Southern landfill project, South Cardup

Browning Ferris Industries (Australia) Pty Ltd and Pioneer Australia Waste Management Pty Ltd

Report and recommendations of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
Bulletin 702
September, 1993

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 report.

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 contents of the assessment report or 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
12th Floor, Dumas House
2 Havelock Street
WEST PERTH WA 6005

CLOSING DATE

Your appeal (with the $10 fee) must reach the Minister's office no later than 5.00 pm on 30 September, 1993.

Environmental Impact Assessment (EIA)

Process Timelines in weeks

Date	Timeline commences from receipt of full details of proposal by proponent	Time (weeks)
15/3/93	Proponent Document Released for Public Comment	8
10/5/93	Public Comment Period Closed	
19/5/93	Issues Raised During Public Comment Period Summarised by EPA and Forwarded to the Proponent	2
24/6/93	Proponent response to the issues raised received	5
16/9/93	EPA reported to the Minister for the Environment	12

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Summary and recommendations

This proposal, by Browning Ferris Industries (Australia) Pty Ltd and Pioneer Australia Waste Management Pty Ltd, is to develop a landfill site at South Cardup, 45km south-east of Perth and 5km south of Byford. The proponents have proposed three stages, although this assessment covers only the first two stages.

Stage 1 is a valley fill which requires diversion of a stream with a 240ha catchment and is underlain by clays which have characteristics suitable for lining material. Stage 1 has been parkland cleared, leaving only the trees. Stage 1 is located above a fault which is not currently active and has not been active for thousands of years. Even if movement occurred along the fault, leachate would still be contained on-site.

Stage 2 would fill in an old shale pit, which contains steeply dipping shale which prevents horizontal movement of groundwater.

Stage 3 would fill in a granite quarry.

Both Stage 1 and Stage 2 are expected to be operational for five to six years (ie a total of 10 to 12 years). Only Stage 1 and 2 have been assessed by the Authority because Stage 3 is not required for at least 10 years during which acceptable waste management practices may change significantly. Details for Stage 3 were not provided in the Public Environmental Review document by the proponent because of the lead-time.

The landfill site is located on the Darling Scarp, is subject to katabatic winds (ie winds caused by differences in temperature above and below the scarp) which would aid odour dispersion, is in a high rainfall area (1200mm or greater) and is in area zoned rural.

This is the first proposal for a privately owned and operated landfill accepting general and municipal waste in Western Australia.

The proposal was initially developed by the proponents in response to a call for expressions of interest in 1990 by the Health Department of Western Australia to operate a low hazard industrial waste facility. The proposal has been modified since 1990. The types of industrial waste acceptable at this site will be determined by waste acceptance criteria to be developed to the requirements of the Environmental Protection Authority and Health Department of Western Australia.

This proposal was referred to the Environmental Protection Authority in July 1992 and a Public Environmental Review level of assessment was set. Following consideration of the Public Environmental Review document and issues raised in public submissions, the Environmental Protection Authority has concluded that the proposal is environmentally acceptable.

Recommendation 1

The Environmental Protection Authority concludes that the proposal by Browning Ferris Industries (Australia) Pty Ltd and Pioneer Australia Waste Management Pty Ltd for the Southern Landfill Project — South Cardup is environmentally acceptable.

In reaching this conclusion the Environmental Protection Authority identified the main environmental factors requiring detailed consideration as:

- **geological suitability of the site;**
- **surface water protection;**
- **acceptable wastes;**
- **operational aspects to limit off-site environmental impacts;**
- **on-going separation from incompatible land-uses;**

- **regulation of establishment and operation; and**
- **maintaining site environmental integrity with respect to clean-up of unexpected pollution, post-closure management and contingencies.**

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

Accordingly, the Environmental Protection Authority recommends that the proposal for Stage 1 and 2 could proceed subject to:

- **the Environmental Protection Authority's recommendations in this Assessment Report; and**
- **the proponents commitments (See Appendix 1).**

As stated above, only Stage 1 and 2 have been assessed by the Authority because Stage 3 is not required for at least 10 years (in until 2003) during which acceptable waste management practices may change significantly. In August 1993 the State Recycling Blueprint was released by the State Government. The Blueprint details goals and objectives for waste management in Western Australia. One of the key targets noted in the Blueprint is halving the amount of waste to landfill by the year 2000.

A waste management hierarchy of waste avoidance, waste reduction, reuse, recycling and waste treatment to reduce hazard or nuisance are waste management measures to be pursued in preference to continuing with current waste disposal methods has been developed by the Commonwealth Environment Protection Agency.

Surface and groundwater management

Advice regarding the geological suitability of the site to the Authority indicates groundwater contamination is considered to be unlikely. However, the proponent has committed to installing and monitoring a network of monitoring bores based on an assessment of site geology.

Extensive works are required to divert the existing stream and surface water. Water downstream of the landfill site must be protected for existing users. A surface water design plan should ensure surface water diversion measures are adequate and that down-stream water quality is protected.

Recommendation 2

The Environmental Protection Authority recommends that, prior to the commencement of tipping in each Stage, the proponent prepare an Environmental Management Programme incorporating surface water design details which includes, but is not limited to consideration of:

- **the detention time of the sedimentation pond (with reference to the effects on discharge water quality);**
- **the size and construction of the stream diversion channels;**
- **the need for compensating basins to control flood peaks resulting from the works; and**
- **a short-term monitoring programme to demonstrate that the works are effective;**

to the requirements of the Environmental Protection Authority on advice of the Water Authority of Western Australia and Shire of Serpentine-Jarrahdale.

(See Recommended Environmental Condition 3)

Waste acceptance criteria

The proponent proposes to develop an assessment procedure to determine the acceptability or otherwise of various classes or types of industrial waste for disposal at this site.

The Authority considers that the assessment procedure developed must ensure that the environment is protected. Other assessment procedures developed have been based on protecting drinking water. However, water quality criteria developed for drinking water do not take into account bio-accumulation, bio-stimulation and the sensitivity of some aquatic fauna to some contaminants.

Subject to the above comment, the proponent could build on the approach taken by the Health Department of Western Australia in its *Waste acceptance criteria* discussion paper which is shortly to be released for public comment.

Recommendation 3

The Environmental Protection Authority recommends that prior to commencement of landfill operations the proponent submit an assessment procedure that determines the acceptability (or otherwise) of various classes and types of waste at this landfill which takes into account protection of the environment, to the requirements of the Environmental Protection Authority on advice of the Health Department of Western Australia.

Landfill gas

Landfill gas contains approximately equal proportions of methane and carbon dioxide, both of which contribute to the Greenhouse Effect. Methane has a significantly greater effect than carbon dioxide. Collecting and burning methane is considered by the Environmental Protection Authority to be the best way to reduce the greenhouse effects of landfill gas. The proponent has made a commitment to prepare a methane (landfill) gas management plan.

Visual impacts

The visual integrity of the Darling Scarp will be affected by Stage 1 of the proposal. In response to concerns about visual impacts raised in submissions, the proponent modified commitments to reduce the visual impact of Stage 1 of the proposal. The proponent has a commitment to prepare landscape plans to the satisfaction of the Shire of Serpentine-Jarrahadale.

If the Shire of Serpentine-Jarrahadale decide to recommend planning approval, the Shire should ensure the visual impact from Stage 1 is addressed by ensuring that the landscape plans minimise the period of visual impact and that the site is rehabilitated to the maximum degree possible so that the visual form, texture and colour of the site is consistent with its surroundings.

Stability

The stability of the landfill and its cap are important considerations, particularly for the Stage 1 valley landfill. Engineering criteria would be checked by the Shire of Serpentine-Jarrahdale to ensure the landfill is stable.

Operational practices

Standard management/operational practices for fencing, access roads, dust control, fire control, supervision, deposition of waste, compacting of waste, covering of waste, litter control and size of tip face were specified in the discussion paper *Criteria for landfill management 1992*, published by Health Department of Western Australia. The proponents commitments regarding the above aspects are consistent with or better than those specified in the *Criteria for landfill management 1992*. The Environmental Protection Authority is satisfied that the proponents commitments in regard to the above are satisfactory.

Noise

The operation of the site will need to comply with the Environmental Protection Authority's normal noise requirements.

Recommendation 4

The Environmental Protection Authority recommends that the following noise levels should be applied so that residences are given the same level of protection as anywhere in Western Australia. This means that noise levels at residences should be:

- **40 dB(A) from 10pm to 7am, every day**
- **45 dB(A) from 7pm to 10pm every day and from 7am to 7pm on Sundays and public holidays; and**
- **50 dB(A) from 7am to 7pm on Monday to Saturday inclusive;**

where such emissions would result in the noise level present at the affected premises exceeding the ambient noise level present at any time by more than 5 dB L_A slow.

The proponent should ensure that noise emissions do not exhibit tones, amplitude modulation, frequency modulation or impulsiveness of a nature which increases the intrusiveness of the noise.

(See Recommended Environmental Condition 5).

Separation distances

Even if the site complies with the standard operational/management practices for a modern landfill operation, off-site impacts would result in reduced environmental amenity beyond the boundaries of site owned by the proponent. The Health Department has recommended the following separation distances for this landfill, based on consideration of reduced environmental amenity with respect to residential uses:

i) 50 metres between the active face of the landfill and the site boundary at all times (Zone A);

ii) 150 metres to the nearest existing dwelling (Zone B); and

iii) 500 metres to the nearest subdivision (Zone C). A rural subdivision could be permitted to take place within this zone provided that statutory building envelopes were located outside of the zone.

Existing land uses adjacent to the site do not appear to be sensitive to reduced environmental amenity and on this basis the proposal is considered to be environmentally acceptable. However, it is acknowledged that existing zonings can permit incompatible land-uses to be established.

The Authority has been advised that the Shire of Serpentine-Jarrahdale's Town Planning Scheme will require amendment to permit a landfill operation to take place. If the Shire of Serpentine-Jarrahdale decide to recommend a scheme amendment to the Minister for Planning, then the Authority considers that mechanisms to ensure separation of incompatible land-uses must be put in place so that:

- new housing occurs only outside the area of reduced environmental amenity as defined above for the duration of landfill operations; and
- the landfill can operate to a reasonable industry standard without adversely affecting people and housing.

Any approved Town Planning Scheme amendment should ensure that this occurs. The Health Department of Western Australia and Environmental Protection Authority will ensure compliance to reasonable operating standards.

The Authority considers that unless mechanisms are in place to ensure that incompatible land uses do not occur within the area of reduced environmental amenity, the impacts of the proposal would need to be limited to the boundaries of the site. Enforcement of environmental regulations to the site boundary in response to complaints from residences established within the area of reduced environmental amenity could require the landfill to cease operation.

Recommendation 5

The Environmental Protection Authority recommends that, should the Shire of Serpentine-Jarrahdale decide to recommend planning approval, the State Government through the Minister for Planning should ensure appropriate mechanisms under the provisions of the Town Planning and Development Act are identified and put in place to ensure that only compatible land uses can be established within the area of reduced environmental amenity associated with this proposal for the duration of landfill operations.

In the absence of these mechanisms, the Authority points out that enforcement of environmental regulations to the site boundary in response to complaints from residences established within the area of reduced environmental amenity could place the landfill operation in jeopardy or require the operation to cease.

Traffic

The proponent provided additional information about traffic in the response to submissions. Truck traffic along the South-West Highway could increase from 1 000 to 1 100 trucks per day. This small increase is not considered environmentally significant.

Regulation of establishment and operation

Any local authority wishing to establish a landfill is required to obtain the approval of and meet the requirements of the Executive Director, Public Health. However, the Health Act does not specifically consider privately operated landfills and as such, no requirement exists for approval from the Executive Director, Public Health. As the Executive Director, Public Health usually considers specific public health and waste management issues, the Authority considers that privately owned landfills should also be required to meet the requirements of the Executive Director, Public Health. The Authority expects that a five yearly review of the landfill management plan, as is required for local authorities, would also be part of the Executive Director's approval.

Recommendation 6

The Environmental Protection Authority recommends that the proponent be required to conform to the requirements of the Executive Director, Public Health with regard to the design, construction and on-going management of the waste disposal site.

(See Recommended Environmental Condition 6)

Maintaining environmental integrity of the site

The Environmental Protection Authority considers that there is a need to ensure that the environmental integrity of the site is maintained during operations and in the long term. This means that there should always be means available to cover the costs of unexpected pollution, post closure management and contingencies (ie polluter pays). Bonds, bank guarantees and/or company guaranties are used elsewhere in Australia to ensure liabilities can be met without recourse to government funds.

The proponents have made some commitments in response to concerns about environmental integrity of the site. These are financial assurances in favour of the Shire of Serpentine-Jarrahdale to cover emergency contingencies and long term risk.

Under the Environmental Protection Act, both the Minister for the Environment and Environmental Protection Authority have a role in determining what is considered to be pollution, and the remedy of that pollution. The existing commitments would not enable the Minister for the Environment to ensure the required works were undertaken using the financial assurances made in commitments in the event of a default by the proponent.

Post closure management

Another concern is that the structure of the guarantees should also ensure that post-closure management measures can be implemented until such time as the waste has fully degraded.

The Environmental Protection Authority has recommended that the financial assurances commitment be linked to any environmental mitigation measures which might be required under the Environmental Protection Act and that the financial assurances address post closure management.

Recommendation 7

The Environmental Protection Authority recommends that prior to the commencement of landfill operations, the long term environmental integrity of the site be ensured through appropriate mechanisms. Measures to achieve this should be identified and subsequently implemented by the proponent to the requirements of the Ministers for the Environment and Health.

(See Recommended Environmental Condition 8)

This proposal has highlighted the need for issues with respect to maintaining the environmental integrity of privately owned landfill sites to be considered by the State government in order that the development and operation of future private sites can be managed under appropriate legislation. The advice of the Senior Officers Committee (Waste Management) should be sought on this matter.

Recommendation 8

The Environmental Protection Authority recommends that the State government consider the issues raised by this proposal with respect to regulation of and maintenance of the environmental integrity of privately owned and operated sites.

Reports prepared to meet environmental conditions would be available via a community liaison committee proposed to be established by the proponent.

1 Introduction and background

The Southern Landfill - South Cardup is the first proposal for a privately owned and operated landfill accepting general and municipal waste in Western Australia.

Other privately owned and operated landfills in Western Australia have been restricted to landfilling specific types of waste, such as builders rubble, clean fill or waste generated from particular industrial or manufacturing process. These landfills are typically approved by a local authority under sections of the Town Planning and Development Act and Local Government Act. General and municipal waste sites have historically been on reserves vested in local authorities and have been approved by the Executive Director, Public Health in accordance with the requirements of the Health Act.

Given the precedent being set by this proposal, the Authority considers it is necessary to describe waste administration and regulation in Western Australia as well as issues specific to privately owned and operated landfills in Western Australia.

The Authority understands that this proposal was initially developed in response to a call from the Health Department in 1990 for submissions from private companies interested in establishing a new low hazard industrial waste disposal site, and has since been changed in response to a perceived need for a regional site for municipal wastes. This project appears to cater for the above needs.

The proposal was referred to the Environmental Protection Authority in July 1992 and a Public Environmental Review level of assessment was set.

1.1 Waste administration and regulation in Western Australia

Under the Health Act of Western Australia the Executive Director, Public Health and local authorities have responsibility for refuse disposal.

The State government has established a Cabinet Committee on Waste Management to consider waste management issues. The Cabinet Committee includes the Ministers for Health (Chair) Environment, Planning, Local Government and Water Resources. A Senior Officers' Committee consisting of officers from each agency associated with the above Ministers reports to the Cabinet Committee.

Section 119 of the Health Act applies when local authorities wish to establish landfill sites for general and municipal wastes. This section provides the Executive Director, Public Health (with the consent of the Governor) with the ability to stipulate requirements for the use of land for the deposit of refuse. Neither this section nor other sections of the Health Act appear to provide the Executive Director, Public Health with the ability to stipulate requirements for the establishment of privately owned refuse sites.

However, the operation of privately owned refuse sites may be controlled under Section 120 (1) of the Health Act which states that "The Executive Director, Public Health may make such orders as he may think fit for improving the condition of, or for closing and prohibiting the further use of, any place for the reception, utilisation, or deposit of sewage, refuse matter or rubbish."

1.1.1 Other approvals required

The Authority understands that this proposal only requires approvals in accordance with the Environmental Protection Act and Town Planning and Development Act.

1.2 Important policy initiatives in waste management

A number of initiatives which could affect the future administration and regulation of waste material in Western Australia have been commenced by either the Health Department itself or by the Health Department on behalf of committees which it serviced. These include:

- Release of a *Discussion Paper for a Metropolitan Waste Strategy* in 1988 which detailed the Health Department's proposed policy on a wide range of waste management issues.
- A review of waste administration arrangements in Australia with a recommendation that a Waste Management Authority be established in Western Australia (See *Waste Management into the 21st Century*, Report of the Working Group on Waste Management, July 1991);
- Development of a discussion paper *Criteria for landfill management* in the Perth Metropolitan Area 1992; and
- Development of *Waste acceptance criteria* for landfills.

