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26 March, 1998

Tim Anderson
President
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Dear Tim,

WOMBAT STATE FOREST FIELD INVESTIGATION REPORT

Thank you for the guided tour of the Wombat State Forest during October 1995, in relation to which please find a copy of the field investigation report attached.

Consultation prior to any public reference to the report or this letter would be appreciated.

You are no doubt aware of G-MW's interest in, and concerns over, water quality and yield in the Loddon Catchment. As you will see from the report, we believe some of the issues raised by Ms. Jones are not areas of legitimate G-MW involvement. For some issues where G-MW has responsibilities or interests, there is insufficient information to draw firm conclusions, particularly in relation to water yield. This in itself is an issue of concern, and we have repeated our request to DNRE for provision of catchment specific data.

G-MW is also encouraging research into water yield from mixed eucalypt forests. We are currently supporting research on run off from a mixed eucalypt forest in the intermediate rainfall belt in south eastern NSW undertaken by the Cooperative Research Centre for Catchment Hydrology. It is hoped that this will provide base line data and point the way for further research at other sites.

Coupe size was an issue for which there was sufficient information for G-MW to express concern to DNRE over the potential effect on Loddon River water quality and yield. Changes to the Code Of Practice For Timber Production and DNRE's stated position (see section 3.3.4, p. 11 of the report) have since provided considerable reassurance. Your views on how successfully these commitments have been implemented would be appreciated.

In relation to the exclusion of fire from stream side and drainage line

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vegetative filter strips, G-MW has written to DNRE seeking its assurance that the relevant provisions of the Code of Forest Practice for Timber Production will be adhered to. Again, any information on the continuation of this practice would be appreciated.

Yours sincerely



Peter Butcher
Environmental Management Officer
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WOMBAT STATE FOREST
FIELD INVESTIGATION REPORT

P. Butcher

March 1998

GOULBURN-MURRAY
WATER

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1.0 INTRODUCTION

1.1 Investigation Background

Concern over management practices in the Wombat State Forest (WSF) were first drawn to Goulburn-Murray Water's (G-MW's) attention by Board member Mr. Ken Pattison at a Board Environmental Audit Committee (EAC) meeting of 7 September 1995.

A letter of 21 September 1995, formally complaining of the impact on water quality and yield in the Loddon River of breaches of the Code of Forest Practice for Timber Production ("The Code") in the WSF, was subsequently sent to the Area Manager Torrumbarry by a G-MW customer. G-MW is not responsible for administration of The Code, and it is therefore not appropriate to use the environmental complaints procedure to respond to the customer's complaint.

However, G-MW has an interest in any question of water quality impacts in its water supply catchments.

The letter raised the following specific issues:-

1. Logging had occurred along drainage lines leading to increased water temperatures, increasing the potential for algae blooms;

2. Water production values had been given insufficient attention in the forestry management of the WSF;

3. "Shelterwood", the silvicultural system used in the WSF, renders second harvest trees unsuitable for saw logging;

4. Shelterwood coupe[1] sizes of up to 120 ha in area greatly exceed the maximum prescribed area of 40 ha;

5. Felled timber suitable for saw logs were being used for woodchip production. Because the tree crowns are subsequently burnt on site, nutrients are released to surface waters and eventually depleted in the soil, and

6. Harvesting has been beyond sustained yield[2], and this will lead to decreased water yield.

G-MW has no interest in the use to which timber is put. Item 3 raised by the complainant is therefore beyond the scope of this investigation. Other claims

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[1] an area within a forest from which trees are harvested for wood production

[2] the rate of timber harvesting that matches annual increments in forest growth, e.g. if trees in a 100 ha forest require 100 years to grow to merchantable size, a harvest of 1 ha pa could be sustained. This would normally be expressed as the volume of timber that cutting such an area would produce.

relating to wood chipping are only dealt with in as much as they relate to water quality or yield.

A party consisting of the complainant, Pyramid-Boort WSC member, Barry Barnes, Kerang Water Quality Coordinator, Charles Thompson, and the Environmental Management Officer conducted a field investigation of that part of the WSF in the Loddon catchment on 25 October 1995.

