Market Garden, Lot 5 Yangetti Road, Keysbrook

Horti (International) Pty. Ltd.

Report and recommendations
of the Environmental Protection Authority

Environmental Protection Authority
Bulletin 613
February 1992

THE PURPOSE OF THIS REPORT

This report contains the Environmental Protection Authority's environmental assessment and recommendations to the Minister for the Environment on the environmental acceptability of the proposal.

Immediately following the release of the report there is a 14-day period when anyone may appeal to the Minister against the Environmental Protection Authority's recommendations.

After the appeal period, and determination of any appeals, the Minister consults with the other relevant ministers and agencies and then issues his decision about whether the proposal may or may not proceed. The Minister also announces the legally binding environmental conditions which might apply to any approval.

APPEALS

If you disagree with any of the assessment report recommendations you may appeal in writing to the Minister for the Environment outlining the environmental reasons for your concern and enclosing the appeal fee of $10.

It is important that you clearly indicate the part of the report you disagree with and the reasons for your concern so that the grounds of your appeal can be properly considered by the Minister for the Environment.

ADDRESS

Hon Minister for the Environment
18th Floor, Allendale Square
77 St George's Terrace
PERTH WA 6000

CLOSING DATE

Your appeal (with the $10 fee) must reach the Minister's office no later than 5.00 p.m. on the date stamped below.

ISSN 1030-0120
ISBN 0 7309 4740 8
Assessment Number 672

Contents

		Page
Summary and recommendations		**i**
1	**Introduction**	**1**
2	**The proposal**	**1**
3	**Environmental impacts and management**	**2**
3.1	Fertiliser use	2
3.2	Irrigation	2
3.3	Soil amendment with bauxite residue	3
3.4	Wastewater treatment	3
3.5	Proponent's commitments	4
4.	**References**	6

Table

1.	Phosphorus and nitrogen application rates for several market garden crops	1

Summary and recommendations

In November 1991, Horti (International) referred to the Environmental Protection Authority for assessment a market garden development at Lot 5 Yangetti Road, Keysbrook. This market garden is located within the coastal plain catchment of the Peel-Harvey Estuary and consequently the Environmental Protection Authority decided to assess the proposal with a Consultative Environmental Review.

Lot 5 Yangetti Road has been used for market gardening since 1985, however operations by the previous owner ceased in June 1990. Horti wish to purchase this property, obtain a well licence and recommence horticultural production.

The Peel-Harvey Estuary has become badly degradred through an excessive inflow of nutrients, and some years ago the Government embarked upon a two-part rescue programme for the Estuary. One part was the Dawesville Channel, to improve flushing in the Estuary to increase its ability to cope with the nutrients it receives. The other part was to control the activities taking place in the catchment to reduce the amount of nutrients flowing in to the Estuary.

For the Estuary to recover and remain healthy, the Authority estimates that the inflow of phosphorus needs to be reduced by about 50% on average. For activities like intensive market gardening, which have in the past been major sources of nutrients, the reduction needs to be substantially more than 50%. To achieve the reduction the Government has set interim target levels for the inflow of nutrients into the Estuary which mean, in operational terms that the loss of phosphorus per hectare per year should not exceed approximately 0.4kg.

This proposal to continue an existing horticultural operation is expected to export about 1kg of phosphorus per hectare per year. While this still exceeds the interim target value of 0.4kg, it represents a reduction of much more than 50% over past activities at this location. It should also provide useful information on how better to manage nutrients in other existing horticultural activities in the catchment. Therefore the Environmental Protection Authority considers that it could proceed, subject to the predicted phosphorus level of less than 1kg per hectare per year is achieved and maintained with appropriate management, monitoring and reporting.

While this monitoring and reporting may help the management of existing horticulture in the catchment, it is unlikely to alter the Authority's present position that new proposals for conventional horticulture should be located so that nutrients do not leach into important wetlands and groundwater systems.

Recommendation 1

The Environmental Protection Authority concludes that the proposal by Horti (International) Pty Ltd to continue market garden operations at Lot 5 Yangetti Road, Keysbrook is environmentally acceptable.

The Environmental Protection Authority considers the main environmental factor requiring detailed consideration to be nutrient management including soil amendment using bauxite residue and irrigation and wastewater management.

The Environmental Protection Authority considers that these environmental factors have been addressed adequately by environmental management commitments given by the proponent or by the Authority's recommendations given in this report.

Accordingly the Environmental Protection Authority recommends that the proposal could proceed, subject to the Environmental Protection Authority's recommendations in this report, and subject to the proponent's commitments to environmental management contained in this report.