Both the *Metropolitan Waste Strategy* and the *Waste Management into the 21st Century* report recognise and promote a role for private industry in the collection and disposal of waste.

The Health Department of Western Australia expects to have a discussion paper on its proposed *Waste acceptance criteria* available for public comment in September this year. The Authority has been advised that the *Waste acceptance criteria* match waste type to landfill design criteria. The basic concept is demonstrated by the Table 1 below. Where appropriate industrial waste streams would be tested to determine the class of landfill required prior to the wastes being landfilled. Waste testing is undertaken either by the owner of the waste or the landfill operator.

Table 1. Tests to determine what type of waste would be used to determine landfill class in the waste acceptance criteria proposed by the Health Department of WA.

Type of waste	Landfill class	Landfill requirements.
Inert	1	Fenced, gate entry
Inert & Non-putrescible	2	Fenced, gate control,buffer zone
Putrescible	3	Meet requirements of the *Criteria for landfill management*. document
Putrescible & Industrial	4	Meet requirements of *Criteria for landfill management* document, lining of site, leachate collection - treatment & management.
Hazardous & Intractable	5	Meet the requirements for a secure landfill

The Authority has also been advised that the *Criteria for landfill management 1992* will be revised and re-published in response to comments received by the Health Department in the near future.

2. Description of the proposal

The proposal is to construct and operate a landfill on land which is currently utilised for a quarry, located 45km south-east of Perth in an area currently surrounded by rural zoned land. The landfill is proposed to be constructed in three stages as follows:

Stage 1 - A valley fill as shown in Figure 1 which would have a capacity of 1.1 million cubic metres, giving an expected operational lifetime of five to six years;

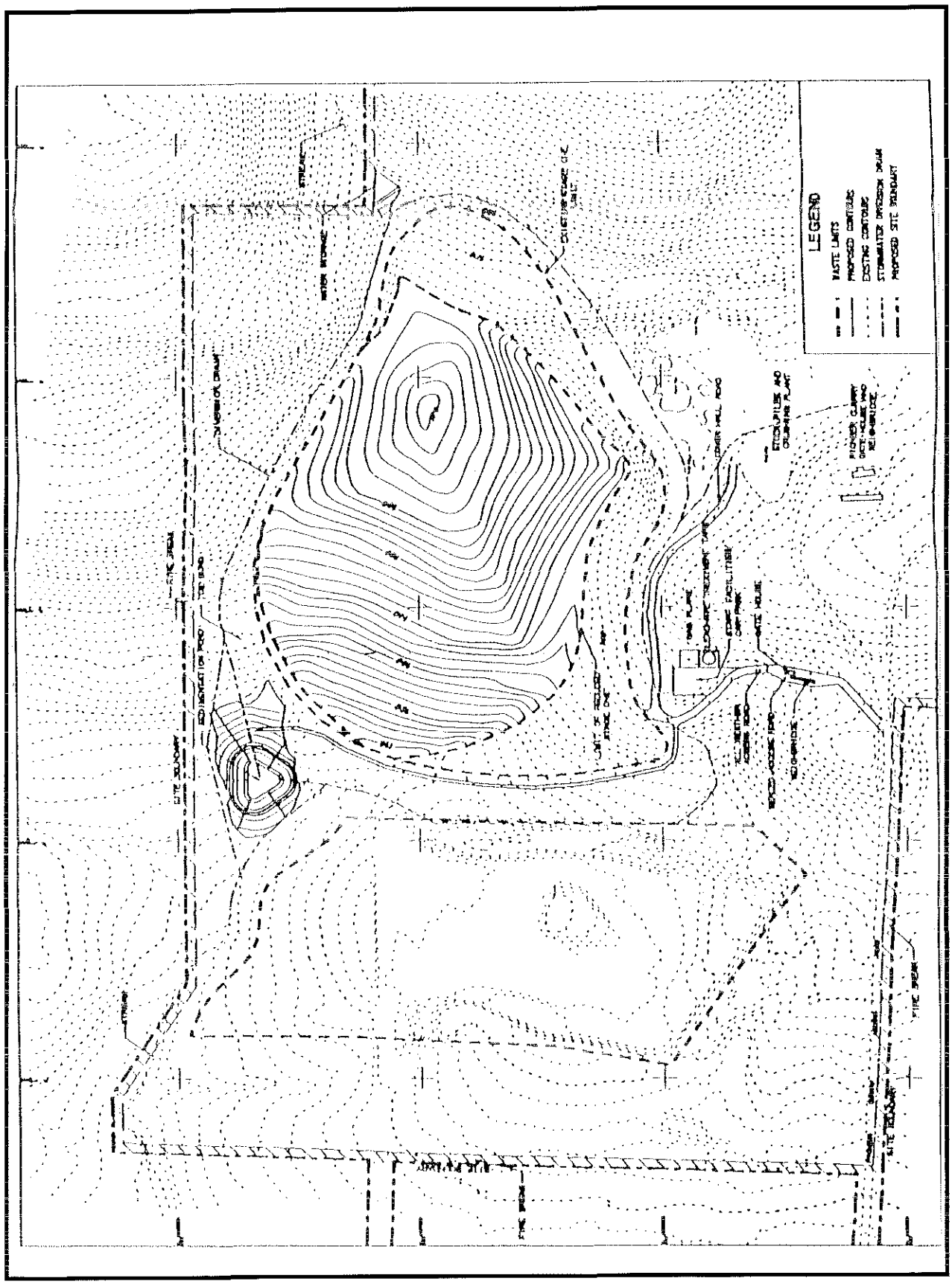

Figure 1. Stage 1 of the Southern landfill project (as amended).

Stage 2 - Infill of the existing Bristile shale pit, shown in Figure 2, over an expected operational period of five to six years; and

Stage 3 - Infill of the Pioneer Concrete hard rock quarry, shown in Figure 2, over a period in excess of 15 years.

The proponent has reduced the size of the Stage 1 valley fill from that shown in the Public Environmental Review in response to concerns expressed in submissions about visual impacts.

The following procedure is intended to be used in each stage, though vegetation clearance would not be required in Stages 2 or 3.

After vegetation clearance from each of the first and second waste disposal cells, the walls and floor of the first cell would be shaped during which excess material suitable for the daily covering of refuse would be stockpiled in a convenient location on the second cell. The base of the cell will then be lined and graded to the leachate collection sump located and the lowest point of the landfill.

When each cell is completely filled it will be capped with an engineered barrier system. The final surface of the completed cell will be re-vegetated with grass to minimise erosion of the landfill cap system to blend into the surrounding landscape.

For each stage, the first cell will be sized to accommodate two years refuse and subsequent cells will be sized to accommodate approximately one years refuse.

The proponents commitments with respect to landscaping and dust should ensure that the visible parts of the valley fill (ie the bund which forms the western face) would be landscaped as soon as possible after construction.

Access to the landfill will be restricted to private contracted transporters and municipal waste collection vehicles to ensure a small tipping face is achieved.

Engineering design details have only been prepared for the first two stages of the facility.

Key engineering measures of the site development include:

- Provision of stormwater diversion drains to divert the stream and run-off generated in areas outside of the active landfill to minimise leachate generation;
- Construction of a lining system consisting of either a 1 m thick clay lining with a permeability of 1 x 10^{-9} m/s or a composite High Density Poly-Ethylene (HDPE)/clay lining on the base and walls of all waste disposal areas to ensure the safe containment of leachate;
- Installation of leachate collection and storage facilities to minimise leachate accumulation above the lining system;
- Leachate will be recirculated through the refuse;
- Construction of a composite low permeability landfill cap; and
- Provision of a landfill gas control system consisting of a series of recovery wells to collect and flare the gas.

A 50m wide vegetated on-site buffer zone is proposed.

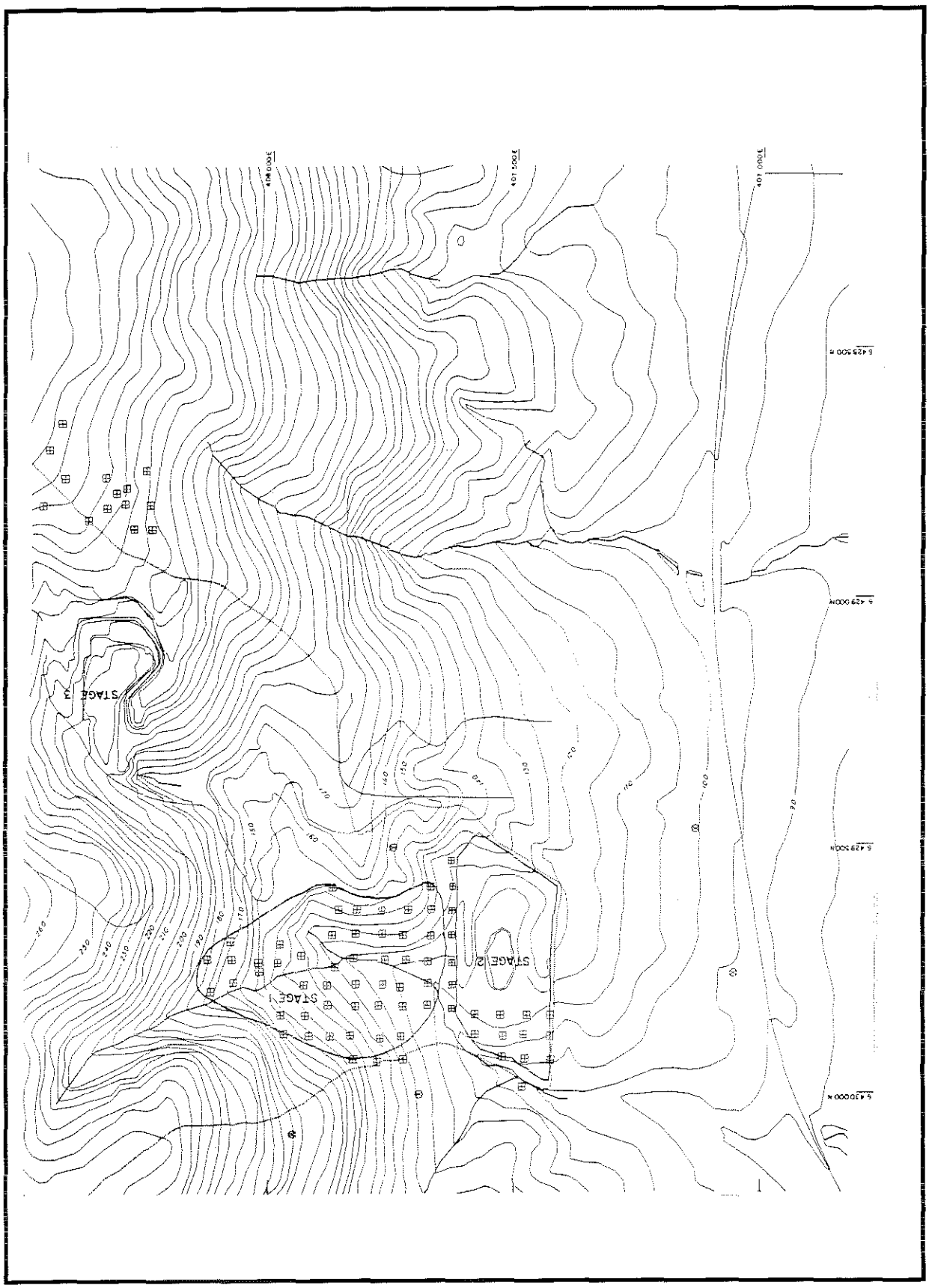

Figure 2. Stages 2 and 3 of the Southern landfill project.

3. Existing environment

The existing environment is described in detail in the Public Environmental Review. Aspects of the existing environment particularly relevant to environmental assessment of the proposal include:

- The Stage 1 landfill is located in a valley on the western face of the Darling Scarp which has a stream flowing through it and which has been parkland cleared for grazing. The stream has an upstream catchment of about 240 ha. The remaining trees have little conservation significance, although they do contribute to the landscape.
- Stages 2 and 3 of the landfill would be located in existing quarries.
- The annual rainfall along the Darling Scarp is higher than on the Swan Coastal Plain as indicated by rainfall data in the Public Environmental Review document showing annual rainfall at Karnet to be 1218 mm compared with 802 mm at Perth Airport.
- The wind pattern at the site has not been studied. Strong katabatic winds are likely to occur, which would assist odour dispersion and reduce the likelihood of temperature inversions. (The Authority receives most odour complaints when winds are light to calm).
- The proposed landfill area lies within the Darling Fault zone. The probabilistic earthquake risk maps show Perth and the South Cardup area to have a comparable seismic risk with an estimated ten per cent chance that the ground motion will exceed 48 mm/s or $0.44 m/s^2$ during a fifty year interval. There is no evidence to suggest that the on-site fault is currently active, or has been active during the last several thousand years.
- Site geology varies across the site with a veneer of sediments underlain by shales and sandstones on the west and granitic bedrock to the east. In Stage 1, the sedimented clay is likely to have the low permeability criteria required for a liner, but contains a high proportion of cobbles and boulders. In the eastern part of Stage 1 bedrock is found at shallow depth. Stage 2 is located within a steeply dipping shale outcrop and Stage 3 is located in granitic bedrock.
- In Stage 1, site hydrogeological studies have observed groundwater in fractured rocks (ie where dolerite dikes intrude the granitic bedrock). However, the movement of groundwater in fractured rocks can be very complex, controlled by the degree of connection, if any, between the various fracture sets.
- Temporary flows of groundwater occur after wet periods along the contact of the irregular soil horizon with the underlying crystalline rocks, resulting in ephemeral springs and soaks.
- In Stage 2 the steeply dipping shale creates a barrier to groundwater movement.
- The land surrounding the project is currently zoned rural.

4. Public submissions

The Environmental Protection Authority required that a Public Environmental Review be prepared for the proposal. The availability of the Public Environmental Review for comment over an eight week period was advertised in 'The West Australian' and local newspapers and the document was circulated to relevant government agencies.

The proponent undertook a programme of consultation with government agencies and the public both prior to and during the submission period. Two public information days were held at the site; one prior to preparation of the Public Environmental Review document and one during the submission period.

The Authority received 14 submissions from members of the public and community groups, and a further eight submissions from State and local government agencies.

A detailed summation of the points raised in the submissions and the proponents response to the submissions is presented in Appendix 2. In summary,the following topics were raised in the submissions:

- the need for and acceptability of the proposal;
- potential for pollution by leachate of groundwater, surface water and water supplies;
- potential for air pollution from landfill gas, fires and dust;
- the need for a clear definition of acceptable wastes;
- a need for accurate information regarding rainfall to ensure that stormwater control measures are adequate;
- concerns about the effect of an earthquake and about the stability of the landfill cap in view of its slope;
- potential impacts from litter, pests and additional truck traffic;
- the need for and impacts of a buffer zone;
- potential visual impacts on the Darling Scarp; and
- issues associated with private ownership of refuse sites.

5. Environmental assessment

5.1 Waste management — acceptable practices in a changing world

As we near the close of the twentieth century the emerging concept of development is one which is ecologically sustainable, recognising the need for the integration of environmental and economic objectives to achieved balanced growth and development.

Conservation of the world's finite resources and protection of the environment are seen as prerequisites for a sustainable future.

In the area of waste management, acceptable waste disposal practices in the developed world have changed dramatically during the last five to seven years. For example new knowledge about the Earth's atmosphere has identified the need to manage methane gas from landfill, the United States has issued "Subtitle D" regulations for operation and establishment of landfills and the European Community is currently preparing a directive on landfills. Many of these measures have meant that the direct per tonne costs of landfill have increased, and costs to the community such as degraded resources (eg contaminated groundwater) have significantly diminished.

Australia in common with other developed nations, has set a target of a halving waste to landfill by the year 2000. As well as this objective there are specific recycling targets for materials such as glass containers, aluminium cans, PET plastic soft drink bottles, newspaper and steel cans.

Waste management is now in many ways materials management with waste minimisation and recycling as strategies to reduce waste and conserving resources.

As part of the National Waste Minimisation Strategy the Commonwealth Environment Protection Agency has developed a waste management hierarchy to assist in pursuing waste management objectives. It begins with waste avoidance and ends with environmentally safe disposal.

WASTE MANAGEMENT HIERARCHY
WASTE AVOIDANCE-Practices which avoid the generation of waste
WASTE REDUCTION- Practices which reduce waste
WASTE REUSE- Direct reuse of materials
RECYCLING- Reclaiming resources for use in other processes
WASTE TREATMENT- To reduce hazard or nuisance
WASTE DISPOSAL- environmentally safe disposal (ie Landfill)

5.1.1 Waste minimisation and recycling in Western Australia.

A 1991 survey indicated that over two million tonnes of waste was dumped in landfill in Western Australia. The State Government has acknowledged that landfilling of this quantity of waste cannot continue and has adopted the target of halving the amount of waste to landfill by the year 2000.

