REPORT ON A PROPOSED LAND USE DETERMINATION FOR THE ROSSLYNNE RESERVOIR (JACKSON CREEK)

WATER SUPPLY CATCHMENT

Prepared for consideration by
The Soil conservation Authority
And Land Conservation Council

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CONTENTS

LOCALITY PLAN

Rosslynne Reservoir (Jackson Creek) Catchment

1. INTRODUCTION

(a) PROCLAMATION

Following a request from the State rivers and Water Supply Commission to the Land Utilisations Advisory Council, the catchments to Rosslynne Reservoir and a proposed pump off-take on Riddells Creek were investigated by Authority catchment officers. A report was prepared recommending that Stage 1: Rosslynne Reservoir (Jackson Creek) Catchment be proclaimed, and that the Middle Gully Creek sub catchment be excluded from the Stage 2 proposals.

The Rosslynne Reservoir (Jackson Creek) Water Supply Catchment was proclaimed on 8th September, 1970, and this was published in the Victoria Government Gazette No. 85, dated 16th September, 1970.

(b) LAND USE NOTICE

Gradual deterioration of catchment values occurred following proclamation and this led to the introduction of a Land Use Notice, gazetted on 16th June, 1974. This specified the following changes in land use which were not to be made without the approval of the Soil Conservation Authority:

1. The clearing of burning of timbered land, and timber utilisation operations.

2. The cultivation of land (excluding household gardens) for cropping, pasture establishment or pasture renovation.

3. The subdivision of any existing allotment of land.

4. The construction of a house, the construction of, or addition to, buildings which produce waste discharge.

5. The construction of tracks, roads or dams, the commencement of any extractive industry or earthworks.

Copies of the notice were sent to all landholders in the catchment accompanied by an explanatory letter. A further letter to all landholders and notices in the local press were used in April 1975, because changes in land use and subsequent catchment deterioration were still occurring, in many cases without approval.

It was then resolved to undertake field investigations for a land use determination. This report and plan are the result of these detailed investigations, discussions with relevant State and Local Government departments and with many landholders in the catchment.

(c) PRESENT PLANNING CONTROLS

Most of the catchment is within the Shire of Gisborne, for which an Interim Development Order is presently in force, controlling subdivision, development, building and clearing. Consultants are in the process of preparing a planning scheme for the Shire. Significant features of the plan are the proposed “conservation zone” which provides for no further subdivision surrounding the Rosslynne Reservoir, a protective streamside zone along creeks, and restrictions on the size of future subdivided lots throughout the remainder of the catchment.

Present indications are that the scheme will effectively acknowledge the Victorian Government’s Statement of Planning Policy No. 8 for the Macedon Ranges and surrounds. This document and the Report of Studies for its preparation identify the need for appropriate planning in the Macedon Ranges are for “protection and utilisation of the resources of the policy area for water supply, tourism, and recreation……”. Most clauses in the statement are of particular importance and relevance to the Rosslynne Reservoir Catchment.

(d) WATER SUPPLY SYSTEM

Construction of the Rosslynne Dam was completed in mid-June 1973 and the 24 700 megalitre capacity reservoir first filled in July 1974. The storage will supply the "preferred development area" of Sunbury and safeguard supplies for private diverters along the Maribyrnong River. The recommended annual requirement to ensure supply for irrigation was approximately 1 000 Ml.

Although supply to Sunbury forms the principal domestic use for the waters of Rosslynne, Gisborne township also draws on these supplies during the summer period. An alternative proposal for augmenting supply to the township of Riddells Creek involves taking water by pumping from the Rosslynne – Sunbury pipeline water.

(e) STREAMFLOW AND WATER QUALITY

Streamflow records indicate that Jackson Creek has a relatively high yielding catchment, although flow is very variable. Estimated long term annual flow is 12 320 Ml, being half the total storage, and representing an average yield of 148.6 Ml per square kilometre. The table in Appendix 1 shows monthly records for the gauging station on Saltwater Creek (at Waterloo Flat) for 1970-75 and Jackson Creek (below the reservoir site) for 1971-75. Yield varies from immeasurably small monthly flows in dry periods to 5 082 Ml (Saltwater Creek) and 9 575 Ml (Jackson Creek) both in November 1971.

Measurements of the level of bacterial indicator organisms have been taken at the Reservoir for three years, and a program of monthly sampling of three sites in the catchment was carried out from October 1972 to November 1974. Results of both of these are shown in Appendix 2.

The creek samples showed a relatively high mean and periodic very high counts, especially after particular instance of pollution, such as cattle wading in the creeks during a dry period.

Slaty Creek sub-catchment, which has the most intensive residential development, has the highest adjusted mean count.

Counts from the Reservoir samples are generally lower as would be expected with detention, however under certain conditions incoming creek flows may cross the surface of the storage to the outlet tower, minimising detention time.

The other parameter of water quality measured regularly at present in the catchment is for Total Dissolved Salts. A table showing values recorded for Saltwater and Jackson Creeks is shown in Appendix 3. They are all well within acceptance W. H. O. limits for domestic water supply.

