## Proposed Turf Farm, Liddelow Road, Banjup

Gazon Pty Ltd

Report and Recommendation of the Environmental Protection Authority

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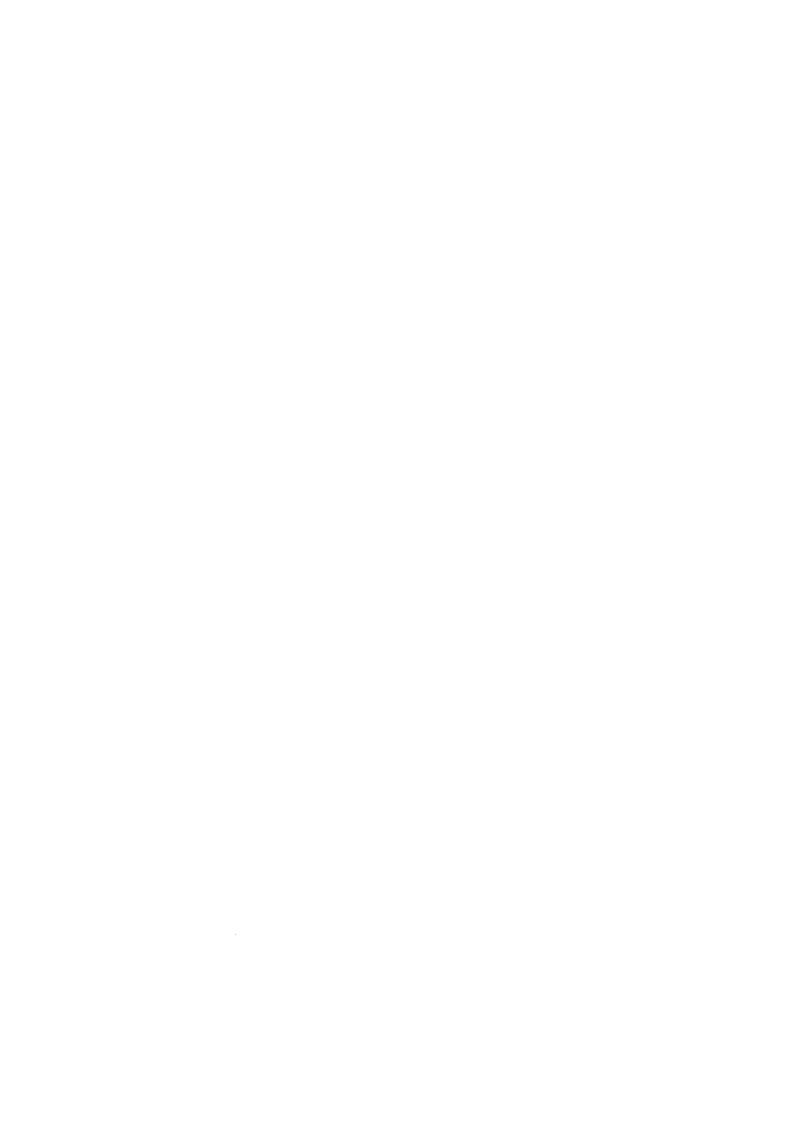
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## **Contents**

		Page
Sı	ummary and Recommendation	i
1.	. Introduction	1
2.	. The proposal	1
3.	. Existing environment	1
4.	<ul> <li>Issues raised by government agencies and a local conservation group</li> </ul>	1 1
5	Environmental impacts	3
	. Conclusions	4
_	References	5
Fi	igure	
1.	Location of the proposed turf farm within the Jandakot Underground Water Pollution Control Area and Public Water Supply Area	2
T	ables	
1.	Summary of issues raised in submissions	3
2.	Estimates of annual nutrient losses from proposed turf farm at and post establishment	4
A	ppendices	
1.	Review of submissions	

- 2. Letter requesting response to issues raised
- 3. Response to submissions by Gazon Pty Ltd
- 4. Derivation of nutrient budget



#### Summary and Recommendation

The Environmental Protection Authority has examined the turf farm as proposed by Gazon Pty Ltd described in the Consultative Environmental Review, and has considered issues raised in submissions from Decision Making Authorities, Government Agencies and a local conservation group. A well licence application was lodged by the proponent, and the Water Authority of Western Australia (WAWA) referred the proposal to the Environmental Protection Authority for assessment following concerns about possible groundwater contamination.