To help reduce the amount of waste in Western Australia by half by the year 2000 a State Recycling Blueprint has been developed by the Department of Commerce and Trade which makes recommendations including:

- the promotion and expansion of kerbside recycling services and community based recycling;
- the shredding and composting of green waste;
- stimulating industry to establish processes and markets for waste materials including plastics, tyres and newsprint;
- the promotion and education of waste minimisation and recycling to the community; and
- the development of purchasing policies at all levels in government and industry.

The State government has not yet considered the recommendations of the Blueprint.

In the Public Environmental Review document the proponent alluded to the possibility of the establishment of a garden waste composting facility at the site. The proponent notes that garden waste accounts for almost 10% of the waste stream currently being disposed to landfill by weight and an even greater percentage by volume. The Environmental Protection Authority would commend this initiative if it were to be implemented.

5.1.2 The future role of and management requirements for landfills

In view of the rapidly changing circumstances in waste management the Authority is reluctant to recommend approvals which last in excess of five years without commencement of implementation. In principle approval beyond 10 years would not be wise because within this period the acceptability of various waste management approaches such as landfill may fundamentally change.

The proponent was made aware of the Authority's reluctance to recommend long-term approvals and accordingly has only specified engineering details for Stages 1 & 2. Stage 1 is expected to have an operational life of five to six years and Stage 2 a further five to six years. As discussed elsewhere in this report, the geology and location of Stage 2 appears to be well suited for landfill.

Recommendation 1

The Environmental Protection Authority concludes that the proposal by Browning Ferris Industries (Australia) Pty Ltd and Pioneer Australia Waste Management Pty Ltd for the Southern Landfill Project — South Cardup is environmentally acceptable.

In reaching this conclusion the Environmental Protection Authority identified the main environmental factors requiring detailed consideration as:

- **geological suitability of the site;**
- **surface water protection;**
- **acceptable wastes;**
- **operational aspects to limit off-site environmental impacts;**
- **on-going separation from incompatible land-uses;**
- **regulation of establishment and operation; and**
- **maintaining site environmental integrity with respect to clean-up of unexpected pollution, post-closure management and contingencies.**

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

Accordingly, the Environmental Protection Authority recommends that the proposal for Stage 1 and 2 could proceed subject to:

- **the Environmental Protection Authority's recommendations in this Assessment Report; and**
- **the proponents commitments (See Appendix 1).**

The Environmental Protection Authority has not considered the environmental acceptability of Stage 3 in this report, and it should be referred to the Authority for environmental impact assessment before planning and construction.

5.2 Geological suitability

5.2.1 Groundwater protection

The Environmental Protection Authority has been advised that, based on an assessment of the site geology, the site is located in an area where the risk of groundwater contamination is small. Stage 1 has a complex geology, but is located on clays with a low permeability. Stage 2 is located on the steeply dipping Armadale shale formation which provides a barrier to groundwater movement. Unlike the sands of the Swan Coastal Plain, the clay soils on the site are likely to have capacity to absorb many of the pollutants commonly found in leachate. The sites geological suitability, combined with lining of the site to the standard proposed in the Public Environmental Review makes groundwater contamination unlikely.

The proponents commitment to Quality Assurance/Quality Control for liner construction is welcomed.

The proponent had proposed a regular grid of monitoring bores down gradient of the landfill. However, the site is located in an area where groundwater flow is controlled by fractures in the bedrock and local geomorphological features. Therefore, the bores should be sited on the basis of good geological and geophysical information so that groundwater flow paths near the site are

intersected, rather than on a gird pattern. In response to submissions, the proponent has amended the list of commitments to install the bores on the basis of geological information

The frequency of sampling is proposed to be to the requirements of the Environmental Protection Authority.

5.2.2 Proximity to the Darling Fault

As noted in the description of the existing environment the landfill is located on a fault line which is not currently active and has not been active for several thousand years, the clays on the site have a capability to absorb most of the pollutants found in leachate and the site is underlain either by clays which are likely to have the low permeability criteria required for a liner, bedrock or steeply inclined shales.

The Authority has been advised that even if an earthquake occurred and some movement occurred along the fault, the geology of the site is such that leachate would still be contained within or directly under the landfill.

5.3 Surface water protection

As outlined in the Public Environmental Review extensive works would be undertaken for Stage 1 to divert the existing stream around the valley landfill, divert uncontaminated surface run-off away from the landfill and collect stormwater contaminated by refuse as leachate. Uncontaminated water would be passed through a sedimentation pond.

Concern was expressed in submissions that dust from contaminated soils or emissions from landfill gas (or its treatment) could adversely affect surface water quality. If the surface water protection works are undertaken at the locations described in the Public Environmental Review and dust from the handling of contaminated soils is controlled in accordance with the Health Department of Western Australia's *Criteria for landfill management 1992* surface waters leaving the site would not become contaminated with dust. Landfill gas or the flaring of landfill gas would not affect water quality.

Concern was also expressed in submissions that the site had a particularly high annual rainfall and experienced heavy rainfall events. The proponent has indicated that the Australian rainfall and runoff 1987 guide to flood estimation, published by the Institute of Engineers had been used to prepare preliminary design criteria.

The proponent has made commitments to undertake the works which the Environmental Protection Authority considers would be required for surface water protection for both Stage 1 and Stage 2. However, the Environmental Protection Authority considers that the detailed design criteria such as the detention time of the sedimentation pond (which effects the discharge water quality), the size and construction of the stream diversion channels and the need for compensating basins to control flood peaks resulting from the works should be detailed prior to construction. A short term monitoring programme to demonstrate that the design criteria have been effective should be implemented, with emphasis on demonstrating that surface water discharge is of acceptable quality. A surface water design plan, which includes consideration of the above should be prepared.

Recommendation 2

The Environmental Protection Authority recommends that, prior to the commencement of tipping in each Stage, the proponent prepare an Environmental Management Programme incorporating surface water design details which includes, but is not limited to consideration of:

- **the detention time of the sedimentation pond (with reference to the effects on discharge water quality);**

- **the size and construction of the stream diversion channels;**
- **the need for compensating basins to control flood peaks resulting from the works; and**
- **a short-term monitoring programme to demonstrate that the works are effective;**

to the requirements of the Environmental Protection Authority on advice of the Water Authority of Western Australia and Shire of Serpentine-Jarrahdale.

(See Recommended Environmental Condition 4)

5.4 Types of waste accepted

The proponent has described at length the types of waste which the proponent considers would or would not be acceptable at the Southern Landfill (See Appendix E of the Public Environmental Review) and has made a commitment that an assessment procedure that determines the acceptability (or otherwise) of various classes and types of industrial waste at this facility would be developed to the satisfaction of the Health Department of Western Australia and Environmental Protection Authority (See Commitment 5)

The Environmental Protection Authority considers that one of the key principles for any assessment procedure developed is that wastes which generate leachates which, if they moved off-site, could cause pollution or unacceptable damage to aquatic ecosystems should be directed to a lined or a secure landfill (ie Classes 4 or 5 as suggested in Table 1, Section 1.1). The assessment procedure developed should use environmental criteria to ensure aquatic ecosystems are protected.

Assessment procedures have been developed elsewhere based on protecting drinking water. However, drinking water criteria do not adequately protect aquatic ecosystems because factors such as bio-accumulation, bio-stimulation and the sensitivity of some aquatic fauna to some contaminants are not adequately considered.

Table 2 explains the basis for drinking water criteria guidelines and compares them with criteria to protect aquatic ecosystems, for a selected number of contaminants.

Clearly, Table 2 illustrates that environmental criteria should be used to determine whether or not a material should or should not be directed to a lined site.

The proponent, in developing the assessment procedure could build on the concepts proposed in the *Waste acceptance criteria* proposed by the Health Department of WA (See Section 1.1).

The Environmental Protection Authority considers that development of an assessment procedure by the proponent is appropriate provided it takes into account protection of the environment and the Health Department *Waste acceptance criteria* discussion paper. The information provided in Appendix E of the Public Environmental Review should also be considered for incorporation into the assessment procedure.

Recommendation 3

The Environmental Protection Authority recommends that prior to commencement of landfill operations the proponent submit an assessment procedure that determines the acceptability (or otherwise) of various classes and types of waste at this landfill which takes into account protection of the environment, to the requirements of the Environmental Protection Authority on advice of the Health Department of Western Australia.

(See Recommended Environmental Condition 5)

Table 2. Basis for drinking water criteria guidelines and environmental criteria to protect aquatic ecosystems for a selected number of contaminants.

Contaminant	Drinking water guidelines (from National Health and Medical Research Council, 1987)		Protection of aquatic ecosystems guidelines (from Australian and New Zealand Environment and Conservation Council, 1992)	
	Drinking water criteria (µg/L)	Notes	Environmental criteria (µg/L)	Notes
Aluminium	Not specified	No conclusive evidence of health effects. Concentrations of 200 µg/L not suitable for kidney dialyses patients.	<5µg/L if pH 6.5 or less, & not > 100µg/L if pH >6 5	USEPA studies showed >100µg/L deleterious to growth and survival of fish at pH >6.5
Cyanide	100	A large margin of safety is provided for this toxic substance.	5	Invertebrates generally more tolerant than fish.
Lead	50	Food and air more important sources.	1-5	Acute toxicities for Australian freshwater species ranged from 180-500 µg/L. Forty four percent of trout developed spinal deformities at lead concentrations of 31 µg/L in soft water.
Phosphorus	Not specified	Must be at levels which do not cause growth which alter other drinking water parameters.	Not specified	Phosphorus is a biostimulant. Concentrations of concern depends on waterbody type. Concentrations of 5-50 µg/L in lakes can cause excessive plant growth
Zinc	5000	Level is based on taste considerations.	5-50	Acute toxicity at 340-9600 µg/L for ten Australian freshwater species.

5.5 Landfill gas and the greenhouse effect

Landfill gas is about 50% methane (CH_4) and 50% carbon dioxide (CO_2) and is generated as a result of anaerobic (ie without oxygen) degradation processes within the landfill. It has been estimated that about 300 m^3 methane is produced per tonne of refuse landfilled (Western Australian Greenhouse Co-ordination Council, undated), however the production rate depends on several factors including the moisture status of the waste.

The long term relative contribution to global warming for each methane molecule is six times that of a carbon dioxide molecule. Burning one methane molecule produces one carbon dioxide

molecule. Therefore, burning the methane produced in tips or preventing its generation through composting or recycling organic waste, is considered to be worthwhile.

A detailed study for the New Zealand Climate Change Programme (Australian and New Zealand Environment Council, 1990) looked at a range of waste management options from a Greenhouse perspective. It found that increased recycling coupled with capture of methane from landfill was the most effective option in reducing Greenhouse emissions. The study estimated that emissions could be reduced by 50% using this approach.

The 'Greenhouse Gas Audit for Western Australia', which has been endorsed by the State Government, concluded that by phasing out CFC and halon usage and reducing the production of methane from landfills the State Government's goal of a 20% reduction in Greenhouse gas emissions could be met.

The proponents commitment to preparation of a methane gas management programme which includes collection and flaring of landfill gas prior to the commencement of tipping operations is acceptable to the Authority.

5.6 Visual impacts

Several submissions expressed concern that Stage 1 would have an adverse effect on the visual integrity of the Darling Scarp and referred to a range of studies which emphasised the visual importance of the Scarp.

In response to submissions, the proponent undertook a visual analysis from two locations along the South-West Highway, reduced the size (height) of the valley landfill, sought permission to plant trees along the highway and modified the commitments so that the bund constructed for the valley landfill would be stabilised with vegetation as soon as possible after construction. The proponent also has a commitment to prepare landscape plans to the satisfaction of the Shire of Serpentine-Jarrahdale. Machinery and refuse would generally not be visible behind the bund. The proponent has indicated that current plans involve establishing grass and a few shrubs on the bund and in the long term establish a few trees.

Stage 1 of the proposal will present a visual impact in the short term because as the landfill is constructed and rehabilitated, the texture, form and colour of that portion of the scarp will change.

When the earth bund is constructed to hide the machinery and refuse from view, it would have a brown appearance until such time as grasses and shrubs establish. This phase in particular would affect the visual sensibilities of those viewing the scarp from the Coastal Plain. The change in appearance may offend people, particularly local people and create fears that further deterioration of the otherwise generally intact regional landscape may occur.

The proponent has not undertaken an analysis of the extent that Stage 1 will be visible from the Coastal Plain.

The Authority recognises that short term visual impact is inevitable if Stage 1 of the proposal is implemented and that with adequate landscape rehabilitation, this need not become long term visual degradation of the scarp face. However, **the Authority considers that the visual impact from the scarp and nearby sites is not regionally significant** and should be addressed by the Shire of Serpentine-Jarrahdale.

In order to address the visual impact associated with Stage 1 the Environmental Protection Authority considers that, if the Shire of Serpentine-Jarrahdale decide to recommend planning approval, the Shire should ensure that the proponents commitments regarding landscaping plans adequately address the visual impact. In particular the Shire of Serpentine-Jarrahdale should ensure that:

- the period of visual impact is minimised by ensuring that landscaping/rehabilitation occurs as soon as possible after earthworks are completed and that forward planting to screen future earthworks from view is also undertaken as soon as possible; and

- the site is rehabilitated to the maximum degree possible so that the visual form, texture and colour of the site is consistent with its surroundings, as viewed from the Coastal Plain.

Clearly grass and shrubs would not be adequate as a long-term rehabilitation measure. The predominant visual character of this portion of the scarp face viewed from the Coastal Plain is woodland, consisting of mature trees with a well developed upper canopy. The proponent may have to increase the width of the bund and install materials in the cap to prevent root penetration into the refuse to permit adequate rehabilitation to take place.

5.7 Landfill stability

The valley landfill is constructed in steep country and, based on the contours shown in Figure 1, the completed landfill would also have a relatively steep profile.

Concerns were expressed in submissions that the landfill may slump or slip in wet conditions causing problems in the future.

The proponent has given a commitment that the landfill will be designed and constructed in accordance with accepted engineering practices for landfills, to the satisfaction of the Shire of Serpentine-Jarrahdale.

The Authority expects that the Shire of Serpentine-Jarrahdale would include consideration of potential for soil erosion based on the slope of the landfill and the potential for slump or slips in evaluating whether the correct engineering criteria are being applied.

5.8 Management/operational practices and environmental effects

The *Criteria for landfill management 1992* published by the Health Department of Western Australia amongst other things, defines standard management/operational practices for fencing, access roads, dust control, fire control, supervision, deposition of waste, compacting of waste, covering of waste, litter control and size of tip face. The Authority understands that the revised criteria will continue to address these management/operational practices.

The proponents commitments are consistent with or better than the level of management required by the *Criteria for landfill management 1992* in regard to the matters noted in the above paragraph. This should ensure that airborne emissions such as odours are minimised and pests do not become a problem.

The Authority expects that the *Criteria for landfill management* would be reviewed and updated as acceptable management practices change. The Authority has been advised that a revised version of the Health Department of Western Australia *Criteria for landfill management 1992* is in preparation and will apply to all metropolitan landfills, including the Southern Landfill.

5.8.1 Noise

The operation of the site will need to comply with the Environmental Protection Authority's normal noise requirements.

Recommendation 4

The Environmental Protection Authority recommends that the following noise levels should be applied so that residences are given the same level of protection as anywhere in Western Australia. This means that noise levels at residences should be:

- **40 dB(A) from 10pm to 7am, every day;**

- **45 dB(A) from 7pm to 10pm every day and from 7am to 7pm on Sundays and public holidays; and**
- **50 dB(A) from 7am to 7pm on Monday to Saturday inclusive;**

where such emissions would result in the noise level present at the affected premises exceeding the ambient noise level present at any time by more than 5 dB L_A slow.

The proponent should ensure that noise emissions do not exhibit tones, amplitude modulation, frequency modulation or impulsiveness of a nature which increases the intrusiveness of the noise.

(See Recommended Environmental Condition 6).

5.8.2 Monitoring, management and reporting

In the response to submissions the proponent has made a commitment to establish a Community Liaison Committee, subject to expressions of interest being obtained from the community.

The proponent has made commitments to prepare reports and annual reports relating to a range of matters such as groundwater and landfill gas.The proponent has indicated that these reports would be publicly available through the Community Liaison Committee, if established.

5.9 Buffer zone

The term buffer zone is often used to describe the separation distance required between incompatible land uses.

A separation distance is usually based on several key principles. Two key principles when considering the required separation distance between houses and a landfill site include:

- people living in their houses should be able to enjoy an environment free from excessive noise, dust, odour, wind-blown litter and nuisance; and
- the landfill site must be managed to a 'reasonable standard' to minimise off-site impacts.