It is considered that a programme of water quality monitoring of the sub-catchment creeks for a range of critical would give valuable information on which to base future management decisions. Similarly in assessing priorities for implementation of the determination, and one of the recommendations of this report is that such testing and measurement be carried out,

2. CATCHMENT DESCRITION

The catchment to Rosslynne Reservoir contains a wide range of types of land and intensities of land use. The Land Conservation Council's Melbourne Study Area report and the Town and Country Planning Board's Macedon Ranges report previously mentioned both cover the catchment and provide valuable information on the area, and should be consulted for more detailed descriptions.

(a) CLIMATE

Average annual rainfall figures for stations close to the catchment are as follows:-

Table 1

STATION	RAINFALL (mm)	WET DAYS
Mt. Macedon	932	186
Macedon	851	140
Gisborne	795	141
Gisborne South	612	120

Authority engineers have prepared a computer programme to generate rainfall intensity, frequency, and duration estimates for most rainfall recording stations, including those surrounding the catchment. There is a strong influence of the Macedon massif on rainfall intensities in the north of the catchment, which exceed those for the majority of the central and western parts of the State, except the Otways.

On average, rainfall availability does not limit the growing season for more than four months for most of the catchment. However, low temperature is an important factor which precludes the growing of many crops in areas which appear otherwise suitable. Several snowfalls occur each year in various sections of the catchment, as far south as Waterloo Flat.

(b) GEOLOGY AND PHYSIOGRAPHY

(refer to appendix 4)

The geology of the catchment reflects four distinct periods – Lower Palaeozoic (Ordovician), Miocene, Pliocene and Recent. Lower and lower-middle Ordovician interbedded sandstones, siltstones and shales from the bedrock for the area. These rocks are tightly folded, and where outcrops indicate axes, these are commonly aligned in a north-south direction. This material is the surface rock for much of the catchment, with varying degrees of dissection.

In the west and north of the catchment the Ordovician parent rock has weathered to a deeply dissected landform with a sub-rectangular dendritic drainage type. This is similar topographically to the adjacent catchments of Pyrete and Goodmans Creeks to the south, and Lerderderg River further west. Another feature of these areas is the presence of 30-50 metre high escarpments (with slopes of up to 100%) located intermittently along the north side of the east-running creeks 9Saltwater and tributaries, and Gisborne0 and which give rise to differential drainage morphology.

Between Saltwater Creek and the south-west boundary, and in the upper Slaty Creek sub-catchment, there is a less-strongly dissected terrain, with an angulate sub-parallel drainage type. A third landform based on Ordovician material is the gently sloping areas in the lower slaty Creek region. This is characterised by low relief and a sub-dendritic drainage pattern.

Tertiary Miocene deposits occur as gravel beds on the southern boundary of the catchment at Bullengarook. The Tertiary material has been a strong influence I the evolution of soils in the southern part of the catchment. It remains the thick beds along the boundary and is evident in isolated hilltop remnants further north. Drainage of these areas forms a coarse dendritic pattern, contrasting with the greater dissection of most of the Ordovician parent material.

Later in the Tertiary and early Quaternary periods numerous flows of basaltic lave occurred. Within the catchment they remain in two forms: one as residual landforms of valley flows, showing the characteristic flat to undulating plateaux, capping steep faces of the less-resistant underlying rock; the other as part of the broad basaltic plains west of Melbourne, crossing into the catchment at the Calder Highway between Gisborne and Macedon. Both Mount Bullengarook and Haires Hill on the catchment boundary are volcanic vents, but little evidence of their lave flows remains within the catchment.

Quaternary alluvial deposits occur at various places along the larger creeks.

(c) SOILS AND VEGETATION

In the northern and western parts of the catchment, coinciding approximately with the strongly-dissected Ordovician areas, the predominant soil type is an acidic reddish-yellow duplex soil. A typical soil profile from mid-slope has 10-15 cm fine-sandy loam A horizon, narrow silty loam A2 layer, overlying mottled light clay B horizon. Further north with greater rainfall, the A-B horizon texture change is less pronounced and gradational soils predominate. On crests in much of the Ordovician country, soils are shallow and stony gradational types, often with outcropping parent material. Depth of soil varies with position on landform and relatively deep pockets of soil may occur between outcrops. Angular quartz fragments are common on the surface and through the profile, indicating the presence of quartz reefs in the base rock. Subsoils are relatively dispersible (Emerson class 2).

Native vegetation on the above areas comprises open forest III (28-40 m height) or II (15-28 m) according to climate, aspect and relief. Over most of the Ordovician country the dominant tree species is messmate (*Eucalyptus obliqua*). This occurs in open forest III associates with narrow-leaved peppermint (*E. radiata*) and some mountain grey gum (*E. cypellocarpa*) on less exposed south and east slopes, and with manna gum (*E. viminalis*) also, close to drainage lines. Messmate and narrow-leaved peppermint again combine as the major species in the open forest associations, on the drier north and west slopes. This association occurs in a broad strip south of Saltwater Creek which is less strongly dissected and has a general northerly aspect. On ridgelines with shallow soils, messmate tends to be replaced by brown stringybark (*E. baxteri*) and some red stringybark (*E. macrorynchа*) while broad-leaved peppermint (*E. dives*) joins narrow-leaved peppermint.

