses described in section 4. Deterioration of water supply values has resulted from gully, tunnel and sheet erosion, stream bank erosion and road and track erosion. Disposal of domestic waste water and stock access to streams also pose significant hazards. Natural factors influencing water quality are forest litter (colour), wildlife (biological pollution) and intensive rainfall events (erosion).

Tunnel and gully erosion are present in several locations on the freehold land. The extent of these problems has been exacerbated by the presence of rabbits and wombats whose control is complicated by the presence of blackberries. Unchecked tunnel erosion can rapidly develop into gully erosion so that rehabilitation measures following disturbance of the susceptible soils are essential. Sheet erosion has occurred even on gentle slopes where inadequate vegetative cover has been maintained after clearing.

Streambank erosion is particularly severe along Morgans Creek in the flood-plain areas where the surrounding trees have been cleared. Although gully structures for erosion control have been isntalled in the past, they have been by-passes and are now ineffective.

Roads and tracks in the Catchment are generally prone to erosion. Table drain erosion and roadside erosion due to poorly maintained and inadequate drainage systems are quite common in the Catchment. Erosion rills can be observed along and across many roads. Forestry operations which are inadequately planned and/or inadequately supervised also contribute to poor water quality.

All these problems contribute turbidity and colour to the water supply. Added to these problems is the potential for faecal pollution by grazing animals and wildlife, particularly birds.

It should be emphasised that 85% of all the soils in the freehold area is developed on Ordovician sediments. A high proportion of these soils is dispersive, unstable and susceptible to erosion if cleared of vegetation. It is therefore essential that land development or changes in land use are carried out in accordance with soil conservation principles to reduce hazards to the soil and to water quality.

## LAND USE DETERMINATION

### *Aims and Strategies*

In summary, the main aims of a Land Use Determination are to provide a basis for:

- improved attitudes to and performance in land management and

- enforcement of land use planning and management, where necessary, under the *Soil Conservation and Land Utilization Act*, 1958.

The following strategies have been adopted for the development of the Nicholson River Catchment Determination.

- Identification and mapping of areas of catchment land which are capable of supporting a variety of land uses i.e. agricultural, forestry, residential and other uses without there being adverse effects on the water supply (least-sensitive land areas).

- Identification and mapping of areas of catchment land which are inherently sensitive to intensive uses in view of requirements of water supply protection, for example cropping, which if undertaken would adversely affect the water supply (sensitive land uses).

- Identification and mapping of areas of catchment land which are inherently unsuitable for uses other than supporting a protective vegetative cover in view of requirements for water supply protection (highly sensitive areas).

However, it should be noted that the above classifications are not mutually exclusive and that, in some of the sensitive and highly sensitive areas, some intensive uses may be undertaken provided that specially designed management conditions are carefully followed. This is to say that, in normal circumstances, such conditions would safeguard against detrimental effects on the catchments or water supply. However, it should be understood that any intensive use greatly increases the risk and degree of detriment occurring outside normal circumstances such as in the case of storms, drought or other unusual events.

## *Factors Affecting the Land Use Determination*

A totally forested catchment is the ideal state for the interests of water supply. However, in a multiple-use catchment, such as Nicholson, the interests of all who benefit from the catchment must be considered during the determination of the most suitable use for catchment lands.

Factors that will influence the ability of the land to sustain a particular level of use are topography, soil characteristics, climate, vegetative cover, productive capability, the land's susceptibility to erosion and the level of management inputs (such as fertilizer, grazing management, etc). These factors are interdependent and their effects are considered in relation to each other to derive land use/land unit combinations which, if used as a basis for planning, would result in minimal land degradation. In the case of determining appropriate land use in water supply catchment area, additional factors involving off-site effects of land use must be considered. These factors relate to protection of the water supply and require the evaluation of land uses on the basis of thesensitivity of their location in the landscape and in relation to the drainage system.

The development of land in the Catchment to the present levels of use has generally been within the capability and suitability of the land. There are minor areas, however, that are considered to be at risk under present use and management. Conversely, there are timbered areas that may be suitable for development for a more intensive level of use. Other areas should remain timbered.

This assessment and classification of catchment land is reflected in the Land Use Determination for the area.

## *Discussion of Land Use Categories*

A description and explanation of the various categories of the Determination follow.

### *Category 1 - Protective Buffers*

This category prescribes a minimum distance from the waterbody, rivers or streams within which disturbance of soil or vegetation should be minimal. In other works the purpose of this category is to provide adequate direct protection for the waterways and waterbodies in the Catchment in the form of a buffer zone. This is a basis requirement for the maintenance of acceptable water quality. The buffer zone functions as a means of stabilising riparian areas and acts as a filter which traps sediment and other contaminants in the run-off water. Where the buffer carries timber it may provide a habitat for native flora and fauna and it also provides shade, food and protection for the water and hence protects the aquatic ecosystem.

### *Category 2 - Protective Forest*

This category consists of three sub-categories: 2a, 2b and 2c.

Sub-category 2a - is predominantly freehold land. Small sections of public land, adjacent to the River and freehold area that were assessed in the study referred to in section 2.3, are included. Land in sub-category 2a is characterised by the following needs:

Often there is a need for the protection and extension of buffer zones. Where steep slopes or hazardous areas occur in the immediate vicinity of waterways or storages satisfactory protection levels can only be achieved by maintaining appropriate vegetative cover, subject to minimum use for maintenance purposes. Other uses must be compatible with this level of protection. There is also need to provide adequate protection to the steeper erosion prone land from the effects of clearing. Generally, land in this sub-category has shallow soils. There is some cleared land in this sub-category, sections of which are unstable. Land in an unstable condition should be established. Encouragement through incentives will be given for this to be achieved through improved management or reforestation. In the freehold areas of this sub-category limited timber protection for on-farm use only may be carried out.

Sub-category 2b - contains public land only. It applies to land with slopes generally greater than $30^o$ or on lesser slopes where there is a need similar to that described in sub-category 2a. Land in sub-categories 2a and 2b have similar management requirements and differ only in that sub-category 3b is unmapped.

Note: Ideally the upper slope limit for forest harvesting operations is set on erosion assessment criteria or other land capability information. Such information is not available for land outside the area which was the subject of the land study referred to in section 2.3. Consequently, for practical purposes, the upper limit for operations within the non-assessed part of the Catchment has been set arbitrarily at $30^o$. Erosion risk assessment may well identify in sub-category 2b with slopes less than $30^o$.

Sub-category 2c - contains public land identified as Nicholson River Natural Features Zone. This Zone, which extends for the entire length of the River in the Land Use Determination area downstream of Marthvale, is described in Appendix B.

Note: The management needs for land in this sub-category, although based on the conservation of natural or scenic values, are consistent with those for the protection of soil and water in the protective forest category. Provisions such as minimal disturbance of soil and vegetation, exclusion of gravel extraction and forest harvesting activities and constraints on the construction of roads and tracks are the most relevant.

The conservation of flora and fauna is a use compatible with the main uses in category 2 (protective forest).

Public land in category 2 will be protected by prescriptions and plans prepared by the Department of Conservation and Environment.

### *Category 3 - Forest Use*

This category consists of two sub-categories: 3a and 3b.

Sub-category 3a - consists of land which, because of steepness, unstable soils or proximity to streams, is best left under forest cover but could sustain low intensity logging. Some of this land has already been developed for grazing purposes. Provided that these areas remain stable and are managed appropriately there will not be any requirement that they be reforested for more appropriate management. However, if signs of deterioration become apparent with attendant risks to water quality the Department may require reforestation of the land concerned.

Some small area in this sub-category which are forested may be suitable for development which would necessitate clearing of native vegetation. The suitability of this land for clearing should receive prior assessment by the Department which will specify any procedures or techniques to be followed during clearing and for subsequent management.

Prior assessment by the Department is required for other uses, such as low intensity residential development, extractive activities, roads and tracks, softwood production and low intensity recreation.

Sub-category 3b - contains only public land. Forestry, flora and fauna conservation and protection of natural and scenic values are the most suitable uses. Slopes generally greater than $30^o$ are considered unsuitable for forestry operations covered by general forestry prescriptions and are included in sub-category 2b, although not mapped on the Determination plan. Other compatible uses are: recreation and extractive activities in the areas set aside for Hardwood Production, State Forest and Uncommitted land, provided appropriate management prescriptions are followed.

### *Category 4 - Grazing*

The most suitable use of land in this category is grazing. On the basis of its cropping capability land in Category 4 has been sub-divided for the purposes of other permitted use. Sub-category 4a land is considered unsuitable for regular cultivation or cropping. Land in sub-category 4b is suitable for occasional fodder crop production.

## ***Land Use Determination Table and Plan***

This section consists of a Land Use Category Table and Plan. The Table sets out general provisions applicable to all categories, the most suitable use and other compatible uses in each category, together with the provisions for those uses. Land uses that are suitable and are likely to be carried out in the Catchment have been included in the table. However, if land uses other than those specified are proposed, proposals should be referred to the Department for assessment prior to any changes or development taking place.

The Determination Table is accompanied by plans No. S-1411, sheets 1-7 (see Figure 4 for key to these areas) showing the location in the Catchment of the various Land Use Categories. Categories within the freehold area (southern half of the Catchment) are shown at 1:25 000 (sheets 1-5), while the Categories for the public land are shown at 1:100 000 (sheets 6 and 7).

The Catchment Plans and Table, have been combined into a single Determination Plan, No. S-1411, which is available from Departmental offices at Melbourne or Bairnsdale.

The Determination Plans and Tables are set out in the pages that follow.

*Table 2 - Land Use Categories*

# Nicholson River Water Supply Catchment

The word "Department", where used in this Determination, means the Department of Conservation, Forests and Lands.

The title "Director-General", where used in this Determination, means the Director-General of the Department of Conservation, Forests and Lands as successor in title to the Soil Conservation.

## **Part A: General Provisions** (applying to all categories)

Proposals for the following activities or development require assessment by the Director-General before they commence:

a) recreational developments
b) hardwood production
c) softwood production
d) extractive industry
e) road or track construction
f) subdivision of land titles
g) mining or mineral exploration, or
h) intensive animal industries.

Prescriptions or proposals for clearing or the cutting of timber or forest harvesting operations are to provide protection to streams, drainage lines, swampy areas or springs not highlighted on plan no. S-1411.

The treatment and disposal of wastes is to conform to the requirements of the *Environment Protection Act*, 1970, the *Health Act*, 1958 and the relevant municipality.

The conduct and management of intensive animal industries is to conform to requirements specified in "Guidelines for the Conduct of Intensive Animal Industries", Environment Protection Authority and Department of Agriculture, Victoria, 1978.

The use of agricultural chemicals is to conform to the requirements of the *Agricultural Chemicals Act*, 1958, the *Environment Protection Act*, 1970, and any relevant guidelines or Codes of Practice published by the EPA or the Department.

The Director-General may, after consultation with the Land Conservation Council determine any conditions pursuant to Section 23 (1) (c) and impose such conditions pursuant to Section 23 (4) (a) of the *Soil Conservation and Land Utilization Act*, 1958 with respect to the use of or management of all or any land in any Category specifying any action for the purpose of:

a) implementing any of the "Provisions of Use"
b) preventing or limiting soil erosion or reclaiming eroded sites, or
c) preserving or improving the quality or yield of water supply.

Such conditions may provide for:
a) the stabilisation or revegetation of exposed or disturbed earth
b) the location of, or design or construction standards of roads, tracks or stream crossings
c) the disposal of road drainage water
d) implementation of Guidelines approved by the Director-General for this Catchment, or
e) other matters as appropriate.

