Development Act 1993

ASSESSMENT REPORT

For the

PUBLIC ENVIRONMENTAL REPORT

for the

Jeffries garden soils organics waste treatment and recycling research facility, Buckland Park

Minister for
Urban Development and Planning

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1 INTRODUCTION

1.1 SUMMARY

This Assessment Report (AR) assesses the social, environmental and economic impacts of the proposal by Jeffries Garden Soils (Jeffries) to construct and operate an organics waste treatment and research facility and associated infrastructure near Virginia. The site is located at the junction of McEvoy and Brooks Road, Buckland Park and is located within the Northern Adelaide Plains horticultural district, approximately 2.5 kilometres to the south west of the township of Virginia. The land is bordered on the western side by the Penrice salt fields.

The original proposal was based on processing up to 305,000 tonnes per annum of green waste on 15 hectares of composting area, on the 123 hectares site and within a 10 year development phase. This proposal was varied on 25 September 2003 in a Development Application to seek approval to process **up to 150,000 tonnes** of green waste per annum.

The site would process mostly green waste from Adelaide kerb side collections and timber and wet organics (grease trap). The composting cycle takes approximately 8-12 weeks and the quantity being processed at any one stage will be a maximum of 19,000 tonnes.

To transport the unprocessed and processed waste, McEvoy Road will need to be upgraded and the turning arrangements on Port Wakefield Road improved to accommodate the covered trucks that will access the site.

Approximately 26 jobs are expected to be created at the site along with providing secure employment for the existing 35-40 Jeffries employees currently located at Wingfield. This assumes a production capacity of up to 150,000 tonnes per annum.

While this AR is intended to be a “stand alone” document, the detailed information on which it is based is contained in the January 2003 Public Environmental Report (PER) prepared by Jeffries, public comments on the PER, Jeffries’ responses to these comments in the PER Response Document (Response) prepared in May 2003 and an Environment Management Plan (EMP) produced in September 2003 and appended to this assessment. It also relies on information, comments and advice provided by relevant South Australian Government agencies.

1.2 ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURES

1.2.1 Overview of Process

Environmental Impact Assessment (EIA) is the process of identifying the potential environmental impacts of a proposal and appropriate measures that may be taken to minimise those impacts. The main purpose of EIA is to inform decision-makers of the likely impacts of a proposal before decisions are taken. The process also allows the community to make submissions on the proposal based on the environmental documents presented for assessment.

1.2.2 Assessment Process

Procedures for Environmental Impact Assessment (EIA) for Major Developments or Projects in South Australia are set out in Sections 46, 47 and 48 of the *Development Act 1993*.

On 23 May 2002, the Minister for Urban Development and Planning declared a proposal by Jeffries to construct and operate an Organics Waste Treatment and Research Recycling Facility at Buckland Park, a “Major Development”. This resulted from the Minister forming the opinion that the development was of major environmental, social or economic importance and a declaration was appropriate or necessary for the proper assessment of the proposal.

An application for the proposed organics waste treatment and research recycling facility was lodged on 28 June 2002. The development described in the application falls within the ambit of the Minister’s declaration and is, therefore, subject to the provisions of Section 46 of the *Development Act 1993.*

To determine the level of assessment and to set the Guidelines, the application was referred to the Major Developments Panel to prepare an Issues Paper for an Environmental Impact Statement, Public Environmental Report or a Development Report.

The Issues Paper was released for public comment on 27 July 2002 for a period of four weeks. This period was extended by advertisement until 20 September 2002 due a technical fault in the original advertisement. This Issues Paper formed the basis for the Guidelines.

After considering the significant issues for the proposal, the Panel determined that a Public Environmental Report (PER) was the required level of assessment and formulated the Guidelines. The public submissions on the Issues Paper were considered in the formulation of the Guidelines, which were released on 6 November 2002.

Jeffries prepared a PER that was placed on public display for a period of 6 weeks (8 January – 19 February 2003), during which time Government agency and public submissions were invited.

During this display period, Planning SA (an agency within the Department of Transport and Urban Planning) held a public meeting (Virginia, 5 February 2003) to provide information to the public about the proposal and to answer questions that would assist the public in preparing submissions. Approximately 130 members of the public attended the meeting. Jeffries’ representatives were in attendance to present the proposal, answer questions and note the issues raised by the public.

In response to the PER, a total of 39 public and 2 Local Government submissions, were received. In addition, 11 submissions were received from State Government agencies. All the submissions were referred to Jeffries for a response.

Following the display period, Jeffries prepared a Response Document addressing matters raised in submissions on the PER. The Response was released on 12 May 2003.

Pursuant to Section 46C(8) of the Act, in this AR the Minister has taken into account the PER, the submissions and Jeffries’ response to them, the comments of the City of Playford, and other matters the Minister considered appropriate. This includes the Groundwater Report and the EMP that are appended to this document.

There has been extensive consultation with the Environment Protection Authority (EPA) and the Department of Primary Industries South Australia (PIRSA) in relation to this assessment and their comments have been included in the relevant sections of this report.

On completion of the AR the Governor, pursuant to Section 48(5) of the Act, must, when making a decision, have regard to the provisions of the appropriate Development Plan, Building Rules (if relevant), the Planning Strategy and, as the proposal is a prescribed activity of environmental significance, the *Environment Protection Act 1993*. The Governor must also, pursuant to Section 48 (5)(e) of the *Development Act 1993*, have regard to the PER and the AR. Further to this, in Section 48 (7) the Governor may specify conditions that should be attached to a development authorisation, which must be complied with in implementing the approval.

Under some circumstances, the Governor may vary or revoke conditions of the development authorisation or attach new conditions to it.

2 BACKGROUND

2.1 THE PROPONENT

Jeffries, the proponent, is a fourth generation business operating as a manufacturer and supplier of soils and compost for retail, wholesale and trade markets. The business also provides grinding equipment for hire to various clients who attend to their own composting and bagging business for compost and potting mixes.

Jeffries is one of two businesses that receive the bulk of Adelaide's suburban green organics for recycling and, from this raw material, produces a wide range of soil conditioning products suitable for horticulture, landscape and home gardening. Jeffries currently operates from a small site at Wingfield owned by the Adelaide City Council (ACC) and licensed by the EPA. The Jeffries' Wingfield lease site is due to close in December 2003 but may be granted a further short extension to its lease. The larger ACC landfill site (Wingfield Landfill) is due to close in December 2004 pursuant to the *Wingfield Waste Depot Closure Act, 1999.*

Jeffries has Australian Quality Endorsement ISO 9001 for its company systems. The company is also committed to pursuing ISO 14001 Environmental Management accreditation for the Buckland Park operation. Jeffries is currently the second largest processor of Adelaide's green waste. Jeffries process about 25% of all green waste or 50,000 tonnes per annum received for composting from the Adelaide metropolitan area. The business has approximately 40 staff.