It was arranged to meet separately with representatives of the then Department of Conservation and Natural Resources (DCNR), who manage the forest and the Wombat Forest Society, who have criticised DCNR over its management.

1.2 The Wombat State Forest and G-MW

The WSF forms part of the Midlands Forest Management Area (FMA). The Midlands FMA is 113, 000 ha in area and the WSF comprises 11,400 ha, or 7.4%, of the Midlands FMA.

Approximately 1/3 of the WSF lies in the Loddon catchment (a small part of the Campaspe's upper catchment also lies in the WSF) . Given that the Loddon has a catchment of approximately 1.5 million ha, the WSF represents only a quarter of one per cent of the total catchment area.

The WSF contributes approximately 11% of the yield at Cairn Curran and approximately 4% of the yield at Laanecoorie (Graeme Hannan, G-MW Senior Production Engineer, pers. comm). Recent water quality reports (Sinclair Knight Merz, 1995) also indicate that the WSF contributes relatively high quality water to the Loddon.

G-MW has an obvious interest in maintaining the yield and water quality of streams in the WSF, but the small percentage of its contribution to total Loddon flows indicates that forestry management practices are unlikely to have a major impact on water supplies to G-MW customers.

1.3 Land Use

Land use closely follows geology in this area. Gradational red clays, developed on Quaternary basalt with flat to undulating terrain, support intensive rain fed stock raising and cropping. Yellow and brown duplex soils, developed on Ordovician turbidite sediments with steeper and more heavily dissected terrain, support native forest.

The original forests of the area were cut down during the gold mining era of the last century. The decision to allow native forest to regenerate reflects the lower agronomic potential of the land systems developed on the Ordovician sediments

and the determination of the fledgling forestry service to return part of the landscape to forest. The WSF is therefore almost all less than 100 years old.

The WSF typically has a mixed species Eucalypt overstorey of messmate (*Eucalyptus obliqua*), narrow leafed peppermint (*E. radiata*), manna gum (*E. viminalis*) and candle bark (*E. rubida*). There is a light understorey of smaller trees, shrubs, forbs and grasses on the ridges and slopes with a denser understorey, including ferns, in the gullies and streamlines.

1.4 Management Of The Wombat State Forest

The Eucalypt overstorey has almost all of the commercial value and at the time of the investigation this was used for saw logs, woodchips or particle board. As previously discussed, the present Department of Natural Resources and Environment (DNR&E) has employed the Shelterwood silvicultural system in the WSF since the 1970s. This involves harvesting a first cut of trees (usually amounting to 75%-80% of the basal area) in coupes of up to 60 ha[3]. Some "habitat trees" and those that are judged to have better future commercial value are retained. The first cut is followed by a regeneration burn. The retained trees are allowed to grow for another 10-15 years when they are harvested from amongst the regrowth.

The key assumptions underpinning Shelterwood are that:-

- with the removal of competition from the trees in the first cut, the retained trees will grow to a greater size than would otherwise have been the case;
- the retained trees will not suppress germination and/or growth from the seed of trees culled in the first cut, and
- a higher sustainable yield is obtained than would be possible under the clearfell system.

[3] The Midlands Forest Management Plan states that "The maximum size of coupes under the shelterwood system has generally been about 120 ha, although, in recent years, first cut coupes have been around 60 ha. ..this Plan limits the maximum area for new shelterwood coupes to 40 ha.." (DNRE, 1996)

2.0 OBSERVATIONS

The G-MW party was given separate conducted tours of the WSF in the Loddon catchment by Mr. Andrew Maclean of DNR&E and Mr. Tim Anderson of the Wombat Forest Society.

2.1 DNR&E Tour

Mr. Maclean conducted the party around a number of sites explaining how Shelterwood operates and the measures that DNR&E take to protect water quality. Photo 1 (see attachment #1) shows regeneration in a coupe that was harvested 10 years ago.