This proposal would comply with what the Environmental Protection Authority considers to be a reasonable standard of operation. As noted above (See Section 5.8) management of landfill operations at this site are consistent with or better than the *Criteria for landfill management 1992* prepared by the Health Department of Western Australia. The *Criteria for landfill management 1992* in effect establish a reasonable industry standard.

Higher standards of management than proposed in the *Criteria* and by the proponent would probably do little to reduce off-site impacts such as odour but add significantly to the cost of landfill operation.

Assuming compliance with the *Criteria for landfill management 1992,* the Health Department has considered the likely severity of off-site impacts at various distances from the landfill based on experience elsewhere in Western Australia and developed the following recommended separation distances for residences from this landfill:

i) 50 metres between the active face of the landfill and the site boundary at all times (Zone A);

ii) 150 metres to the nearest existing dwelling (Zone B); and

iii) 500 metres to the nearest subdivision (Zone C). A rural subdivision could be permitted to take place within Zone C provided that statutory building envelopes were located outside of the zone.

Figure 3 shows the extent of each separation distance for all three stages of this proposal.

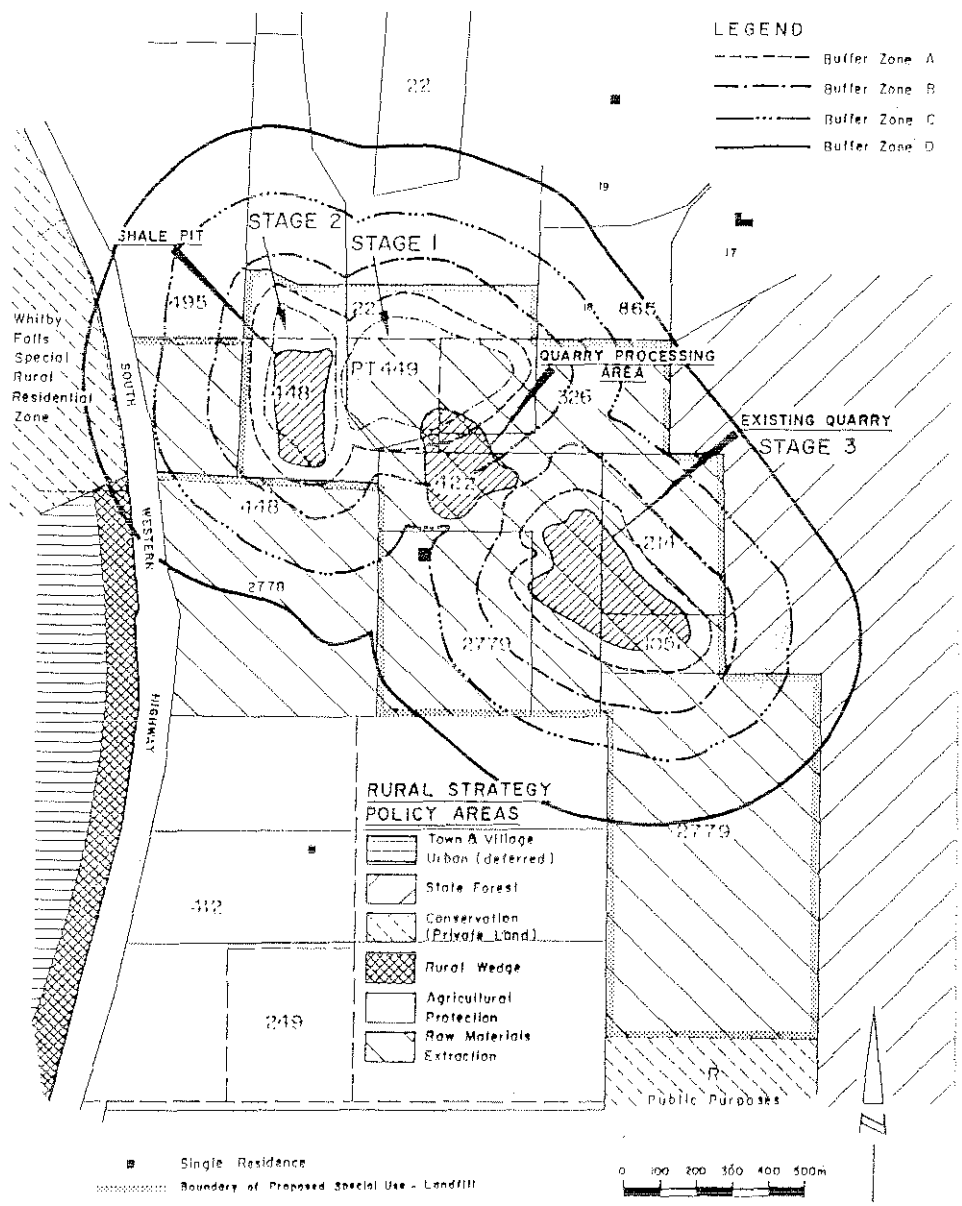

Figure 3. Separation distances for residential uses recommended by the Health Department of Western Australia for this proposal.

The Health Department separation distances are consistent with a recent suggestion put forward to the Environmental Protection Authority by the proponent (See Appendix 3).

Land within the separation distances shown in Figure 3 is currently zoned Rural or State Forest. Existing land-uses do not appear to be sensitive to the reduced environmental amenity which would occur as a result of landfill operations.

Unless a rezoning which permits incompatible land-uses occurs, or a house is constructed within the area affected by reduced environmental amenity, then this proposal is environmentally acceptable.

The Authority understands that the only incompatible land use currently permitted in the areas identified as having reduced environmental amenity would be the construction of individual houses on each of the surrounding lots.

The Town Planning and Development Act, rather than the Environmental Protection Act, provides the mechanisms to ensure that adequate separation distances are maintained to prevent incompatible developments occurring too close together.

The Authority has been advised that the Shire of Serpentine-Jarrahdale's Town Planning Scheme will require amendment to permit a landfill operation to take place and that the amendment would require approval from the Minister for Planning.

If the Shire of Serpentine-Jarrahdale decide to recommend a scheme amendment to the Minister for Planning, then mechanisms to ensure separation of incompatible land-uses must be put in place so that:

- new housing occurs only outside the area of reduced environmental amenity as defined above for the duration of landfill operations; and
- the landfill can operate to a reasonable industry standard without adversely affecting people and housing.

Any approved Town Planning Scheme amendment should ensure mechanisms are in place to ensure incompatible land uses are not established in the area of reduced environmental amenity. The Environmental Protection Authority and Health Department will ensure that the landfill operates to a reasonable industry standard.

Unless mechanisms are in place to ensure that incompatible land uses do not occur within the area of reduced environmental amenity, then the impacts of the proposal should be limited to the boundaries of the site. Enforcement of environmental regulations to the site boundary in response to complaints from residences established within the area of reduced environmental amenity could require the landfill to cease operation.

The Environmental Protection Authority concurs with the advice of the Health Department and those of the proponent that, assuming a reasonable standard of operation, the impacts from this proposal would extend beyond the boundaries of the site.

The Authority considers that unless mechanisms are in place to ensure that incompatible land uses do not occur within the area of reduced environmental amenity, the impacts of the proposal would need to be limited to the boundaries of the site. Enforcement of environmental regulations to the site boundary in response to complaints from residences established within the area of reduced environmental amenity could place the landfill operation in jeopardy or require the operation to cease.

The Environmental Protection Authority considers that, based on existing land-uses, the proposal is currently environmentally acceptable. However, the Environmental Protection Authority notes that a change to land-use within the area of reduced environmental amenity, either through a the building of residences or a rezoning could result in conflicting environmental values and make the proposal environmentally unacceptable.

Recommendation 5

The Environmental Protection Authority recommends that, should the Shire of Serpentine-Jarrahdale decide to recommend planning approval, the State Government through the Minister for Planning should ensure appropriate mechanisms under the provisions of the Town Planning and Development Act are identified and put in place to ensure that only compatible land uses can be established within the area of reduced environmental amenity associated with this proposal for the duration of landfill operations.

In the absence of these mechanisms, the Authority points out that enforcement of environmental regulations to the site boundary in response to complaints from residences established within the area of reduced environmental amenity could place the landfill operation in jeopardy or require the operation to cease.

5.10 Traffic

The proponent addressed the issue of traffic impacts in more detail in the response to submissions. Truck traffic along the South-West Highway could increase from 1 000 to 1 100 trucks per day. This small increase is not considered environmentally significant.

6. Issues associated with privately operated landfills

The recommendations that follow in this section largely reflect the inadequacies of existing legislation to deal with privately operated landfills. It should be noted a Working Group on Waste Management considered some of the issues raised below in its report *Waste Management into the 21st Century* published in July 1991.

6.1 Regulation of establishment and operation

As noted in Section 1.1, the Health Act provides the Executive Director, Public Health with the ability to stipulate requirements for the use of land for refuse disposal by local authorities, but not for privately owned refuse sites.

The Environmental Protection Authority considers that the Executive Director, Public Health should have the same ability to stipulate requirements prior to commencement of construction for this proposal as normally occurs for local authorities. Whilst this would be covered to some extent by the proponents commitments, the Environmental Protection Authority considers that a specific recommendation is appropriate to clearly indicate that the proponent should conform to the requirements of the Executive Director, Public Health.

The Executive Director, Public Health usually considers specific public health and waste management issues.

The Environmental Protection Authority expects that the Executive Director, Public Health would ensure on-going compliance with modern management practices by requesting review of the landfill management plan every five years.

Recommendation 6

The Environmental Protection Authority recommends that the proponent be required to conform to the requirements of the Executive Director, Public Health with regard to the design, construction and on-going management of the waste disposal site.

(See Recommended Environmental Condition 7)

6.2 Post-closure management

Management of the refuse site is necessary until the waste has fully degraded, which can be many decades after closure of the site for tipping. When the waste is fully degraded methane is no longer generated and pollutant concentrations in leachates reach levels which are not likely to have adverse impacts on the environment.

The proponents have recognised the need for management following closure.

The Authority considers that responsibility for post closure management should remain with the proponent or an agency or group of agencies which are accountable to the community, have a guarantied life and which can ensure that there are sufficient funds to manage the site until the waste is fully degraded. The proponent should have the ability to generate funds for post closure management during the site's operation. Therefore the Authority considers that the proponent should take responsibility for funding post-closure management.

Subject to the comments below (Section 6.3), the proponents commitments adequately address post-closure management issues.

6.3 Clean-up of unexpected pollution and other contingencies

The proponent has recognised a need for financial assurances to cover unexpected pollution and other contingencies. Such assurances are needed to ensure the on-going environmental integrity of the site.

The environmental integrity of a site is achieved by ensuring that there are always sufficient assets available to ensure pollution can be prevented and unexpected pollution can be cleaned-up to acceptable levels during operations and in the long term. This means that there should always be sufficient funds available to cover post-closure management (ie pollution prevention), the costs of unexpected pollution and contingencies (ie polluter pays).

In other states of Australia environmental protection or waste management agencies have required private landfill operators to provide suitable bank guaranties and/or bonds to ensure liabilities can be met without recourse to government (taxpayers) funds. The Authority understands neither the Health Act nor Environmental Protection Act make specific mention of the receipt or administration of the above.

The proponents have made some commitments in response to concerns about environmental integrity of the site. These are financial assurances in favour of the Shire of Serpentine-Jarrahdale to cover emergency contingencies and long term risk.

Under the Environmental Protection Act, both the Minister for the Environment and Environmental Protection Authority have a role in determining what is considered to be pollution, and the remedy of that pollution. The existing commitments would not enable the Minister for the Environment to ensure the required works were undertaken using the financial assurances made in commitments in the event of a default by the proponent.

Another concern is that the structure of the guarantees should also ensure that post-closure management measures can be implemented until such time as the waste has fully degraded.

There are a number of mechanisms which could be explored to enable the State government to obtain the necessary sureity, such as the Ministers for Environment and Health holding guarantees under enabling legislation such as a State Agreement Act, or creation of a Waste Management Authority (or similar) with a clear head of power with regard to requiring and administering guarantees.

Recommendation 7

The Environmental Protection Authority recommends that prior to the commencement of landfill operations, the long term environmental integrity of the site be ensured through appropriate mechanisms. Measures to achieve this

should be identified and subsequently implemented by the proponent to the requirements of the Ministers for the Environment and Health.

This proposal has highlighted the need for issues with respect to maintaining the environmental integrity of privately owned landfill sites to be considered by the State government in order that the development and operation of future private sites can managed under appropriate legislation or statutory controls.

Many of the above comments reflect the deliberations of the Senior Officers Committee.

Recommendation 8

The Environmental Protection Authority recommends that the State government consider the issues raised by this proposal with respect to regulation of and maintenance of the environmental integrity of privately owned and operated sites.

7. Conclusions

The Environmental Protection Authority concludes that the proposal by Browning Ferris Industries (Australia) Pty Ltd and Pioneer Australia Waste Management Pty Ltd for the Southern Landfill Project — South Cardup is environmentally acceptable.

In reaching this conclusion the Environmental Protection Authority identified the main environmental factors requiring detailed consideration as:

- geological suitability of the site;
- acceptable wastes;
- surface water protection;
- operational aspects to limit off-site environmental impacts;
- on-going separation from incompatible land-uses;
- regulation of establishment and operation; and
- maintaining site environmental integrity with respect to clean-up of unexpected pollution, post-closure management and contingencies.

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

Accordingly, the Environmental Protection Authority recommends that the proposal for Stage 1 and 2 could proceed subject to:

- the Environmental Protection Authority's recommendations in this Assessment Report; and
- the proponents commitments (See Appendix 1).

The Authority has established an implementation and auditing system which requires the proponent to advise the Authority on how it would meet the requirements of the environmental conditions and commitments of the project. The proponent would be required to develop a Progress and Compliance report for this project as a section of the recommended audit programmes.

The Authority's experience is that it is common for details of the proposal to alter through the detailed design and construction phase. In many cases alterations are not environmentally significant or have positive effects 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.

The Authority believes that any approval for the 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 consideration of the proposal should occur only following a new referral to the Authority.

8. Recommended environmental conditions

Based on its assessment of this proposal and recommendations in this report, the Environmental Protection Authority considers that the following Recommended Environmental Conditions are appropriate.

SOUTHERN LANDFILL PROJECT - SOUTH CARDUP (741)

STAGES 1 AND 2

1 Proponent Commitments

The proponent has made a number of environmental management commitments in order to protect the environment.

1-1 In implementing the proposal, the proponent shall fulfil the commitments (which are not inconsistent with the conditions or procedures contained in this statement) made in the Public Environmental Review and in response to issues raised following public submissions. These commitments are consolidated in Environmental Protection Authority Bulletin YYY (See Appendix 1)

2 Subsequent Stages

2-1 Stages 1 and 2 only may be implemented. The proponent shall refer to the Environmental Protection Authority plans for Stage 3 or subsequent stages of landfill construction and operations at or adjacent to the site.

3 Implementation

Changes to the proposal which are not substantial may be carried out with the approval of the Minister for the Environment.

3-1 Subject to these conditions, the manner of detailed implementation of the proposal shall conform in substance with that set out in any designs, specifications, plans or other technical material submitted by the proponent to the Environmental Protection Authority with the proposal. Where, in the course of that detailed implementation, the proponent seeks to change those designs, specifications, plans or other technical material in any way that the Minister for the Environment determines on the advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

4 Environmental Management Programme

Surface water and a stream with a 240ha catchment must be diverted around the refuse to minimise generation of leachate and to protect downstream water quality.

4-1 Prior to the commencement of landfill operations in each stage, the proponent shall prepare a Environmental Management Programme plan which includes, but is not limited to consideration of:

(i) the detention time of the sedimentation pond (with reference to the effects on discharge water quality);

(ii) the size and construction of the stream diversion channels;

(iii) the need for compensating basins to control flood peaks resulting from the works; and

(iv) a short-term monitoring programme to demonstrate that the works are effective.

to the requirements of the Environmental Protection Authority on advice of the Water Authority of Western Australia and the Shire of Serpentine-Jarrahdale.

4-2 Prior to the commencement of landfill operations at each stage, the proponent shall implement the surface water design plan required by condition 4-1.

5 Environmental waste acceptance criteria

Wastes will be tested to ensure the landfill design is suitable for the waste.

5-1 Prior to commencement of landfill operations the proponent shall prepare an assessment procedure that determines the acceptability (or otherwise) of various classes and types of waste which take into account protection of the environment, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority and Health Department of Western Australia.

6 Noise Limits

The proponent should conduct operations so that noise emissions do not unreasonably impact on the surroundings.