The proposed turf farm is located within the catchment of the Peel-Harvey estuarine system, and is within the Jandakot Underground Water Pollution Control Area and Public Water Supply Area and is also in close proximity to Lake Banjup. The soils are of the Jandakot series of the Bassendean Association and have almost no ability to retain applied phosphorus or nitrogen.

The proposal is for the growth of couch grass (*Cynodon dactylon*) in the form of turf in a readily accessible area south of the river because of the disproportionate concentration of turf farms north of Perth and the forecast of demand exceeding supply.

Initially 4 ha would be developed with expansion of between 2-4 ha each year until 12-14 ha were under turf. Fertilization practices during the establishment phase of each hectare (ie for the first crop) would include an initial application of deep litter poultry manure (40 tonnes/ha), followed by six smaller applications (each of one tonne/ha) of deep litter poultry manure at four-weekly intervals. After establishment (ie for the second and subsequent crops), the four-weekly applications of poultry manure (each of one tonne/ha) would be supplemented by inorganic nitrogen fertilizers (20 kg nitrogen/ha/crop).

Based on average analyses for deep litter poultry manure, these applications are approximately equivalent to 483 kg phosphorus/ha/crop and 1495 kg nitrogen/ha/crop during the establishment of each hectare (ie for the first crop) and then reducing to an ongoing application of around 63 kg phosphorus/ha/crop and 215 kg nitrogen/ha/crop for second and subsequent crops. There would be a maximum of two crops each year.

In comparison, an average sized septic tank produces 3.5 kg phosphorus/yr and 22 kg nitrogen/yr. Dryland agriculture in the Peel-Harvey catchment uses phosphorus application rates of around 9-15 kg phosphorus/ha/yr, and these levels of application across the catchment have led to nutrient enrichment of the estuary. Typical fertilizer applications for established horticultural crops such as onions are much higher than those proposed for the turf farm and are in the order of 240 kg phosphorus/ha/yr and 640 kg nitrogen/ha/yr.

Irrigation water at 80% of pan evaporation figures supplied by the Bureau of Meteorology would be applied to the turf during the months September to April using low pressure rotary irrigators with daily applications during the peak of summer. Irrigation scheduling would be optimised using a pan evaporation meter and three jet filled soil tensionmeters. If managed correctly, the proposed irrigation system could result in minimum amounts of water passing through the root zone of the turf. Even if summer irrigation management is as efficient as possible, leaching of soil nutrients cannot be prevented in the event of rainfall.

The proposed turf farm raises a number of issues including:

- It is within the Jandakot Underground Water Pollution Control Area and Public Water Supply Area and is between current and proposed bore fields. Within this area, development that may adversely impact the quality of the groundwater is opposed by WAWA.
- WAWA is only prepared to grant an initial water allocation for 4 ha of turf because of concerns about possible nitrate contamination. Extension beyond this amount would be contingent on three years' satisfactory monitoring of superficial groundwater on-site.
- The proposed turf farm is also within the catchment of the Peel-Harvey estuarine system and the
  Western Australian Department of Agriculture has advised that clearing of existing vegetation on
  the site would be prevented under the Soil and Land Conservation Act because of the risk of
  nutrient leaching and off-site degradation.

The Jandakot water mound is one of the major sources of Perth's potable water. Policies are currently being proposed to protect this resource from contamination. Nitrate has been shown to be one of the major contaminants of underground water supplies worldwide. The proposed turf farm will contribute to nitrate contamination of the Jandakot Public Water Supply Area.

The property is bounded on its western margin by the Peel Main Drain which leads directly to the Peel-Harvey estuarine system. The site is low lying and is in a gazetted drainage area. Surface runoff

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is unlikely during summer but may occur in winter when superficial water tables rise to intercept the local drainage network.