Photo 2 shows an undisturbed site that has not had any silvicultural treatment. Photo 3 shows a coupe that was given the first Shelterwood harvest approximately 15 years ago. Photo 4 shows a drainage line in the same coupe. Mr. Maclean advised the party that there would "probably" be no logging or ground disturbance 5 metres either side of this drainage line to provide a vegetative filter strip to protect water quality, in accordance with the Code of forest Practice then in place. DNRE have since advised that the new Code Of Forest Practice requires a 10 m filter strip which provides an additional level of protection.

Photo 5 shows a coupe shortly after the first Shelterwood harvest. Photo 6 shows a snig track and retained filter strip in the same coupe.

Photo 7 shows the Loddon River immediately downstream of the Lyonville Spring Road Bridge, approximately 3 km before it exits the WSF. Mr. Thompson took field measurements indicating that the water had a turbidity of less than 10 NTU and electrical conductivity of less than 100 EC.

2.2 Wombat Forest Society Tour

Photos 8 and 9 show tree crowns lying in drainage lines at recently harvested coupes at the Boundary Road coupe.

Photo 10 shows a drainage line in the Bridge Road coupe, which Mr. Anderson stated was burnt during a regeneration burn approximately 3 years ago following a first Shelterwood harvest the previous year. I was able to observe partially burnt tree crowns that had been felled into the drainage line. Regrowth of bracken and grasses in the drainage line was consistent with a reasonably hot fire. There was no evidence of erosion scour.

Mr. Anderson claimed that the cutting rate in the WSF exceeded both sustained yield and the legislated sustained yield. For instance, he claims that the combined first and second Shelterwood harvest legislated sustained yield is 900 ha per

annum, but the gazetted figures for 1995/6 and 1996/7 are 2,200 ha and 1976 ha respectively.

Mr. Anderson emphasised that he was not opposed to timber harvesting, per se, but to the manner in which it was currently being conducted by DNRE in the WSF.

3.0 DISCUSSION

3.1 General Considerations

The then Department of Conservation and Natural Resources (DCNR) commissioned a detailed investigation of the claims of those opposed to the current management of the WSF (O'Shaughnessy et al, 1995). The investigation took place in that part of the WSF drained by the Lerderderg River. This location was chosen because this catchment has:-

- the highest percentage of area under forest that has been managed on the Shelterwood system;
- a stream gauging site with more than 30 years of data, and
- a State Wide Water Quality Monitoring Network site with 18 years' data at O'Briens Bridge.

The report concludes that there have been "..no important long term trends in water yield and quality.. during the period 1960-95 and 1976-95 respectively." (O'Shaughnessy et al, 1995). The authors qualify this conclusion by drawing attention to the low sampling frequency for water quality and warn that "..small short-term trends may not have been detected due to the "noise" characteristics of such data" (O'Shaughnessy et al, 1995).

This is a significant qualification. Erosion, which is the water quality factor most likely to be associated with forestry operations, is more likely to be caused by low frequency, high intensity rainfall and flow events.

The report also concludes that "..land use patterns during the period have not caused important changes in water yield and quality" (O'Shaughnessy et al, 1995). The authors suggest that use of Shelterwood has specifically contributed to maintenance of water quality and yield in this catchment.

O'Shaughnessy et al developed a worst case unit area water yield model, which is summarised in Fig. 1, over. This assumes that some form of clear fell is applied, resulting in fully stocked regeneration.

O'Shaughnessy et al comment that, "Experimental evidence is that at least 20% of a catchment has to be effected in the one year by a change in vegetative cover for the effects to be hydrogically detected". For the entire WSF, this would amount to an annual clear fell (i.e. *Shelterwood 2* cut) of 2,280 ha, *which does not occur.*

Mr. Anderson has referred me to comments by Dean Haywood (Haywood, undated) which dispute the catchment specific conclusions of the report and also suggests

that the Lerderderg catchment it is not typical of the WSF in terms of physical conditions or forest management. Whilst this latter suggestion may be the case,