6-1 The proponent shall ensure that noise emissions do not exceed:

- 40 dB $L_{A10,\ 1\ hour}$ slow and 50 dB $L_{A\ max}$ slow between 2200 hours and 0700 hours on any day when measured on any noise-sensitive premises;
- 45 dB $L_{A10,\ 1\ hour}$ slow and 55 dB $L_{A\ max}$ slow between 1900 hours and 2200 hours on any day, and between 0700 hours and 1900 hours on Sundays and gazetted public holidays, when measured on any noise-sensitive premises;
- 50 dB $L_{A10,\ 1\ hour}$ slow and 70 dB $L_{A\ max}$ slow between 0700 hours and 1900 hours on Monday to Saturday inclusive, when measured on any noise-sensitive premises; and
- 65 dB L_A slow when measured at or near the boundary of premises that are not noise-sensitive premises (other industries);

where such emissions would result in the noise level present at the affected premises exceeding the ambient noise level present at any time by more than 5 dB L_A slow.

6-2 The proponent shall ensure that noise emissions from those activities which are of concern to occupiers of noise-sensitive premises do not exhibit tones, amplitude and frequency modulation, and impulsiveness of a nature which increases the intrusiveness of the noise.

6-3 The proponent shall conduct noise surveys and assessments in consultation with the Environmental Protection Authority.

The following definitions apply to these conditions:

"ambient noise" means the generally non-intrusive noise which is always present due to such sources as motor vehicles operating on roads (other than those adjacent to the premises where the noise environment is being assessed), general industrial, commercial and other activities where individual noise sources such as fans, machinery, refrigeration and air-conditioning plant and vehicles cannot be identified, and natural noise sources such as wind-induced vegetation noise, but not the noise caused by the allegedly offending source or sources;

"dB $L_{A10,\ 1\ hour}$ slow " means the A weighted noise level exceeded for 10% of the time, determined over a time period of one hour with a sound level meter set to measure in slow dynamic response mode, and

"noise-sensitive premises" means any land or building that is used as a residence, guest house, hotel, motel, caravan park, school, church, hospital, or as an office or consulting rooms, where such office or consulting rooms are not located in an industrial area.

7 Control and management of the site

The Executive Director, Public Health will be responsible for ensuring appropriate management of the refuse site.

7-1 The proponent shall conform to the requirements of the Executive Director, Public Health with regard to the design, construction and on-going management of the waste disposal site.

8 Long-term environmental integrity of the site

The environmental integrity of the site should be ensured by appropriate mechanisms to address unexpected pollution, post-closure management and contingencies.

8-1 Prior to commencement of landfill operations, the proponent shall ensure that mechanisms are identified and implemented to guarantee the long-term environmental integrity and performance of the site to the requirements of the Ministers for Health and Environment.

9 Proponent

These conditions legally apply to the nominated proponent.

9-1 No transfer of ownership, control or management of the project which would give rise to a need for the replacement of the proponent shall take place until the Minister for the Environment has advised the proponent that approval has been given for the nomination of a replacement proponent. Any request for the exercise of that power of the Minister shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the project in accordance with the conditions and procedures set out in the statement.

10 Time Limit on Approval

The environmental approval for the proposal is limited.

10-1 If the proponent has not substantially commenced the project within five years of the date of this statement, then the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment shall determine any question as to whether the project has been substantially commenced. Any application to extend the period of five years referred to in this condition shall be made before the expiration of that period, to the Minister for the Environment by way of a request for a change in the condition under Section 46 of the Environmental Protection Act. (On expiration of the five year period, further consideration of the proposal can only occur following a new referral to the Environmental Protection Authority.)

11 Compliance Auditing

In order to ensure that environmental conditions and commitments are met, an audit system is required.

13-1 The proponent shall prepare periodic "Progress and Compliance Reports", to help verify the environmental performance of this project, in consultation with the Environmental Protection Authority.

Procedure

The Environmental Protection Authority is responsible for verifying compliance with the conditions contained in this statement, with the exception of conditions stating that the proponent shall meet the requirements of either the Minister for the Environment or any other government agency.

If the Environmental Protection Authority, other government agency or proponent is in dispute concerning compliance with the conditions contained in this statement, that dispute will be determined by the Minister for the Environment.

9. References

Australian and New Zealand Environment and Conservation Council 1992.*Australian water quality guidelines for fresh and marine waters* Australian and New Zealand Environment and Conservation Council November 1992

Health Department of Western Australia 1992 *Criteria for landfill management 1992* Perth, Health Department of Western Australia

National Health and Medical Research Council and Australian Water Resources Council 1987 *Guidelines for drinking water quality in Australia* Australian Government Publishing Service Canberra

Working Group on Waste Management 1991 *Waste management into the 21st Century* Perth, Health Department of Western Australia

Appendix 1

Proponent's commitments

9 COMMITMENTS

The Proponent, Pioneer-BFI Waste Services, provides the following commitments concerning the construction, operation and management of the proposed sanitary landfill on Lot 8 and Part Lots 6 and 3 South Cardup.

9.1 General Commitments

(1) The Proponent will adhere to the proposal as described in the Public Environmental Review (PER) and as assessed by the Environmental Protection Authority (EPA), and will fulfil the commitments made therein and summarized below.

(2) The Proponent will develop, operate and manage the proposed sanitary landfill to the satisfaction of all relevant Government agencies including the following:

- EPA;
- Health Department;
- Water Authority;
- Department of Conservation and Land Management; and
- Shire of Serpentine-Jarrahdale.

(3) As the proposed landfill is intended as a secure facility for the disposal of municipal, commercial and industrial waste only, the Proponent will ensure that hazardous, liquid and soluble chemical waste or other forms of intractable wastes will be excluded from the site.

(4) The Proponent will provide a contribution of $20 000 towards the provision of a transfer station at the existing Mundijong landfill to obviate the need for direct public access to the tipping face of the Southern Landfill.

9.2 Industrial Waste

(5) The Proponent will submit an assessment procedure that determines the acceptability (or otherwise) of various classes and types of industrial waste at this facility for approval by the Health Department of Western Australia and the Environmental Protection Authority. Only industrial waste that meets the acceptability requirements will be disposed of at the landfill. Forming part of the screening program will be elutriation and flash point testing and the installation of radiation detection equipment.

9.3 Design Features

(6) The landfill will be designed and constructed in accordance with accepted engineering practice for landfills, to the satisfaction of the Shire of Serpentine-

Jarrahdale. Where necessary, slope stability analyses of constructed walls and bunds will be undertaken to verify their integrity.

(7) The Proponent will progressively develop the landfill as a series of cells. The first cell will be sized to accommodate two years' refuse, followed by cells sized to accommodate one year's refuse, in accordance with the staging plan included in the PER.

(8) The Proponent will maintain a vegetated buffer zone with a minimum of 50 m in width around the perimeter of the landfill site.

The buffer zone will be comprehensively landscaped and will contain a perimeter fence and a firebreak track.

A landscaping plan shall be prepared, which shall be developed to achieve the following objectives:

(i) that initial planting is undertaken between the landfill and neighbouring properties, and the landfill and the South-Western Highway in the planting season before or immediately following the commencement of site development earthworks, whichever is the earlier; and

(ii) to provide vegetative cover on the bund walls and other earth structures as soon as practical following construction or final contouring, to minimise visual impact;

(iii) to allow integration with the longer term Post-Closure Plan.

The landscaping plans will be submitted to the Shire of Serpentine-Jarrahdale for approval within six months of the granting of all the necessary approvals to commence landfilling operations.

All initial plantings will be maintained at all times. Failed plantings will be replaced immediately to the satisfaction of the Shire of Serpentine-Jarrahdale.

(9) The Proponent will implement site security measures to control vandalism, theft and illegal dumping, including the construction of a 1.8 m high wire mesh with lockable gates around the landfill facilities.

9.4 Development and Operational Features

Site Preparation

(10) The Proponent will ensure that prior to the commencement of construction of the landfill cells, the final excavated surface is graded to allow gravity drainage across each of the landfill cells.

Cell Sealing

(11) During the development of landfill cells, the Proponent will ensure that a 1 m thick compacted clay liner will be constructed over the excavated surface. A 300 mm drainage blanket will be installed on the upper surface of the clay liner as part of the process of constructing the liner (refer to Commitment 17).

(12) The Proponent will ensure that clay sources used in construction of the landfill cells will meet the following specifications, under laboratory conditions:

- in situ permeability of 1×10^{-9} m/s or less when clay is placed and compacted; and
- gypsum content of less than 1%.

(13) The Proponent will engage specialist geotechnical consulting engineers to perform Quality Assurance/Quality Control (QA/QC) in the selection of clay and construction of the clay liner. A QA/QC report will be prepared for the clay liner of each cell for submission to the EPA and Health Department of Western Australia which certifies that the liner has been constructed to meet the permeability requirements with materials that have been tested and found suitable.

(14) The Proponent will ensure that, during development of the landfill cells, the liner will be constructed and compacted in thin layers (no more than 300 mm loose thickness) and density and moisture content will be controlled by continuous compaction testing.

(15) The Proponent will ensure that, prior to deposition of refuse within a landfill cell, a starter embankment of 2 m in height will be constructed around the perimeter of the liner to prevent leachate and stormwater from leaving the active cell. Construction techniques and controls for the starter embankment will be similar to those applying to the clay liner.

(16) The Proponent will ensure that, on completion of the clay liner and starter embankment, a 300 mm thick sand or gravel cover (the drainage blanket) will be placed to provide protection against cracking of the clay material resulting in desiccation.

(17) In the event that a suitable clay source for construction of the basal liner of a landfill cell or cells and the starter embankment, is not accessible, the Proponent will utilize a synthetic barrier membrane to seal the landfill cell or cells. In this event, the Proponent will submit a supplementary report to the EPA and Health Department specifying the liner system to be used and explaining the leachate collection system to be installed. This report would be submitted to the EPA and Health Department prior to commencement of construction of the cell or cells in which the alternative lining system was to be installed, and construction of the cell or cells will not commence until the EPA and Health Department are satisfied that the systems proposed are acceptable.

The Proponent will endeavour to place a layer of refuse over the completed drainage blanket at the earliest opportunity to provide additional protection against dehydration of the clay liner.

Leachate Collection

(18) The Proponent will ensure that a leachate collection system comprising a 300 mm deep permeable (permeability rating of 1 x 10^{-1} cm/s or more) drainage blanket is placed immediately above the basal clay liner. A series of drains consisting of high strength drain coil pipe will be installed in this layer, leading to a collection sump within each stage of the landfill. Leachate will be pumped from the sump to permanent leachate treatment tanks. The system will be designed to the satisfaction of the relevant authorities.

(19) The Proponent will ensure that leachate collection drains will gravity feed to a sump (lined with HDPE and filled with 20 mm gravel screenings) located within each stage of the landfill constructed integrally with the clay liner. The design storage volume of the sump will be determined by suitable modelling, to the satisfaction of the Water Authority of Western Australia.

(20) The Proponent will ensure that leachate will be recirculated through the refuse through a series of slotted pipes buried during landfilling, or by trickle irrigation of the internal surfaces of the active landfill cell.

(21) The Proponent will ensure that prior to depositing refuse in a newly constructed cell the leachate collection pipes are connected into the existing leachate collection system serving the completed cells allowing flow to the leachate sump within each Stage of the landfill.

(22) The Proponent will initially construct a permanent leachate treatment tank(s) to service all landfill cells within Stages 1 and 2. A second permanent leachate treatment tank will be constructed for Stage 3. The leachate treatment tank(s) will be covered and bunded appropriately. The leachate treatment tank(s) will be sized according to the results of the computer modelling to estimate leachate generation.

(23) As part of the normal site operational practice, the Proponent will pump leachate from the leachate sump of each Stage as required to the leachate treatment tank, or recirculate the leachate through the landfill as described earlier. Leachate within the treatment tank may be returned to the active landfill cell during dry periods for disposal through recirculation, or transferred to tanker trucks for off-site disposal.

Placement and Compaction of Refuse

(24) During operation of the site, the Proponent will ensure that refuse will be progressively placed and compacted into thin layers to maximize the compacted refuse density.

(25) During operation of the site, the Proponent will ensure 'Daily' cover (clean soil or other suitable material) is applied over the exposed surfaces at the active landfill area in layers (not less than 150 mm in the case of soil) so that there will be no

exposed garbage at the end of the day. The Proponent will apply 'Intermediate' cover to the top of the active landfill area and to surfaces which will be exposed to the environment for periods greater than six weeks in layers of not less than 300 mm.

Cell Completion

(26) The Proponent will ensure that, upon completion of refuse deposition, landfill cells will be covered with a 300 mm layer of low permeability clay over the Intermediate cover. A further 300 mm layer of sub-soil and a final 100 mm layer of soil suitable for vegetation establishment will be placed over the low permeability clay layer.

(27) The Proponent will ensure that, as part of on-going operational practice, the final landfill surface will be constructed to a predetermined crossfall to enhance surface runoff while safeguarding against erosion and to ensure that final contours of the site will blend into the surrounding environment.

(28) The Proponent will ensure that, on completion of each landfill cell, shallow rooted native vegetation (in accordance with advice from the Department of Conservation and Land Management and the Shire of Serpentine-Jarrahdale) will be established and maintained.

Surface Water Runoff

(29) During the active operation of a landfill cell, all surface water runoff from within the active cell will be treated as leachate and the Proponent will ensure that it will be collected and disposed of through the leachate drainage system.

(30) The Proponent will ensure that a site drainage system will direct runoff water from areas outside the landfill boundary, undeveloped areas within the landfill boundary and from the rehabilitated surfaces of completed landfill cells, away from the active tipping areas. Water from this system will not have contacted refuse, and therefore it will be uncontaminated and may directly discharge into the stream.

Road Construction and Maintenance

(31) The Proponent will ensure that, from the outset of the landfill operation, all roads to be used by visitors to the site will be sealed (up to the gatehouse).

(32) The Proponent will ensure that surface runoff from internal roads within the landfill site will not contact refuse and will be directed to the on-site sedimentation pond.

(33) The Proponent will ensure that a water tanker will be permanently on-site and available for dust suppression on all unsealed trafficked areas during dry periods or as required.

Wheel Cleaning Facilities

(34) As part of the initial site development, the Proponent will ensure that a wheel cleaning drive through is installed on the egress from the landfill cell area to dislodge debris and sediment from vehicle wheels. Debris collected in the sump will be regularly removed and disposed of within the active landfill cell. Contaminated water within the drive-through will be treated as leachate.

9.5 Management of Environmental Impacts

Water Resources

Commitments regarding Cell Sealing and Leachate Collection also pertain.

(35) The Proponent will ensure that an underdrain is constructed beneath the low permeability liner where required to collect and divert water egressing from the fractured granite to the sedimentation pond.

Odours

Commitments regarding Cell Sealing, Leachate Collection and Water resources also pertain.

(36) The Proponent will ensure that particularly odorous refuse will only be accepted at the landfill by prior arrangement and that any such material received will be covered immediately.

Litter

Commitments regarding Placement and Compaction of Refuse also pertain.

(37) The Proponent will ensure that any landfill related litter along the site access routes within a 2 km radius of the site is removed at least weekly.

(38) The Proponent will ensure that, as part of normal operational practices, portable litter control screens will be placed in the vicinity of the active tipping face to intercept any material blown from the tipping face.

(39) The Proponent will ensure that, as part of normal operational practices, any litter blown from the tipping face and intercepted by the portable screens, the site security fence or perimeter vegetation will be collected daily and returned to the tipping face.

Noise

Commitments regarding Design Features (perimeter buffers and earth bunds) also pertain.

(40) The Proponent will ensure that all vehicles and machines operating at the landfill site and which are under its control will be fitted with effective exhaust system silencers.

(41) The Proponent will limit the daily hours of operation of the landfill between 0600 and 1800 hours Monday to Saturday and 1000 and 1600 hours on Sundays.

Dust

Commitments regarding Design Features (perimeter buffers and earth bund), Road Construction and Maintenance, and Wheel Cleaning Facilities also pertain.

(42) The Proponent will, during initial site development and as part of normal operational practices, ensure the stabilization by vegetation or other means of disturbed areas not immediately needed for landfill operations.

(43) As part of normal operational practices, the Proponent will ensure that any unsealed trafficked areas are watered as necessary to lay dust.

(44) As part of normal operational practices, the Proponent will ensure that:

- active tipping area will be dampened (either by leachate irrigation or water application) as necessary to lay dust; and
- overburden, cover material stockpiles will be stabilized with temporary cover vegetation, mulching, watering or other technique to suppress dust generation.

Pests

Commitments regarding Placement and Compaction of Refuse also pertain.

(45) The Proponent will ensure that, as part of normal operational practices, any large appliances, crates etc, placed in the active tipping area will be specifically crushed before covering with refuse and cover material, and that any tyres dumped, unless shredded or split, will be spread out and carefully covered.

(46) The Proponent will implement supplementary control measures directed towards specific pest species on an as required basis in conjunction with and to the satisfaction of the EPA, Water Authority, Department of Conservation and Land Management, Shire of Serpentine-Jarrahdale or other regulatory authority.

Landfill Gas Management

(47) Prior to the commencement of tipping operations, the Proponent shall prepare a methane gas management plan which addresses monitoring, collection, disposal and potential beneficial uses of landfill gas to the satisfaction of the Environmental Protection Authority and the Health Department of Western Australia.