The estimated quantity of nitrogen and phosphorus potentially available for leaching (not taken up and removed in cut turf rolls), is likely to be greater than that observed for dryland farming in the Peel-Harvey system. The Western Australian Department of Agriculture is responsible for implementing key Ministerial conditions arising from the Peel-Harvey Stage 2 ERMP, and has advised that clearing would be prevented under the Soil and Land Conservation Act because of the risk of nutrient leaching and off-site degradation.

The Environmental Protection Authority concludes that the proposed turf farm is environmentally unacceptable because of the high levels of nutrient contamination of ground and surface waters which it would generate.

#### Recommendation

The Environmental Protection Authority concludes that the proposal to operate a turf farm as described in the Consultative Environmental Review is environmentally unacceptable and recommends that it not proceed. Accordingly, the Authority also recommends that a well licence should not be issued.

#### 1. Introduction

Gazon Pty Ltd has submitted a proposal to establish a turf farm at Lot 392 Liddelow Road, Banjup (Figure 1).

The basis for the proposal is the disproportionate concentration of turf farms north of Perth and the forecast of demand exceeding supply. An application for a commercial water licence in the Jandakot Underground Water Pollution Control Area and Public Water Supply Area was referred to the Environmental Protection Authority. The Authority set the level of assessment at Consultative Environmental Review (CER).

## 2. The proposal

The proposal was to clear 50% of the 14 ha property in the first year and immediately plant 4 ha of couch grass (*Cynodon dactylon* cultivar variety Santa Anna and Wintergreen) in the form of turf. Subsequently, the area under turf would be expanded by 2-4 ha annually until 12-14 ha were under turf in the third year. A maximum of two crops of rolled turf would be lifted each year.

Fertilization practices during the establishment phase of each hectare (ie for the first crop) would include a once only application of 40 tonnes/ha of deep litter poultry manure followed by six smaller applications (each of one tonne/ha) of deep litter poultry manure at four-weekly intervals. For second and subsequent crops six applications (each of one tonne/ha) of deep litter poultry manure at four-weekly intervals along with 20 kg/ha/crop of inorganic nitrogen would be applied for each crop. Given the Western Australian Department of Agriculture (WADA) average analysis for poultry manure (Nitrogen 3.25%, Phosphorus 1.05%, Potassium 1.10%, Calcium 9.00% and Magnesium 0.75%), the application of phosphorus would be 483 kg/ha/crop for the first crop and 63 kg/ha/crop for second and subsequent crops. The application of nitrogen would be 1495 kg/ha/crop for the first crop and 215 kg/ha/crop for second and subsequent crops. There would be a maximum of two crops each year.

It is anticipated that 168,000 kL of water for 14 ha would be required, however the WAWA would allow 4 ha only for a three year trial. The intention of the proponent would be to irrigate during the months September to April at 80% of pan evaporation rates supplied by the Bureau of Meteorology, using low pressure rotary irrigators with a daily application during maximum evaporation periods. A pan evaporation meter and three jet-filled tensionmeters would aid in irrigation scheduling and rescheduling would occur in periods of peak moisture loss.

### 3. Existing environment

The proposed turf farm is located 1.1 km south-south-east of Banjup Lake. It is low lying, within the catchment of the Peel Main drain and is part of the Bassendean Dune System on the Swan Coastal Plain.

The soils at the site are typical of those of the Swan Coastal Plain and consist of highly siliceous acid grey sands with yellow sand or coffee rock at depth. These soils have little or no capacity to retain nutrients with a phosphorus retention index (PRI) typically less than one.

The existing vegetation is virgin bush which consists mainly of Banksia and native grasses.

Depth to groundwater is 3-4 m and the proposed development is within the Jandakot Underground Water Pollution Control Area and Public Water Supply Area.