In the central southern part of the catchment most of the soils are strongly influenced by Tertiary sediments. In general these can be described as friable mottled duplex soils. A typical profile consists of 10 cm of fine-sandy loam A1, and 20 cm of sandy loam A2, over a relatively well-structured mottled light clay. The soils formed from the Tertiary material are generally deeper than those previously described, and similar soils occur where underlying Ordovician rock or remnants of overlying basalt combine with the gravels. Rounded fragments of quartz are common through the profile, indicating the alluvial origin of the gravel material.

Most of this land-type has been developed for grazing, and as a result, little native vegetation remains. Where timber occurs, it consists mainly of open forest II: messmate again being the major species with narrow-leaved peppermint. In some gently-sloping areas manna gum becomes the dominant species with candlebark (*E. rubida*) and narrow-leaved peppermint.

In certain areas of the catchment where slopes are below 1% to 2%, very poor drainage results from a seasonally high water table. A typical soil profile in these areas has 15-20 cm of fine to very fine-sandy loam in the A1 horizon, and 20-30 cm of silty-clay loam in the A2 over o mottled light to medium clay B horizon.

Some alluvial deposits along the major creeks have similar soil type and poorly-draining properties. The dominant tree in such situations is generally swamp gum (*E. ovata*) with understorey species suited to wet conditions. Other alluvial terraces with better drainage conditions have manna gum and candlebark with narrow-leaved peppermint.

Soils on the two volcanic vents have shallow gradational profiles. A typical profile would have 20 cm red clay loam over 20 cm light clay with increasing parent rock with depth. The slopes (from 8% to 20%) of both vents are fully cleared, but on the undulating country below, narrow-leaved peppermint and manna gum comprise the timber canopy. This soil type also appears in some isolated areas where residuals of basalt flows occur.

Understorey species throughout the catchment show a wide variety of native trees, shrubs, heath and grasses in the forested areas. Density of growth and types of species reflect the availability of moisture, and in the sheltered stream gullies, ferns and other shrubs also appear. Grass tree (*Xanthorrhea australis*) is common in localised drier areas, with heath and low shrubs. The diversity in management of freehold land has also led to a range of understorey species. Where timber has mostly been removed, followed by low-intensity use, thick stands of silver wattle (Acacia dealbata) have resulted. Blocks cleared and left have reverted to an even-aged forest of natural timber with a thin understorey dominated by common heath (*Espacris impressa*). On well-drained slopes where intensity of grazing has been reduced, bracken has frequently become the dominant ground cover.

3. LAND USE AND HAZARDS TO WATER SUPPLY

(a) FORESTY

Timber harvesting has been a major activity within the Reserved forest in this catchment for over one hundred years. Initially harvesting operations were under little or no supervision, but since the early 1900s control of timber harvesting has been gradually strengthened and trees have been removed on a selection or “thinning from below” basis. The shelterwood system of silviculture has recently been introduced into the areas being managed for hardwood production to overcome some of the disadvantages of the selection system.

This type of silviculture is a relatively intensive means of reducing the stocking of the forest to enable vigorous regrowth to establish, while maintaining a forest cover on the site and concentrating growth on the retained overwood trees.

Under this system timber harvesting will be more intensive but less frequent than under the selection system.

Pulpwood harvesting has utilised mainly small sized defective trees in the past, but in the future it is planned that operations will be concentrated more on the log residues from sawlog harvesting and they will take place more or less concurrently with sawlog procurement. Chipping of the pulpwood I the forest is being considered as a method to facilitate the efficient utilisation of sawlog residues.

The production of sawlogs, pulpwood and poles is expected to continue as a major use in the catchment area, and the removal of minor forest procedure such as firewood and posts will also continue in response to local demand.

It is anticipated that there will be that there will be a continuing change to greater use of rubber tyred skidders and loaders in forest operation.

Pulpwood and sawlog operations have presented some problems in the past where there has been prolonged soil disturbance during the wetter periods of the year, however the management prescriptions drawn up by the forests commission in consultation with the Soil conservation Authority should provide a satisfactory basis for implementing adequate control in the future.

The L. C. C. ‘s main (final) recommendations for the Melbourne Study Area in this catchment are that the majority of the Reserved forest be used for hardwood production, and that there be a small extension of the existing softwood plantations brining the total in the catchment to approximately 500 ha.

Establishment of softwood plantations on cleared freehold land with the aid of Forest Commissions loans has involved only small area of land.

Military training exercises are carried out in Reserved forest about six to eight times per year and in general the required standards of forest practice are adhered to, and this activity offers minimum hazard to water quality.

(b) FREEHOLD DEVELOPMENT

Almost half of the land (49%) within the catchment is under freehold tenure and is subject to a diversity of uses ranging from urban settlement to broadacre grazing enterprises. “Rurban” subdivision demand has limited the latter use to less than ten farming properties.

The fact that there are presently over 400 landholders indicates the degree of settlement which has occurred and consequently the intensity of use to which the land is subjected under a spectrum of managerial ability.

(i) Rural Subdivision

The proximity of available land to Melbourne has result in increasing demand in the Shire of Gisborne for permanent living on a few hectares.

By far the greatest demand has been for small parcels of land in the 4 to 16 hectare range for hobby farming activities. An estimated 125 allotments below 6 hectares and a further 35 about 16 hectares have been created by subdivision within the last ten years. Most of the remaining Crown allotments are also below 40 hectares, and are held in individual ownership, and are either being used, or have the potential, for similar activities.