Jeffries is considered an industry leader in Australia for developing organic horticultural and landscape products. It has won many awards in this area and has invested significantly in plant and equipment for their business.

2.2 COMPOSTING PROCESS

Composting involves the aerobic (in air) biological decomposition of organic materials to produce a stable humus like product. To derive the most benefit from this natural, but typically slow, decomposition it is necessary to control the environmental conditions during the compost process. Doing so plays a significant role in increasing and controlling the rate of decomposition and determining the quality of the resulting compost.

Compost is the end product of the composting process, which also produces carbon dioxide and water as by-products. How much water depends on the climate and, as South Australia has a dry climate, it is likely the compost process here would be a net user of water.

Compost is humus, which is dark in colour, has a crumbly texture and an earthy odour, and resembles rich topsoil. The final product has no resemblance in physical form to the original green waste. Good quality compost is devoid of weed seeds and organisms that may be pathogenic to humans, animals of plants. The composting process is considered to be an environmentally sound and beneficial means of recycling organic materials.

The most common form for large scale composting operations is to form the green materials into windrows or triangular shaped mounds (when viewed in cross section) that are regularly turned and aerated. In this form it takes 8-12 weeks to convert the green materials to compost.

2.3 THE PROJECT

The application being assessed was lodged on 25 September 2003. The total amount of waste to be received per year of green organics and wet organics is 150,000 tonnes.

It should be noted that Planning SA considers incoming materials to the site to be those specified in section 5.2.2 of the PER. These are green organics (foliage, grass cuttings, prunings, branches), saw dust, timber (pallets, boxes), and wet organics (processed grease trap residue, street sweepings).

The project comprises:

Stage 1

Open windrow Recyclable Organics Facility

- Construction of incoming materials receival building
- Construction of 4.6 hectares windrow composting area
- Construction of final processing and storage area
- Commence incoming material (up to 75,000 tonnes per annum) and recyclable organics production

General Site

- Landscaping Plan
- Workshop construction.
- Wheel wash facility

Stage 2

Open windrow Recyclable Organics Facility

- Incoming material forecast at 100,000 tonnes per annum;
- Expand the windrow composting area

Landscaping and Garden Products Manufacturing

- Acceptance of incoming pallet/ timber materials
- Manufacturing of soils, mulches, potting media

Information, Education and Training Facility

- Construction of facility building

Stage 3

Open windrow recyclable Organics Facility

- Incoming material forecast at +120,000 tonnes per annum

Head office/ Administration Centre

- Construct building
- Green houses constructed.

The development under assessment in this Assessment Report **does not include:**

- Processing of recyclable materials in the range 150,000 tonnes to 305,000 tonnes or above
- In- vessel composting on the site
- A biomat base to the windrow area
- Other forms of green wastes or wet organics other than those already specified above
- A transfer station

3 NEED FOR THE PROJECT AND ALTERNATIVES

3.1 NEED FOR THE PROPOSAL

As outlined in the PER (Section 5.1) Jeffries believes there is a demonstrated benefit in terms of general environmental, social and economic outcomes in relation to the composting of green and organic wastes as opposed to disposing of them to landfill. This view is consistent with EPA policy of eventually achieving a zero organics waste to landfill and the Local Agenda 21 program to which most councils are signatories.

As further support for its proposal, Jeffries referred to the report *Integrated Waste Strategy for Metropolitan Adelaide, Progress on Implementation*, *1999* produced by Planning SA, the EPA and DIT, where the following is stated :

"Green Waste composting and processing sites need to be established urgently to encourage private sector investment and enable green waste producers to establish viable markets. It is anticipated the establishment of secure green waste composting sites will:

- Facilitate development of viable green waste industries;
- Conserve valuable landfill space and prolong the life of landfill facilities which will represent a major saving to the state;
- Reduce harmful methane and leachate products contributed by land filling green waste;
- Establish South Australia as a national leader in green waste processing;
- Assist in meeting National and State landfill targets and reduce greenhouse emissions;
- Provide infrastructure enabling councils to increase the number of green waste kerbside collection systems servicing metropolitan Adelaide
- Encourage greater participation within the community to separate green waste for kerbside collection."

Jeffries is of the view that the establishment of secure and appropriate green waste processing areas is a priority for State and Local Government.

Jeffries indicated it had spent 10 years investigating 7 sites in the northern Adelaide region with assistance from the EPA and the then Department of Industry and Trade. The Jeffries Board determined that Buckland Park was the most suitable site to establish a green waste/organics waste processing area as the area was already degraded.

The proposed location was expected to have a range of benefits to Jeffries including proximity to the source of materials and the end product markets and was also of a size suitable facilitate to the expansion of the composting operations to 150,000 tonnes per annum. In terms of existing infrastructure, the site is considered by Jeffries to provide many of its requirements including road access, water supply and electricity.

3.2 ECONOMIC JUSTIFICATION

3.2.1 Economic Benefits

An assessment (PER Section 5.3) of the likely economic benefits of the proposal has been undertaken by the proponent. The assessment addresses the benefits attributable to the development of a composting facility in terms of:

- Diversion of green wastes and other organic wastes from landfill to compost
- Reduced water consumption for horticulturalists and viticulturalists
- Improvement of soil structures and reduced use of fertilizers results in better crop yields
- Creation of employment opportunities in a relatively high unemployment area (especially youth unemployment)
- Supports the regional agricultural and horticultural business of the area.

In the PER Jeffries indicated that it would invest some $7 million in the development and there would be additional wages of $1.56 million due to increased employment.

These benefits were also identified in the document provided in Appendix 4 of the PER, Nolan – ITU report on *Organic Waste Economic Values Analysis Summary Report*, January 2002. This report was prepared on behalf of the Department of Industry and Trade and the Environment Protection Authority and it was indicated that the existing organics recycling industry generated a direct income of about $12.2 million. In addition the authors conclude that

"*It is apparent from the cost benefit analysis, based upon economic aspects only, that the "source separation" composting scenarios* (that Nolan-ITU investigated) *result in the greatest benefit to the State due to downstream agricultural flow-on benefits and high labour requirements, and that augmentation of the current "source separation" organic processing capacity will result in additional benefits. Therefore, source separation of organics with processing into compost products should be encouraged."*

In its submission PIRSA indicated that the PER had understated the potential economic impact of pest plants and diseases on the horticulture industry. PIRSA indicated that the wholesale value at the packing shed was in the order of $300 million in 2000-2001 of which 43.5% was susceptible to fruit fly risk. These figures were also indicated in some of the public submissions.