Initially, gas will be disposed of by flaring. When monitoring results indicate that action to manage landfill gas emissions is warranted, the Proponent will implement the methane gas management plan to the satisfaction of the Environmental Protection Authority on advice of the Health Department of Western Australia. The

Proponent will liaise with the relevant authorities regarding beneficial uses of landfill gas over the operating and post-closure life of the landfill.

Fire

Commitments regarding Placement and Compaction of Refuse, Landfill Gas Collection, and Landfill Gas also pertain.

(48) The Proponent will ensure that, from the outset of the landfill operation, site operational and management practices will not include utilization of fire except for the controlled flaring of landfill gas.

(49) The Proponent will ensure that from the outset of the landfill operation, adequate manpower and machinery resources to combat any fires which may occur within the landfill site will be maintained on-site during operating hours.

(50) The Proponent will make the water tanker truck available to the Shire of Serpentine-Jarrahdale or the Bush Fires Board to assist in fighting fires subject to the proximity of the problem and the Proponents needs at that time.

Social Impacts

Effectively all Commitments given pertain directly or indirectly to the amelioration of social impacts.

9.6 Environmental Monitoring

Water Resources

(51) The Proponent will progressively construct a series of dedicated groundwater monitoring bores to specifications acceptable to the EPA and the Geological Survey Division of the Department of Minerals and Energy. It is anticipated that monitor bores will need to be installed on the basis of geological considerations to ensure effective groundwater monitoring along sections of the site boundary down hydraulic gradient from areas used for landfilling.

(52) On commissioning of each monitor bore and prior to the commencement of tipping, groundwater will be sampled and analysed for a range of potential contaminants to provide background information on groundwater quality. Parameters determined will include pH, salinity (as TDS), redox potential, major ions, nutrients, total organic carbon, and heavy metals to the satisfaction of the Environmental Protection Authority on advice from the Chemistry Centre and the Water Authority of Western Australia.

(53) The Proponent will implement a programme of regular sampling from the monitor bores. This programme will be determined by the site hydrogeological considerations and to the satisfaction of the EPA and other relevant authorities, although, initially, sampling on a three-monthly basis is envisaged. Water samples collected will be analysed for a select range of parameters. These will include pH,

salinity (as TDS), zinc, total organic carbon, five-day biochemical oxygen demand, ammonia-nitrogen, and total alkalinity to the satisfaction of the Environmental Protection Authority on advice from the Chemistry Centre and the Water Authority of Western Australia.

(54) The Proponent will sample privately owned bores on selected properties in the vicinity of the landfill, initially on an annual basis, and analyse samples for a select range of parameters. These will include pH, salinity (as TDS), and ammonia-nitrogen to the satisfaction of the Environmental Protection Authority on advice from the Chemistry Centre and the Water Authority of Western Australia.

(55) Groundwater samples will be collected and analysed in accordance with recognized standard procedures, and to the satisfaction of the EPA and the Water Authority of Western Australia.

(56) If monitoring indicates that groundwater quality is being affected to an unacceptable degree, as determined by the Environmental Protection Authority, the Proponent shall prepare a strategy for clean-up of groundwater contamination, to the satisfaction of the Environmental Protection Authority on advice of the Water Authority of Western Australia.

(57) The Proponent shall implement the strategy for clean-up of groundwater contamination required by Commitment 56 (above) to the satisfaction of the Environmental Protection Authority on advice from the Water Authority of Western Australia.

(58) Should groundwater analyses indicate contamination by landfill leachate, the Proponent will immediately undertake further sampling and analysis for a more extensive range of parameters in consultation with, and to the satisfaction of, the EPA and the Water Authority of Western Australia.

(59) Any complaint about a deterioration in groundwater quality reasonably attributable to the landfill operation will be immediately investigated by the Proponent in consultation with, and to the satisfaction of, the EPA and the Water Authority of Western Australia.

(60) The Proponent will implement a programme of regular water sampling of the sedimentation pond, into which groundwater collected by the landfill underdrain flows. Water samples collected will be analysed for the same parameters as for samples taken from the groundwater monitoring wells to the satisfaction of the Environmental Protection Authority on advice from the Chemistry Centre and the Water Authority of Western Australia.

(61) As soon as leachate is detected in the leachate collection sump, and thereafter in conjunction with the groundwater monitoring programme, samples will be collected and analysed for comparison with anticipated leachate chemistry. Continuing sampling and analysis will be co-ordinated with the groundwater monitoring programme, and analytical results will be included in the periodic performance reports.

Other Environmental Monitoring

(62) From the outset of the landfill operation, the Proponent will maintain a complaints register in which details of any complaints from local residents, within the Serpentine-Jarrahdale municipality about the landfill operation will be recorded to the satisfaction of the EPA.

(63) The Proponent will monitor the activity of Silver Gulls at the landfill site, from the outset of landfilling operations, in consultation with, and to the satisfaction of, the Department of Conservation and Land Management.

(64) Following the installation of the landfill gas extraction system, the Proponent will measure landfill gas flow rates at six-monthly intervals. Results will be forwarded directly to the EPA and will also be incorporated into the periodic performance reports.

9.7 Performance Reporting

(65) The Proponent will submit annual performance reports to the EPA, Health Department and the Shire of Serpentine-Jarrahdale within three months following each anniversary of the commencement of the landfilling operation. These reports will address such matters as:

- the stage reached in the various operational and management programmes being implemented;
- results from monitoring programmes instituted, including the complaints register, and the response to any complaints received;
- modifications to the various programmes that have been implemented in response to monitoring results; and
- any unforeseen or extraordinary event associated with the landfill that has adversely affected off-site environmental quality (and the Proponent's response to that event) occurring during the preceding twelve months.

The final report submitted during a reporting period will provide a detailed review of performance over the entire period and of any modifications to operational and management programmes intended.

(66) The Proponent will respond, through an interactive process with the EPA, Health Department and the Shire of Serpentine-Jarrahdale, to any issues those agencies may raise following receipt of the performance reports.

(67) At the same time that periodic performance reports are submitted to the EPA, Health Department and Shire of Serpentine-Jarrahdale, the Proponent will make the reports available to relevant community organizations within the Shire of Serpentine-Jarrahdale

(68) Any unforeseen or extraordinary events associated with the landfill that adversely affected off-site environmental quality, and the Proponent's response to any such event will be reported immediately (by the Proponent) to the EPA, Health Department, and Shire of Serpentine-Jarrahdale.

9.8 Contingency Planning

(69) The Proponent will submit, for review by and approval from the Shire of Serpentine-Jarrahdale prior to commencement of landfilling activities, a contingency plan for emergency situations after consultation with the Shire of Serpentine-Jarrahdale, Environmental Protection Authority, Health Department of Western Australia, Bush Fires Board, Water Authority of Western Australia and the Department of Conservation and Land Management.

(70) The Proponent will respond to any unforeseen contingency associated with the landfill and which is producing a demonstrable and unacceptable off-site impact in consultation with the EPA, Health Department of Western Australia, the Shire of Serpentine-Jarrahdale, and to the satisfaction of the Minister for the Environment as appropriate.

9.9 Management Following Closure

(71) The Proponent recognizes that certain management responsibilities will continue following closure of the landfill site and will ensure that such responsibilities will be discharged in consultation with the relevant regulatory authorities (presently the EPA and the Health Department of Western Australia).

(72) The Proponent shall be responsible for construction, operation, decommissioning and post-closure management of the site until such time as the waste has fully degraded, to the satisfaction of the Environmental Protection Authority.

(73) Within two years after the date of commencement of construction, the Proponent shall prepare a draft decommissioning and post-closure management plan, to the satisfaction of the Environmental Protection Authority.

(74) At least two years prior to closure, the Proponent shall prepare the final decommissioning and post-closure management plan, to the satisfaction of the Environmental Protection Authority.

(75) The Proponent shall implement the final decommissioning and post-closure management plan required by Commitment 74, to the satisfaction of the Environmental Protection Authority.

9.10 Financial Assurances

(76) Within six months of commencement of landfilling operations, the Proponent will establish financial assurances in favour of the Shire of Serpentine-Jarrahdale to cover emergency contingencies and long-term risks in a form and to an amount acceptable to the Environmental Protection Authority, Health Department of Western Australia and the Shire of Serpentine-Jarrahdale.

(77) The amount of the financial assurances shall be reviewed every five years by the Environmental Protection Authority in consultation with the Shire of Serpentine-Jarrahdale and the Health Department of Western Australia.

(78) Company guarantees, if offered by the Proponent, shall be supported by annual audited accounts from each guaranteeing entity.

(79) The preparation of the legal agreement relating to the financial assurances shall be executed by the Proponent's solicitors at the Proponent's expense.

Appendix 2

Public submissions and proponent's response

SOUTHERN LANDFILL
SOUTH CARDUP
PUBLIC ENVIRONMENTAL REVIEW
RESPONSES TO PUBLIC SUBMISSIONS

Woodward-Clyde

300 Albany Highway
VICTORIA PARK WA 6100
Telephone: 09 362 4322
Facsimile: 09 361 4872

July 1993
Report Number 2535/3

S:\2535\C4087\22 July 1993\Pth\JSY.fct
AGC Woodward-Clyde - A.C.N. 000-691-690

1.0
EXISTING ENVIRONMENT DESCRIPTION

1.1 SURFACE WATER FLOWS AND MANAGEMENT

1.1.1 Submission: Karnet and Jandakot rainfall data should be used to determine criteria - not Perth Airport. One submission suggested Karnup figures should be used with a 200% factor.

Response: Preliminary surface drainage design was performed in accordance with accepted engineering practice, using the Australian Rainfall and Runoff 1987 Guide to Flood Estimation, published by the Institute of Engineers, Australia. Preliminary design for the area is based on a 1:100 year rainfall event for Zone 8 temporal pattern and appropriate design isopleths for the area as set out in the above publication.

1.1.2 Submission: The flow of water over the valley surface between Stages 1 and 2 needs re-assessment to ensure that the tip will not be washed away. The volume and velocity of the water is sufficient to carry blue metal 5 to 10km downstream (one owner about 5 km downstream noted that he built his roads from the blue metal washed downstream!). Concerned that volumes underestimated.

Response: As for 1.1.1.

1.1.3 Submission: Which stormwater criteria have been used for design (1:10 1:100 year event).

Response: Final design of the diversion drainage system has yet to be undertaken. A 1:100 year event criterion will be used in the design.

1.1.4 Submission: Provision for diverting surface runoff is insufficient - What will happen with a sudden downpour: possibly will wash much of the waste downstream.

Response: Sufficient provision is made in the design of the diversion of surface runoff to account for likely heavy downpours. Additionally, the landfill structures, both as initially proposed and with the reduction in total capacity as outlined in these responses to public submissions on the PER, will be designed to withstand any likely erosive event. Further, Pioneer-BFI Waste Services (PBFI) is committed to collection and disposal as leachate of rainfall/runoff entering the landfill cells, and disposal of leachate by recycling or disposal at an approved site. The financial guarantees committed to by PBFI will ensure that in the event of any problems arising with the drainage or leachate collection system these will be rectified to the satisfaction of the EPA and other designated authorities.

1.1.5 Submission: Disposal of any increase in stormwater runoff should be to the approval of the local authority and compensated either within the development or by local authority compensating basins

Response: It is not anticipated that any significant increase in runoff will occur from the site, as extensive clearing of vegetation will not be undertaken, and the establishment of the facility will not involve extensive sealed or covered areas. Additionally, PBFI has committed to the establishment of extensive areas of revegetation with indigenous species. A combination of all these factors is expected to result in no significant increase in runoff from the site.

All runoff leaving areas of the site altered by the development will be directed to the diverted drainage system, which will be linked to a sedimentation pond, as indicated in the PER. This will ensure that any increased sediment load will not be carried beyond the site.

1.1.6 Submission: The drainage system will need to be maintained forever.

Response: It is acknowledged that the drainage system will need to operate permanently to divert water around the Stage 1 landfill area. For this reason the

system will be designed to be a permanent structure requiring minimal maintenance, and to operate independently beyond the post-closure after care period (i.e. without requirements for pumping etc.).

1.2 GROUNDWATER

1.2.1 Submission: Groundwater inflow into the Darling Fault needs further investigation.

Response: The landfill liner is designed to have very low permeability, all material entering the landfill will be required to comply with defined acceptance criteria, and leachate will be fully contained by the liner. Contamination of groundwater is therefore not expected to occur from operation of the landfill. Monitoring bores will be established down gradient from the landfill to enable any contamination, if it did occur, to be detected, as committed to in the PER.

The inflow of groundwater into the Darling Fault is addressed in the PER. Information available indicates that the Armadale Shale underlying Stage 2 of the landfill reduces or inhibits the westerly flow of groundwater, though faulting of the shale may compromise these shales as a groundwater movement barrier. However, because of the regional geology, it is unlikely that large volumes of groundwater flow into the Darling Fault.

1.3 WIND

1.3.1 Submission: Wind measurements and intensity is lacking specifies to subject site - winds in the area are known to be stronger than at Perth Airport.

Response: It is acknowledged that wind velocities at the site could exceed those of Perth Airport. Specific wind data are not available for the site. However, PBFI has committed that landfilling operations at the site will be managed to ensure that wind blown litter and dust, and odour, do not become a problem. Daily covering of refuse and strict control of landfilling operations will ensure that the threat of fire at the site is minimised. Firefighting facilities will be appropriate for an area known to be subject to occasional high winds.

1.4 FLORA AND FAUNA

1.4.1 Submission: Fauna and vegetation survey is incomplete (ie Wandoo tree species).

Response: An assessment of vegetation at the site showed that the Stage 1 landfill area has been highly disturbed by agricultural clearing and use, and the Stage 2 site by clay removal for brickmaking. The vegetation is therefore considered to be of little conservation value. The description in the PER noted the presence of Eucalyptus calophylla, E. rudis and E. marginata on the land on which Stages 1 and 2 of the landfill are proposed, but did omit to include the presence of E. wandoo (Wandoo). These species exist predominantly as isolated trees without indigenous understorey or groundcover species. As part of PBFI's commitment to maintaining existing vegetation on the site, the maximum number possible of these trees will be retained on the site during and following landfilling operations.

1.4.2 Submission: Valley is an attractive tree-line creek, in harmony with its surroundings not a degraded environment

Response: The valley has been cleared for agriculture, and only isolated remnant trees have been retained from the original vegetation. It has therefore little conservation value, and can be considered to be degraded with respect to its condition prior to agricultural development. Further, the valley has in part been infilled by Pioneer's quarrying and associated activities.

2.0
ACCEPTABLE WASTES

2.1 Submission: There is a need for a clearer definition of what constitutes non-hazardous and hazardous waste.

Response: The Operations Management Plan in Appendix E of the PER clearly describes the wastes which will be accepted into the landfill, and those that will not be accepted.

2.2 Submission: US EPA criteria only measure solubility of products in isolation from other pollutants (Eg acids and alkalies) which may increase solubility and increase leachate concentrations.

Response: Acceptance criteria described in the PER are a guide based on the assessment approach and procedures currently employed by regulatory authorities in Victoria, as stated in the PER. Acceptance criteria for the Southern Landfill will conform to those currently being developed by the Health Department of Western Australia.

2.3 Submission: Pyrites from the CSPB site in East Fremantle would not be acceptable at this tip.

Response: Pyrites from the CSPB site may need to be pretreated before they would become acceptable at the Southern Landfill site to comply with the acceptance criteria referred to above. Pre-acceptance testing will be conducted on all industrial material before acceptance for disposal at the Southern Landfill.

2.4 Submission: The dumping of contaminated wastes from places such as Kwinana could result in a disastrous outcome.

Response: Disposal of wastes from Kwinana will only be allowable if the wastes comply with the acceptance criteria. As the landfill is designed for disposal of materials meeting these guidelines, minimal risks will be involved in such disposal. Financial guarantees to be put in place by PBFI will ensure that

any problems which might arise with landfill management would be rectified to the satisfaction of the EPA.

3.0
EARTHQUAKES AND LANDFILL STABILITY

3.1 EARTHQUAKES

3.1.1 Submission: Concerned that an earthquake may break clay seal (based on deep large cracks generated across Jarrahdale and Scrivener Roads during the Meckering earthquake and 60 cm chasm on Nettleton Road on another occasion). Contaminated soils may contaminate groundwater if an earthquake occurs.

Response: The probability of significant seismic activity at the Southern Landfill site is addressed in the PER. The landfill will be engineered to be capable of tolerating likely earthquake events, and the risk of failure of the landfill is considered to be extremely small. The financial guarantees to be provided by PBFI will be sufficient to cover full rectification of any problem occurring with the landfill, including the worst case scenario.

A report by the USEPA following the California earthquake in 1987, which registered 7.1 on the Richter Scale found that no structural damage was sustained by any landfills within a 40 km radius of the centre of the earthquake, further indicating that the engineering design used in today's modern landfills is able to satisfactorily account for seismic activity.