# 4. Issues raised by government agencies and a local conservation group

Responses to the CER were requested from the three decision-making authorities:

- Western Australian Department of Agriculture;
- Water Authority of Western Australia;

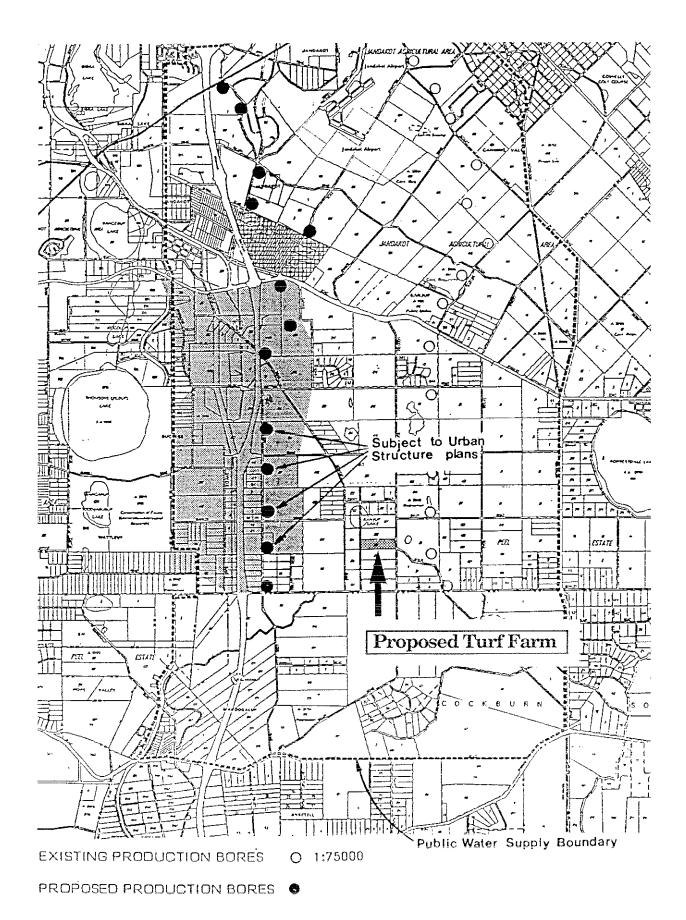


Figure 1: Location of the proposed turf farm within the Jandakot Underground Water Pollution Control Area and Public Water Supply Area.

#### City of Cockburn;

and from the Department of Conservation and Land Management, and the Banjup Action Group Incorporated. A list of the issues raised is provided in Table 1.

Table 1 - Summary of issues raised in submissions

Issue	Number of submissions
CER guidelines not met	1
Nutrient leaching unacceptable	3
Clearing unacceptable	1
Impact on wetlands, flora and fauna	3
Location within Peel-Harvey catchment	1
Location within Jandakot UWPCA	3
Variability of nutrient source	1
Literature relevance	1

The predominant concerns were nutrient leaching, water management, impact on wetlands and the Jandakot Underground Water Pollution Control Area and Public Water Supply Area, and that the Consultative Environmental Review guidelines were not adequately addressed in the report. A detailed review of the submissions is included in Appendix 1. Appendix 2 is the letter from the Authority to the proponent outlining the issues raised by the government agencies and local interest group, and Appendix 3 contains the proponent's responses.

### 5. Environmental impacts

The principal environmental issue is that of leaching and runoff of nutrients into the ground and surface waters and subsequent impacts on wetlands, flora and fauna, public water supplies in the Jandakot mound, and on the Peel-Harvey estuary.

Dryland agriculture in the Peel-Harvey catchment typically has phosphorus application rates of around 9-15 kg phosphorus/ha/yr, and these have led to major damage to the estuary. The proposed turf farm is suggesting application rates of 483 kg phosphorus/ha/crop and 1495 kg nitrogen/ha/crop as each stage of the development is established (ie for the first crop on each hectare) and 63 kg phosphorus/ha/crop and 215 kg nitrogen/ha/crop for second and subsequent crops. Nutrient uptake by established turf varies between 5-74% of that which is applied (Brown *et al.* 1977, 1982, Petrovic, 1989) and is dependent on the nutrient application rate (Burns et al. 1985, see Appendix 4).

Given the nutrient application rates outlined in the CER (Table 2), the proportion of applied nutrient recovered in the forage dry matter of the crop can be estimated (Table 2, Appendix 4). The remaining nutrient not accounted for in the forage dry matter of the crop has the potential to be lost from the system through such mechanisms as soil adsorption, volatilization (nitrogen), soil removal during the harvesting process, or by leaching to groundwater and runoff to surface waters.