## Part B: Land Use Categories (most suitable uses)

| No. | Land Use Category<br>Land Affected | Most Suitable Use | Provisions of Use |
|---|---|---|---|
| 1a. | Land within 200 m of the full supply level of the Nicholson Reservoir and the Water supply offtake on the Nicholson River as shown on Plan No. S-1411. | Protection of the Nicholson River and associated facilities, the water supply off-take and Catchment streams from the effects of erosion and pollution. | 1. No disturbance of soils or vegetation should take place other than the minimum necessary for the management of frontages, or the construction of access or other works relating to fire prevention or reservoir management.<br><br>2. Proposals for development involving such disturbances require the prior approval of the Director-General. |
| 1b. | Land within 40 m of the banks of the Nicholson and Barmouth Rivers as shown on Plan No. S-1411. | | |
| 1c. | Land within 20 m of the banks of:<br><br>i) streams and drainage lines within the Catchment as shown on Plan No. S-1411.<br><br>ii) other permanent streams or drainage lines identified by field observation which carry water or are likely to carry water during winter. | | |
| 2a. | Land as shown on Plan No. S-1411. | Protection of soil and water from the effects of erosion and pollution by retention of forest and other vegetative cover. | 1. The same provisions as for Category 1 apply except limited cutting of timber on freehold land for on-farm use may be approved by the Director-General and made subject to conditions for protecting catchment values. |
| 2b. | Land within the Catchment (unmapped) with a slope generally greater than $30^{o}$. | | |
| 2c. | Land identified as Nicholson River Natural Features Zone. (Described in Recommendation K8 of LCC Final Recommendations for Gippsland Lakes Hinterland Area.) | | 2. Use of land identified as Nicholson River Natural Features Zone is to be in accordance with the appropriate LCC Recommendation, as approved, where this does not conflict with provision 1 above. |

## Part B: (Continued)

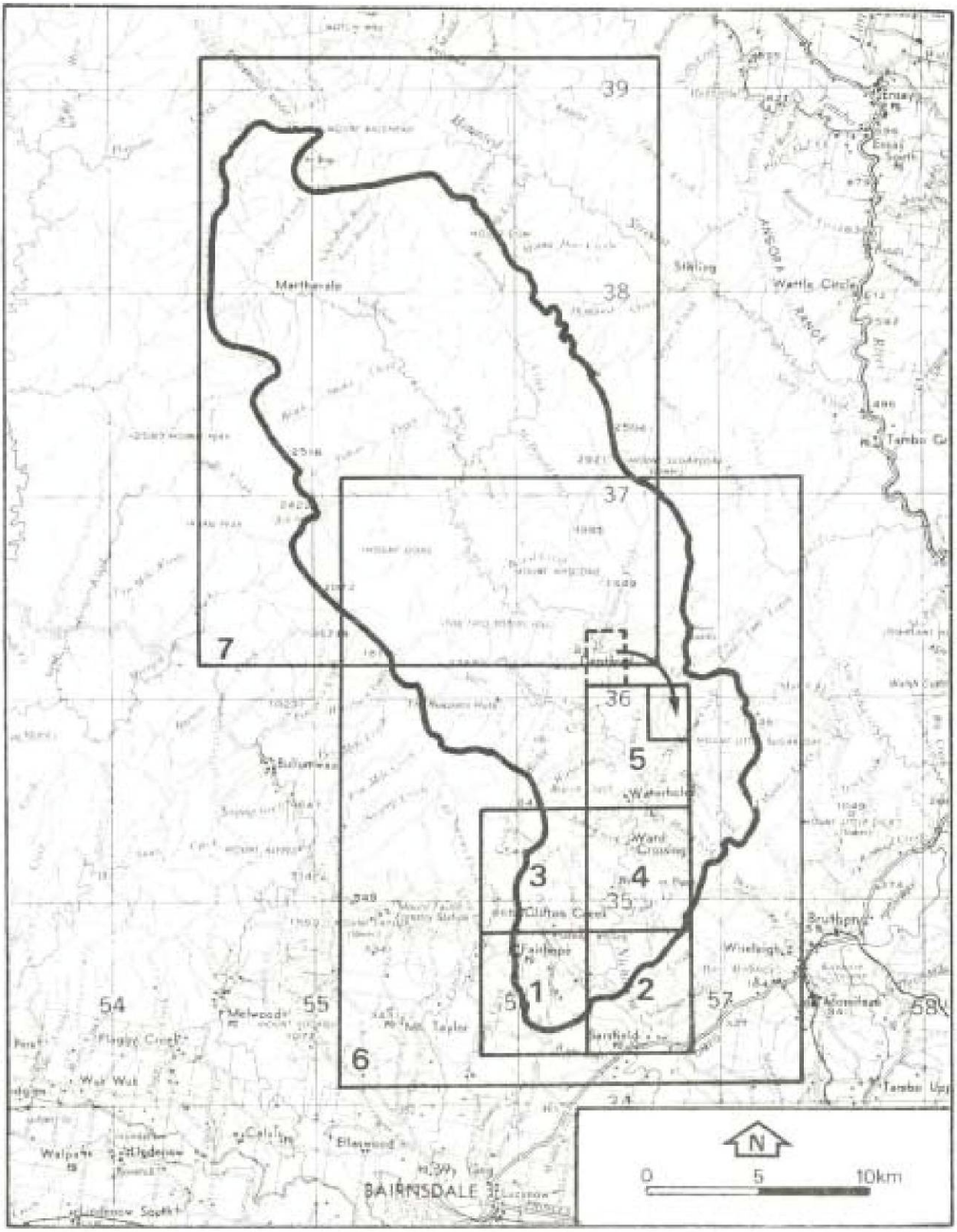
| No. | Land Use Category<br>Land Affected | Most Suitable Use | Provisions of Use |
|---|---|---|---|
| 3a. | Land as shown on Plan No. S-1411. | Low intensity logging; parts may be suitable for clearing for pasture development. | 1. Proposals for the cutting of timber or for the clearing of land for pasture development require the prior approval of the Director-General and may be made subject to conditions which include provisions for:<br>*a)* adherence to the published *Code of Forest Practices for Timber Production*<br>b) the improvement of vegetative cover<br>c) the number, type and timing of stock grazing<br>d) the stabilisation of disturbed or exposed soil<br>e) any other measures for protecting catchment values.<br>2. The Director-General may specify conditions requiring the reforestation of areas that previously have been cleared. |
| 3b. | All public land - excepting that in Categories 1 & 2 - with slope generally less than $30^{o}$ (unmapped) | Hardwood production. | Forest operations shall be in accordance with a management plan and prescriptions developed by the Department with public consultation and shall be in accordance with the published *Code of Forest Practices for Timber Production*. The prescriptions are to provide for the protection of streams, drainage lines, swampy areas and springs in any area proposed for harvesting. |
| 4a. | Land as shown on Plan No. S-1411. | Grazing and pasture production. | The Director-General may specify conditions which include provisions for:<br>a) the improvement of vegetative cover<br>b) the number, type and timing of stock grazing<br>c) the stabilisation of disturbed or exposed soil; or<br>d) any other measures for protecting catchment values. |
| 4b. | Land as shown on Plan No. S-1411. | Grazing, pasture production and occasional cropping. | In addition to the above, the Director-General may specify conditions relating to methods of cultivation for crops, including rotation periods, temporary exclusion of areas from cropping and other conservation techniques. |

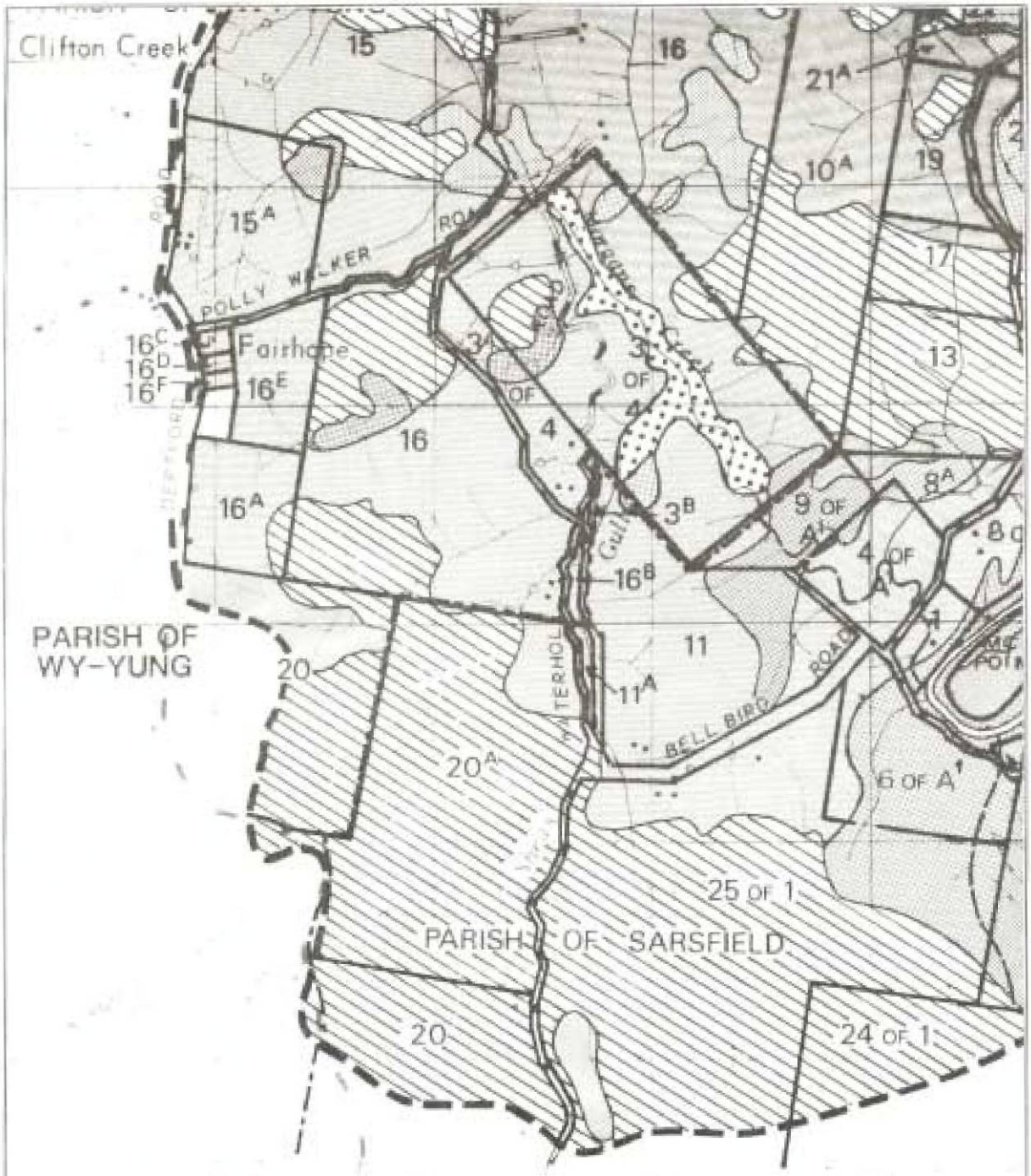
## Part C: Other Acceptable Uses

| Other Uses | Land Use Categories affected | Provision of Use |
|---|---|---|
| Flora and Fauna conservation | 1 & 2 with public land and 3b. | Public land shall be used in accordance with management plans prepared by the Department and be consistent with the specific LCC Recommendations accepted by government. |
| Recreation | 3a, 3b, 4a, 4b. | The Director- General may specify conditions providing for:<br>a) the siting, construction and management of recreational facilities, or<br>b) the exclusion of certain areas from recreational use. |
| Softwood production | 3a, 3b, 4a, 4b. | 1. The clearing and preparation of land for plantation establishment and all softwood operations are to be in accordance with a management plan adopted by or approved by the Department which shall be in accordance with the published *Code of Forest Practices for Timber Production.*<br>2. The Director-General may specify conditions providing for:<br>a) the timing, method or extent of clearing operations; or<br>b) particular areas to be excluded from clearing and plantation establishment. |
| Grazing | 1, part 2a, 3a, 3b. | The Director-General may specify conditions providing for:<br>a) stocking rates<br>b) maintenance of vegetative cover; or<br>c) temporary or permanent exclusion of stock from particular areas. |
| Residential Use | 3a, 4a, 4b | The advice of the Director-General must be obtained prior to the siting or construction of dwellings, effluent disposal systems or access roads. |
| Mining, mineral exploration, or extractive industry | Part 2, 3a, 3b, 4a, 4b | 1. The advice of the Director-General must be obtained prior to the siting or commencement of any earthworks.<br>2. The Director-General may specify conditions providing for:<br>a) the provision of access<br>b) the conduct, timing or extent of operations which cause surface disturbance<br>c) the disposal or detention of drainage or waste waters<br>d) the rehabilitation of disturbed area, or<br>e) the exclusion of particular areas from the proposed activity. |

| Other Uses | Land Use Categories affected | Provision of Use |
|---|---|---|
| Roads and tracks | All | The Director-General may specify conditions providing for:<br>a) the location, or the design or construction standards of roads or tracks or stream crossings<br>b) the stabilisation of disturbed or exposed soil, or<br>c) the manner of disposal of road or track drainage waters |

***Figure 4 - Key to Land Use Determination Mapsheets (Sheets 1-7)***






NICHOLSON RIVER
WATER SUPPLY CATCHMENT
LAND USE DETERMINATION

S-1411

SHEET 1

N

0 400m

KEY TO ADJOINING MAPS

Legend:

Catchment boundary

Parish boundary

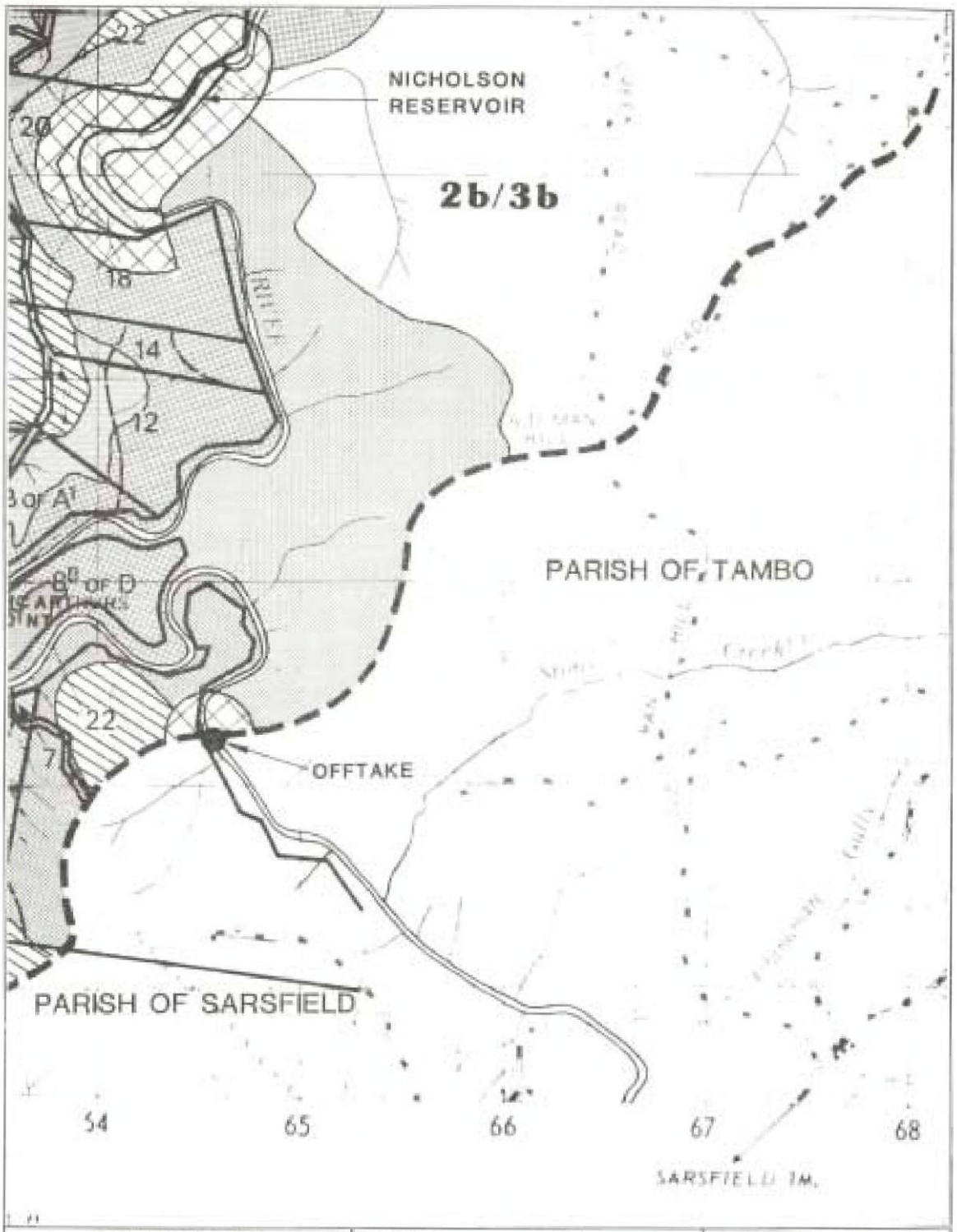
Allotment boundary 3 OF 4

Land Use Categories:

1a 2b 2b 3b 3b

40m 20m 1b 1c 2c 4a

2a 3a 4b




NICHOLSON RIVER
WATER SUPPLY CATCHMENT
LAND USE DETERMINATION

S-1411
SHEET 2

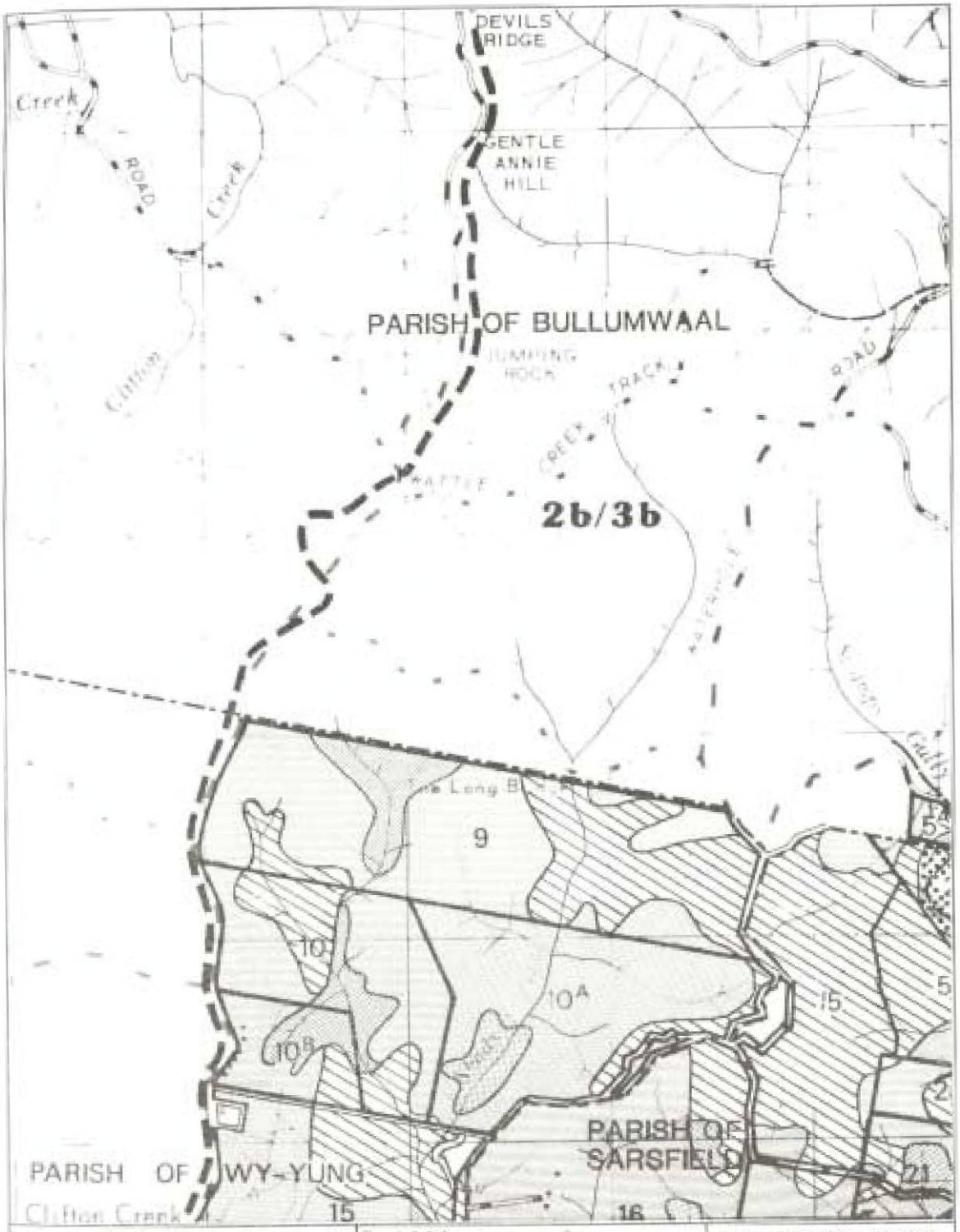
Legend:

Catchment boundary
Parish boundary
Allotment boundary
3 or 4

Land Use Categories:

1a, 1b, 1c, 2a, 2b, 2c, 3a, 3b, 4a, 4b

KEY TO ADJOINING MAPS




NICHOLSON RIVER
WATER SUPPLY CATCHMENT
LAND USE DETERMINATION

S-1411

SHEET 3

KEY TO ADJOINING MAPS

Legend:

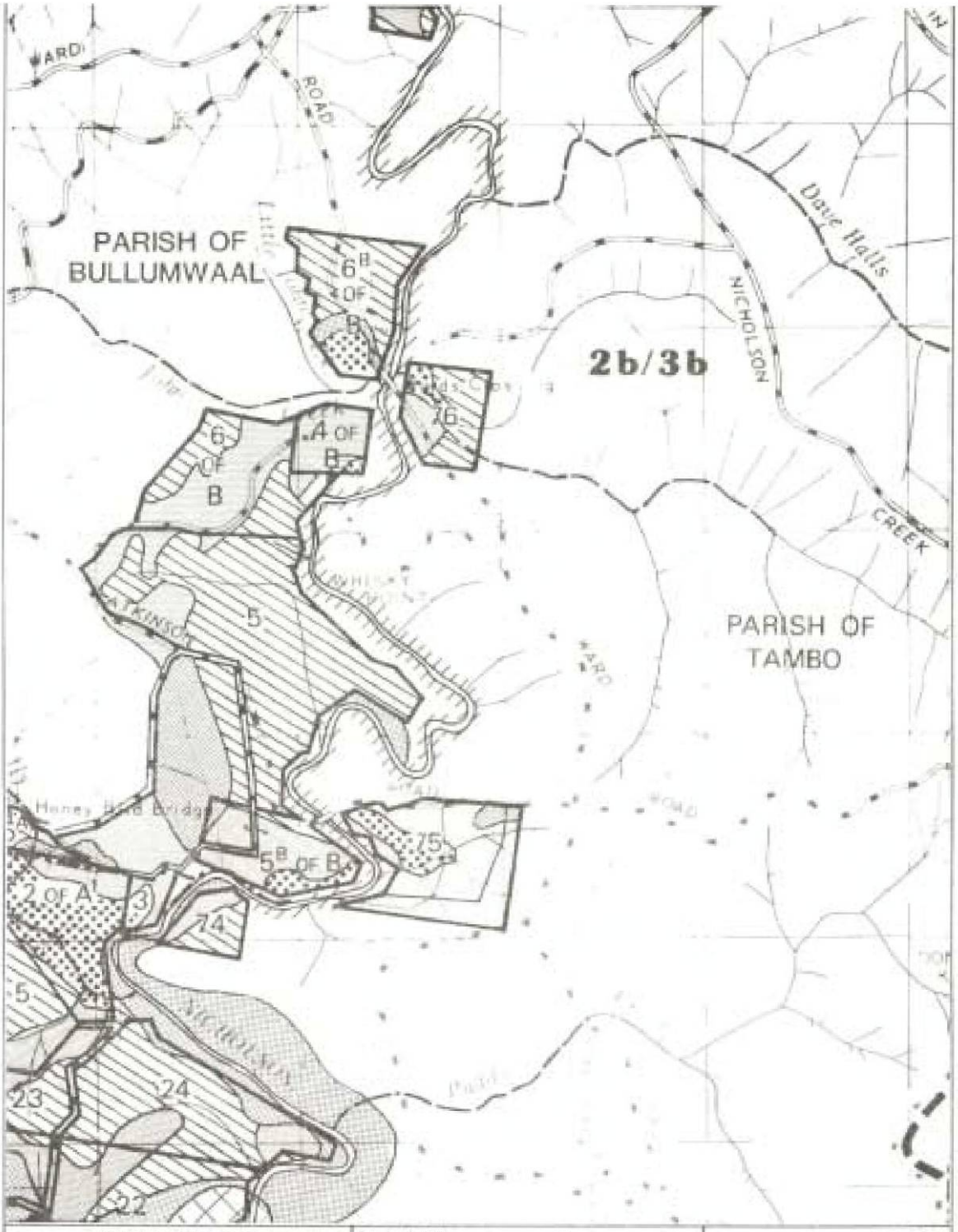
Catchment boundary

Parish boundary

Allotment boundary 3 or 4

Land Use Categories:

1a, 1b, 1c, 2a, 2b, 2c, 3a, 3b, 4a, 4b




NICHOLSON RIVER
WATER SUPPLY CATCHMENT
LAND USE DETERMINATION

S-1411

SHEET 4

KEY TO ADJOINING MAPS

Legend:

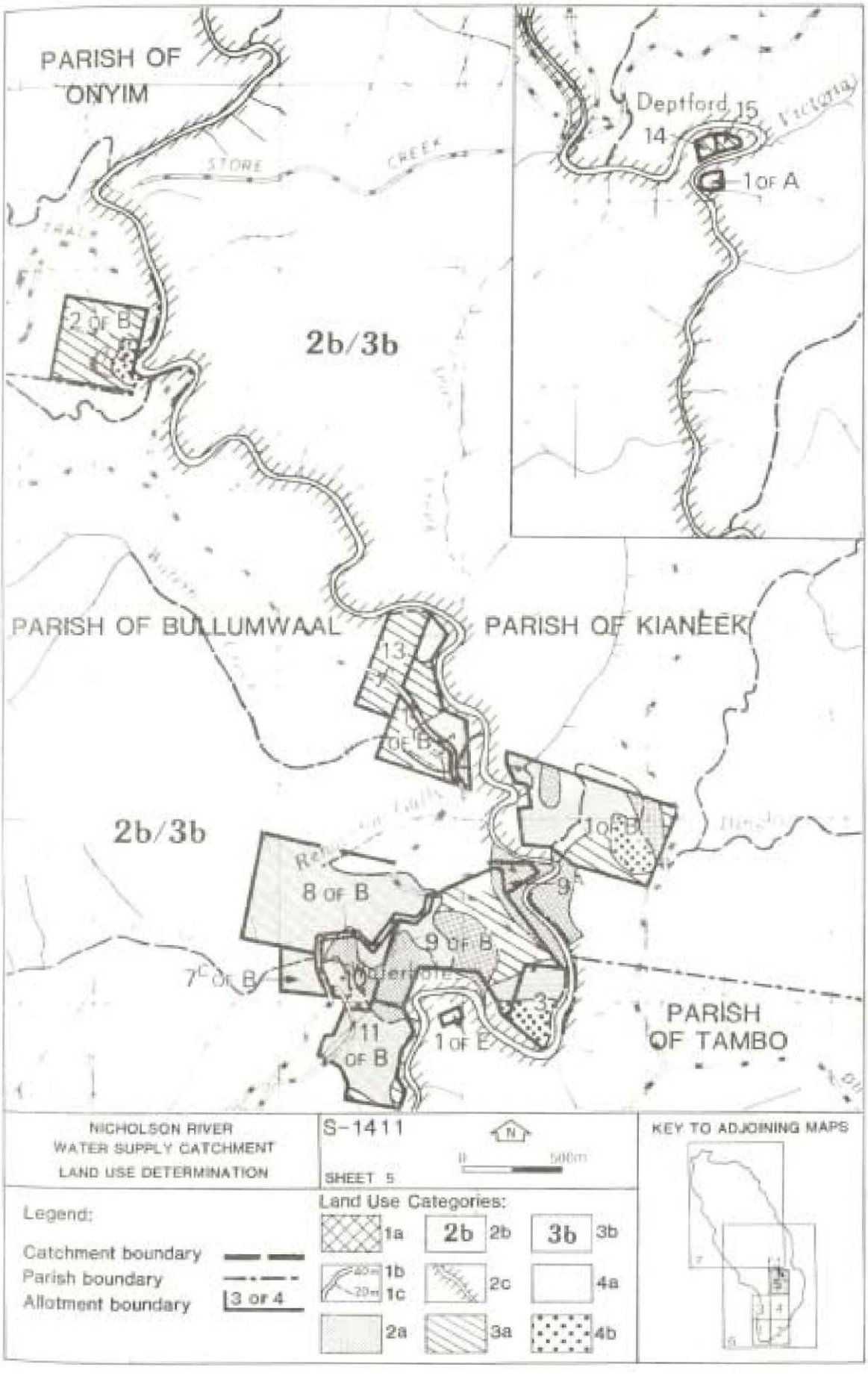
Catchment boundary

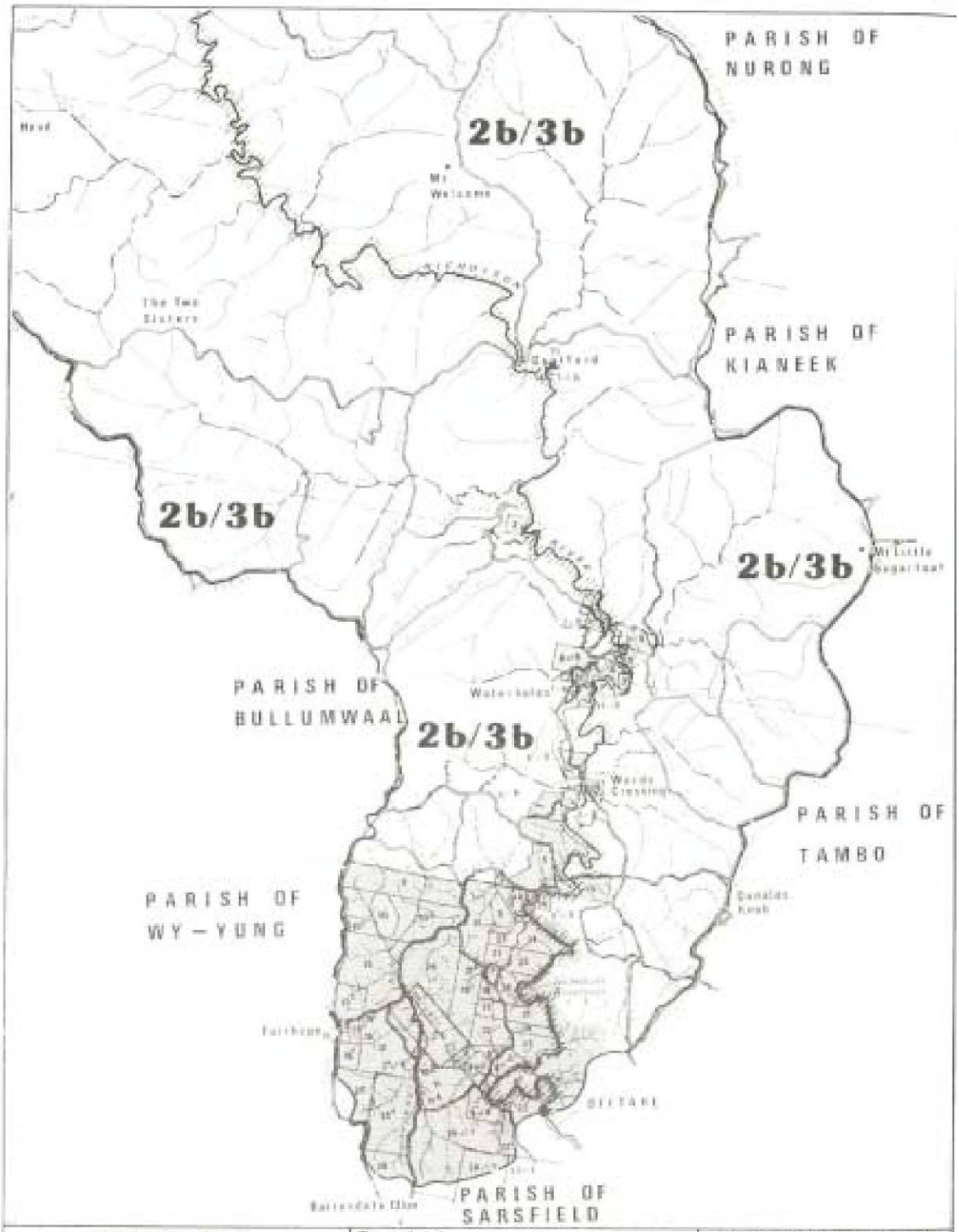
Parish boundary

Allotment boundary 3 OF 4

Land Use Categories:

| | | | | | |
|---|---|---|---|---|---|
| 1a | | 2b | 2b | 3b | 3b |
| 1b | | | 2c | | 4a |
| 1c | | | | | |
| 2a | | | 3a | | 4b |


PARISH OF ONYIM
STORE CREEK
Deptford
15
14
1 OF A
2 OF B
2b/3b
PARISH OF BULLUMWAAL
PARISH OF KIANEEK
13
OF B
2b/3b
1 OF B
8 OF B
9
9 OF B
7 OF B
10
11
OF B
1 OF B
3
PARISH OF TAMBO
NICHOLSON RIVER
WATER SUPPLY CATCHMENT
LAND USE DETERMINATION
S-1411
SHEET 5
N
0
500m
KEY TO ADJOINING MAPS
Legend:
Catchment boundary
Parish boundary
Allotment boundary
3 OF 4
Land Use Categories:
1a
2b
2b
3b
3b
1b
1c
2c
4a
2a
3a
4b




NICHOLSON RIVER
WATER SUPPLY CATCHMENT
LAND USE DETERMINATION

S-1411

SHEET 6

KEY TO ADJOINING MAPS

Legend:

Catchment boundary

Parish boundary

Land Use Categories:

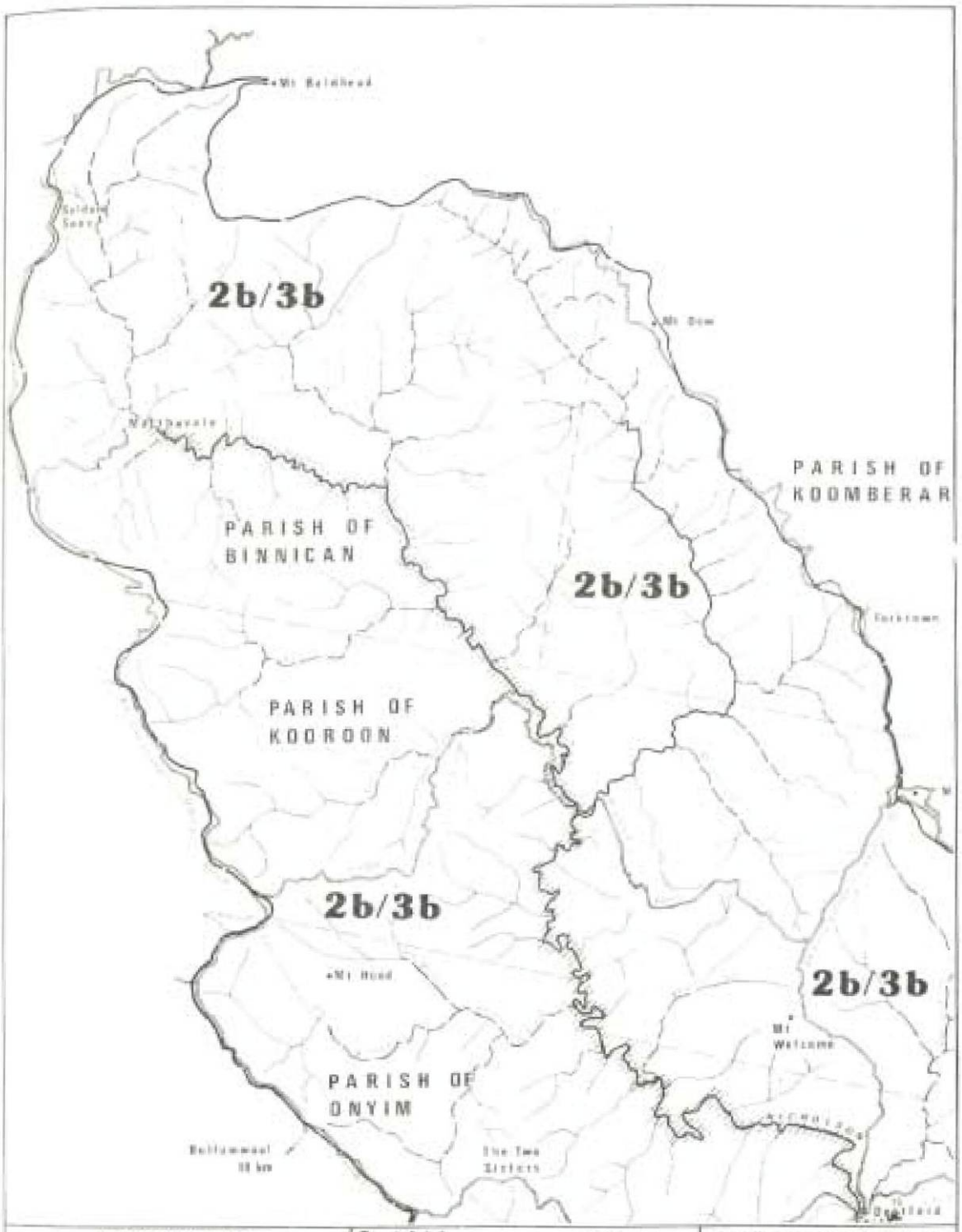
1b
1c

2b 2b

2c

3b 3b

Refer to sheets 1 to 5




NICHOLSON RIVER
WATER SUPPLY CATCHMENT
LAND USE DETERMINATION

S-1411

SHEET 7

0 1 2 3km

KEY TO ADJOINING MAPS

Legend:

Catchment boundary

Parish boundary

Land Use Categories:

1b 1c

2b 2b

2c

3b 3b

Refer to sheets 1 to 5

## *Policy for Implementing the Land Use Determination*

The application and implementation of the Land Use Determination to the management of Catchment land is carried out by the Department's regional staff working co-operatively with local government, water board, landholders and other Catchment users as the case may be, to reach the main objective of sound management of land within the Catchment.

In order to achieve this, certain provisions of the Determination may need to be applied which would be of particular concern to some landholders in the Catchment. These provisions relate to the possible requirements for limiting access of stock to stream areas, the reforestation of some areas of cleared land and intensive animal industries.

To reduce uncertainty or unnecessary concern about these issues the following policies will apply to certain activities in the Nicholson River Water Supply Catchment.

## *Limitation of Stock Access to Streams*

It is often of farm practice to allow stock free access to a stream running through or adjacent to the property, especially where pre-emptive rights exist. However, in reaching the water's edge stock may initiate or exacerbate stream bank erosion resulting in a reduction in water quality. There is also evidence that stock tend to defecate and urinate disproportionately in and near the stream, thus contaminating the water. There are circumstances where this is highly undesirable and alternative watering points are required to protect a domestic water supply or other valuable water resources from biological contamination, turbidity and nutrient enrichment.

Where the Director-General is of the opinion that stock are causing a significant and avoidable decline in water quality, conditions may ultimately be imposed which require the stabilisation of existing access areas and/or the complete exclusion of stock from the problem area. Such conditions would only be imposed after consultation with the landholder and after consideration of the alternatives such as co-operative improvement schemes. If such conditions were imposed, the Director-General would be required to determine and apportion the costs of compliance with these conditions. This would involve consideration of the loss of productive land, the capital costs (such as fencing) and the provision of alternative stock water supplies.

## *Reforestation of Cleared Areas*

In accordance with the Determination some of the cleared areas in the Catchment would be best suited to reforestation to protect the water supply. These areas are inherently erosion prone and are likely to contribute significantly to a decline in water quality if stable cover of vegetation is not maintained. If, after close investigation involving consultation with the landholders concerned, it is clear that current or improved management cannot maintain a stable vegetative cover, the only remaining course may be to impose conditions requiring reforestation of these areas. Reforestation is a long term solution and in the short term consideration will be given to alternative methods of maintaining adequate soil cover. If such conditions were imposed, the Director-General would be required to determine and apportion the costs of compliance with the conditions. This would involve consideration of the loss of any productive land and the capital cost of revegetation. Before resorting to such regulatory measures, alternatives such as co-operative management schemes would be fully investigated with the landholder.