In some instances the location of these subdivisions has been in marginal "farming" development requires an above-average level of management to precent land deterioration and subsequent lowering of stream water quality. In many cases owners have undertaken clearing operations with no attempt to follow-up revegetation either by reafforestation or pasture improvement.

Lack of knowledge of sound agricultural practices, combined with inflated expectations as to the land's capability to support grazing enterprises, had led to overstocking on may properties with the consequence of reduced ground cover, surface compaction and an increase in poor quality runoff.

Experience in this area has shown that a stocking rate of one adult cow or horse for every 1.2 hectares (3 acres) is generally the maximum that can be carried under an improved pasture cover. On cleared, unimproved country, this rate is approximately halved.

Excessive earthworks associated with building site preparations, inappropriate alignment and poor construction standards of access tracks, together with delays in stabilising disturbed areas and lack of maintenance, have also caused catchment deterioration in some instances.

Whilst many of these effects are short term and can be minimised by a continuing extension programme, it is noted that many landholders are city commuters who do not have time, incentive, or often financial resources to devote to a desirable rate of property improvement.

A further limitation on "farmlets" adjacent to the Bacchus Marsh-Gisborne road is brought about the high water table and flat topography where residents have found it necessary to excavate surface drains to reduce waterlogging problems. Under these conditions, effective absorption of domestic effluent does not occur and surface leakage results. Further subdivision of areas affected by a high water table is not considered desirable and development of these remaining unoccupied lots may require a higher standard of effluent treatment to minimise the water quality hazard associated with liquid domestic wastes. Surface drains through the area are common and as the intensity of management increases, residents will continue to construct these to aid and hasten the discharge from their land.

(ii) Residential Subdivision

Three intensive residential areas are located within the Slaty Creek subcatchment adjacent to the Calder Highway. They are the southern section of Macedon township, Lodged Plan 12938. Allotments sizes are 0.4 hectares or less and these are keenly sought after because of the attractive "natural" settings they offer.

All these areas present an existing and potentially escalating threat to long-term water quality in Rosslynne Reservoir. Of particular concern is the rapid development of allotments with the Pineacres Estate (LP12938). Here shallow, podzolic soils with poor infiltration characteristics combine with a relatively steeply dissected terrain predisposing Slaty Creek to pollution. The causes for concern are sediment and turbid runoff arising from development works, and incomplete absorption of effluent resulting from the relatively high residential density.

It is generally recognised by the authorities involved that a limitation on intensity of use would be desirable in these inappropriate subdivisions. The Soil Conservation Authority has

recently prepared a policy statement indicating its concern at developments in the Pineaces Estate and proposing various courses of action, including consolidation of lots, to the Shire.

Specific restriction on future development will cover provisions for siting of houses and access tracks to minimise soil disturbance, and location of effluent disposal areas,

(iii) Other Intensive Uses

Commercial enterprises of special interests to catchment values include a sawmill, and a privately owned recreation camp catering for secondary school students.

Vehicular activities associated with sawmill operations have created sedimentation problems, necessitating implementation of revegetation programmes. It has also been necessary to construct a detention pond downslope of the log treatment works to safeguard against chemical leakage directly into watercourses.

Recreation activities pursue by thirty residential participants and one hundred and twenty day visitors at the previously mentioned Recreation Camp have cause significant increases in hard surfacing and runoff. Generally these activities are confined to the gentler slopes along ridgelines and sediment is usually intercepted by vegetation before it reaches drainage lines. Effluent disposal has also emerged as a major problem with this form of use and even though the original absorption field has been extended, surface leakage still occurs periodically. More venture like this are not considered desirable in view of the ease of compaction and poor infiltration characteristics of the soils encountered.

(c) AGRICULTURE

Land devoted to dull-time agricultural production has diminished in recent years due to the demand for hobby farms on sub-economic units.

Soil of low to moderate fertility require regular fertiliser applications to sustain stocking rates of 1 adult cow on approximately 1.2 hectares. Full-time farmers apply superphosphate at least every second year at rate around 100 kg per hectare, and potash is applies at similar rates to paddocks cut for hay.

Grazing properties based on improved or semi-improved pastures are the prime enterprises. Beef cattle are preferred to sheep as the latter require a higher stock husbandry input under the cool, wet climate experienced in this locality.

Dairy farming is practised on one 100 hectare property and its economic viability can mainly be attributed to above average management and higher returns due to a “whole milk” marketing contract.

Further clearing for pasture improvement is generally considered uneconomic as the cost of conversion exceeds the limited financial returns on present and projected estimates.

Overstocking is less of a hazard to water quality on these larger holdings compared with hobby farms, as there is greater flexibility in management due to property size, and a higher level of management. Minor damage to the banks of define watercourses by stock trafficking does occur where streams provide watering points for stock, and while watercourses are unfenced, there is a possibility of periodic bacterial contamination.

(d) RECREATION

Demand for outdoor recreation, both on private and public land within the catchment, is increasing and reflects the community’s greater affluence, mobility and leisure time.

Several private landholders have reacted to these demands and are prepared to extend their facilities accordingly. Apart from the Recreational Camp mentioned earlier, other recreational

outlets include a horse hire service for trail riding at Bullengarook and the Macedon Caravan Park, situated at the southern end of Macedon township.