Quoted literature values for nutrient uptake are for established turf only and may not be directly applicable to farmed turf where much of the above-ground and near surface soil and root material is harvested twice yearly. The estimates here take no account of nutrient removal in soil contained within the harvested turf rolls.

It is well established that the sandy soils of Jandakot are freely drained, and that most of the applied phosphorus and nitrogen will leach beyond the root zone of crops, including grasses.

The expected nutrient loss rates from the proposed turf farm will be in excess of those for conventional dryland agriculture within the Peel-Harvey estuarine system.

Table 2 - Estimates of potential nutrient losses from proposed turf farm for the first and subsequent crops.

	First Crop		Second and subsequent crops	
	Р	N	Р	N
Nutrient applied (kg/ha/crop)	483*	1495*	63†	215†
**% of applied nutrient recovered in forage dry matter of crop	13	30	48	80
††Nutrient not accounted for in forage dry matter of crop (kg/ha/crop)	422	1045	33	43

P = Phosphorus

#### N = Nitrogen

- \* These application rates include a once only application of 40 tonnes/ha of poultry manure which supplies 1300 kg of nitrogen/ha/crop and 420 kg of phosphorus/ha/crop. Six applications at 4 weekly intervals of 1 tonne/ha of poultry manure supply the remaining 195 kg of nitrogen/ha/crop and 63 kg of phosphorus/ha/crop.
- † These application rates are derived from six applications at 4 weekly intervals of 1 tonne/ha of poultry manure supplying 195 kg of nitrogen/ha/crop and 63 kg of phosphorus/ha/crop. The remaining nitrogen is supplied as inorganic nitrogen at a rate of 20 kg/ha/crop.
- \*\* See Appendix 4 for derivation of these values (Burns et al 1985)
- †† This nutrient has the potential to be lost from the system through such mechanisms as soil adsorption, volatilization (nitrogen), soil removal during the harvesting process, or by leaching to groundwater and runoff to surface waters.

### Conclusions

The Jandakot water mound is one of the major sources of Perth's potable water. Policies are currently being put in place to protect this resource from contamination and to ensure its long term sustainability. Nitrate has been shown to be one of the major contaminants of underground water supplies worldwide. The proposed turf farm will contribute to nitrate contamination of the Jandakot Public Water Supply Area.

The property is bounded on its western margin by the Peel Main Drain which leads directly to the Peel-Harvey estuarine system. The site is low lying and is in a gazetted drainage area. Surface runoff is unlikely during summer but may occur in winter when superficial water tables rise to intercept the local drainage network.

The estimated quantity of nitrogen and phosphorus potentially available for leaching (not taken up and removed in cut turf rolls), is likely to be greater than that observed for dryland farming in the Peel-Harvey system. The Western Australian Department of Agriculture is responsible for implementing key Ministerial conditions arising from the Peel-Harvey Stage 2 ERMP, and has advised that clearing would be prevented under the Soil and Land Conservation Act because of the risk of nutrient leaching and off-site degradation.

The Environmental Protection Authority concludes that the proposed turf farm is environmentally unacceptable because of the high levels of nutrient contamination of ground and surface waters which it would generate.

#### Recommendation

The Environmental Protection Authority concludes that the proposal to operate a turf farm as described in the Consultative Environmental Review is environmentally unacceptable and recommends that it not proceed. Accordingly, the Authority also recommends that a well licence should not be issued.

### 7. References

- Burns JC, Westerman PW, King LD, Cummings GA, Overcash MR and Goode L. (1985) Swine lagoon effluent applied to 'Coastal' Bermudagrass: I. Forage yield, quality and element removal. *J. Environ. Qual.*, **14**; 9-14
- Brown KW, Duble RL and Thomas JC (1977) Influence of management and season on fate of N applied to golf greens. *Agron J* **69**; 667-71
- Brown KW, Thomas JC and Duble RL (1982) Nitrogen source effect on nitrate and ammonium leaching and runoff losses from greens. *Agron J* 74; 947-50
- King LD, Westerman PW, Cummings GA, Overcash MR and Burns JC (1985) Swine lagoon effluent applied to 'Coastal' Bermudagrass: II. Effects on soil. J. Environ. Qual., 14; 14-21
- Petrovic AM (1989) The fate of nitrogenous fertilizers applied to turf grass. Department of floriculture and ornamental horticulture, Cornell University Ithaca, NY 14853
- Westerman PW, Overcash MR, Evans RO, King LD, Burns JC and Cummings GA (1985) Swine lagoon effluent applied to 'Coastal' Bermudagrass: III. Irrigation and rainfall runoff. *J. Environ. Qual.*, **14**; 22-25.