## *Intensive Animal Industry*

Intensive animal industries (such as feedlots and milking sheds) have the capacity to generate large quantities of animal wastes which, if allowed to enter the stream system, may result in a marked decline in water quality. Disposal of such wastes is usually to land, however a breakdown in this system can result in effluent contaminating the water supply, resulting in increased levels of bacteria and viruses, elevated levels of nutrients and objectionable tastes and odours.

It is important to note that stock may carry some disease organisms capable of infecting humans. If the water has been contaminated by certain animal wastes, there is the possibility of spreading bacterial, viral and parasitic diseases through the water supply system. (Indicator organisms, such as *Eschericia coli*, are a standard means of identifying faecal contamination.)

The accession of nutrients to the stream system may result in excess growth of algae and other aquatic plants either in the stream, in storages or in the water distribution system. It is therefore prudent to ensure that the operation of existing or planned intensive animal industries does not affect the quality of water harvested from a catchment.

The operation of existing intensive animal industries in the Nicholson River Water Supply Catchment should be in accordance with the published *Guidelines For The Conduct of Intensive Animal Industries* (Department of Agriculture, Victoria; Environment Protection Authority, 1978).

The establishment of additional intensive animal industries in the Nicholson River Water Supply Catchment should be discouraged unless it can be satisfactorily demonstrated that operations or waste disposal will not affect water quality.

## GUIDELINES FOR LAND DEVELOPMENT AND SUBDIVSION

Interim Development Orders of the Shires of Bairnsdale and Tambo indicate concern for the excessive development of land. The purposes of the Rural A zones in both Shires are aimed at avoiding the unnecessary fragmentation of land. For various reasons in both orders, the land may be subdivided into allotments not smaller than 2 ha in area for the building of a house but the overall density of subdivision remains at one house per 30 ha within a parcel of land.

The Shire of Omeo on the other hand has set no size limit for land development and proposals for this purpose are considered individually.

The present constraints on subdivision appear to be adequate to protect the stability of the land in the Catchment. However, a general subdivision of the land available would increase erosion hazards due to earth moving activities for access roads and tracks, construction of houses and their associated effluent disposal and drainage systems are the inevitable change in land use intensity.

The following guidelines provide an initial basis for evaluating subdivision proposals and for indicating the areas of input the Department seeks in commenting on development proposals within the Catchment.

- The size of the allotment and location of boundaries should take proper account of the topography.
- The boundaries of each allotment should follow ridge lines or spurs wherever possible and should not following the drainage lines.
- Allotment boundaries and access should be planned to minimise drainage line crossings.
- Soil type should be suitable for a proposed land use which is more intensive. Shallow and dispersible soils, for instance, present hazards when cleared or during construction activities.
- There mustbe a suitable house site (building envelope) with equally suitable access provision (alignment and minimal length) identified in each subdivided allotment, based on consideration of topography, effluent disposal capability etc.
- A minimum distance of 100 m should be provided between effluent disposal systems and drainage lines to prevent water pollution by effluent.

The above guidelines should also apply to the planning and construction of other facilities such as recreational facilities and dairy sheds. Although statutory planning within the Catchment is administered by three Shires it is highly desirable that the planning controls be consistent and in conformity with the Land Use Determination.

## REFERENCES

Land Conservation Council 1983. *Final Recommendations. Gippsland Lakes Hinterland.*

Land Conservation Council 1983. *Final Recommendations. Alpine Area.*

Soil Conservation Authority 1975. *Report on the Nicholson River Water Supply Catchment (Lakes Entrance Waterworks Trust) proposed for Proclamation.*

# APPENDICES

## *Appendix A - Land Inventory for the Nicholson River Water Supply Catchment Freehold Land Area*

## Introduction

This land inventory of freehold land in the Nicholson River Water Supply Catchment was carried out to provide a rational basis for assessing the hazards potentially associated with land use and land use changes as they may impact on water supply values.

The information on soil and land characteristics provided in the inventory has formed the main foundation for the categorisation of land presented in the Determination. It will also form the basis for future assessments by the Department of the hazards associated with developments within the Catchment and for the specification of any detailed management requirements or extension programs.

The information is presented in three parts.

Part A - Is a series of mapsheets, Plan No. S1410 (sheets 1-5), showing the distribution of land types of the freehold land in the Catchment (see Figure 5 for details of location).

Part B - Describes various land types identified in Part A. It includes information on soil types, soil profile descriptions and other soil characteristics.

Part C - Describes, for each land type, the existing and potential erosion hazards and the relationship these have to land management for various uses or development.

## Overview of the Landscape

The freehold land of the Catchment consists primarily of landscape derived from parent materials of the Ordovician and Tertiary periods, with relatively small areas of recent alluvium and colluvium.

The landscape on Tertiary sediments consists of low hills and moderate to steep slopes, rounded crests and non-incised drainage lines. The soils are layered, with a coarse grey topsoil overlying variable subsoils.

In contrast, the terrain derived from Ordovician sediments comprises moderate hills, often with narrow crests, steep with moderate side slopes and a number of drainage channels incised into small alluvial deposits. Soils are generally stony red gradational or yellow duplex types, with variable alluvial soils in the drainage lines. The alluvial/colluvial deposits along the Nicholson River have deep, dark loamy soils and a gentle slope.

## Summary of Hazards to Water Supply

### Landscape derived from Ordovician sediments

**Stony red soils:** the major hazards is associated with clearing operations and with road batters; the slope of the land and its proximity to drainage lines determine the extent of the hazard.

**Yellow duplex soils:** these are prone to tunnel and gully erosion, and to slumping of road batters. Eroding land will generate turbid run-off. Stabilisation of the gullies is difficult due to the erodible subsoil and thin topsoil.

### Landscape derived from Tertiary sediments

The topsoil is easily eroded if loose and bare, however resultant sediment is readily trapped. Subsurface layers may be quite dispersive and their exposure may result in turbid run-off which is far more difficult to manage without detriment to water supply.

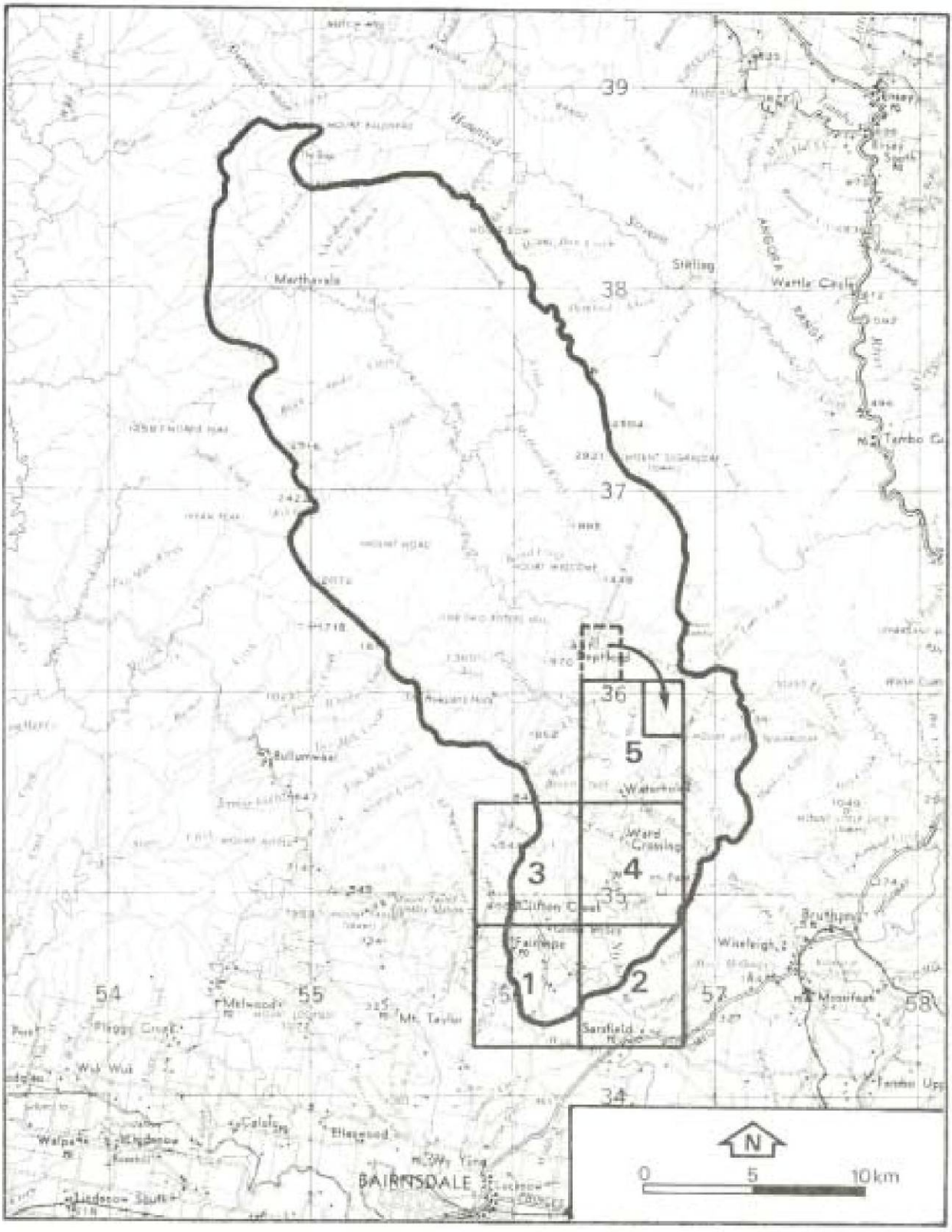
### Alluvium/colluvium

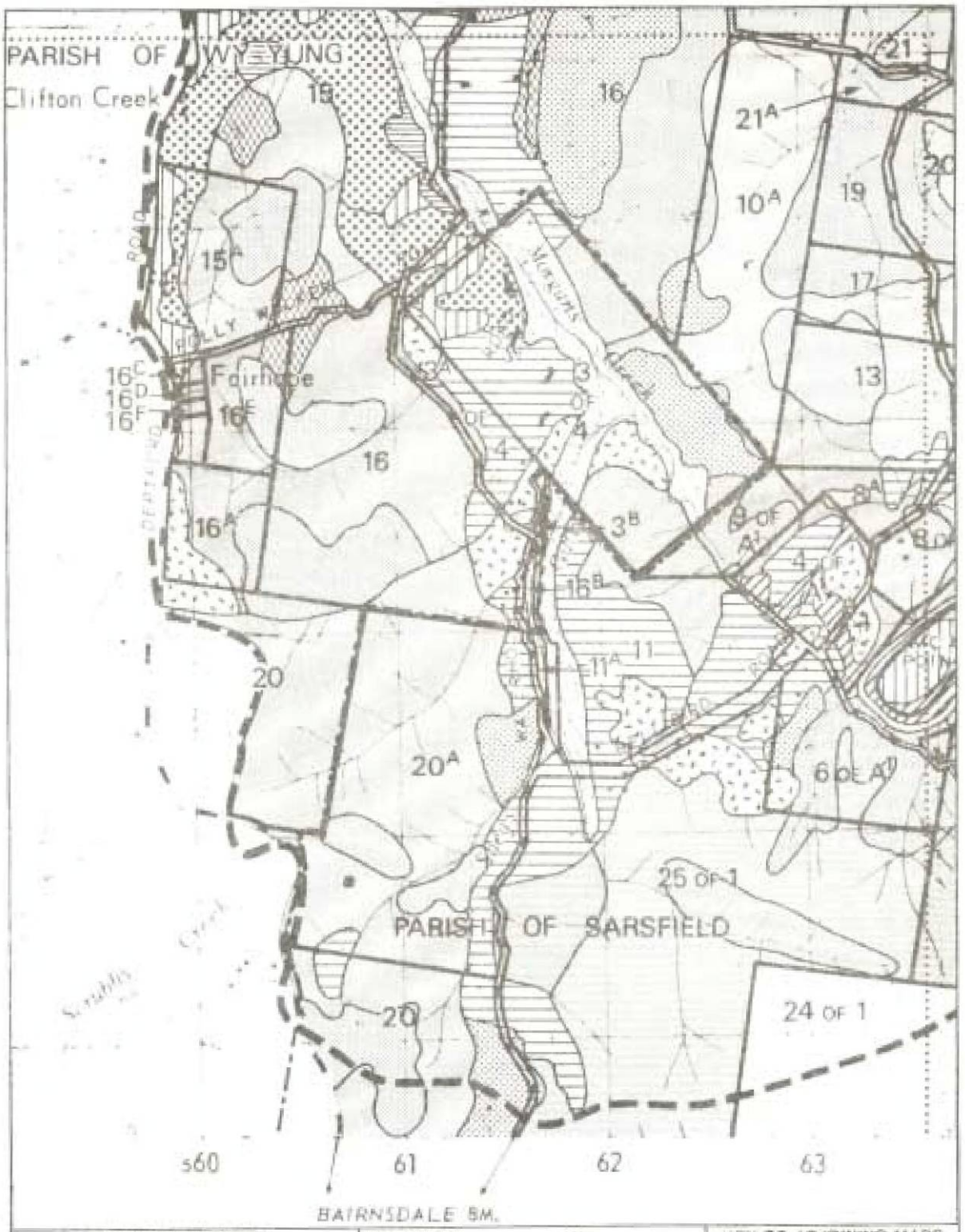
Erosion of these soils will inevitably be reflected in lowered water quality due to their close proximity to the Nicholson River. However, the soils are generally of lower erosion hazard, more gently sloping and well grassed. Streambank erosion is of concern in some areas, particularly along Morgans Creek.