Recommendation 2

The Environmental Protection Authority recommends that prior to commencement of horticultural operations the proponent should prepare and submit an Environmental Management Programme to the satisfaction of the Minister for the Environment. This programme should describe the detailed implementation of the proposal. The programme should be implemented and periodically reviewed to the satisfaction of the Environmental Protection Authority on advice from the Western Australian Department of Agriculture, and should include, but not necessarily be limited to:

- soil amendment using bauxite residue;
- irrigation scheduling to minimise water use;
- fertiliser use based on soil and plant tissue analyses;
- drainage management and wastewater treatment;
- monitoring of nutrients and radionuclides.

The management programme should be designed to ensure that this operation will not result in phosporus losses to the Peel-Harvey Estuarine System of greater than one kilogram per hectare of market garden per year. This maximum rate of phosphorus loss should be achieved by 31 December 1994. The management programme should include contingency plans for reducing phosphorus export rates from the property should monitoring indicate that acceptable phosphorus loss rates are not being achieved.

1. Introduction

In November 1991, Horti (International) referred to the Environmental Protection Authority for assessment a market garden development at Lot 5 Yangetti Road, Keysbrook. The size of Lot 5 Yangetti Road, Keysbrook is 89 hectares, of which up to 52 hectares will be irrigated. This market garden is located within the Coastal Plain Catchment of the Peel-Harvey Estuary.

In recent years the Western Australian Government has moved to rehabilitate and protect the Peel-Harvey Estuary from the noxious algal blooms caused by nutrient enrichment of this waterway. One important element of the Government's strategy has been for the Environmental Protection Authority to assess intensive land use proposals which are likely to contribute nutrients to that estuary, such as intensive market gardening. Consequently, the Environmental Protection Authority decided to assess this horticultural proposal with a Consultative Environmental Review.

Lot 5 Yangetti Road has been used for market gardening since 1985, however operations by the previous owner ceased in June 1990. Irrigation is by a linear move steriline irrigator, pumping water from a central channel, or from a deeper aquifer during summer months. The central channel is fed primarily by the local groundwater flows, which can be within a metre of the soil surface during winter.

Horti wish to purchase this property, obtain a well licence, and recommence horticultural production, using techniques which are environmentally acceptable.

2. The proposal

The proposal is to recommence market garden operations and to irrigate up to 52 hectares for approximately eight months of the year. It is proposed that during the period December - March the area of market garden will be between 30 and 40 hectares so that groundwater abstraction is not in excess of groundwater well licence conditions.

Horti have not indicated the types of crop to be grown, but estimate that average phosphorus applications will be approximately 91kilogrammes/annum/hectare with two crops per year. Fertiliser will be applied in the form of NPK Blue or a similar fertiliser.

Table 1: Examples of phosphorus and nitrogen application rates for several crop types. From: McPharlin & Luke (1989) and Western Australian Department of Agriculture Farmnotes 92/83 and 114/88.

Crop	Status	Phosphorus applied (kg/ha/crop)			Nitrogen applied (kg/ha/crop)		
		Total	Organic	Inorganic	Total	Organic	Inorganic
Cabbage	Established	100	40	60	495	120	375
	New	260	200	60	975	600	375
Cucumber	Established	140	40	100	530	120	410
	New	250	200	50	530	600	410
Cauliflower	Established	120	40	80	570	120	450
	New	280	200	80	1050	600	450

Table 1 indicates the rate of nitrogen and phosphorus applications for several vegetable crop types. Horti has undertaken to apply fertilisers based on recommendations from soil and plant tissue analyses, therefore anticipated application rates will be lower than those typically used by the industry.

3. Environmental impacts and management

Since the mid 1970s the Peel Inlet and Harvey Estuary have suffered severe degradation from algal blooms. These algal blooms have resulted from excessive amounts of nutrients (principally phosphorus) entering this large waterbody. When an algal bloom dies, or "collapses", large amounts of organic material decompose causing massive and sudden reductions in dissolved oxygen and the death of many aquatic species. The decaying material also causes unpleasant odours in an area valued for recreation, tourism and residential development. For these reasons the Western Australian Government has acted to protect and rehabilitate this important waterway.

In October 1990 the Environmental Protection Authority reported on a number of new horticultural proposals in the coastal plain catchment of the Peel-Harvey Estuary. The Authority indicated that new developments which result in nutrient export rates greater than approximately 0.4kg phosphorus/ha/yr and/or 4kg nitrogen/ha/yr are environmentally unacceptable.

Phosphorus and nitrogen losses from Lot 5 Yangetti Road have not been accurately established for the previous operation. However, the property drains into the Peel-Harvey via Yangedi Swamp, Punrak Drain and the Serpentine River. It is likely that levels of nutrient export were very high and that substantial management undertakings would be required for the market garden to be environmentally acceptable.