Minor erosion problems periodically occur with horse trail riding but these can be effectively contained with the co-operation of the owners concerned.

The Macedon Caravan Park is of greater concern. The liquid wastes, particularly sullage, from many "permanent" as well as transient users, is not being absorbed in the land but is being discharged to a drainage line. This is a further instance of poor location on land that cannot withstand the pressures of use. In the interests of the catchment, treatment of this sullage must eventually be introduced or the park relocated.

Recreation on public lands, largely Reserved Forest, takes the forms of bushwalking, picnicking, pleasure driving and to an increasing extent trail bikes and four-wheel drive vehicles. Damage to date has been limited to isolated cases of recreational vehicles leaving forest roads and fire control access tracks. It may be necessary to provide greater weekend supervision to these later activities should land deterioration increase. The Forest Commission has recently allocated funds to Trentham Forests Office for this purpose.

Littering and damage to stream environs is noted at several sites in the catchment which are popular with day visitors. The Authority has used its "domestic water supply catchment" signs at problem spots but there is a need for proper planning in the provision of picnic and rubbish collection facilities.

The Land Conservation council's (final) recommendations for this area include two small sections of the Macedon Regional Park, zoned for conservation, recreation and timber productions.

(e) ROADING

Roads throughout the catchment generally provide access to land owners rather than links between isolated rural centres. The two exceptions are the Calder Highway along the eastern boundary, and the Bacchus Marsh-Gisborne road near the extremity of the southern boundary. Both these links are well drained, high standard, bitumen surfaced roads, and provide little hazard to water quality. The Country roads Board manages the highway directly, and the Bacchus Marsh-Gisborne road by allocation tot he Shire.

Apart from isolated section of bitumen surfacing within some subdivisions, the surface of other roads is crushed rock and gravel from local quarries. Sediment from these roads is considered to be a significant problem and is due primarily to concentrated flows arising from minimal maintenance, insufficient surface drainage and lack of batter stabilisation. Batter slumping and table drain scouring are particular problems in Lawson road, with sediment being deposited on an adjoining landholder's property.

Whilst it would be difficult to justify sealing of these roads, increase funding is required to upgrade the existing standards. Demonstrations of the Authority's Firm mulch spreading equipment and seed and fertiliser blower broadcaster have been carried out to illustrate to local Shire representative techniques available for batter stabilisation.

There is also a considerable number of roads maintained by the Forests commission. Total length of these and the above within the catchment is 88 kilometres.

Undeveloped road reserves extend for an estimated 18 km, mainly within the Slaty Creek subcatchment. Opening of these reserves would be of doubtful benefit to landholders' interests and would create further sedimentation problems. On these grounds their development should not be encouraged.

(f) MINING AND EXTRACTIVE INDUSTRIES

The most important aspects of mining in the catchment are now historic. Auriferous quartz reefs in the Ordovician rock has been thoroughly worked, and many old shafts are evident in forested areas.

Under certain conditions the Ordovician rock beds included slate and there is one deposit which has been worked commercially. The quarry is located on the bank of the Saltwater Creek with poor access from the opposite side. The Authority has opposed moves to re-open this site, and at present it is a popular picnic spot.

The Tertiary gravel beds are a rich source of construction gravels and one commercial pit is presently operating on the southern catchment boundary. Several other extractive sites have been worked at various times throughout the catchment, but are no longer used.

There are no mining leases in the catchment, and apart from the above extractive industry licence, one mineral search licence is currently held for a small area south of “Bourkes Court”. No operations have been carried out there to date.

4. LAND CLASSIFICATION

Prints from a series of aerial photo runs flown in November and December 1975 were obtained at a scale of 1: 30, 000. These, and a set of 1969 photos at 1: 18, 000 were used for the aerial photo interpretation and the detailed follow-up field work.

The landforms recognised are mapping in appendix 5. A description of each follows:

RUGGED

This landform is based on Ordovician parent rock, and is deeply dissected with side slopes greater than 20% and drainage line and ridge slopes up to 10%. Soils are generally shallow and stony, with an acidic duplex profile and dispersible subsoils which are unresponsive to gypsum treatment. Infiltration is moderate where the surface is protected by litter, but these soils are hard-setting and prone to compaction with development leading to reduced infiltration. Percolation rates of water into holes or trenches are low to very low. Rugged areas occur in the north-west and most of the headwater areas of the catchment.

HILLY

Base on Ordovician and Tertiary parent material, this landform has a medium dissection with side slopes between 12% and 20%. Soils derived from the Ordovician rock have properties similar to those in the Rugged landform, Tertiary-based soils having slightly better characteristics although they are still prone to compaction with development. Hilly areas are widely distributed, particularly in the centre and west of the catchment.

UNDULATING

Again based on Tertiary and Ordovician parent material, this landform has low relief and slopes of 5% and 12%. Soil type is commonly a friable duplex containing gravels in the B-horizon, with better infiltration and drainage characteristics. This landform occurs in the south-east and east of the catchment.

BASALTIC PLAINS

Derived from late Tertiary early Quaternary basalt flows, this landform occurs as plateaux or plains with slopes of less than 5%. Soils of two general types: a heavy-textured yellow duplex soil, with low to very low permeability, and a moderately permeable shallow gradational soil. Basaltic plains occur in the small areas as shown on the landform map.