3.2 LANDFILL STABILITY

3.2.1 Submission: Concerned non-structured bund may eventually lead to movement of the mass down the valley.

Response: The landfill will be designed and constructed in accordance with accepted engineering practices for landfills, to the satisfaction of the Shire of Serpentine-Jarrahdale. Where necessary, slope stability analyses of constructed walls and bunds will be undertaken to verify their integrity.

4.0
BUFFER ZONE ISSUES

4.1 ON SITE BUFFER

4.1.1 Submission: On what basis was the 50m buffer chosen.

Response: The 50 m buffer zone width was chosen on the basis of requirements for adequate visual and noise screening for the site. No statutory requirements currently exist in Western Australia to determine dimensions for the on-site buffers. It should be noted that the buffer zone will have a minimum width of 50 m.

4.1.2 Submission: The 50m vegetation buffer zone of trees and shrubs should be seeded with indigenous species and would provide a much needed 'green strip' to the area.

Response: PBFI has committed to establishment of the on-site buffer zone with retained and planted vegetation, and plans for landscaping will be submitted to the Shire of Serpentine-Jarrahdale (Commitments 8 and 9, and Appendix E2.3.2) within six months of the granting of all necessary approvals to commence landfilling operations.

PBFI also commits to the use of indigenous species in the buffer zone, to provide a 'green strip' in the area.

4.2 OFF-SITE BUFFER

4.2.1 Submission: Private land (Lot 18) affected by buffer is within 40-50 m of tipping face.

Response: PBFI has specified that the off-site buffer should be 200 m to the nearest house, and 500 m to the nearest residentially zoned area. The proposed landfill and associated buffers comply with these commitments.

4.2.2 Submission: Need of much larger buffer/ 500m at least/ 500m as recommended by Health department of WA/ to ensure adequate litter control, pest control, fire control, landfill gas odour control.

Response: The Victorian EPA guidelines, upon which the buffer distance is based, are considered adequate for properly managed landfills, and these have been adopted for the Southern Landfill proposal. The Health Department of WA's 1992 draft criteria for landfill management have not been adopted by government, and are presently subject to modification by the Department. Finalisation of the effective off-site buffer will be subject to agreement between PBFI, the Shire of Serpentine-Jarrahdale, and the Health Department.

4.2.3 Submission: A 2-500m landscape buffer zone as a bush corridor should be promoted.

Response: PBFI agrees that a landscape buffer should be promoted.

4.2.4 Submission: The buffer should be secured by the proponent and not inflicted on neighbouring properties. Has the permission of affected landholders been sought? (One submission from a neighbour noted no direct consultation). Use of land for buffer without consultation could result in court action.

Response: Under the operating conditions of the Pioneer quarry, a 2 km buffer presently exists around the quarry under the State Planning Commission's Basic Raw Materials Policy, as stated in the PER. The proposed Southern Landfill lies within this zone. PBFI believes that the proposed buffers are adequate for the purpose intended, at least until other specific local regulations are developed.

4.2.5 Submission: Buffer relies on neighbouring properties and State Forest suffering devaluation so proponent can make profit.

Response: As for 4.2.4.

4.2.6 Submission: The spread of residential properties through this area would be constrained for several decades by this proposal.

Response: Residential development in the area is already constrained by the 2 km buffer around the quarry, under the State Planning Commission's Basic Raw Materials Policy, the planning provisions of the Shire of Serpentine-Jarrahdale's Town Planning Scheme No. 2 and the Rural Strategy, and under the Perth Metropolitan Region Scheme. The proposed landfill development does not exacerbate the existing constraints.

5.0
VISUAL IMPACTS

5.1 Submission: The need to protect visual integrity of the Darling Scarp is recognised in several reports (Eg System 6). Further visual assessment should be done before approvals are given. The valley fill would be highly visible.

Response: The size of the proposed valley landfill has been reduced as a result of concerns expressed to PBFI during the environmental impact assessment. The new landform is 25% less in area and 15 metres less in height. A visual impact assessment, comparing the initial and revised valley landform has been and is attached to this response (Attachment A). Reduction in the area of Stage 1 will also reduce the area of land needed to be cleared for site works for Stage 1. PBFI is committed to tree planting for screening and general landscaping purposes as part of the development and operation of the landfill. Further tree planting will be extended to the road verge for the South-Western Highway (Attachment A).

5.2 Submission: A landscaping schedule should be negotiated up-front and bonds required. Stormwater drains should be landscaped.

Response: PBFI has undertaken to submit landscaping plans to the Shire of Serpentine-Jarrahdale for approval within six months of the granting of all necessary approvals to commence landfilling operations (see Appendix E2.3.2).

5.3 Submission: It is difficult to understand that in these times even further damage to the escarpment through mining and landfilling is being considered.

Response: No comment.

5.4 Submission: The site should be either re-developed as parkland or re-forested to its original state.

Response: The site will be developed as grassland in Stages 1 and 3 and parkland in Stage 2 after the cessation of landfilling activities.

6.0
LEACHATE CONTROL, GROUNDWATER AND GROUNDWATER MONITORING

6.1 Submission: It is considered that the site is in an area where the risk of contamination is small.

Response: Agreed.

6.2 Submission: System relies on dispersion, but no dispersion model appears to have been produced.

Response: The system does not rely on dispersion. The system relies on containment of all solid material and leachate within the landfill.

6.3 Submission: Leachate should be removed off-site rather than recirculated.

Response: PBPI considers that leachate recirculation poses minimal environmental risks. Recirculation of leachate promotes breakdown of organic material in the landfill, promoting gas generation (with will be subject to stringent management), and reducing the length of the aftercare period for the landfill.

6.4 Submission: The proposed compaction of clay has major flaws because of the lack of uniformity of the material, varying permeability rates when exposed to contaminants, solubility and dispersability when subject to pollutants and drying, cracking and shrinking depending on moisture conditions.

Response: The quality assurance/quality control program for construction of the clay liner will ensure that permeability specifications are met (Commitment 14).

6.5 **Submission: Arguments that clay soil in this area is less likely to allow leaching of hazardous material is misleading. Control of material to be dumped at the site could not be stringent enough and hence toxic materials would poison the water we drink.**

Response: The PER proposes that the landfill will be constructed with a compacted clay liner and a leachate collection system, and all material accepted into the landfill will be subject to stringent testing and acceptance criteria. These provisions, together with the hydrogeological characteristics of the site (Section 4.4 of the PER), should ensure that groundwater in the area will not be contaminated. As an additional check, groundwater monitoring bores will be installed at the site to monitor water quality.

6.6 **Submission: Please provide details for specifications of leachate pipe, sand and filter materials. What provision is made for failed components?**

Response: The leachate collection system will be conservatively designed. All manufactured engineering components will comply with appropriate Australian standards. Sand and filter materials will be conservatively selected to comply with accepted engineering practices. The financial assurances committed to by PBFI will ensure that any problems will be rectified by PBFI to the satisfaction of the EPA. Specific engineering details will be provided to the relevant government authorities as part of the Works Approval application to commence construction.

6.7 **The pattern of monitoring bores should be on the basis of good geological and geophysical information so that groundwater flow paths near the site are intersected, rather than establishing a grid pattern.**

Response: Agreed.

7.0
WATER QUALITY AND EFFECTS ON WATER SUPPLIES

7.1 Submission: Concerned about water quality from sedimentation pond being discharged into natural drainage system.

Response: Water will flow from the drainage around the landfill and from the sealed road areas etc into the sedimentation pond. No leachate will be directed into the sedimentation pond. The pond will be designed to allow sediment to settle, ensuring the quality of water discharged into the creek system meets current standards. The quality of water in the sedimentation pond will be regularly monitored (Commitment 65), as will the need for removal of sediment sludge from the pond.

7.2 Submission: Permanent biological testing of the run-off water from the tip site and quarry should occur.

Response: Water quality monitoring committed to by PBFI (Commitments 57, 58, 59, 60, 65, 66) will continue until the aftercare period for the landfill has been completed, and the company is released from the financial assurances bonds.

7.3 Submission: Concerned that fall-out from burning gasses and leachate will affect our water supply, which is about 1 km from the site.

Response: The landfill will be fully lined with all leachate being collected for:

(i) Recirculation back to the landfill or
(ii) Offsite treatment or
(iii) Onsite treatment.

No leachate will be released into external drainage.

Landfill gas will be flared at high temperature to remove odorous gases. No air-borne particulate material will be released as part of that process.

7.4 Submission: Concerned about leaching contaminants into groundwater.

Response: As for 6.5 and 7.3.

7.5 Submission: Many residents of Cardup are dependent on groundwater. No company can guarantee that underground supplies will not be contaminated. If the proposal proceeds the company should be required to:

- **Meet expenses of connecting houses west of the quarry to scheme water; and**
- **Allow only putrecibal waste and inert commercial and industrial waste.**

Response: The Southern Landfill will accept only wastes that comply with the acceptance criteria, and all landfilled material will be contained by the clay liner.

PBFI has also committed to groundwater monitoring around the landfill and in privately owned bores, to detect any decrease in groundwater quality should it occur (Commitments 56 - 60).

7.6 Submission: If groundwater contamination is detected, what work suspension measures will be invoked?

Response: PBFI will prepare a Landfill Management Plan, including contingencies for responding to any problems which may arise, following approval to construct the landfill. The financial assurances to be implemented by PBFI will ensure that any problems which arise will be rectified to the satisfaction of the EPA.

8.0
OPERATIONAL PROBLEMS

8.1 AIR QUALITY

8.1.1 Submission: Concerned about increase in dust pollution and environmental hazards to the atmosphere.

Response: The PER contains full descriptions of the environmental management proposals for the Southern Landfill, and contains numerous commitments relating to environmental management to address the air quality concerns.

8.1.2 Submission: Concerned that contaminated dust will be blown onto adjacent properties. This may contaminate dairy produce. One submission was concerned dust would reach Byford.

Response: As for 8.1.1

8.1.3 Submission: Concerned about strong odours upwind from the valley, even with the use of daily cover. Submission expressed concern about odours reaching the taxpayer subsidised "Showcase WA Centre" at Tumblegum Farm, Cardup Village and Byford townsite.

Response: As for 8.1.1

8.1.4 Submission: Noxious gases will be released into the atmosphere through incineration.

Response: Landfill gas generated at the site will be flared, as described in and committed to in the PER (Commitments 50, 51, 52). Commitments 53 and 54 specifically exclude the incineration of waste material at the site, apart from landfill gas flaring.

8.2 LITTER

8.2.1 Submission: Concerned about windblown litter. What does routine litter collection mean (ie daily, weekly etc)?

Response: Litter will be collected daily

8.2.2 Submission: How is this to be cleared from private land adjoining, especially where tiping edge is 40-50m from the nearest property. Also pathogens and noxious weed seeds could be blown to adjoining properties.

Response: Litter which may escape the litter screens will be manually collected. Collection on private property will be conducted only with the permission of the owner(s) of the land.

Risk of pathogen release will be minimised through the practice of daily covering of the active tipping face.

In accordance with the *Agriculture and Related Resources Protection Act 1976*, PBFI will be required to monitor the landfill site for the presence of noxious weeds and to take action to remove such weeds immediately if they are found to be present.

8.3 NOISE

8.3.1 Submission: Noise levels are likely to be higher from this operation than from quarrying. For example noise trucks grinding up the hill to the site is a concern and the number of trucks is likely to be larger. The proposal underestimates several factors.

Response: The PER contains commitments relating to noise levels at the site, and to hours of operation of the facility (Commitments 43, 44). Section 7.5 in the PER discusses noise issues at the site. It is noted that the Pioneer Quarry operations have not received complaints about noise, and much of the operations of the proposed landfill will be below natural ground level. Noise attenuation

will be further assisted by the buffer zone, and by revegetation to be conducted at the site.

8.3.2 Submission: Concerned that the site will operate on Saturday and Sunday. Operations should be prohibited on Sunday and 7am-6pm Mon-Fri and 7am to 1pm Saturday.

Response: The site will open between 6am and 6pm Monday to Saturday for general receival of approved landfill material. On Sundays, the site will be open between 10am and 4pm only for servicing the requirements of transfer stations, including the station proposed for construction at the existing Mundijong tip site. It is expected that the average number of daily truck loads will be significantly less on Saturdays and Sundays, relative to the rest of the week.

8.3.3 Submission: Increased noise levels will affect our residence (Comment received from residents on Kiln Road and others 2.5 kilometres away).

Response: PBFI do not accept that noise from landfilling activities at the Southern Landfill site will be audible under normal circumstances 2.5 km from the site.

8.3.4 Submission: Noise from Henly park is occasional and could be controlled by putting mufflers on equipment.

Response: Agreed.

8.4 PESTS

8.4.1 Submission: An air and land disease threat will be created by an increase in seagull and non-indigenous rodent species.

Response: PBFI has committed to daily covering of the landfilled material (Commitment 26), to ensure that no material will be exposed at the end of each operational day. Commitments (48, 49) have also been made to pest management. These commitments will ensure that the seagull and rodent populations at the site are not encouraged.

8.4.2 Submission: A zero seagull population should be maintained.

Response: Agreed, as for 8.4.1

8.4.3 Submission: A vermin proof fence should be constructed.

Response: PBFI believe that there is no justification for the construction of a vermin-proof fence, given the provisions for vermin control which are committed to in the PER. However, it should be noted that a 1.8 m chainwire fence will be provided around the perimeter of landfill activities.

8.5 LANDFILL GAS

8.5.1 Submission: What percentage of gas will be collected? Concerned remaining gas will be dispersed to neighbours especially prior to capping & Stage 1 (this would take 2 years).

Response: Capping of the landfill will commence in year 1. Of the gas produced, 90% will be collected and flared. The balance will be lost to the atmosphere. These numbers will be verified by the monitoring of monitor bores installed as part of the landfill gas management provisions.

8.6 FIRE

8.6.1 Submission: The proposal greatly increases the risk of fire in the adjacent State Forest through dumping of highly flammable materials.

Response: Commitments (53, 54, 55) are made in the PER with respect to fire management. A Fire Management Plan will also be developed as part of the overall Landfill Management Plan to be developed by PBFI. PBFI will also control the types of materials deposited into the landfill, and the use of daily cover of material deposited into the landfill (Commitment 26) will minimise the likelihood of fire.

8.6.2 Submission: A fire management plan should be negotiated which includes consideration of the bushfire rating and fire fighting equipment.

Response: As for 8.6.1

8.7 TRAFFIC

8.7.1 Submission: More information should be provided on truck movement routes and intensity on the road network. The affect on the Byford Township in terms of noise, congestion and times of operation are unresolved. One submission was concerned proposal will make it more difficult for school children to cross the road.

Response: The issue of traffic impacts on the Byford township was not specifically addressed in the Public Environmental Review, because it was not considered to be a potentially major adverse impact.

(i) Predicted Access Routes

It is not possible at this time to accurately specify transport routes or traffic volumes that will be associated with operation of the landfill. However, assuming that the landfill operates at 125,000 tonnes of waste per year it is likely to receive 5,000 tonnes per annum of municipal waste from the Shire of Serpentine-Jarrahdale, 70,000 tonnes per annum of commercial waste supplied by private collection companies (including BFI Waste Services), and 50,000 tonnes of industrial waste supplied by private operators. Potentially these waste loads could be generated from a number of sources and hence geographical locations.

The commercial waste is expected to be primarily sourced from the Perth area and therefore will probably be transported through Byford en route to the landfill. The industrial waste is expected to be mainly sourced from the Kwinana region and therefore these wastes could be transported on roads that connect with South Western Highway south or north of Byford. The municipal waste from the Shire of Serpentine-Jarrahdale will be transported to the landfill

from a number of directions, not all of which would involve transportation through Byford.

(ii) Existing and Predicted Traffic Loads

The most recent (1988) traffic count figures from the Main Roads Department show that at that time 5,500 vehicles used South Western Highway (south of Kiln Road) daily. In February 1992 traffic counts were taken in Byford at Clifton Street, north of the major intersection at Nettleton Road. Total vehicle movements between 7.00 am and 7.00 pm for South West Highway were 7,463, 14% (approximately 1,044) of which were heavy vehicles.

The following table presents an estimate of the type and frequency of the heavy traffic that will be associated with operation of the landfill at annual volumes of 125,000 tonnes and 225,000 tonnes (being the anticipated fully developed operating capacity of the site in 8-10 years from commencement). The figures are based on a five day working week because in reality most of the waste delivery will be limited to Monday-Friday. It is emphasised that these figures are indicative only at this time, nevertheless the volume of additional traffic generated by the landfill operation is minor (initially an additional 56 trucks per day will pass through Byford).