In its Response document, Davidson Viticultural Consultants, on behalf of Jeffries, indicated that the estimated cost of the worst-case scenario of the simultaneous development of Phylloxera, Fruit Fly, Glassy Winged Sharp Shooter/Pierces Disease and Potato Cyst Nematode would be $106.3 million.

3.2.2 Construction Phase

In the PER the construction of the organics waste treatment and recycling research facility was expected to be staged over 10 years or more. As the development has been scaled back to 150,000 tonnes subsequently it is now proposed to schedule it in two stages. The first will be up to 75,000 tonnes per annum for the first five years and the further stage of 75,000 tonnes will require a new or expanded EPA licence but would not need further development authorisation. The estimated investment is approximately $7m dollars at full development.

Section 5.4.2 of the PER outlines the estimated person days required to establish each stage of the proposal. It should be noted that some of the items listed in Section 5.4.2 have been deleted in the Response Document i.e., the Northern Adelaide Waste Management Authority (NAWMA) recyclable organics transfer facility and the in-vessel composting. New construction work includes enclosing the receival of waste area in a building with a concrete slab as referred to in the Response Document.

Construction of the base for the windrows and the drainage swales and basins will need to occur early in the development and will require some earthworks to build up the windrow area and establish the clay liner required by the EPA.

3.2.3 Operating Phase

An additional 26 persons (currently 40 employees) will be employed by Jeffries, within a 5 year period on site. This would include 10 who are currently at Wingfield. This assumes a processing level of 150,000 tonnes per annum. If a future development authorisation is given to allow processing up to 305,000 tonnes per annum, the workforce would increase but probably not double.

There are also multiplier effects of both kerbside collection and transport of green waste materials and the use of the end product in supporting jobs in the horticulture, viticulture and associated transport industries.

There are expected to be economic benefits in terms of waste being diverted from landfill to composting which results in a reduced landfill space being occupied by green waste. Because more green waste is diverted to composting there will be reduced landfill gas generated within landfill sites. The cost of disposal of household waste will increase significantly when the ACC Wingfield landfill closes in December 2004. This waste will need to be transported much greater distances to the approved landfill sites to the north of Adelaide. The reduction of the amount of green waste going to landfill will also reduce these transport costs for councils and householders.

Transport costs from the source of the material will increase for the proponent at this site but many of its markets are located in the surrounding area of the Northern Adelaide Plains so that delivery transport costs will be reduced.

3.2.4 Benefits to Existing and Future Industries

There is an already existing high demand for compost and landscaping products produced by Jeffries. It is likely that this will increase steadily over the next few years. Composting reduces water costs and fertilizer use and improves yields in horticultural and viticulture industries. The use of compost improves soil water holding capacity and reduces water loss as a result of percolation, evaporation, and run off. The impact of water restrictions may also encourage the use of composts and mulches.

Compost for the home gardener and for metropolitan councils to apply to reserves and parks is sought after for improving soils.

Jeffries also supplies wood chip material for landscaping and playgrounds for providing “soft fall” materials. This is part of the recycling of wood pallets presently undertaken at Cormack Road, Wingfield but would be transferred to Buckland Park at a future stage. The supply of these pallets is predominantly from the 2 major car manufacturers and the numbers of these pallets will increase with increased production particularly with GMH recently going to 24 hour/3 shift operations.

It is expected that the cost of delivering waste to landfills will increase significantly in the next few years with the closure of the Wingfield Landfill in 2004. Diverting green waste to composting operations will reduce the cost of transporting waste to landfill and the landfill space will be available for putrescible wastes rather than green waste which is a resource.

3.3 PROJECT ALTERNATIVES

3.3.1 Not Proceeding with the Project

If an alternative site in the northern area for green waste recycling is not sourced in the next few months, the majority of the 50,000 tonnes of waste currently collected and treated by Jeffries will go to landfill. The ACC has indicated that it will not renew the licence to carry out composting at the current Jeffries Wingfield site beyond June 2004. However there are no other facilities that can handle 50,000 tonnes of green material. A new site would need to be found.

The disposal of green waste to landfill does not fulfil the State Government policy on green waste recycling and would result in the approved landfills being filled more rapidly than estimated. More greenhouse gas in the form of methane will be generated in these landfills.

The benefits of composting to the horticultural and viticultural areas particularly to the north of Adelaide would be lost if the metropolitan green waste is wholly diverted to landfill.

3.3.2 Alternative Sites

Jeffries has spent 10 years investigating 7 sites in the northern Adelaide region with assistance from the EPA and the then Department of Industry and Trade. In the opinion of Jeffries, none of these sites offered the size and infrastructure requirements necessary to sustain and expand their business.

The Buckland Park site was selected by Jeffries based on the following factors:

- A site with enough area for management of the process including mounds and tree planting areas and area for future expansion.
- Large enough for large internal buffers
- Large enough for commercial horticulture
- Large enough to facilitate an integrated facility
- Long term site security
- Location on a direct transport route between the source of the organic wastes and the market;
- Location with respect to natural gas connection and power grid;

- Availability of infrastructure;
- Availability of water;
- Manageable environmental impacts;
- Relative capital and operating costs;
- Availability of workforce within the region;
- Level topography;
- No evidence of Native Title issues; and
- No known Indigenous or non-indigenous heritage issues.

4 DESCRIPTION OF THE PROPOSAL

4.1 OVERVIEW

The Buckland Park site for the proposed Jeffries operation is 123 hectares in size, with Agri-business (woodlots, horticulture etc) operations occupying 70% of the site and the recyclable organics recovery operation (workshops, receiving areas, windrows etc), the remaining 30%.

Part of the land is presently being cropped for potatoes but up until Jeffries purchased the site little cropping activity had occurred for some time. There is an old intensive dairy on part of the site that has been derelict for a number of years and there are a number of sheds and tanks (including a large silo), which are in an average state of repair. Part of the land has been used for illegal dumping of household material which will need to be removed as part of the general clean up of the site.

The current Development Application is for up to 150,000 tonnes per annum, with Stage 1 comprising 75,000 tonnes per anum. The southwest portion of the site (where the windrows are proposed) is located the farthest distance from other horticultural enterprises and is 1,000m from the nearest residence. The receival shed is proposed to be located adjacent to the windrows and will be a fully enclosed building with a concrete lined floor.

While plans and documentation included in the EMP indicated adequate design information for Stage 1, the concept layouts suggest that expansion to 150,000 tonnes can be accommodated on the site.

4.2 INFRASTRUCTURE

4.2.1 Transport

Jeffries commissioned Murray F Young & Associates to undertake a traffic assessment of the Buckland Park site (Appendix F of the PER). Access to the site will be from Port Wakefield Road and along McEvoy Road.