VOLCANIC VENTS

The two volcanic vents were also active during the late Tertiary-early Quaternary eras, and the landform now present has slopes of 8% to 20%, and a shallow gradation soil. Outcropping rock and the shallowness of the soil restrict cultivation.

'WET' AREAS

This landform includes alluvial flats, creek terraces, and poorly-drained areas, with a slope of less than 2%, which have a 'wetness' limitation to development, owing to a seasonally high water table. Soils in these areas are usually yellow mottled duplex types, with very low permeability. This landform occurs in the Bullengarook area, in the lower reaches of Slaty Creek, and along much of Saltwater creek.

5. DISCUSSION & THE LAND USE DETRMINATION

Most land in this catchment would suffer a low level of sheet erosion under producing forest. An annual soil loss level of the order of 1 tonne per hectare would be expected from a 15% slope. This is quite significant when it is considered that a permissible level of total solids (500 mg/1-W. H. O) in domestic water supply is equivalent to a soil loss of approximately 0.7 tonne per hectare when expressed entirely as suspended and colloidal material in mean annual flow and averaged over the catchment.

With greatly intensified land use, figures of around 90 tonne per hectare* per year could be expected, leading to gross deterioration of water quality and hydrological changes to the water flow pattern. For example, for a small catchment with slopes of 16%, after conversion of forest cover to residential use, with associated impervious and hard surfaced areas peak discharge may increase 20 times.*

Such increases in peak flow lead to drainage line and stream bed and bank erosion, movement of sediment, and have the effect of reducing the distribution of flow through the year. Reduced infiltration to recharge springs may lead to a significant reduction in flow in dry periods.

The effects of development on perennially of flow are not as critical for supply quantity reasons with a storage the size of Rosslynne Reservoir, however the hydrological effects on catchment deterioration, such as increased peak flows and the stop-start nature of flow, are significant.

Much of the heavier eroded material is deposited in the upper reaches of streams. Sediments may also be dropped onto productive land, or with deeply entrenched stream like Slaty Creek, carried to the reservoir, reducing storage capacity.

Turbidity in storm runoff is also a major problem particularly after disturbance of the relatively dispersible subsoils found in a large proportion of the catchment.

Bacterial indicator levels have consistently been high, and the relative levels of faecal streptococci to faecal coliforms suggests that the source is not only from animals. With partial or ineffective absorption of septic tank effluent in the intensively subdivided areas around Macedon, the public health aspects of unsuitable land use become more prominent.

The origins of these problems of maintaining a satisfactory water supply from the catchment lie mainly in unwise land use and management. The general solution is to match the land use to the suitability of land and required management for each landform.

Historically the Wombat forest area was heavily cut-over to provide miner's timber requirements, the Rugged and Hilly areas being subsequently allowed to grow back to forest as their grazing productivity was low. With modern fertilisers, machinery, and good management, landowners on the larger holdings can achieve satisfactory production form the better components of the Hilly landform. With the existing fragmented title basis in the catchment, however, and the limited finances and low average level of management demonstrated by most small lot owners, the most suitable overall use for Rugged and hilly areas is timber production.

Grazing has been the major use of the areas of Undulating, Basaltic Plain, and volcanic Vent landforms, and it is considered that this use is compatible with water production, and so should continue to be the major use for this land. Management is still important, however, if erosion and catchment deterioration are to be avoided. Sheet, tunnel, and gully erosion is evident and provision must be made for application of management and development constraints through the provisions of the land use determination.

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* Calculated from the "Interim Guidelines for Minimising Soil Erosion and Sedimentation from Construction Sites" manual.

Residential use is well established, with approximately 520 separate lots in the catchment, many of which have houses. The distribution of these is greatest around the established Macedon township, and in the Bullengarook area. Development of these closely followed a rising demand for 'hobby farms' and house blocks away from the city. However, this has not been restricted to land suitable for residential use, leading to the problems outline don pages 6 and 7 of this report, for Rural and Residential subdivisions.

If further large-scale subdivision was to be planned for this area, a capability assessment would need to be carried out, covering such relevant parameters as gradient, flood frequency, drainage, soil depth, surface texture, structure, aggregate stability, and profile permeability, to guide such development to suitable areas. But it is considered that the present level of allotment subdivision, if fully developed for residential use, would approach the upper limit of residential use, would approach the upper limit of residential use desirable for this catchment. The propose Gisborne Shire Planning Scheme underlines this by including a no-further-subdivision 'conservation zone' in a broad sweep around the reservoir.

With regard to small-scale subdivision of single allotments elsewhere in the catchment, the Authority would consider each application individually. Under the Local Government (Subdivision of Land) Act 1973, proposals are forwarded to the State Rivers and Water Supply commission, and when these are in proclaimed catchment the Authority's comments are requested.

For homesites on individual lots, Authority officers will continue to carry out inspections and provide information as to the best site, access track alignment, and other associated matters. It is of particular importance that domestic wastes are satisfactorily disposed of within each allotment in unsewered areas, and investigation into the most suitable methods is necessary.

TABLE 2 - PROPOSED LAND USE DETERMINATION.