Through discussions with Government agencies, Horti has become aware of the Government's objectives in the Peel-Harvey area and the practices that may be required to suitably manage this market garden. To best manage this market garden, Horti have undertaken to follow the recommendations of the Horticulture Division of the Western Australian Department of Agriculture.

The focus of Horti's environmental management will be to limit phosphorus loss from its market garden. This will include minimal use of fertiliser and irrigation water, the application of gypsum-amended bauxite residue to bind excess phosphorus and downstream drainage wastewater treatment.

3.1 Fertiliser use

Fertiliser use will be based on soil and plant tissue analyses, and fertiliser application rates will follow advice of the Department of Agriculture.

The area of market garden is drained with underground slotted polythene pipes, which direct subsurface drainage into a central channel, which then drains off-site. To a limited extent, nutrients will be recycled from irrigation water drawn from this central channel, thus reducing the quantities of fertiliser nutrients moving off-site.

3.2 Irrigation

Horti has undertaken to minimise water use and thereby reduce the leaching of fertiliser nutrients beyond the root zone. The proponent will employ advice provided by the Department of Agriculture regarding irrigation rates and scheduling. In addition, Horti will undertake dense plantings of Tasmanian Blue Gums along property boundaries to minimise nutrient and water losses from the site.

3.3 Soil amendment with bauxite residue

The proponent, in collaboration with the Department of Agriculture proposes to progressively condition the soil with gypsum amended bauxite residue. This process will form the basis of a series of experimental trials.

Over the last 10 years bauxite residue, a waste product from Alcoa's alumina refineries, has been identified as a substance capable of binding substantial quantities of phosphorus. Bauxite residue is already being applied on a small scale to bind phosphorus from domestic effluent and in effluent pond linings for small scale animal industry. From these small scale trials it is apparent that bauxite residue (which is highly alkaline and must be neutralised with gypsum before use) could be used to bind phosphorus that would normally leach beyond the plant's root zone. It is anticipated that phosphorus loss from market gardens could be substantially reduced if bauxite residue is applied and mixed at rates of between 40 and 60 tonnes per hectare (McPharlin, *pers. com.*).

As an experimental trial, Horti with advice from the Department of Agriculture intends to initially amend 18 beds (six beds in stages over the first year) with bauxite residue at 60t/ha. Fertiliser management will be based on soil testing of the bauxite residue amended soil. The total area amended in the first year would be 33% of the irrigated area, with the entire amended over five years.

Gypsum amended bauxite residue contains trace quantities of the radionuclides (radioactive elements) thorium-232 and radium-226. Radium-226 is derived from the gypsum used to neutralise the alkaline bauxite residue, whilst the thorium-232 occurs naturally in the bauxite mined to produce aluminium.

The Radiation Council of Western Australia considers the levels of radioactivity present in soils amended with bauxite residue at these rates should be so low as to pose no health risk. The Council therefore has not objection to the proposal proceeding.

The Department of Agriculture and the Radiological Council of Western Australia consider it unlikely that there will be a significant uptake of radionuclides by root and leaf vegetables. Department of Agriculture experimental data indicate that radioactivity levels in vegetable crops grown on bauxite residue amended soils are unlikely to exceed 0.03 becquerels/kg (McPharlin, *pers. com.*), whilst the National Food Authority has considered that radioactivity levels below 100 becquerels/kg should not pose a health risk (National Food Authority, 1991).

Nevertheless, this is an important public health issue, and therefore uptake of radionuclides by crop vegetables should be monitored by the proponent as part of the overall management of this development. Results of this monitoring should be forwarded to the Radiological Council of Western Australia and the Health Department of Western Australia.

3.4 Wastewater treatment

Horti propose to treat drainage wastewater to remove phosphorus prior to it leaving the property. This treatment will be via drainage through filter beds using bauxite residue and lime to strip phosphorus from drainages waters. These filter beds will be simple ponds constructed with timber walls, approximately 10 x 6 metres in size.

Likely phosphorus export scenario with wastewater treatment is (taken from the Horti Consultative Environmental Review):

Phosphorus applied as fertiliser	91kg/ha
Crop uptake and removal	25kg/ha
Bound by bauxite residue	60kg/ha
Filter bed removal	5kg/ha
Predicted export rate to the Peel-Harvey drainage	~1kg/ha (may be much less)

3.5 Proponent's commitments

The proponents have made a series of commitments, including;

- soil amendment with gypsum amended bauxite residue, with rates of bauxite residue amendment determined in consultation with Western Australian Department of Agriculture;

- fertiliser use is to follow the advice of the Western Australian Department of Agriculture to minimise leaching losses and be based on pre-planting soil testing and post planting leaf analysis. Fertiliser use will also account for fertiliser recycling through the irrigation system;

- on advice from Western Australian Department of Agriculture, ensure efficient irrigation water distribution standards are met and that water scheduling procedures minimise the percolation of irrigation water beyond the plant rootzone.