The intersection of McEvoy Road and Port Wakefield Road will need to be upgraded to allow the turning of larger vehicles into the Buckland Park site. The upgrade consists of widening the existing left turn deceleration lane from Port Wakefield Road into McEvoy Road from its current width of 3 metres to 3.5 metres and extending the length by 25 metres. Jeffries has agreed to undertake this work as part of the upgrade to McEvoy Road and it will be to the satisfaction of Transport SA (TSA). In addition McEvoy Road will be sealed (as outlined in section 5.5.1 of the PER) to the standard required by the City of Playford. Letters of agreement between the proponent and the council have been signed to achieve this upgrade and are part of the documentation supporting the application.

TSA in their submission raised an issue concerning the Brooks Road/McEvoy Road intersection that will be the access point to the development. TSA indicated that this would form a 4 way intersection with potential for accidents. However, this is a local council matter and was not raised by the City of Playford in its submission. It should be noted that Brooks Road is unsealed and slightly corrugated and does not carry a high traffic volume.

It is proposed that the access point would need to be designed to accommodate large truck movements and the sight lines in that area are very clear. A give way sign at the intersection would require trucks to give way to traffic along Brooks Road.

Traffic generation

Jeffries has estimated that 90% of all vehicles accessing the Buckland Park site will do so on weekdays. Jeffries has estimated the traffic generated by the proposal in the following tables which are also in the EMP provided by Jeffries. These figures relate to a production level of 75,000 tonnes per annum or Stage 1 of the development. Should the proposal be approved, processing would be limited to 150,000 tonnes per annum.

Table 1 Daily Truck and Semi-trailer Movements

(truck in + truck out =two vehicle movements)

Year	Rigid Body Trucks[1]		Semi-Trailers[1]		Total
	Week Days	Weekend	Week Days	Weekends	
0-1	18	2	10	2	32
1-2	22	4	16	2	44
2-3	30	4	18	4	56
3-4	36	6	26	4	72
4-5	48	6	30	6	90

Table 2 Daily Staff and Visitor Vehicle Movements

(vehicle in + vehicle out = two vehicle movements)

Year	Staff Movements[2]		Visitors		Total
	Week Days	Weekend	Week Days	Weekends	
0-1	14	2	12	2	30
1-2	20	2	12	2	36
2-3	24	4	14	2	44
3-4	32	4	14	2	52
4-5	40	4	14	2	60

Notes:
1. Carrying capacity of vehicles varies between 7.5 – 25.0 tonnes
2. Assumes a pro-rata increase based on forecast increases in truck movements

4.2.2 Operational Requirements

In addition to the road access described above, infrastructure requirements for the site include power, water, telephone and sewerage. The site currently has 3 phase power which is available at the south western boundary. Recycled water is available from Bolivar and drinking water will be collected from rainfall captured on site. Sewage will be treated on site by a package treatment plant (section 5.8.1). The package plant selected will be to the satisfaction of the council or the Department of Human Services. The site has telephone connections and gas will not be required.

Fuel, lubricants, solvents and paint will be stored on site. The 20kL fuel tank will be stored in an enclosed, fully bunded area.

A wheel wash and wash bay facility will be provided for vehicles arriving at and leaving the site. Vehicles moving between different operational areas within the site will also pass through the facility.

The depot will store and process incoming materials and process and load the final product for transport to markets.

The plant and equipment required for the depot include:

- Stationary shredder
- Van Gelder Grinding Mill and Peterson Grinding Mill
- Front-end loaders, Excavators and Dump Trucks
- Scat Windrow Turner
- Incoming Materials Trommel Screen
- Finlay Trommel Screen and Turbo Chieftain Powerscreen for mature compost.

4.2.3 Construction Requirements

Construction requirements such as electricity and water are provided on site and road access, parking turn around and laydown areas can be accommodated within the site and through upgrading the access road.

As indicated above McEvoy Road will need some sealing and widening to cope with vehicle movements.

Sewage will be treated on site. This must be to the satisfaction of either the Council or the Department of Human Services.

The site will be designed to retain any stormwater during the construction phase and worked areas will be wetted down to avoid dust problems.

4.2.4 Future Expansion

The initial proposal as detailed in the PER included ultimate development of the site to 305,000 tonnes per annum and incorporation of in-vessel composting technology for food waste. It is no longer proposed to install the in-vessel composting technology or operate a Materials Recovery Facility in conjunction with NAWMA, as part of this development (Response Document).

Stage 2 will now involve expansion of windrow composting to 150,000 tonnes per annum and this will occur between the initial windrows in the south west of the site and the eastern boundary of the Service, Administration and Workshop area (Figure 6.2 of the EMP). It is anticipated by the proponent that the site and the infrastructure will accommodate future growth requirements.

Any significant changes in site function (including production in excess of 150,000 tonnes per annum) would have to be assessed by the relevant authorities at the time and any licensing and off site impacts would have to be determined.

4.3 CONSULTATION

4.3.1 Jeffries Community Consultation

The community consultation activities undertaken to date by Jeffries have included:

- Letters inviting comment on the issues to be addressed in the PER were sent to relevant stakeholders, including community and industry groups and Local and State Government agencies and approval authorities;
- A statutory public meeting was held on 5 February 2003 at the Virginia Horticulture Centre and was attended by approximately 130 people mostly opposed to the development on that site.
- Tours of the existing operations at Wingfield for community members including the Vietnamese Growers of the NAP.
- Circulation of newsletters outlining progress on the assessment of the Buckland Park site.
- An undertaking to meet with any concerned members of the community especially those in close proximity to the site to discuss the impact of the proposal and what might be done to mitigate it.
- An environmental health meeting was held at Virginia Primary School with the Jeffries consultants to address issues of concern in terms of health impacts and the proximity of the primary school to the proposed composting area.

Refer to Section Appendix 1 for a summary of the issues that were raised during the public consultation period.

Aboriginal

On the advice of the State Aboriginal Heritage Committee, consultation was undertaken with Kaurna Meyunna Inc. Kaurna Elders Inc and the Kaurna Aboriginal Community Heritage Association (KACHA). Members of the Aboriginal community have also been on site as observers when Jeffries has undertaken excavations as part of their groundwater studies. No items of significance were discovered with this activity.

4.3.2 Statutory Consultation

PER Preparation

In accordance with the provisions of *Development Act 1993*, following the declaration of the Jeffries proposal as a Major Development by the Minister of Urban Development and Planning, an Issues Paper was released for public comment by the Major Developments Panel.

The submissions to the Issues Paper formed an important input to the preparation of the Guidelines for the preparation of the PER. Key issues raised in response to the Issues Paper included the health effects of the proposal, impacts on residents in terms of noise, odour and traffic, impacts on groundwater and management of stormwater. The possible release of pests and diseases to the horticultural area of the NAP was also identified as an issue.