CATEGORY NUMBER	LAND USE CATEGORY	PROVISIONS OF CATEGORY
1	Land to be retained for the protection of the reservoir, streams and watercourses. Covers Land - Adjacent to maximum operating level of Rosslynne Reservoir (minimum width 100 m); - within 30 m, 20 m or 10 m of streams and watercourses (as shown on Plan No. S-362); - within such greater distance of streams or watercourses as the Authority may specify.	A. Disturbance of soil and vegetation should be minimal on land in this category. B. The Authority may specify conditions for the construction of stream crossings, and for improvements in the location and design of existing crossings, or other conditions where necessary.
2	Land is retained as forest. This land may be used for low intensity recreation, and parts of it may be suitable for residential use.	A. All forest operations are to be in accordance with forest management prescriptions made or approve by the Authority. B. Residential use id subject of Authority approval of site suitability, and imposition of conditions where necessary. C. Grazing of forested land in this category should be limited to that required to reduce fir hazard.
3	Land best suited to forest use, parts of which may be used for grazing or residential use.	A. All forest operations are to be in accordance with forest management prescriptions made or approved by the Authority. B. The Authority may specify conditions as to areas suitable for clearing, the timing of operations, soil conservation measures, and management of land after clearing. C. Residential use is subject to Authority approval of site suitability, and imposition of conditions where necessary.

TABLE 2 - PROPOSED LAND USE DETERMINATION CONTINUED……

CATEGORY NUMBER	LAND USE CATEGORY	PROVISIONS OF CATEGORY
4	Land suitable for grazing, or parts of forestry of which may also be suitable for other agricultural uses or for residential use.	A. The Authority may specify conditions relating to stocking rates, clearing and development operations, the areas suitable for intensive uses, or other catchment protection measures. B. Residential use is subject to Authority approval of site suitability, and imposition of conditions where necessary.
4A	Land suitable for grazing. (Land in this category has a significant limitation to measure development owing to excessive seasonal wetness).	A. The Authority may specify conditions relating to use of this land.

6. CATCHMENT MANAGEMENT

To assist in the implementation of the land use determination, it is proposed to prepare management guidelines for each category. These will take into account the different types of land in each category, and will cover such matters as the timing of operations, stabilisation, revegetation, other conservation measures, and local hydrology. The recommendations of the Authority's Land management disturbance committee and the Soil Stabilisation and Revegetation Manual will be used for these purposes.

A majority of landholders in the non-urban areas of the catchment operate hobby farms. There is a need for information on agricultural practices and land use generally, orientated towards small holdings. Additional guidelines may be necessary for this situation, as part of an intensified extension programme. Discussions have commenced with officers of the Department of Agriculture and other Departments with that purpose in mine.

As has been mentioned in other parts of the report, visitor use for picnic and recreation purposes in the forest areas is increasing. If deterioration is to be prevented, there will be a need for a programme covering the provision of necessary facilities, public education, and surveillance, particularly at weekends.

The monitoring of streams in the various sub-catchments recommended below will provide data to assist in the preparation of the above guidelines, and in determining any maximum residential density considered appropriate in intensively developed and high hazard areas.

7. RECOMMENDATIONS

(a) That, after consultation with the Land Conservation council, the authority approves the Land Use Determination proposed in this report, under Section 23(1) of the soil conservation and Land Utilisation Act 1958;

(b) That, in conjunction with the State Rivers and Water Supply Commission, a programme of stream monitoring be set up for the main sub-catchment, to measure flow, bacterial indicator organisms, turbidity, phosphate and nitrate on a regular basis.

(c) That the recommendations for management of the catchment after Determination, included in the body of the report, by approved by the authority.

S. W. RANSOME
R. G. PATRICK

Catchment Officers.

APPENDIX 1 - STREAMFLOW RECORDS

MONTHLY TOTALS – MEGALITRES

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D
SALTWATER CREEK												
1970	1668	21	641	368	289	454	195	1650	2497	200	1041	319
1971	216	993	62	84	351	536	207	284	289	731	5085	204
1972	63	252	47	31	31	26	90	82	196	51	30	5
1973	0	998	51	33	84	1207	848	1860	1444	972	293	350
1974	419	50	16	290	4035	544	2967	2391	2024	1560	322	103
1975	40	4.5	16	12	28	40	132	847	-	-	-	-
JACKSONS CREEK												
1971	84	1179	23	40	371	2181	357	719	656	1752	9575	409
1972	162	671	122	40	43	50	191	87	476	60	19	3
1973	6	3304	115	142	353	246	10	254	202	16	7	9
1974	10	4	0	2	-	-	-	-	-	-	-	-
1975	-	62	84	40	63	29	26	1608	4208	-	-	-

APPENDIX 2 - BACTERIAL INDICATOR ORGANISM COUNTS

Fc – Escherichia coli FS – faecal streptococci

Site		Organosms/100 ml				Number of Samples
		Minimum	Maximum	Mean	Standard Deviation	
Saltwater Creek at Waterloo Flat	FC	10	8700	820	2063	21
(omitting highest counts)	FC	10	1020	201	305	19
	FS	8	2620	296	656	16
Gisborne Creek at Dixon Road (omitting highest counts)	FC	0	5210	324	1108	22
	FC	0	740	92	202	21
	FS	8	400	60	-	16
Slaty Creek at Blackwood Road	FC	0	5900	1040	1607	21
(omitting highest counts)	FC	0	2670	586	-	19
	FS	32	1340	257	309	16
Rosslynne Reservoir at dam wall	FC	0	350	30	13	35