Review of submissions

#### Review of submissions

#### **CER** Guidelines

Concern was raised that the presentation of the report did not meet the guidelines established by the Environmental Protection Authority for preparation of the Consultative Environmental Review.

#### Nutrient leaching

Several submissions raised the concern of nutrient leaching on Bassendean Sands and the proponent's assumption of nearly 100% nutrient uptake and nutrient translocation into the harvested material. One pointed out that there was no possibility of controlling nutrient loss even with stringent management controls in place, particularly in winter. Another pointed out that there was no indication of nutrient status of the soil in the post harvest periods.

#### Clearing

It was mentioned that a notification of Intention to Clear would need to be lodged with the Commissioner of Soil Conservation and that any clearing would be prevented under the Land Conservation Act due to the risk of nutrient leaching and off-site degradation.

#### Impact on wetlands, flora and fauna

There was concern that the already diminishing winter damplands and wetlands and associated flora and fauna may be further affected by an allocation of water for this proposal, however, if the current status of the winter damplands and wetlands was due to public water supply demands only, then this concern was retracted.

#### Location within Peel-Harvey catchment

One submission indicated that the property lies within the Peel-Harvey catchment and that any further nutrient leaching in this area is highly undesirable. This system is currently under Ministerial directive to reduce the nitrogen and phosphorus pollution of the waterbody.

## Location within Jandakot underground water pollution control area and public water supply area

Several submissions pointed out that the property lies within the Jandakot Underground Water Pollution Control Area and that the current land-use policy within this area is to oppose development that may adversely impact the quality of the groundwater, unless it is demonstrated to the contrary. Reservations were expressed over the existing status of the Jandakot mound and the potential for dwindling supplies of potable groundwater to be further depleted through groundwater pollution.

#### Variability of nutrient source

One submission raised the question of variability in the nutrient content of the manure source and indicated that adequate sampling and analytical procedures would be necessary to determine the actual application rates of nutrients to the soil.

#### Literature relevance

The relevance of the quoted literature to the proposal was questioned. The major points of concern were that the literature cited concentrates on established turf rather than turf farming and that the reported losses of nutrients (in particular nitrogen) for established turf was extremely variable. It may not be possible to use figures for established turf in estimating uptake and losses for farmed turf where much of the above ground material is harvested twice yearly.



Letter requesting response to issues raised





WORTH PROTECTION

Mr A Pitsikas 15 Riley Street TUART HILL WA 6060

> 68/88 D Deeley

Dear Sir

#### RESPONSE TO COMMENTS MADE BY DECISION MAKING AUTHORITIES

A number of concerns have been raised by several of the Decision Making Authorities during their review of your Consultative Environmental Review report. The Environmental Protection Authority would welcome your response to the issues presented below within two weeks, in order to assist in the assessment of your proposal.

- 1. The report does not adequately address the Consultative Environmental Review guidelines set by the Environmental Protection Authority.
- 2. Leaching of nutrients is inevitable even with careful management of fertilizers and irrigation on Bassendean sands, particularly in winter. The property lies within the Peel-Harvey catchment and any further nutrient leaching in this area is highly undesirable.
- 3. Clearing will be prevented under the Soil and Land Conservation Act due to the risk of leaching and offsite degradation.
- 4. Many of the references cited in the report refer to <u>established turf</u> only and not to turf farming and as such may not be directly related.
- 5. The report makes the assumption that all nutrients taken up by the crop will be removed in the harvested material and makes no allowances for nutrient loss from residual plant material post harvest.
- 6. The Water Authority of WA has previously advised Gazon Pty Ltd that it will only allocate enough water for 4 hectares of turf, and that extension beyond this area would only be considered after 3 years, if monitoring data indicated no adverse environmental impacts.