## Limitations of the Study

The land types, described here and mapped initially onto 1:25 000 aerial photographs, are generalisations based on stereo-photo interpretation and limited field work. As such, small areas of land (particularly close to streams and therefore of prime importance to catchment management) may not be accurately described and may require further investigation. Further, while the delineation of Land Types (or map units) endeavours to group those areas of land with similar characteristics relevant to catchment management, the nature of the land itself dictates the identification and delineation of the map units. For example, the separation of Ors and Ohs units is far more clearcut than the separation of the Ohs and Oss units because of physiographic factors. However, Ohs and Oss units do not represent broad areas with different management requirements for adequate catchment protection.

*Figure 5 - Key to Land Type Mapsheets (Sheets 1-5)*






NICHOLSON RIVER
WATER SUPPLY CATCHMENT
LAND TYPES OF FREEHOLD LAND

S-1410
SHEET 1

N

0 500m

Legend:

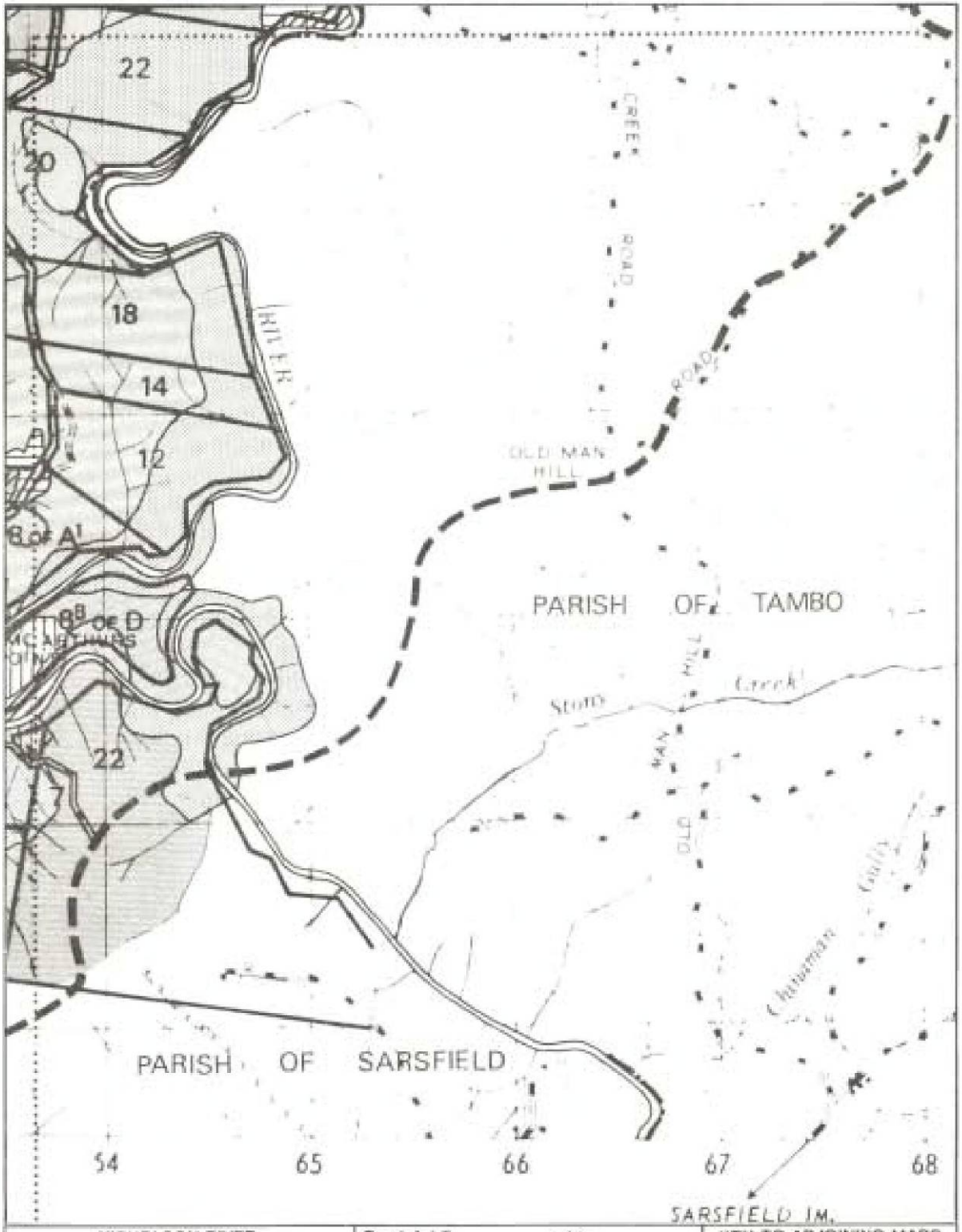
Catchment boundary
Parish boundary
Allotment boundary
Overlap boundary

3 OF 4

OSS OHS ORS
OSY OHY ORY
TS TH TR
AL1 AL2

Refer to table for land type description

KEY TO ADJOINING MAPS




NICHOLSON RIVER
WATER SUPPLY CATCHMENT
LAND TYPES OF FREEHOLD LAND

S-1410
SHEET 2

N

0 500m

Legend:

Catchment boundary

Parish boundary

Allotment boundary

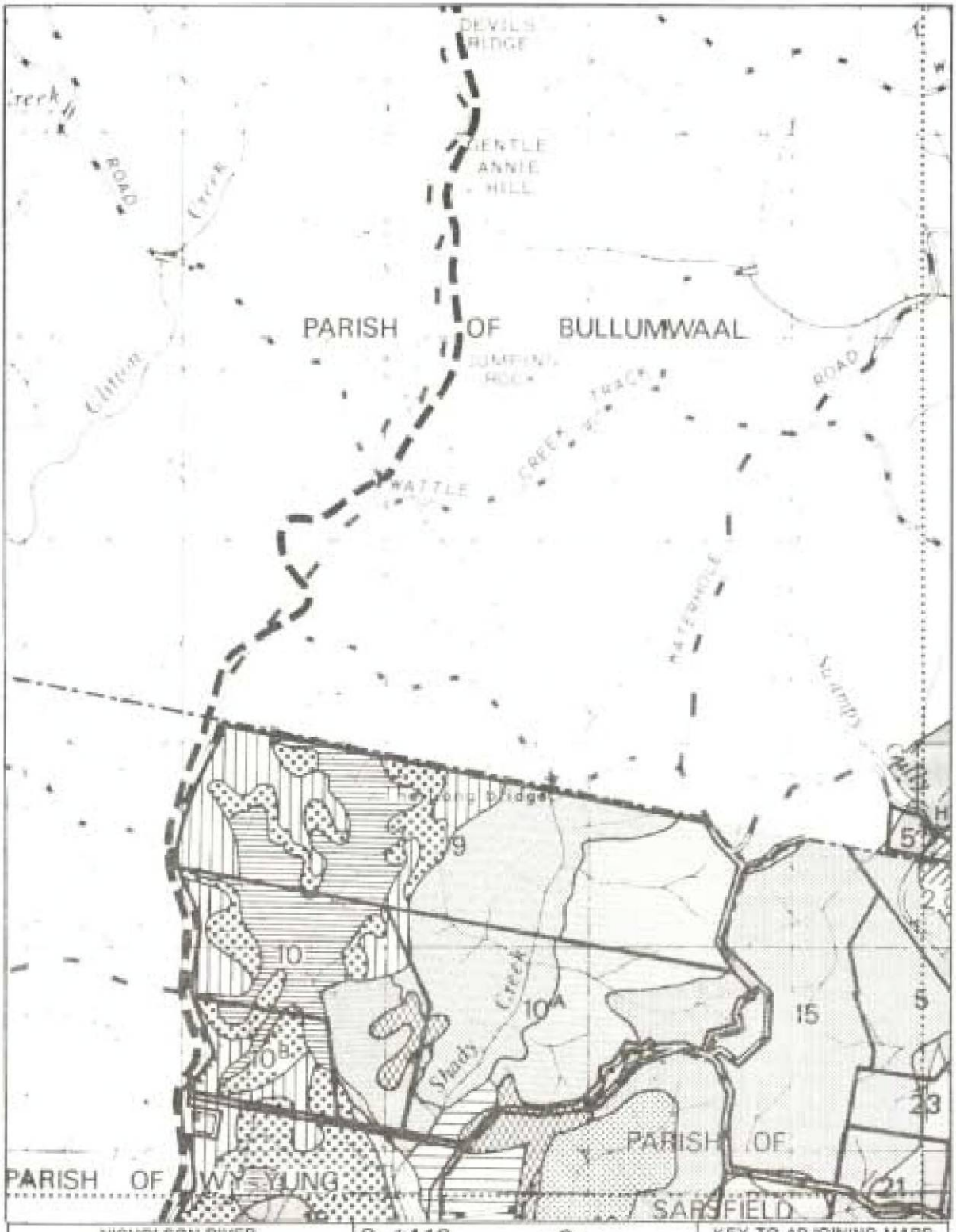
Overlap boundary

3 OF 4

OSS OHS ORS
OSY OHY ORY
TS TH TR
AL1 AL2

Refer to table for land type description

KEY TO ADJOINING MAPS




NICHOLSON RIVER
WATER SUPPLY CATCHMENT
LAND TYPES OF FREEHOLD LAND

S-1410

SHEET 3

N

0 500m

Legend:

Catchment boundary

Parish boundary

Allotment boundary

Overlap boundary

3 OF 4

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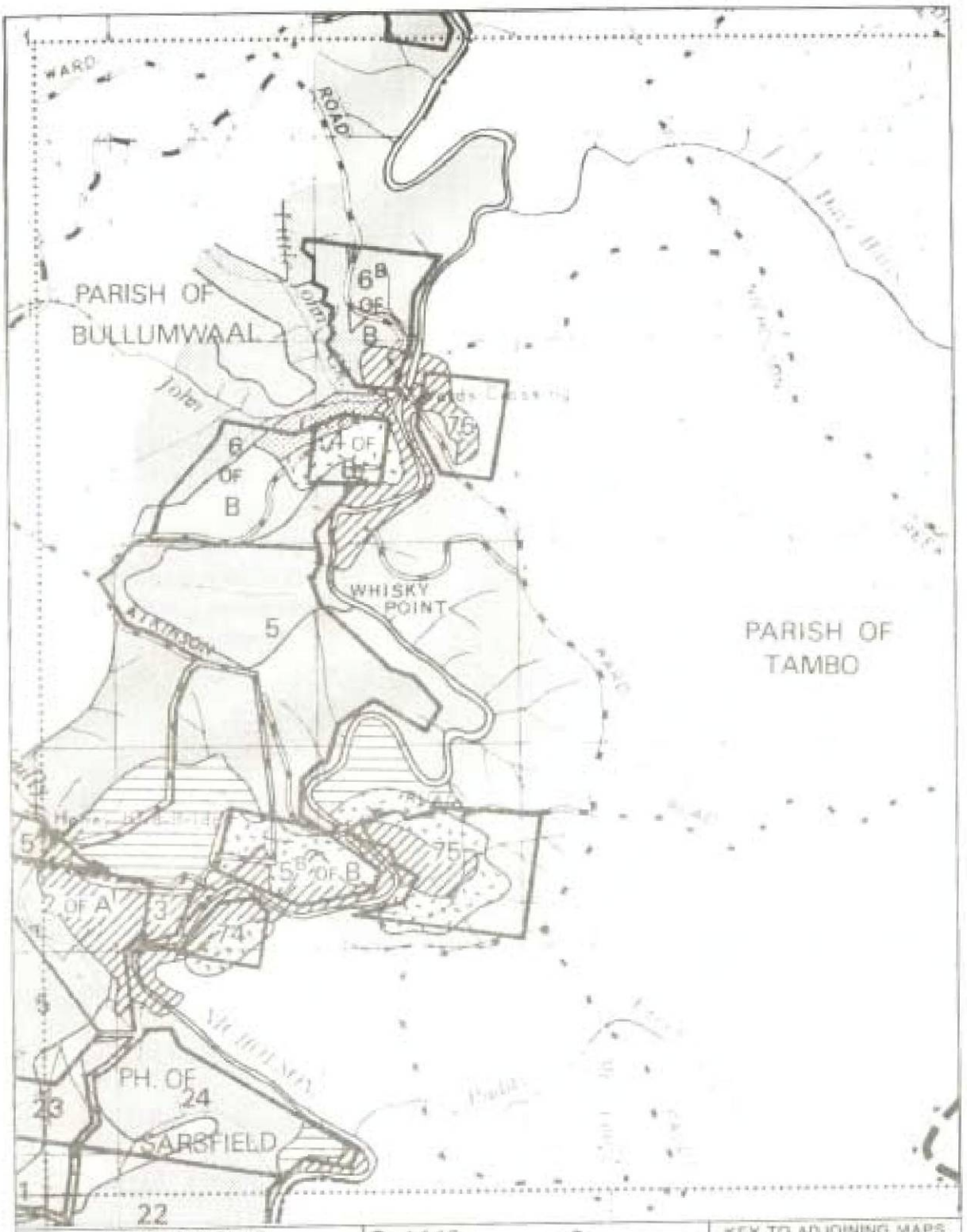
AL1 AL2