APPENDIX 3 - STREAM QUALITY RECORDS

TOTAL DISSOLVED SALTS – Milligram/litre

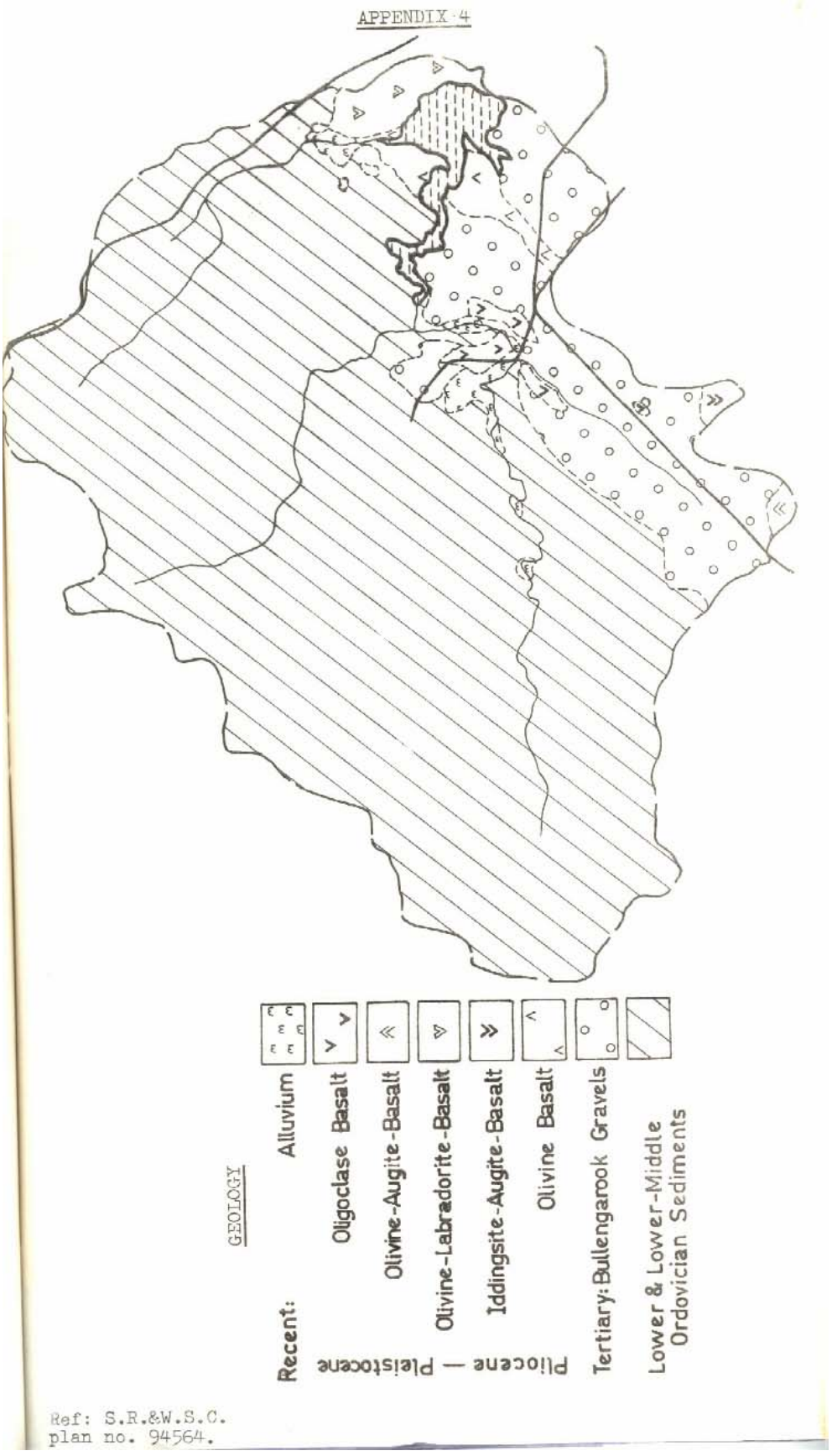
Saltwater Creek

June 1973	180
June 1973	120
June 1973	70
July 1973	150
July 1973	80
September 1973	147
January 1974	139
August 1974	90
September 1974	127
September 1974	88
October 1974	78
November 1974	91
November 1974	148
December 1974	180
January 1975	212
May 1975	214
July 1975	126
January 1976	174

Jacksons Creek

May 1972	360
July 1972	120
February 1973	275
July 1974	109
August 1974	115
August 1974	119
September 1974	117
January 1975	132
March 1975	139

APPENDIX 4


APPENDIX 4
GEOLOGY
Recent:
Alluvium
Pleistocene — Pliocene
Oligoclase Basalt
Olivine-Augite-Basalt
Olivine-Labradorite-Basalt
Iddingsite-Augite-Basalt
Olivine Basalt
Tertiary: Bullengarook Gravels
Lower & Lower-Middle Ordovician Sediments
Ref: S.R.&W.S.C.
plan no. 94564.