Public Comment on PER Document

Jeffries prepared a PER, which was placed on public display for a period of 6 weeks (8 January 2003 to 19 February 2003), during which time government agency and public comments were invited.

In response to the PER, a total of 39 public and two local government submissions, City of Playford and the City of Salisbury. All the submissions were referred to Jeffries for a response.

Major issues associated with the construction and operation of the proposed Jeffries Organics Waste Treatment and Research Recycling Facility and raised during the public comment period included:

- Health risks to nearby residents due to air emissions;
- Pest plants, insects and disease impacts on the Northern Adelaide Plains horticultural and viticulture area;
- Potential damage to nearby market gardens;
- Damage to marine ecosystem through discharges to Barker Inlet;
- Noise and odour impacts;
- Potential pollution of groundwater;
- Buffer zones; and
- Traffic impacts.

There has been a strong and sustained opposition to this development in the Virginia area. This has originated from the growers on the Northern Adelaide Plains, the parents and staff of the Virginia Primary School and from neighbours to the development site. However, the opponents of this proposal have endorsed the need for such a facility in the northern area.

Government Submissions

Since the project was first proposed, Jeffries has maintained a dialogue with all relevant SA Government departments to assist in the assessment of the proposal. Written submissions were received by the following Government agencies:

- Environment Protection Authority
- Primary Industries and Resources SA
- Planning SA
- Department of Human Services, Environmental Health Services
- Department of Water Land and Biodiversity Conservation
- Department of Environment and Heritage
- Department of Administrative Services
- Department of State Aboriginal Affairs
- Transport SA
- Department of Treasury and Finance

Reference to the submissions are made in the appropriate section of the AR.

5 ENVIRONMENTAL ISSUES AND MITIGATION MEASURES

In addition to an assessment of effects, the Guidelines require a clear identification of Jeffries' commitments to avoid, mitigate, satisfactorily manage and/or control any potentially adverse impacts of the development on the physical, social or economic environment. In the following sections, these commitments are identified.

5.1 PHYSICAL IMPACTS

5.1.1 Impacts on Air Quality

Air quality impacts from this operation will primarily be in the form of odour and dust from the composting operations, dust and chemical use from the horticultural operation and dust from any unsealed roads.

The potential impacts from the proposed horticultural operation should be consistent with or improved from that currently experienced by local farmers. Impacts from delivery, storage and composting of organic material have the potential to be higher that the traditional land uses in the area.

The proponent has suggested strategies to reduce and confine impacts on air quality. Windrow turning, grinding and screening will only be undertaken when water content of the windrows mitigates dust and odour issues.

Odour is also to be reduced by maintaining aerobic conditions within windrows through frequent turning, triggered by temperature monitors moisture levels and good drainage.

Meteorology

This site's climate, in terms of suitability for composting, is generally warm and dry. Relatively low rainfall conditions enable moisture conditions to be more easily controlled and warm conditions encourage the microbial activity necessary for composting.

Occasional high winds for this site have caused concern from nearby residents in relation to odour and dust with this proposal.

The prevailing winds are from the southwest but periodic strong north winds may precede cold changes.

Wind speeds derived from data collected at the Adelaide Airport (coastal) and Edinburgh Air Force Base (8km from site) indicate that wind speeds rarely exceed 40km/h and are usually in the range 11-20km/h.

For Adelaide Airport and Edinburgh, wind direction is predominantly south westerly for January-April, north to north east May – August mornings and west to south west May-August afternoons. September – December winds are predominantly south westerly with stronger winds in the afternoon.

Rain falls predominantly in winter; this is a pattern typical of the Adelaide region. The recorded average annual rainfall rain for Edinburgh Air Force base 8km away is 434mm, with 293mm falling between May-October. Average annual rainfall for the site is expected to be within 400-450mm.

Dust

Dust may be generated during the turning of windrows, blending of compost with soil and during loading of the finished product. In addition, there are potential impacts associated with upgrading of McEvoy Road, construction of the screening and vegetation mounds (including delivery of fill), construction of the windrow platforms and surface water ponds and from internal site access roads.

As the main access road to the site is to be sealed and widened and loads covered, dust is unlikely to be an issue during transport to the site and transport off-site of the finished product.

During the construction phase of development Jeffries proposes to wet down those areas that have the potential to produce a dust hazard or nuisance.

On the basis of information from its existing site at Wingfield, and taking into consideration the fact that composting facilities are set back 500m from Brooks Road and at least 1,000m from the nearest residence, Jeffries has concluded that impacts from any dust generation is expected to be low.

During operation the following dust mitigation features will apply:

- Boundary windbreaks
- Use of covered trucks
- Receival and initial processing in an enclosed building
- Ensuring compost moisture levels are adequate during turning
- Use of watering on roads and operational areas
- Restricting vehicle speed to 10km/h on site
- Meteorological monitoring on site, to fine tune management procedures
- A dust monitoring program to track performance over time
- Windrow turning and compost screening will be stopped or reduced during high wind conditions if dust generation becomes a problem.

Due to the site being entitled to a 511ML annual water allocation and the reuse of recycled water from composting and other operations, water for dust control should therefore be adequate.

Dust monitoring off site will be undertaken at the Brooks Road/McEvoy Road site boundary and at the southern and western site boundaries. The target value of compost dust within the dust collected by the monitoring traps is 5%. If this is exceeded then an investigation into the cause and remedial action will be taken.

Advice received from the EPA indicates that with good management and the mitigation measures mentioned above, it is considered that there should not be a dust nuisance at the surrounding houses from the composting operations.

This AR concludes that with appropriate dust management measures there should not be a dust nuisance created by this development.

Odour

The Guidelines required Jeffries to investigate the potential for odours from the composting to impact adjacent receptors, to undertake appropriate modelling and to describe how odours would be controlled and monitored. The assessment undertaken by Jeffries is included in Sections 5.2.4 and 5.2.6 of the PER.

In its assessment, Jeffries used odour emission data from its current operations at Wingfield. The odour modelling indicated that the site could be operated and managed to ensure compliance with the EPA requirements. Odour control measures to be incorporated at the site include, the control of material received at the site, primary processing within an enclosed building, and the maintenance of aerobic conditions in the windrows.

Twelve public submissions raised concern as to the potential for the composting process to generate objectionable odours and to impact on residents and the Virginia Primary School. The City of Playford also raised concerns of potential odour impacts on the community.

The Environment Health Services Group of the Department of Human Services indicated that odours would be effectively controlled if the measures contained in the PER were implemented.