Please contact Mr D Deeley or Mr D Weaver of this Authority on 2227133 should additional information be required.

RAD Sipper

**EVALUATION DIVISION** 

20 February 1990



Response to submissions by Gazon Pty Ltd



Environmental Protection Authority

1 Mount Street

PERTH WA 6000

REF NO.: 68/88

- 9 APR 1990

Gazon Pty. Ltd. Angler Way SORRENTO WA 6020 Tel: 246 2374

Dear Sir.

#### RESPONSE TO CONCERNS OF THE CONSULTATIVE ENVIRONMENTAL REVIEW

- 1. Point one fails to address any specific issue it is therefore impossible to adequately respond to this statement. It would seem that the statement was unfounded and totally unwarranted, due to the fact that the Consultative Environmental Review was developed in conjunction with an Environmental Protection Authority Officer from inception to final completion.
- 2. Potential leaching of nutrients are clearly shown (turf production graphs VIII p. 30). However, the proposers are confident of being able to "finely tune" the fertiliser regime in terms of being able to adapt to seasonal changes particularly Autumn/Winter and significantly reduce the amounts of fertiliser applied thus, ensuring full utilisation by the plant.
- 3. The proposers have indicated since initial consultations with Western Australian Water Authority (October 1987) that the virgin bush block was to be cleared. The proposers have only been recently advised on the soil and land conservation act (January 10th 1986). If clearing is prohibited under the soil and land conservation act (January 10th 1986) why weren't the proposers advised of such a clearing prohibition in October 1987?
- 4. Turf farming has the advantage of being an established area of Turf in terms of fibrous root and stolon density underground and has the added advantage of removal of a substantial amount of nutrients and top soil thus, being a very efficient plant in terms of nutrient export. References cited in the report are directly related to turf and turf farming cannot be made.
- 5. Any possible nutrient loss from residual plant material, post harvest, will be utilised by the actively growing stolon and fibrous root system that reains after each harvest.
- 6. The restriction of a 4Ha limit was imposed only after consultation between Gazon Pty. Ltd. and W.A.W.A. (August 1987) when Gazon Pty. Ltd. advised the W.A.W.A. that the required minimum to make the proposed Turf Farm financially and economically viable was 7Ha.

Should you wish to contact me for a suitable meeting or elaboration of the above, please do not hesitate to contact me.

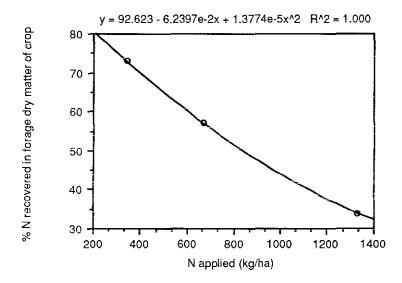
Yours faithfully

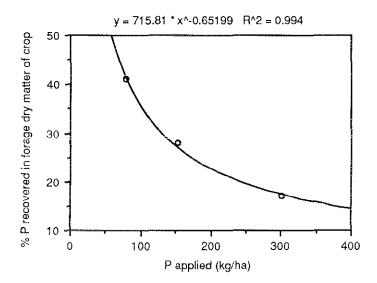
MD Shak

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Derivation of nutrient budget







Given the relationships established above for nitrogen and phosphorus (data from Burns et al 1985), the percentage of applied nutrient (Table 2 indicates the nutrient application rates) that is recovered in the forage dry matter of the crop can be estimated. Knowing the percentage of applied nutrient that is recovered in the forage dry matter of the crop, the quantity (kg/ha/crop) of nutrient that is found in the forage dry matter of the crop can be calculated. The amount of nutrient that is not accounted for in the forage dry matter of the crop (ie nutrient which has the potential to be lost from the system through such mechanisms as soil adsorption, volatilization (N), soil removal during the harvesting process, or by leaching to groundwater and runoff to surface waters) can be estimated by difference. Other relevant information on the effects of nutrient applications on soil properties and nutrient losses via runoff can be found in Westerman et al (1985) and King et al (1985).