Refer to table for land type description

KEY TO ADJOINING MAPS




NICHOLSON RIVER
WATER SUPPLY CATCHMENT
LAND TYPES OF FREEHOLD LAND

S-1410

SHEET 4

N

0 500m

KEY TO ADJOINING MAPS


Legend:

Catchment boundary

Parish boundary

Allotment boundary

Overlap boundary

3 OF 4

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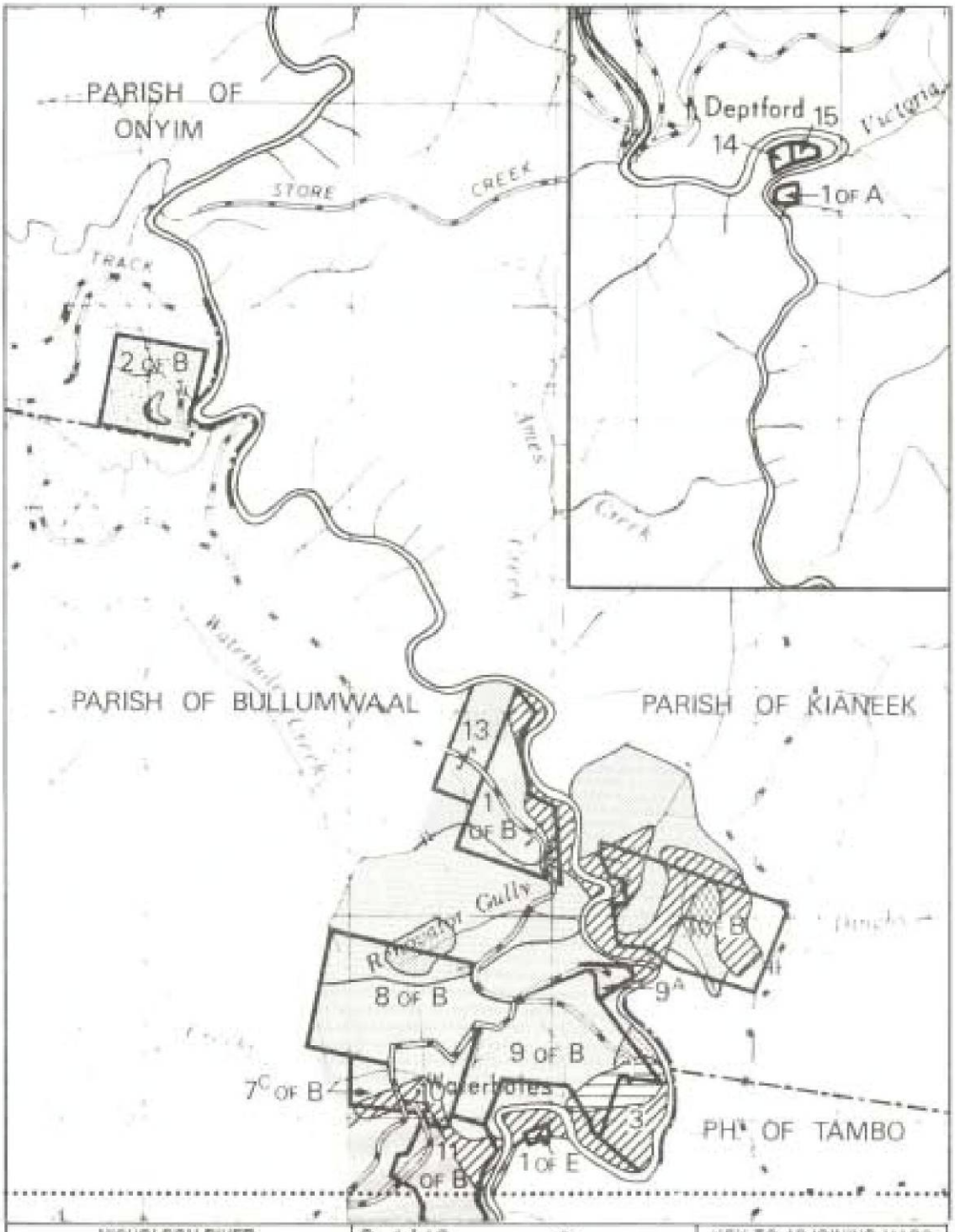
AL1 AL2

Refer to table for land type description


PARISH OF ONYIM
STORE CREEK
TRACK
2 OF B
Deptford
15
14
1 OF A
PARISH OF BULLUMWAAL
PARISH OF KIANEEK
13
1 OF B
8 OF B
9A
9 OF B
7C OF B
Waterholes
3
1 OF E
PH OF TAMBO
NICHOLSON RIVER
WATER SUPPLY CATCHMENT
LAND TYPES OF FREEHOLD LAND
S-1410
SHEET 5
0
500m
KEY TO ADJOINING MAPS
Legend:
Catchment boundary
Parish boundary
Allotment boundary
3 OF 4
Overlap boundary
OSS
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AL2
Refer to table for land type description

**Part B: Description of Land Types**

PART B: DESCRIPTION OF LAND TYPES

| Land/Soil Type | Landform, Slope | Profile Description |
|---|---|---|
| **Land Types on Ordovician Parent Material** | | |
| **ORT**<br>Yellow duplex and yellow gradational types | Low, gentle hill; slopes <15% | ● Yellow duplex soil:<br>A1 0–10 cm grey brown fine sandy loam, weakly structured.<br>A2 10–50 cm yellow brown fine sandy loam, apedal – massive.<br>B 50–90 cm yellow silty clay or light clay, brown mottles, structured, dispersive.<br>C decomposing sandstone.<br>VARIANTS: Paler soils, not as dispersive, with much kaolinitic clay in lower portions of the profile are found on broad crests e.g.<br>Yellow gradational soil with some stones:<br>A 0–17 cm dark brown fine sandy loam.<br>B 17–80 cm+ yellow brown light sandy clay loam, fragments of parent material throughout and occasional outcrops of sandstone. This soil is found on some crests at the edge of typical yellow duplex soils.<br>DRAINAGE: Sheds and transmits water on crests and lower slopes. Impeded profile drainage due to the light clay subsoil may exacerbate site drainage problems. |
| **ORY**<br>Yellow duplex type | Moderately steep hillslopes and associated narrow crests; slope 10–25%, commonly 12–20% | ● Yellow duplex soil:<br>A1 0–15 cm dark brown fine sandy loam, apedal–massive.<br>A2 15–40 cm bleached fine sandy clay loam, apedal.<br>B 40–100 cm+ yellow silty clay or light clay, brown mottles, structured, dispersive.<br>VARIANTS: Fragments of parent material may be present throughout the profile at the edges of distribution of the soil type.<br>DRAINAGE: The land sheds water freely. Internal drainage however, may be somewhat impeded. |

**Part B:** (continued)

PART B: Continued

| Land/Soil Type | Landform, Slope | Profile Description |
|---|---|---|
| **Land Types on Tertiary Parent Material.** | | |
| TR<br>Layered soils | Crests and other gentle slopes; slopes 0-13%, commonly <10% | ● Layered soil:<br>0-15 cm grey sandy loam.<br>15-100 cm+ red light clay to pale gravelly sands and clay loams. One or more of these subsurface layers may be dispersive.<br>DRAINAGE: Generally sheds water, although impeded profile drainage may result in a seasonally perched watertable close to the surface. |
| TH<br>Layered soils | Sideslopes of low hills slope; 10-25%, commonly 10-20% | ● Layered soil:<br>0 - 20 cm grey sandy loam.<br>20 cm+ various layers, eg. sands, loamy sands, sandy loams or course gravelly material, sometimes dispersive.<br>Profile characterised by bleached A2, lack of pedality, frequently thin iron-humate hard pan at >50 cm.<br>DRAINAGE: Sheds water, internal drainage may be impeded by the pan. However, there is sufficient slope to prevent water ponding. |
| TS<br>Layered soils | Steeper hill slopes and associated narrow crests; slope 20-40%, commonly 25-30% | ● Layered soil:<br>0-15 cm± grey sandy loam.<br>15 cm+ various layers, eg. gravelly sands, sandy loams.<br>Profile characterised by bleached A2 and/or frequently thin iron-humate hard pan at 50 cm.<br>DRAINAGE: Sheds water rapidly (steep slope). Formation of seasonal perched watertable likely for extended periods. |
| TDL<br>Variable | Minor and intermediate drainage lines rounded in cross sections, larger drainage lines may have a flat bottom. Slope: bed-grade varies with the land type surrounding drainage line | ● Variable soil:<br>Profile reflects the nature of surrounding soils, frequently sandy, but with clay at depth.<br>DRAINAGE: Receives and transmits water. |

**Part B:** (continued)

**PART B:** Continued

| Land/Soil Type | Landform, Slope | Profile Description |
|---|---|---|
| **Land types on Alluvium** | | |
| **AL 1**<br>Deep sandy loam soils | Floodplain along major creeks, mainly Morgans Creek sub-catchment; slope 0 - 3%, commonly < 2% | ● Duplex soil:<br>0-45 cm dark grey fine sandy loam or loamy fine sand, weakly structured.<br>45-125 cm yellow brown fine sandy clay loam, mottled, unstructured.<br>125-165 cm+ gleyed silty clay, weakly structured.<br>VARIANTS: May have a gleyed fine sandy clay instead of the silty clay. Layers may have thinner layers of other soil materials (silty loams, loamy sands etc.) between the topsoil and subsequent layers.<br>DRAINAGE: Very poor. |
| **AL 2**<br>Deep, dark loamy soil or deep fine sandy soil | River terraces and alluvial flats generally associated with the Nicholson River | ● Dark loam soil: (generally, but not exclusively, occupies higher positions in landscape)<br>0-45 cm dark grey loam or silty loam, moderately structured.<br>45-120 cm+ dark brown silty loam or clay loam, mottles ±, moderately structured.<br>● Sandy soil: (generally occupies lower positions in the landscape)<br>0-50 cm dark grey fine sandy loam or loamy sand, structured.<br>50-100 cm+ grey brown or yellow brown loamy fine sand or fine sandy loam or fine sandy clay loam, mottles ±, weakly structured or apedal-massive.<br>DRAINAGE: Free internal drainage, lower areas may be waterlogged periodically. Surface drainage is slow due to gentle slopes. |

**Part C: Erosion hazard assessment and associated land management factors for various uses or development**

**Ordovician Land Types**

| Land Type | Erosion Hazards/ Existing and Potential | Clearing | Grazing | Cropping | Effluent Disposal | Residential | Roads |
|---|---|---|---|---|---|---|---|
| ORY<br>Yellow duplex and yellow gradational soils; slope < 15% | Yellow duplex soils are the most erodible in the Catchment, (site erodibility is also affected by slope and drainage conditions). Variations of these soils are more stable.<br><br>Soils are prone to tunnel and gully erosion, slumping of road batters and table drain erosion. The dispersive B horizon readily generates turbidity and sediment.<br><br>Existing erosion is a major source of turbidity and some sedimentation. Erosion has been caused by incorrect clearing operations, unimproved pastures, overgrazing, and lack of rabbit control. | Turbid runoff can be expected from subsoils exposed by clearing. | Above average management practices and controlled stocking is required. | Soil structure breaks down with repeated cultivation. | Appropriate design and siting of absorption fields can generally overcome site limitations. | Topsoiling of exposed subsoil is desirable. | Appropriate road design, construction and maintenance are essential. Runoff from table drains will erode the drain and become turbid. This water should be diverted onto stable grassed areas at frequent intervals before entry to the stream system. |
| ORY<br>Deep yellow duplex soils; slope 10-25%; commonly 12-20% | Prone to gully erosion rather than tunnel erosion. Table drain erosion and slumping of exposed batters also occurs sporadically. Exposure of the dispersive subsoil will produce turbid runoff. Unimproved pasture, overgrazing, and lack of rabbit control leads to gully and tunnel erosion. | As above | As above | As above plus the fact that increasing slope contributes to rilling of ploughed land. | As above | Appropriate siting and low residential density is essential. | Slope gradient will result in extensive exposure of subsoil in road batters. Table drains may erode freely and batters slump if there is inadequate cross drainage from table drains. Runoff water should be diverted onto stable grassed areas before entering stream system. |
| OSY<br>Dominantly yellow duplex soils; slope 20-40%, commonly 25-30% | Prone to sheeting rather than gully or tunnel erosion, due to its greater slope. Drainage lines at the foot of the slope are erosion prone and are a source of turbidity and sediment to streams. | Adoption of erosion control techniques, eg. windrowing of debris on contours and minimum disturbance of drainage areas is necessary. | As above | Not advisable due to slope constraints. | Specific design and setback from streams is required. | Not suited due to slope constraints, erodible subsoil and possible effluent disposal problems. | Steep slopes require cutting of deep batters, exposing erodible subsoil, generating rapid runoff through the drainage system with significant off-site effects. |
| ORS<br>Stony red soils slope 0-15%, commonly 5-10% | Moderately prone to sheet erosion when bared and disturbed. Some evidence of past erosion is visible in uncleared areas. Vigorously growing and well established pasture is resistant to erosion. | Erosion control techniques essential, especially in areas close to drainage lines. | Control of grazing is essential, overgrazing may result in significant sheet erosion. | Above average management practices essential as soil structure breaks down with repeated cultivation. | Appropriate design and siting is required to overcome site limitations. | Erosion control measures are required. | Diversion of road drainage water onto stable grassland before entry into streams is required. |