In its initial submission the EPA indicated that the odour modelling did not comply with the requirements of the EPA Guidelines - Odour Assessment (previously Technical Bulletin No. 25) and they requested additional technical information on the odour emission data for each odour source.

In its response, Jeffries re-iterated the management measures that had been presented in the PER and provided a revised odour modelling report that was stated as complying with the EPA guidelines. Jeffries also stated that the additional technical information requested by the EPA would be provided in the EMP and that it was more relevant to address some of the information at the licensing stage.

The EPA then indicated that its concerns had not been adequately addressed in the Response Document and following further discussion with Jeffries additional modelling of odour was undertaken and the results consolidated in the EMP.

In its final submission the EPA noted that the amended location of the windrows should have the effect of lowering the potential odour impact at the nearest houses. EPA indicated that there was some uncertainty in the documentation relating to the nature of material to be composted and whether modelling had taken this into consideration, however it was accepted that the proposal had previously included the receipt of wet organics and these had been considered in previous modelling.

The EPA also indicated that as a result of local circumstances, it could be expected that there would be some local odours from the spreading of fertilisers on properties in the area.

The EPA confirmed that the modelling methodology used by Jeffries in the EMP complies with the EPA "Guidelines for Odour Assessment Using Odour Source Modelling" (SA EPA 373/03 September 03). For the locality under consideration, the appropriate criteria would be 10 odour units (OU) (99.9 percentile, 3 minute average) for isolated houses, 8 OU where there is a group of houses in a small area and 6 OU where there is a group of houses with more than 60 people. For most of the area, 8 or 10 OU would be the applicable criteria.

The modelling undertaken by Jeffries indicates that the predicted odour impact (99.9 percentile, 3 minute mean) is 2 OU or less at any house not associated with the development. The 8 OU contour is predicted to be completely west of Brooks Road (or within the site). The EPA noted that if there was some windrow turning conducted outside of the hours modelled, there may be an increase in the predicted odour levels at the neighbouring houses. As the predicted odour impacts are considerably below the EPA criteria, the EPA advised that any extra odour emission would not cause the odour criteria to be exceeded. While the odour impact is predicted to be acceptable, odours may still be detected at surrounding houses at times.

The predicted odour impacts were also produced for 98 percentile and 1 hour average. This modelling shows the area of impact for repeated low level exposure and to account for the effects of extremes or outliers in the meteorological data. The EPA indicated that normally, when the predicted level is below 0.5 OU (98%, 1 hour average) the odour impact would be acceptable. Jeffries modelling tended to show that the higher odour impacts would tend to be to the south west and to the north north west. The EPA advised that the predicted odour level of 0.25 OU or less at all houses not associated with the development was acceptable.

The EPA noted there is a derelict house/shed east south east of the site on the east side of Brooks Road and there may be potential problems with odours if a house was developed on this site, despite the predicted odour level of 6 OU being below the EPA odour criteria.

The meteorological data used was obtained from Edinburgh Air Force base 8km inland. The Jeffries site, being coastal, is likely to have more wind movement and thus odours will disperse more easily.

Conclusions

The EPA has advised that the modelling undertaken indicates that the proposed development, with a throughput of 150,000 tonnes per year, will not cause an unacceptable odour impact at neighbouring houses not associated with the development. It is concluded by the EPA, therefore, that there is minimal risk of environmental harm of nuisance resulting from odour or dust from the subject site.

The EPA has advised that the composting operations must be located at all times at least 1,000 metres from the nearest existing residential dwelling not associated with the development. All existing residences comply with this requirement.

The EPA has recommended that to minimise the chance of odour nuisance occurring in the future, careful consideration should be given to any residential development within approximately 1000 metres of the proposed site.

There are two land holdings which are located within the 1,000 metre area, one has a derelict house and the other has a centre pivot irrigation system. On the basis of the land holding it would be feasible (should the owner choose to do so) to establish houses on portions of these allotments which would be located approximately 800 metres from the composting operations. At this distance the odour modelling indicates ground level concentrations of approximately 2.5 odour units for the 3 min. 99%ile and 0.25 odour units for the 1 hour 98%ile which are well below the EPA guideline levels. On this basis this assessment concludes that possible odour impacts on potential new dwellings are not significant and do not unreasonably constrain future development potential.

5.1.2 Greenhouse Gases

Green house gas emissions are considered a significant cause of current Global Warming. Increased levels of carbon dioxide, methane and other gases produced by human activities, are trapping more heat in the atmosphere and causing an increase in global temperatures and changes in climate.

The only gases that are produced other than those naturally derived from normal decomposition are regarded as greenhouse gases. Energy used to power machinery and produce electricity in the composting process is part of the production of greenhouse gases through the burning of fuels.

The breakdown of organic materials in low oxygen conditions can produce methane, which is 21 times more damaging as a green house gas than carbon dioxide. Composting procedures are designed to aerate the compost to promote rapid processing and elimination of methane production.

Emissions from these sources can be balanced by the greenhouse savings produced by the use of compost products with soil, through the following:

- Carbon stored within the soil
- Reduction in the use of artificial fertilisers and other additives
- Improved soil structure, and retention and availability of moisture and nutrients
- Rehabilitation of degraded land and mitigation of land degradation.

The process for identifying all greenhouse aspects of compost production is complex, given the range of activities involved and the impacts on various forms of agriculture.

For instance, improving soil structure by adding composted carbon increases soil water and nutrient holding properties. The soil is also easier to cultivate. The use of less irrigation water and artificial fertiliser is a beneficial process, as both require energy to get to the farm gate, and in the case of chemical fertilizer, to produce artificially.

Soils that are easier to cultivate require less fuel and wear and tear on cultivation machinery, therefore significant savings can be achieved in this area alone.

At worst, given the complex nature of modelling the effects of composting, the Jeffries proposal is regarded in this assessment as benign in a greenhouse sense and may even be beneficial.

5.1.3 Chemical Storage

The PER Guidelines required Jeffries to provide details of the management of dangerous substances. The storage of chemicals and fuels on site can create a pollution problem if not adequately contained

In section 5.6.3 of the PER Jeffries indicates that there will be minor quantities of dangerous substances stored on the site, including lubricants, fuel, solvents and paints, necessary for the maintenance of plant and equipment used at the site. Fuel will be stored in a 20 KL tank within a fully bunded area within an undercover dangerous substances storage area.

Jeffries will be required to comply with appropriate Australian Standards, the Dangerous Substances Act and Regulations and EPA bunding guidelines.

In the event of spillage, Jeffries proposes to implement the following management measures (section 5.6.5 of the PER):

- Notification to EPA
- Investigation to assess the nature and extent of problem
- Development and implementation of a remediation plan
- Submission of a post remediation report to EPA

There were no public submissions specifically relating to dangerous substances.