Waste Category	Transport Medium	Average No. of Loads Per Day (Based on a 5 Day Working Week and a 125,000 t/a)	Average No. of Loads Per Day (Based on a 5 Day Working Week and a 225,000 t/a)
Municipal	5 tonne capacity truck	4	8
Commercial	8 tonne capacity truck	35	64
Industrial	12 tonne capacity truck	17	30
Total		56	102

Assuming that all commercial and half the municipal and industrial waste passes through Byford, the traffic impact of the landfill will amount to an increase in heavy truck movement of 10.7%

Existing access to the Pioneer quarry is via South Western Highway. From the Highway a sealed bitumen access road runs east up the hill and then deviates round the slope to the weighbridge. Currently there are usually 40 - 45 laden truck movements (33 tonne total capacity truck and trailer combinations) per normal working day (Monday to Friday) on this access road. The road is used solely to provide access to the Pioneer Concrete quarry. An increase in traffic loads on this road associated with operation of the landfill will therefore not affect the community, as this road is not generally available for public use.

(iii) Hours of Operation and Predicted Traffic Activity

Site operating hours, and consequently landfill-related traffic movements, will be restricted to between 0600 and 1800 hours Monday to Saturday and 1000 and 1600 hours on Sunday. These operating hours are more extensive than those which currently apply the existing Pioneer Concrete quarry operations. However, in terms of traffic activity on the South Western Highway, the hours of operation are within the usual periods of peak traffic activity.

(iv) Impacts Associated with Material Transported

Waste will be supplied to the landfill in fully enclosed refuse trucks as are routinely operated by BFI and other commercial waste collection companies. The use of such vehicles will preclude release of loose litter/waste onto the road during transport and will provide an adequate buffer against emission of odours from putrescible wastes while they are in transit. Any odours associated with the transport of such wastes are arguably no greater than those associated with the transport of livestock in cattle trucks, which is a relatively common activity in this region.

It should also be noted that South Western Highway is a major State highway that has been designed and engineered to cater for heavy traffic. State and local government planning schemes for areas encompassing the Highway have taken

the associated traffic impacts (noise, public safety, drainage, etc.) into account in the allocation of roadside buffer zones, and set-back distances for buildings and amenities.

8.7.2 Submission: The proposal will increase heavy vehicle traffic by /200%/ more than 80 trucks per day/ through Byford.

Response: As for 8.7.1

8.7.3 Submission: Concerned at truck traffic pulling out onto South West Highway, which has a 110km/h speed limit, will result in a fatal accident.

Response: The intersection of the existing quarry access road and South Western Highway will be constructed to current design standards, and subject to approval by the Mains Road Department of Western Australia.

8.7.4 Submission: The provision of an acceleration lane does not conform with normal practice and would be unacceptable unless the need can be substantiated beyond information in the PER.

Response: All traffic using the PBFI facility will be subject to the traffic laws of Western Australia.

8.8 SOCIAL IMPACT

8.8.1 Submission: I could not live with this terrible threat to our lives and would sell up and move.

Response: No comment.

8.8.2 Submission: The proposal will reduce the value of our property and impinge on the lifestyle in a clean open area which we sought by purchasing in this area.

Response: A US report is available from PBFI on the issue of Landfills and their impact on property values.

8.9 MONITORING AND REPORTING

8.9.1 Submission: The company's commitment to monitoring and control of leachates is supported. Management that permits a coordinated flexible response to contingencies which may arise is supported.

Response: No comment required.

8.9.2 Submission: Self testing of waste types accepted is not satisfactory because of the potential for biophysical damage.

Response: All waste testing will be conducted by NATA registered laboratories, and only wastes complying with the designated acceptance criteria will be disposed of in the landfill.

PBFI will establish, if the community is willing to participate, a community liaison committee (CLC).

The purpose of this CLC shall be to improve communication between PBFI and the community, and to disseminate information to and from PBFI.

If supported by the community the CLC shall:

(i) Meet as required but at least quarterly.
(ii) Comprise one representative of PBFI and at least three representatives from the community.

It is suggested that:

(i) The community representatives be appointed by Shire of Serpentine-Jarrahdale after receiving recommendations from the Ratepayers Association.

(ii) At least half yearly representatives of the Shire of Serpentine-Jarrahdale, EPA and Health Department be invited to attend a CLC meeting.

(iii) At each meeting PBFI table any new reports prepared since the last meeting and a copy of the "Landfill Complaints Register".

8.9.3 Submission: Annual reports should be public information.

Response: Annual reports on the operation and environmental performance of the Southern Landfill will be made available to the CLC.

8.9.4 Submission: Concerned that some problems, such as odour will not be able to be fixed even if complaints are received. Will a record of response to complaints be kept to assess effectiveness of responses. How do you assess if odour problem fixed to a satisfactory level.

Response: The operation of the Southern Landfill will be subject to scrutiny by the EPA, the Shire of Serpentine-Jarrahdale and the Health Department of W.A. Environmental performance of the landfill and the operator (PBFI) will also be subject to the performance bond financial guarantees committed to by PBFI. PBFI also commits to the establishment of a complaints register for the site, and information on complaints received and action taken will be submitted to the EPA and the Shire of Serpentine-Jarrahdale as part of the annual report on operations of the site.

9.0
GENERAL COMMENTS

9.1 NEED FOR PROPOSAL AND TIMING

9.1.1 Submission: Tip is not required at the present time. Should be delayed until recycling committee presents its final report.

Response: The Health Department of W.A. advertised some two years ago for expressions of interest from private enterprise to establish a landfill to take the wastes now proposed to be accepted at the Southern Landfill site. The need for the facility has in fact increased since then, and is supported by the Health Department. Additionally there a need in the Shire of Serpentine-Jarrahdale for a site to replace the current disposal site at Mundijong.

9.1.2 Submission: Proposal to shift industrial waste should wait until Stage 3 becomes available. There is too much potential for Stages 1 and 2 to pollute the stream and the Peel-Harvey Estuary.

Response: The Southern Landfill will be constructed and operated to prevent adverse environmental impacts. The landfill will be lined and leachate controlled, and operations will be strictly controlled as described and committed to in the PER.

9.1.3 Submission: Concerned that the approval will be given for entire proposal too quickly because the Shire needs an new site.

Response: The Southern Landfill proposal is subject the normal approvals processes applying to proposals of this type.

9.1.4 Submission: Approval should not span the thirty to sixty years not appropriate because of potential for growth in the area and changing landfill operating standards over time.

Response: The landfill operation will be subject to on-going monitoring and review by the regulatory authorities to ensure that the operations comply with current standards. The third stage of the proposal is for landfilling of the existing Pioneer quarry, which is the only practical method for rehabilitation of quarries of the size of that at the site.

9.2 PRIVATE OWNERSHIP

9.2.1 Submission: The principle of a private enterprise company receiving reward based on the amount of polluted material it can secure in the shortest amount of time is of concern. Instead the principle waste minimisation should be promoted.

Response: PBFI supports the principle of waste minimisation. However waste is still being generated within the community, and a requirement exists to dispose of the waste in an environmentally responsible manner. The proposed Southern Landfill is designed to address this need.

9.2.2 Submission: Concerned about private operation of the landfill. Legal agreements should be drafted by the State or Shire at the proponents expense. Company guarantees should not be considered under any circumstances. Bank guarantee must be tens of millions. Note that no ACN numbers for the companies in the Public Environmental Review.

Response: PBFI has committed to providing financial assurances concerning the Southern Landfill, at the expense of PBFI (Commitments 81 - 84). These are expected to take the form of both company and bank guarantees.

Company A.C.N. numbers are not required to be provided in PER documents.

9.3 RAW MATERIALS EXTRACTION

9.3.1 Submission: The proposal is affected by the Department of Planning and Urban Development "Basic Raw Materials Policy Statement" which gives excavation as a priority over other land uses. Establishment of the landfill Stages 2 and 3 must occur only after excavation is complete.

Response: PBFI supports the statement. The staging of the landfill will allow raw materials extraction to be completed before landfilling commences.

9.4 ACCEPTABILITY OF VARIOUS STAGES

9.4.1 Submission: I am opposed to Stage 1 of the landfill because the valley is unsuited for this purpose, and I do not agree that the valley is degraded land.

Response: PBFI has proposed the valley fill in response to current market requirements, as the first stage of a facility that will ultimately rehabilitate two areas of land which have been used for extractive industry. The areas proposed for Stages 2 and 3 of the landfill (the shale pit and the quarry) are still subject to further raw material extraction and are not available to meet the current (immediate) need for landfilling space.

The area of the proposed valley fill has been cleared for agriculture, and quarrying-related activities in its eastern portion.

9.4.2 Submission: Using quarries for landfill is acceptable, but are concerned about using a valley as a landfill site on environmental and visual sensitivity grounds.

Response: As for 9.4.1. It should be noted the proposed size of the valley landfill has been reduced from 1.8 million cubic metres to 1.1 million cubic metres, in response to concerns expressed to PBFI during the environmental impact assessment of the Southern Landfill proposal. Potential visual impacts of the valley fill have been reduced accordingly.

9.4.3 Submission: Stage 3 is acceptable for industrial waste.

Response: PBEI agrees with the comment. Stages 1 and 2 are also suitable for acceptance of the wastes proposed, as these stages, and Stage 3, will be engineered for this purpose.

10.0
GENERAL COMMENTS

10.1 Submission: No information to compare this operation with others in the world - we need the worlds best

Response: The proposed Southern Landfill is designed and will be constructed to international standards.

10.2 Submission: Concerned site will contaminate groundwater and increase fire hazards.

Response: See responses to other submissions.

10.3 Submission: That the quarry is not aesthetically pleasing is no reason to pollute the area and surrounds with landfill.

Response: The proposed landfill development will be strictly engineered and operated to minimise adverse environmental impacts. Upon closure of the landfill stages, they will be capped and landscaped, effectively rehabilitating the shale pit and quarry.

10.4 Submission: Concerned that Stage 2 mining rehabilitation plan now abandoned.

Response: The existing shale pit area will be landfilled as Stage 2 of the Southern Landfill proposal, and vegetated and landscaped to the satisfaction of the EPA, and in consultation with the Shire of Serpentine-Jarrahdale. Land use at the end of the post-closure aftercare period will be parkland for Stage 2, and agriculture for Stages 1 and 3.

Approval of the Southern Landfill proposal will involve acceptance of the rehabilitation proposals, thereby making existing quarry rehabilitation plans redundant.

10.5 Submission: Want a total study of cumulative impacts of quarrying and landfilling.

Response: A total study of the cumulative impacts of quarrying and landfilling is beyond the scope of the PER.

10.6 Submission: Tip should not be located on the Darling Scarp; suggest using Bauxite pits east of the scarp.

Response: The distance over which wastes would need to be hauled and the availability of the bauxite pits for landfilling preclude this option.

10.7 Submission: Stage 1 will not be useful to the community for about 100 years.

Response: Stage 1 is currently privately owned and lies within the existing quarry buffer. This buffer will be maintained for the duration of the quarry activity.

10.8 Submission: Contrary to PER site is not accessible to the community - this depends on construction and waste transfer stations.

Response: The landfill will be available for disposal of community refuse, but direct access to the landfill by the public will not be permitted. Household wastes are to be delivered to off-site transfer stations, from which only licensed commercial contractors or council vehicles will be able to collect the wastes and deliver them to the landfill for disposal.

10.9 Submission: The life expectancy of the site is overestimated.

Response: The life expectancy of the site will depend entirely on the ultimate size of the landfill stages, in particular the quarry, and the quantity of wastes received.

10.10 Submission: Past assurances about safety has led to caution about accepting such assurances.

Response: No comment.

10.11 What is the point of having an EPA when one decision such as allowing this proposal will destroy the whole ecosphere in the district of Cardup.

Response: No comment.

ATTACHMENT A

VISUAL IMPACT

Concerns over the visual impact of the proposed Stage 1 landfill were expressed to PBFI by the Shire of Serpentine-Jarrahdale and members of the public during the preparation of the PER, and during the public response period. To address these concerns, PBFI has revised the size and commissioned a Visual Impact Assessment of Stage 1. The results of the Visual Impact Assessment are presented in this attachment.

Stage 1 of the landfill has been reduced from the 1.8 million cubic metres total volume proposed in the PER, to 1.1 million cubic metres. This action was initiated by PBFI following revision of the required life of Stages 1 and 2, and in response to concerns with respect to the visual impact of the original proposal. The reduced volume results in a reduction of 25% in the total area of Stage 1, and a reduction of 15 m in the finished height. Both the initially proposed and revised plan for Stage 1 is shown on Figure 1.

The visual impact of the proposed landfill was assessed at two points on the South-Western Highway, as indicated on Figure 2. The site is most visible from these points. At other points on the highway, and further to the west, the site is obscured by trees. The assessment was made by using a montage set of colour photographs to give a panoramic view of the site, and overlaying both the initially proposed and revised landfill areas. The blue lines represent the extent at the revised landfill area, whilst the pale green areas represent the finished surfaces as they would appear once a cover of pasture grasses was established. These photographs, from each of the two viewing points indicated on Figure 2, are provided on Figures 3 and 4.

It is emphasised that the surface indicated on Figures 3 and 4 are final (approximately year 7) surfaces. For the years preceding the final year, the height of the landfill will be less than the final height, as landfilling will commence at the lowest (western) end.

To indicate the screening effect which would be achieved by the establishment of trees of 3 - 4 m height along the highway, an overlay is provided on Figure 3. This screening will be achieved within three years by the establishment of fast growing

endemic tree species along the eastern road verge for some 500 m in the vicinity and immediately north of the intersection of Norman Road and South-Western Highway. As seen on Figure 3, the effect of this tree planting would be to fully screen the landfill from South-Western Highway at the point where it would otherwise be most visible. Though possibly visible from other points on the coastal plain, the visual impact of the revised Stage 1 will be minor.

To indicate the desire of PBFI to minimise all environmental impacts of the landfill, the company, as a commitment additional to those in the PER, will, in July 1993 conduct dense tree planting along the section of the road verge shown on Figure 2, in consultation with the Main Roads Department (MRD) and the Shire of Serpentine-Jarrahdale, and will maintain the area to the satisfaction of the Shire. Permission for the proposed tree planting has already been received by PBFI from the MRD.

In summary, reduction in the size of the Stage 1 landfill will have the following benefits:

- Reduced visual impact
- Reduction in the area of land to be cleared for Stage 1 site work
- Reduction in the required drainage works on the Stage 1 site
- An increase in the size of the on-site buffer, due to the reduction in the area required for Stage 1.

Appendix 3

Proponent's letter regarding separation distances

PIONEER-BFI WASTE SERVICES
116 KURNALL ROAD, WELSHPOOL, W.A. 6105
PH. 09 458 4641 FAX. 09 351 8030
A PIONEER AUSTRALIA WASTE MANAGEMENT PTY. LTD. (A.C.N. 006 299 832)
AND BROWNING-FERRIS INDUSTRIES (AUSTRALIA) PTY. LTD. (A.C.N. 005 179 484) PARTNERSHIP

August 9, 1993

Environment Protection Authority
Westralia Square
141 St. George Terrace
Perth WA 6000

Attention: Mr. Ron Van Delft

Dear Sir,

SOUTHERN LANDFILL, SOUTH CARDUP
SITE BUFFER PROPOSAL

Further to your letter to the Shire of Serpentine-Jarrahdale dated July 1, 1993 and our subsequent telephone conversation, Pioneer-BFI Waste Services recognise the Environmental Protection Authority's need for adequate buffers for the Southern Landfill, South Cardup.

In preference to the complete sterilisation of land (prohibition of dwellings) within 500 metres of the landfill footprints for the operating life of the landfill as proposed in your letter, Pioneer-BFI Waste Services request an approach similar to that developed for poultry farms.

Pioneer-BFI Waste Services would support :-

"The proposed active landfill areas must have :-

a) a minimum buffer distance of 50 metres within the boundary of the site (Buffer Zone A);

b) a minimum buffer distance of 150 metres to an existing single dwelling (Buffer Zone B);

c) a minimum buffer distance of 300 metres to an existing rural residential zone (lots of 4ha or less) (Buffer Zone C);

d) a minimum buffer distance of 500 metres to an existing residential zone (Buffer Zone D); and

at the time of obtaining development consent"

and -

"The Shire of Serpentine-Jarrahdale should not generally support proposals for residential development in respect of :-

a) a new residential dwelling within 150 metres of the boundary of an active area;

b) a new rural-residential zone with the lots of 4 hectares or less, within 300 metres of the boundary of an active landfill area".

c) a new residential zone within 500 metres of the boundary of an active landfill area.

The accompanying diagrams for each proposed landfill stage show these buffer boundaries.

For comparative purposes, I have attached extracts from the following documents regarding the establishment of buffers for landfill sites :-

* Environment Protection Authority of Victoria State Environment Protection Policy (Siting and Management of Landfills Receiving Municipal Wastes) July 1991;

* Redvale Landfill, Auckland, New Zealand, Landfill Operation Plan.

Yours sincerely,

DANIEL G. FYFE
PROJECT MANAGER

PB0723.DOC
DGF/LS