- treatment of drainage water to remove phosphorus prior to flowing from the property;

- management of irrigation to reduce water loss to drainage, including dense planting of Tasmanian Blue Gums along northern boundary;

- monitoring of drainage water phosphorus levels, based on advice and specifications provided by the Water Authority of WA and Western Australian Department of Agriculture; and

- reporting of monitoring results to Western Australian Department of Agriculture and EPA on or near 30 June 1993 and within twelve months prior to 31 December 1996. At this latter stage the need for additional means of phosphorus control shall be evaluated and implemented by Horti.

The Peel-Harvey Estuary has become badly degraded through an excessive inflow of nutrients, and some years ago the Government embarked upon a two-part rescue programme for the Estuary. One part was the Dawesville Channel, to improve flushing in the Estuary to increase its ability to cope with the nutrients it receives. The other part was to control the activities taking place in the catchment to reduce the amount of nutrients flowing in to the Estuary.

For the Estuary to recover and remain healthy, the Authority estimates that the inflow of phosphorus needs to be reduced by about 50% on average. For activities like intensive market gardening, which have in the past been major sources of nutrients, the reduction needs to be substantially more than 50%. To achieve the reduction the Government has set interim target levels for the inflow of nutrients into the Estuary which mean, in operational terms that the loss of phosphorus per hectare per year should not exceed approximately 0.4kg.

This proposal to continue an existing horticultural operation is expected to export about 1kg of phosphorus per hectare per year. While this still exceeds the interim target value of 0.4kg, it represents a reduction of much more than 50% over past activities at this location. It should also provide useful information on how better to manage nutrients in other existing horticultural activities in the catchment. Therefore the Environmental Protection Authority considers that it could proceed, subject to the predicted phosphorus level of less than 1kg per hectare per year is achieved and maintained with appropriate management, monitoring and reporting.

While this monitoring and reporting may help the management of existing horticulture in the catchment, it is unlikely to alter the Authority's present position that new proposals for conventional horticulture should be located so that nutrients do not leach into important wetlands and groundwater systems.

Recommendation 1

The Environmental Protection Authority concludes that the proposal by Horti (International) Pty Ltd to continue market garden operations at Lot 5 Yangetti Road, Keysbrook is environmentally acceptable.

The Environmental Protection Authority considers the main environmental factor requiring detailed consideration to be nutrient management including soil amendment using bauxite residue and irrigation and wastewater management.

The Environmental Protection Authority considers that these environmental factors have been addressed adequately by environmental management commitments given by the proponent or by the Authority's recommendations given in this report.

Accordingly the Environmental Protection Authority recommends that the proposal could proceed, subject to the Environmental Protection Authority's recommendations in this report, and subject to the proponent's commitments to environmental management contained in this report.

Recommendation 2

The Environmental Protection Authority recommends that prior to commencement of horticultural operations the proponent should prepare and submit an Environmental Management Programme to the satisfaction of the Minister for the Environment. This programme should describe the detailed implementation of the proposal. The programme should be implemented and periodically reviewed to the satisfaction of the Environmental Protection Authority on advice from the Western Australian Department of Agriculture, and should include, but not necessarily be limited to:

- **soil amendment using bauxite residue;**
- **irrigation scheduling to minimise water use;**
- **fertiliser use based on soil and plant tissue analyses;**
- **drainage management and wastewater treatment;**
- **monitoring of nutrients and radionuclides.**

The management programme should be designed to ensure that this operation will not result in phosporus losses to the Peel-Harvey Estuarine

System of greater than one kilogram per hectare of market garden per year. This maximum rate of phosphorus loss should be achieved by 31 December 1994. The management programme should include contingency plans for reducing phosphorus export rates from the property should monitoring indicate that acceptable phosphorus loss rates are not being achieved.

The Authority believes that any approval for a proposal based on this assessment should be limited to five years. Accordingly, if the proposal has not been substantially commenced within five years of the date of this report, then such approval should lapse. After that time, further considerations of the proposal should occur only following a new referral to the Authority.

The Authority's experience is that it is common for details of a proposal to alter as it is established or implemented. In many cases alterations are not environmentally significant or have a positive effect on the environmental performance of the project. The Authority believes that such non-substantial changes, and especially those which improve environmental performance and protection, should be provided for.

4. References

Environmental Protection Authority (1990). New conventional sprinkler irrigated agricultural proposals in the Swan Coastal Plain catchment of the Peel-Harvey Estuary. Bulletin 449.

McPharlin, I and Luke, G (1989). Irrigation and fertilizer management for horticultural crops on the Swan Coastal Plain. *Journal of Agriculture*, Western Australian Department of Agriculture, 30, 91-95.

National Food Authority (1991) Agenda Paper November 1991.