5.1.4 Solid and Liquid Wastes

Water that comes in contact with the compost material will have elevated concentrations of nutrient. The proposed management measures include the separation of water that has come into contact with compost material or from the compost process, from general surface water runoff. Details of the management measures are provided in section 5.1.6 of the PER.

Wastewater from the ablutions area will be stored and treated in accordance with the requirements of the Department of Human Services using a package sewage treatment plant.

The servicing and repair of plant and equipment used in the composting process will be undertaken on a concrete surface which drains to an oil water separator.

Solid wastes such as materials delivered with compost that are not amenable to the composting process will be removed by the screening process and stored in an in-situ compactor before removal to an EPA licensed waste depot (section 6 of EMP).

This assessment concludes that Jeffries would be able to comply with the requirements of the EPA, DHS and council in relation to solid and liquid wastes.

5.1.5 Noise Emissions

The guidelines for the PER required Jeffries to provide information on the expected levels of environmental noise associated with the operation of the facility and increased road usage (identifying all potential noise sources) and to describe the extent to which the noise emissions can be reduced and contained to minimise effects upon the wider locality (including potential future residential development).

Environmental noise impacts would be related to on-site operations, and traffic movements, including the transport of raw material, finished product and site workers. Jeffries has advised that the depot opening hours would be 7am to 5pm Monday to Friday, 7am to 4pm Saturday and 10am to 4pm Sunday. Operating hours may be outside the opening hours to maintain equipment usage.

Jeffries' assessment was included in section 5.2.11 of the PER, in which it was indicated that noise impacts would be related to the following plant; primary processor, trommel screen, industrial grinders, windrow turner, front end loaders, excavator, tip trucks and water truck. With the exception of an enclosed electrically powered primary processor, the proposed composting facility will essentially utilise the same plant and equipment that currently operates at Jeffries' existing site at Wingfield.

In the EMP, Jeffries has indicated that 32 daily movements of trucks and semi-trailers and 30 daily staff and visitor movements would occur in the first year of operation. These movements would increase to 90/day for trucks and semi-trailers and 60/day for staff and visitors in the fifth year of operation.

Jeffries indicated that a noise survey undertaken at the Wingfield facility (which generally has the same equipment proposed for the new site) indicated that noise levels were within statutory requirements. The inclusion of a 1.5m perimeter landscaping and future wood lot mounds at the proposed compost facility would result in lower noise levels than at the existing Wingfield site. Jeffries' consultant predicted that noise levels along McEvoy Road would be within the desirable range for upgraded existing roads and new roads as defined in Transport SA Traffic Noise Guidelines.

A number of submissions were received on the PER relating to increased noise levels due to greater traffic movement (particularly trucks) and potential health related impacts (sleep disturbance, annoyance) of traffic noise on residents. Several submissions disputed the volume of traffic indicated by Jeffries as using McEvoy Road.

The EPA questioned the applicability and reliability of noise data acquired at the Wingfield site to the proposed Buckland Park compost facility and whether it confirmed acceptable levels outside the 7am to 10pm period. In addition the EPA indicated that the proposed 1.5m high earth bank and vegetation would not be adequate for noise attenuation.

In addition to comments relating to potential health effects the Department of Human Services suggested that consideration should be given to a reduction in speed limits along McEvoy Road and avoidance of out of hours deliveries. The City of Playford indicated that the existing speed limit of 100km/h on McEvoy Road would need to be reduced to 60km/h.

In section 14 of the Response Document Jeffries provided its view that the facility would comply with EPA requirements, as the plant and equipment were the same as currently used at Wingfield and there was a buffer distance of 1000m to the nearest house. In terms of traffic noise Jeffries re-iterated its conclusion from the PER. It also indicated that the deletion of the NAWMA recyclable organics transfer facility from the proposal, requiring a 50km/h speed restriction for drivers accessing the facility and minimizing the after hours traffic movement, would further reduce potential noise impacts.

Management and Monitoring

The proposed management and monitoring measures for the site were included in section 7.14 of the Environment Management Plan. Jeffries has indicated that it has sufficient knowledge of the plant and equipment proposed to be used at the compost facility to be able to comply with the EPA maximum noise level, of 47 dB (A) between 7am and 10pm, when measured at the receptor and that noise levels will not exceed 40dB(A) between 10pm and 7am. Jeffries has also given a commitment to the following:

- All plant and equipment operating on the site will be maintained in accordance with the manufacturer's requirements, including the fitting of exhaust mufflers;
- The compost facility will be surrounded by a 5m mound within 5 years of site establishment;
- Where possible the use of excavators and dump trucks in lieu of front end loaders for composting
- Monitoring of noise levels to establish a noise profile for the site

Conclusion

Establishment and operation of the compost facility at Buckland Park has the potential to create noise impacts due to site activities and off-site due to traffic movements.

Normally, a noise assessment is undertaken that is specific to the site under consideration, using existing background levels, local climatic conditions and topography. This has not been undertaken by Jeffries, since it has relied on data from its existing operations at Wingfield on the same plant and equipment that will be used at the proposed Buckland Park site. Not withstanding, Jeffries has made a commitment to not exceed the EPA Environment Protection (Industrial Noise Policy) maximum permissible levels of 47 dB (A) between 7am and 10pm and 40dB(A) between 10pm and 7am.

The distance to the nearest sensitive receptor is measured at approximately 1.0 km. It is seen as imperative by the EPA that the buffer distance to sensitive receptors is maintained.

There will be increased traffic movement along McEvoy Road, of which the majority will be trucks and semi-trailers that have the potential to create adverse noise impact on residents. Jeffries proposes to restrict drivers accessing the site to a speed limit of 50km/h, although it is not clear how this will be managed or enforced. The reduction in speed is consistent with the recommendation of the Department of Human Services and the City of Playford.

The proposed management and monitoring measures as detailed by Jeffries in the Environment Management Plan are considered reasonable to mitigate potential impacts. Notwithstanding, in the event of noise complaints arising from the composting operation, Jeffries may be required by the EPA, in the form of a report by a suitably qualified acoustic consultant to ensure, that the relevant maximum levels prescribed in the Environment Protection (Industrial Noise) Policy 1994 are not being exceeded. Licence conditions set by EPA may be modified eg to limit hours of operation of equipment if there was a breach.

5.1.6 Surface Water Management

Background

The Guidelines required the proponent to, *"Describe stormwater and wastewater management and the potential impact on both groundwater and surface water, including the risks of contaminated water entering these water systems."* In addition the proponent was required to, *"Detail the measures to be taken to protect and monitor groundwater and surface water resources and their associated environments."*

The composting and processing areas have the most potential for the production of surface flows since they will be established with low permeability compacted clay liners and compacted rubble hard stand areas. These areas are also potentially the most polluting in terms of surface runoff becoming contaminated with composting products and leachate. The majority of the site will be used for horticulture and has less potential for runoff, except in unusual circumstances.