**Part C:** (continued)

PART C: Continued

| Land Type | Erosion Hazards/ Existing and Potential | Clearing | Grazing | Cropping | Effluent Disposal | Residential | Roads |
|---|---|---|---|---|---|---|---|
| **CMS** Stony red soils with shallower variants; slope 10–25%, commonly 12–20% | Topsoil susceptible to erosion if bared and loosened. Road batters and table drains are generally stable. | Erosion control measures necessary to avoid sedimentation of streams. | Overgrazing may cause sheet erosion. | Not suitable | Appropriate design and siting can generally overcome site limitations. | Only on moderate slopes with adoption of erosion control measures. | Safe disposal of road drainage water at stream crossings and cross drainage from table drains is required to maintain road stability. |
| **CSS** Shallow stony red soils; slope 20–40%, commonly 20–30% | This land is prone to sheet erosion, due to slope factors, contributing turbidity and sediment to the stream system. | Will cause extensive sheet erosion. | Well established pasture and controlled grazing will prevent sheet erosion. | Slope factors preclude regular cultivation. | Suitable design, installation and siting are required for satisfactory disposal. | Slope factors preclude steeper areas from development, other areas require strict stabilization techniques. | Proper planning and maintenance standards are essential, including batter stabilization, proper road drainage and management of runoff. |
| **CDL** Alluvial soils | Prone to gully erosion if bared due to flow concentration. Erosion would generate high sediment loads and turbidity in the stream system. | Intermediate drainage lines should not be cleared because of erosion hazard. Stabilization by revegetation may be necessary. | Controlled grazing only. | Not suited to regular cultivation. | Not suited due to wetness and high pollution hazard. | Not suited due to wetness and roading limitations. | Not suited. Road crossings require stabilization measures. |
| **Land Types on Tertiary Parent Material** | | | | | | | |
| **TR** Layered soils; slope 0–15%; usually 10% | The topsoil may erode easily if bared and loosened, and exposed to moderate or heavy rainfall. Subsurfaces are not deeply exposed in road batters and pose little hazard. | Few problems | Few problems | Few problems | No problems if properly designed and sited. | Few problems | Few problems |
| **TH** Grey sandy loam over a variety of subsoil layers; slope 10–25%, frequently 10–20% | The topsoil may erode easily if bared and disturbed, but the sediment is readily trapped. Subsurface layers may be dispersible when exposed during clearing or in road batters. | Debris should be windrowed on the contour and drainage lines protected. | Controlled grazing only. | Not well suited for regular cultivation. | Proper design and siting of effluent disposal fields can overcome slope limitations. | Stabilization of soil batters and disturbed areas essential. | As for residential |
| **TS** Grey sandy loam soils; slope 20–40%, commonly 25–30% | Tendency to sheet erosion under existing forest cover; more stable under good pasture. Clearing operations can be followed by a period of turbid runoff. Coarser sediment also likely to move but can be trapped easily. | Exposure of subsoil results in turbid runoff. | Suited for controlled grazing. | Not suited to regular cultivation due to slope and coarse topsoil. | Appropriate siting and design is required for satisfactory disposal of effluent. | Not well suited because of slope which increases the extent and depth of soil exposed. | Steeper slopes will have considerable depth of dispersive profile layers exposed in road batters. |

**Part C:** (continued)

PART C: Continued

| Land Type | Erosion Hazards/ Existing and Potential | Clearing | Grazing | Cropping | Effluent Disposal | Residential | Roads |
|---|---|---|---|---|---|---|---|
| **TDL** Varied, reflecting the nature of surrounding soils, often sandy but more clay with depth. | Generally well grassed and stable (few are incised) however erosion of the larger drainage lines may occur if disturbed and loosened. The resultant coarse sediment is easily trapped. | Protection is required during clearing. Bared areas should be stabilized with posture as soon as possible. | Suited for grazing. | Not suited to cultivation. | Not suited due to wetness limitations. | Not suited due to wetness limitations. | Culverts are essential. Care is needed in design and construction of table drains near these drainage lines. |
| **Alluvial Land Types** | | | | | | | |
| **AL 1** Fine sandy soils with clay at depth. Extensive areas of flood plain along major creeks. | Erosion of this land has a significant effect on water quality due to its proximity to major streams. It will contribute both sediment and turbidity. There is a small area of salinity along Morgans Creek below an CHS land unit. Treatment of this area is advisable. There are extensive gullies in this land that have now stabilized. | This land is largely cleared. Further clearing should be discouraged because of high erosion hazard. | Care in stock management is needed, especially in areas with existing erosion. | Cultivation presents slight hazard to water quality. | Not capable of continued satisfactory effluent disposal. Severe seasonal limitations. Failing systems will seriously contaminate the stream. | Not suited to residential development due to effluent disposal limitations. | Should be confined to essential stream crossings only, with careful planning applied. Channelling of flow through pipe culverts increases the risk of erosion during the periods of high flow. |
| **AL 2** River terraces and alluvial flats along the Nicholson River. | These soils are generally of low erosion hazard. Erosion of this soil will be readily reflected in reduced water quality due to proximity of the land to Nicholson River. | Generally free of trees. Clearing is of little concern due to free internal drainage of the soil. | Few problems, however damage to river banks at crossings and drinking points are of concern, especially faecal contamination. | Not practical or economical due to the small area involved. | Correct site selection is essential for satisfactory effluent disposal. Failure would immediately be reflected in water quality due to proximity to the Nicholson River. | Not suited due to limitations of flooding and effluent disposal. | Not suited for roading, however stream crossings are inevitable and require careful planning and construction, especially in relation to re-entry of road drainage. |

## *Appendix B - Summary of Land Conservation Council Recommendations relevant to the Nicholson River Water Supply Catchment (adapted from Final Recommendations, Gippsland Lakes Hinterland Area and Alpine Area - Special Investigation)*

The summary:

- reflects changes that have taken place in the organisational management and responsibilities within the public land management with particular relevance to the Department of Conservation and Environment.

- includes only the specific recommendations. The published text within each chapter includes information preceding the actual recommendations. Statements concerning key issues and matters of policy are made and should be referred to if necessary.

**GIPPSLAND LAKES HINTERLAND AREA**

**E7** (Nicholson River diversion weir, Tambo Water Board)

It is recommended that once a Land Use Determination has been made, public land containing the following

areas:- the storage areas

- diversion works

- associated facilities

- the buffer zones around diversion works and storages, as defined in the Land Use

Determination- any other allotments considered necessary

be used for

- water supply purposes

- other activities permitted by the Tambo Water Board after consultation with the Department of Conservation and Environment and the Environment Protection Authority.

and that these areas be permanently reserved under section 4 of the *Crown Land (Reserves) Act*, 1978 for water supply purposes, and be managed by the Tambo Water Board.

Notes

1. The primary object of management of the buffer zone must be to protect water quality. Subject to this principle, the Tambo Water Board may permit other secondary uses in the buffer zone. In such cases the principles of management must be agreed upon by that Board and any other authorities concerned.

2. In some instances it may not be practicable for the Board to manage all or part of the buffer zone. In such cases agreement should be reached between the Department of Conservation and Environment and the Board at the time the Land Use Determination for the Nicholson River Water Supply Catchment is made. The agreement may include leaving the management of the buffer zone with the Department on the basis that it would be managed with the prime object of protecting the water quality.

3. The Council considers that fossicking and prospecting under a Miner's Right should not be permitted on land under the control of the Board around storages and facilities etc.

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also refers to Nicholson Reservoir

**F4** (Nicholson - Mt Alfred)

It is recommended that the area shown on Figure 3 of this report be used:

- Primarily to produce hardwood timber in a manner having due regard for landscape values as seen from the main roads outside the forest.

and that

- Major secondary uses be to:

  Provide opportunities for open-space recreation and education

  Conserve native plants and animals, and provide opportunities for the development of wildlife conservation techniques

  Produce honey, forage, gravel, sand and other forest products as defined in the *Forests Act*, 1958

- Water production values be recognised and protected

- The special value of the *Eriostemon verrucosus* at Mt Dow be protected by management prescriptions.

Note: Management should conform to the policies outlined in the Water Production chapter.

Note: (1987) It is Council's intention that the State Forest concept as presented in the "Final Recommendations - Alpine Area, Special Investigation" should be taken to apply to public land previously recommended for Hardwood Production or an Uncommitted land.

**K1** (Public land water frontage reserves)

It is recommended that the public land water frontages:

be used to

- protect adjoining land from erosion by the maintenance of adequate vegetation cover

- maintain the character and quality of the local landscape

- conserve native flora and fauna

- provide opportunities for low-intensity recreation

- allow access to water and for grazing of stock by adjoining landholders under licence where appropriate.

that

- where a licence has been issued for a public land water frontage as in (a) (v) above, restricted recreation use by the public be permitted (non-damaging activities such as walking, nature observation, fishing, or just relaxing should be allowed, while potentially damaging activities such as camping, lighting fires, or using motor or motorised recreation vehicles should be prohibited).

- licensees be required to provide stiles in any fences erected across their licence area if requested to do so by the management authority.

- cultivation not be permitted, except with the approval of the Department of Conservation and Environment, and that, in the Nicholson River Water Supply Catchment, the Department be consulted to ensure that approval to cultivate is in accordance with the Land Use Determination affecting the water frontage made under the *Soil Conservation and Land Utilization Act*, 1958.

- in particular cases, licensees be required to fence off and exclude stock temporarily from some parts of the licence area where, in the opinion of the Department of Conservation and Environment or other management authority, special measures are necessary to protect water supplies, to rehabilitate eroding areas, or to permit regeneration of native plants that have particular value for nature conservation.

that

the Department of Conservation and Environment be consulted prior to the proclamation of roads, the construction of roadways or the creation of buildings on public land water frontages.

and that

- public land water frontages be permanently reserved under section 4 of the *Crown Land (Reserves) Act*, 1978

- the area be managed by the Department of Conservation and Environment or by a committee of management where one is appointed.

Note: Public land water frontage reserves have not been shown on Figure 3 of the report. The appropriate Parish plan should be referred to in order to determine the precise boundaries of these reserves.

**K8** (Natural features zone - Nicholson River)

It is recommended that, for the area indicated on Figure 3 of this report, management be primarily aimed

at:- protection of natural and scenic values

- provision of recreational and interpretative facilities where this does not conflict with (a) above.

and

- timber harvesting and gravel extraction not be permitted

- any new roading be constructed only where essential for the purposes of management, protection and transport of timber and be designed to minimize effects on scenic and natural conservation values and that management be the responsibility of the authority managing the adjacent public land.

Note: The area shown on Figure 3 should not be taken as delineating exact boundaries to the natural features zones. It is intended that these zones should include both the visual corridor (comprising those parts of the valley that can be seen from the stream) and the environmental sequence from relatively dry foothill country, through the species-rich intermediate zone, to the riverine section. In may areas the visual corridor will include this sequence and as such will determine the width of the zone. In other places, however, not all of the environmental sequence will be visible from the stream and in these cases the natural features zone will extend beyond the visual corridor. While the extent of these zones will vary according to local circumstances, it is expected that in most cases it will not be less than 100 m and not greater than 300 m from the bank on either side of the stream. These zones should be delineated on management plans where appropriate.

**U1** (Uncommitted land)

It is recommended that the area shown on Figure 3 of this report be used to:

- maintain the quality of the land to meet future demands

- produce those goods and services required by the community (such as forest produce, grazing and honey) that can be supplied without seriously reducing the long-term ability of the land to meet future demands.

Note: (1987) It is Council's intention that the State Forest concept as presented in the "Final Recommendations - Alpine Study Area, Special Investigation" should be taken to apply to public land previously recommended for Hardwood Production or as Uncommitted land.

**V1** (Other reserves and public land)

It is recommended that, for the small areas of public land shown on Figure 3 of the report, existing legal use and tenure continue

and that

- where the land is not reserved for a specific purpose, such areas be used in a way that will not preclude their reservation in the future, for as-yet-unknown public purposes, and be managed as if they were Uncommitted land.

**ALPINE AREA - SPECIAL INVESTIGATION**

**I1** (State Forest)

It is recommended that those shown on Figure 3 of this report be used in accordance with the principles for forest management expressed in the text of the final recommendations and the areas be used to:

- supply water and protect catchments and streams
- produce hardwood timber
- conserve native plants and animals, and provide opportunities for the development of wildlife conservation techniques
- provide opportunities for open-space recreation (including hunting) and education
- produce honey, forage, gravel, sand and other forest produce
- protect the historic value of sites associated with early mining and the timber tramlines and old sawmill site in the vicinity of Mt Baldhead by the implementation of management prescriptions

and that they become State Forest

Note: The Council's intention is that the State Forest concept should be taken to apply to public land previously recommended for Hardwood Production or as Uncommitted land. It is not equivalent to State Forest as defined under the *Forests Act,* 1958.