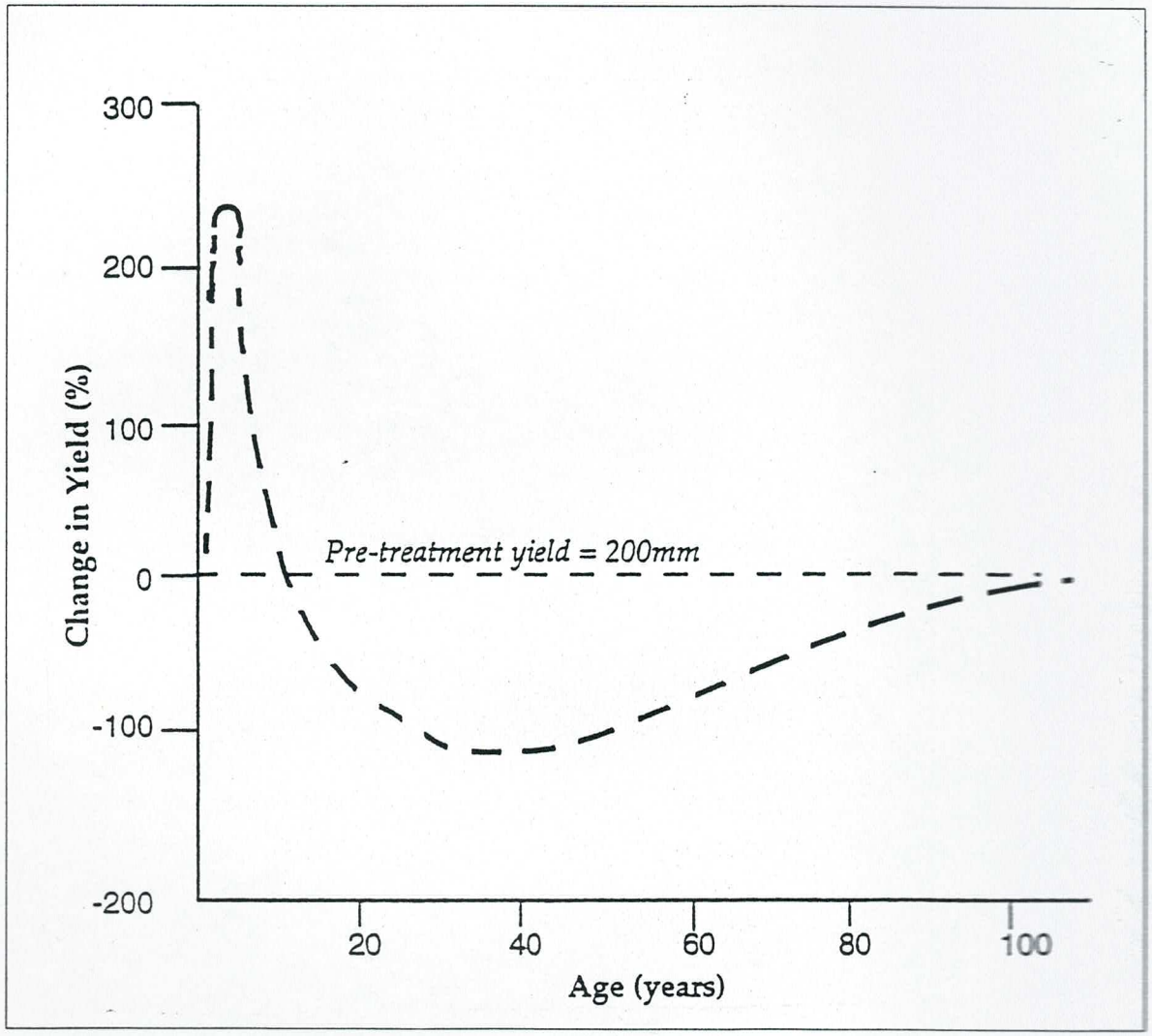

Fig 1: Approximate worst case age/yield curve for an even aged mixed species Eucalypt forest in Central Victoria (O'Shaughnessy et al., 1995)

there are no data to support the proposition that water yield and quality characteristics are substantially different between the catchments of the Lerderderg and Loddon Rivers within the WSF. There are several important differences between this model, and earlier *empirically* derived relationships between water yield and ash forest stand age, given in Fig. 2. over. Fig. 1 is accepted as the best model available, but should be treated with the level of scepticism appropriate to an unvalidated model.

The closest stream gauging site on the Loddon site of the WSF is at Vaughan, 25 kilometers downstream. The confounding effect of other land uses would make it very difficult to draw conclusions on the impact of forestry practices on water yield.

Mr. Haywood's comments centre on 2 issues: He disputes the validity and applicability of O'Shaughnessy et al's statistical analysis and concludes that the worst case water yield model is based on conditions in the Yarra catchment and may not be appropriate for the geology, soils, vegetation and climate of the Lerderderg catchment.

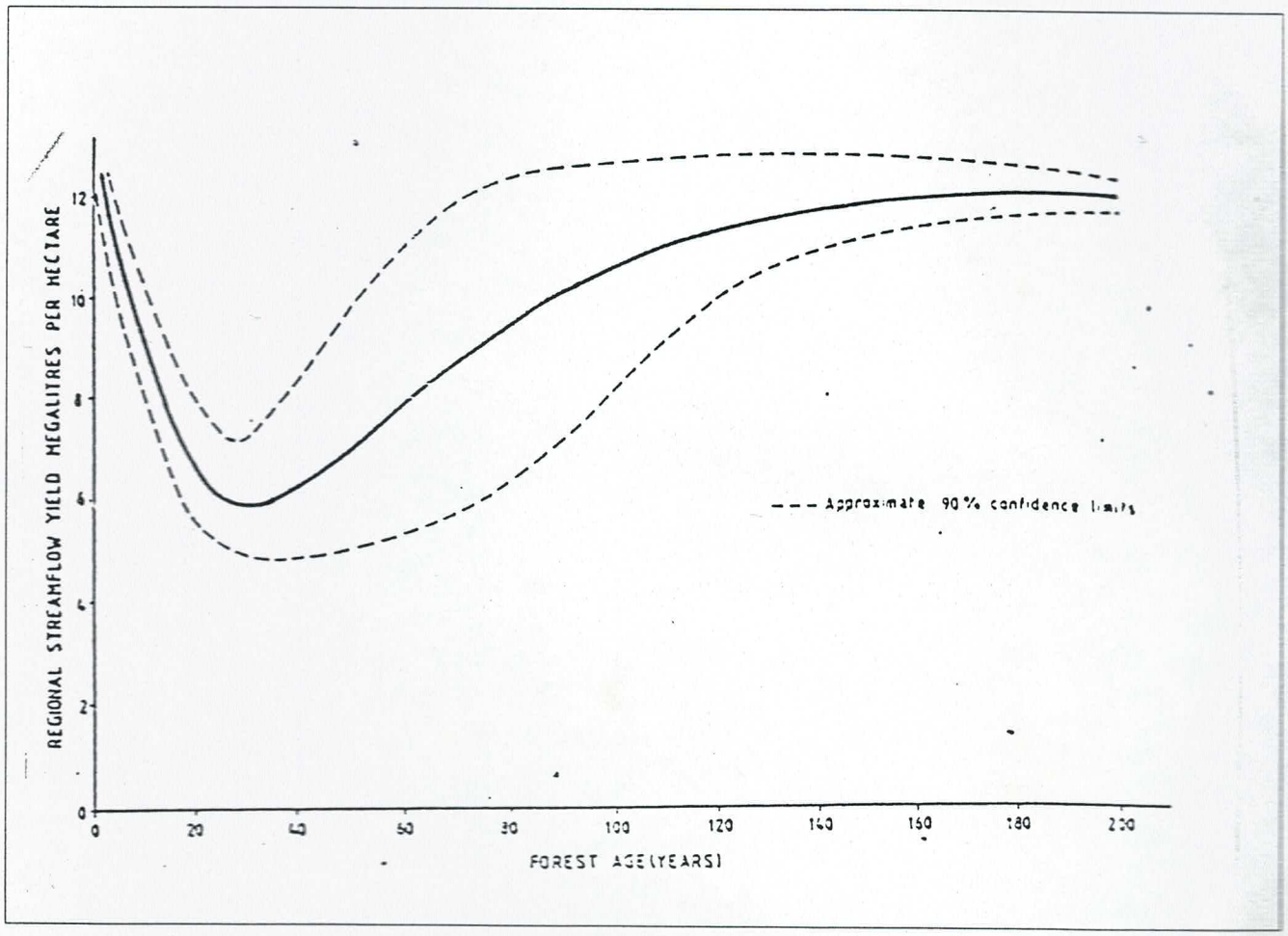

Fig 2: Regional age stand/water yield relationship for an ash type forest (after Kuczera, 1985)

G-MW is unable to resolve all of the issues surrounding O'Shaughnessy et al's statistical analysis, because all the details are contained in a separate report prepared by one of the authors which have not been made available. In two areas,

the use of rainfall as a control and whether the relationship between rainfall and stream flow is linear, Haywood raises potentially serious issues for O'Shaughnessy's et al's report.

G-MW does not take the worst case water yield model to be anything more than a preliminary approximation and believe the authors appropriately identified uncertainties associated with its derivation.

The absence of catchment based timber harvesting data for that part of the WSF drained by the Loddon River is a concern. G-MW requested such data in September 1994, but the then Department of Conservation and Natural Resources advised that it did "..not maintain timber harvesting records on a catchment-specific basis". The absence of relevant hydrologic data further limits G-MW's ability to draw firm conclusions.

G-MW is not aware of any insurmountable difficulty in determining the annual Shelterwood cut for those parts of the WSF in the Loddon and Campaspe catchments and provision of this data would provide the basis for removing any lingering uncertainty over the alleged water yield effects.

The Lerderderg Catchment report is only slightly less reassuring on the question of water quality, and although Mr. Anderson was able to point towards breaches of The Code, there was no evidence that these were leading to increased rates of erosion.

The SKM salinity traverse recorded the following data for the Loddon River at Glenlyon, below the junction with Doctors Creek:-

	July 1995	**May 1994**
Electrical Conductivity	173	150
Nox (mg/L)	0.930	0.630
Total N (mg/L)	1.330	1.030
Total P (mg/L)	0.019	0.017
FRP (mg/L)	ND	0.003
Turbidity (NTU)	20	ND

ND: No data

Table 1: Water quality data for the Loddon at Glenlyon

It should be noted that the equivalent data sets for Doctors Creek indicated consistently lower quality water for that tributary and that Glenlyon is approximately 5 km downstream of the point where the Loddon leaves the WSF.

This is good quality water, but the absence of long term data specific to the WSF places severe limits on G-MW's ability to draw firm conclusions.

3.2 Issues Arising From Field Inspection

The felling of trees into streams and drainage lines is a breach of s 2.2.3 of The Code as it operated at the time of inspection, in as much as buffer and filter vegetation will be more likely to ignite during revegetation burns when the fine, dry litter from dead crowns is introduced into stream sides and drainage lines. The tree crowns will also act as fire conduits into the stream and drainage lines.

This was certainly the case at the Bridge Road coupe.

The absence of erosion scour from the Bridge Road coupe drainage line may be fortuitous.

3.3 Issues Raised By Complainant

3.3.1 Increased Water Temperatures

Elevated temperatures are a factor in triggering and sustaining blue-green algae blooms, although winter blooms have been recorded in Victoria. Hours of sunlight are now thought to be at least as important as water temperature in generating blooms.

It would be technically feasible for reduction in foliage cover to increase insolation and therefore increase water temperatures. Given the relatively small percentage of the catchment occupied by the WSF, it is judged that any temperature effect would have to be associated with a bloom relatively high in the catchment for there to be a significant contribution to an algae bloom.

The nearest recorded blue-green algae bloom has been at Cairn Curran reservoir, 50 kilometers downstream. Any temperature effect in the upper catchment is unlikely to be significant over such a distance.

3.3.2 Attention Given To Water Yield.

Information on the impact of forest management on water yield in mixed Eucalypt forests is sparse, but it is now the subject of concerted scientific research. O'Shaughnessy noted the difficulty of detecting change in stream flows from changed land management activities against the background of highly variable stream flows.

Management practices in areas of the Wombat State Forest which are small relative to the total catchment are unlikely to produce detectable changes in streamflow. There is no evidence available at this point that indicates that overall

streamflow would be significantly increased or decreased by current management practices in the Wombat State Forest.

3.3.3 Shelterwood And Sawlog Production

As previously discussed, this is not an area of legitimate interest to G-MW.

3.3.4 Shelterwood Coupe Size

G-MW is unable to resolve the apparent contradiction between statements made by Mr. Maclean and Ms. Jones' claims on coupe size. S. 2.3.2 of The Code required that clearfell coupe size does not exceed 40 ha and, where it was necessary to harvest adjacent coupes in successive years, the area harvested in not more than 3 successive years was not to exceed 120 ha. For shelterwood the Code merely required that coupe size "..must be determined by the forest type, its stand condition and other relevant environmental factors."

The Midlands Forest Management Plan (DNRE, Ibid.) appears to concede that shelterwood coupes may have been as large as large as 60, and possibly, 120 ha. The Midlands Forest Management Plan now commits DNRE not to exceed a shelterwood coupe size of 40 ha, in line with the revised Code, published in 1996.

G-MW is not in a position to make any judgement on the issue, other than to say that the current commitment by DNRE to 40 ha shelterwood coupes has the potential to provide a resolution.

3.3.5 Release Of Nutrients To Surface Waters

There is no evidence of deleterious impacts of Potassium and micro nutrients on surface waters, and discussion will therefore be limited to the impacts of releases of Nitrogen and Phosphorus. Some Nitrogen would be lost to the atmosphere for regeneration burns exceeding 320°C and highly soluble forms of Phosphorus would be released to soil and water. It is felt that such burns are likely to exceed 320°C.

The phosphorus compounds would be adsorbed by clays, iron compounds and organic matter in the soil, except where infiltration was impeded by vehicle traffic during harvesting. Where filter strips and buffer zones are maintained this should not be a problem.

The limited water quality data that are available tend to indicate that excessive nutrient loads are not being routinely contributed to the Loddon from the WSF.

The burning of the filter strip at the bridge Road coupe is a contrary indication.

The absence of long term, catchment specific data prevents G-MW from making any final judgment.

3.3.6 Sustainable Yield And Water Yield

It is suggested that this issue has been adequately dealt with under 3.3.2

4.0 CONCLUSION

G-MW is primarily concerned in this case with impacts on Loddon River surface water quantity and quality.

There does not appear to be any evidence that the current Wombat State Forest management regime has decreased water yield. Given the absence of key data sets and difficulty in identifying potential yield changes, long term research into this issue is the only way to determine the need for changes to management practices.

There is also no evidence that the current Wombat State Forest management regime has degraded Loddon water quality. However, the Code provisions for the protection of filter strips appears to have been infringed and, if such infringements are sufficiently widespread, have the potential to lower Loddon water quality.

Conflicts over whether another breach of the Code occurred in relation to coupe size does not appear to be easily resolved. The key outcome is that DNRE is now committed to 40 ha shelterwood coupes, and that this will deliver better environmental outcomes.

Peter Butcher
Environmental Management Officer

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Sinclair Knight Merz, August 1995, *Salinity And Nutrient Traverse Of The Upper Loddon River - May 1994 And May 1995.*

ATTACHMENT # 1: Site Inspection Photographs

All photographs taken by P. Butcher on 7 September 1995.



Photo 1: Regeneration following harvest 10 years previously Osborne Road coupe



Photo 2: Osborne Road experimental site showing undisturbed forest .



Photo 3: Coupe on east side of Osborne Road after Shelterwood 1 harvest 15 years previously.



Photo 4: Drainage line on coupe on east side of Osborne Road



Photo 5: Unnamed coupe after Shelterwood 1 harvest in 1993/94 season.



Photo 6: Unnamed coupe, snig track and filter strip



Photo 7: Loddon River at Lyonville Spring Road Bridge.



Photo 8: Boundary Road coupe, tree crowns in drainage line, general view



Photo 9: Boundary Road coupe, tree crowns in drainage line, view along drainage line



Photo 10: Bridge Road coupe showing trees felled into a drainage line and vigorous regrowth allegedly after a post shelterwood 1 burn 3 summers previously