PER and Response Document

In section 5.2.20 of the PER, Jeffries indicated that due to the topography, stormwater would be contained within the site. The specific measures that would be adopted to protect and monitor surface water and groundwater resources included:

- Regrading of surface slopes to achieve effective drainage grades.
- Constructing a 300 mm thick compacted clay liner with a permeability of 1 x 10-9 m/sec in the receival and windrow areas.
- Installation of a 500 mm biomat to absorb surplus surface water.
- Construction of drainage swales and a storage pond to intercept and store any surplus stormwater.

In the PER it was concluded that there would be negligible risk to external surface water systems and Jeffries would ensure that composting activities would not have an adverse impact on groundwater.

Appendix 8 of the PER included excerpts of a surface water assessment undertaken for the proposed site. It was recommended that a peak storage surface water dam with a capacity of 3500 KL and a second storage dam of 6000KL capacity be established at the site. Surface water from the smaller storage would be pumped to the larger storage, which would have a 300 mm overflow pipe. It was not clear from the documentation whether the recommended design was going to be adopted by Jeffries.

In its submission, the EPA indicated it required additional information on the stormwater and wastewater management systems. In addition design proposals were required, including site layout, management of groundwater, surface water and leachate, clearly justifying the suitability of the proposal in terms of groundwater impact potential. Groundwater issues are discussed further in section 5.2.4.

The Department of Environment and Heritage (DEH) indicated that there should be separate systems for the collection and storage of clean and potentially contaminated stormwater and sought additional information on whether excess water would be allowed to discharge off-site, on the treatment of wastewater, impacts on groundwater and adjacent creeks and management of high rainfall events. In addition it was indicated that the proponent should consider establishing a wetland as part of surface water management measures.

In its Response Document, Jeffries provided additional information on the design aspects for surface water management and concluded that the site was not prone to flooding and that all rainfall could be retained within the site. The design information was the same as included in Appendix 8 of the PER with surface water retained in large ponds in the southwest portion of the site. As indicated previously, the biomat was removed from the proposal, however Jeffries did not undertake a review on how this would impact the proposed stormwater management measures.

In response to the DEH submission, Jeffries indicated that the inclusion of a mound around the site would ensure that all stormwater would be retained within the site and not result in an impact on adjacent surface waters. The assessment had also indicated that extreme rainfall events would be retained within the site. Surface water runoff from greenhouses and the centre pivot area would be used to irrigate landscaping and the woodlot area. Jeffries indicated that the surface water storage area would be designed to ensure it was compatible with the suggestion of incorporating a wetland into the overall surface water management system.

Environmental Management Plan

The EPA and Planning SA did not consider that the Response Document provided sufficient information on the surface water management measures, which was compounded by the uncertainty of the location of groundwater below the site (refer to section 5.2.4).

Jeffries submitted an Environmental Management Plan (EMP) that included management and monitoring aspects for establishment of Stage 1, namely the production of 75,000 tonnes of compost. The EMP incorporates amended surface water management measures, taking into consideration the measured groundwater levels and site topography.

The additional information was provided in section 7.5 and Figures 7.1(A), 7.1(B) and 6.4 of the EMP, and the amended surface water management measures comprises the following:

- Retaining all surface water within the site.
- Establishing a fill platform for the windrow area to enable surface water to flow to the drainage swales and sumps. A 300 mm thick compacted clay liner with a permeability of 1 x 10-9 m/sec would be constructed below the composting area and topped with a 200 mm thick layer of compacted rubble.
- Separation of wastewater from the receival, processing, storage and dispatch areas and stormwater from the remaining areas of the site.
- Collection of rainfall from the windrow area (estimated to be 98 KL/year for average conditions) within drainage sumps comprising concrete pits underlain by a 300mm thick layer of compacted clay and high density polyethylene geomembrane.
- Recovery and re-use of wastewater from the drainage sumps to irrigate windrows.
- Surplus water from the sumps would be pumped to a reed bed established adjacent to the wheel wash facility. The wetland would be lined with a 300 mm thick compacted clay liner.
- Runoff from the hardstand areas (calculated as 910 KL for average conditions) and access roads would drain directly to the surface water ponds that have a capacity in the order of 6.4 ML.
- Rainfall runoff from a 1 in 25 year storm event (calculated as 2 ML) would also be stored in two 300 mm deep surface water ponds located directly south of the windrows. The base would comprise a 300 mm thick compacted clay liner with a permeability of 1 x 10-9 m/sec and a grassed topsoil cover.

The wheel wash and wash bay area, off the access road from Brooks Road, will internally drain to its own settling tanks and reed bed. The reed bed has been designed as a secondary settling feature. Water from the reed bed will be reused and captured sediment will be recycled into the composting process.

The windrow area is proposed to have a minimum 2% grade towards drainage lines and 1% grade along the swale drains, which will have a 300 mm thick compacted clay liner and HDPE liner. The surface of the swale drain will be covered with topsoil and grassed to minimise erosion.

Jeffries has indicated that if the volume of recovered surface water runoff is greater than required for the composting operation and not able to be stored in the reed bed and surface water ponds that they would install an above ground polyethylene storage tank. Aeration devices would be installed within the tanks to ensure that anaerobic conditions do not occur.

Jeffries proposes to undertake surface water sampling and analysis from the composting area on an annual basis. The parameters for analysis, which are indicated in Table 7.1 of the EMP have been approved by the EPA.

The EPA reviewed the EMP and indicated that the stormwater assessment methods and calculations included in Appendix H of the EMP were acceptable for determining the capacity of the proposed infrastructure and water run-off calculations.

Conclusions

Surface Water

The amended proposal is for the processing of 150,000 tonnes of compost in two stages. An EMP has been provided for the 75,000 tonne Stage 1 and includes amended surface water management measures.

The proposed management measures, include the retention of surface water within the site, incorporation of provisions for re-use and separation of clean and impacted water, the installation of low permeability liners to minimise the potential for groundwater contamination, and contain appropriately designed surface water storages. **These are considered by this assessment to be acceptable.**

Figure 6.2 provides a conceptual layout for the proposed expansion of the compost operations to 150,000 tonnes and associated surface water storage pond. The consultant has recommended monitoring of the capacity and operation of the surface water sumps as a check on design calculations. This information will enable refinement of the surface water management measures for expansion to 150,000 tonnes.

The EPA concluded that the proposal will not result in an unacceptable risk of environmental harm or nuisance providing the level of site preparation, management and maintenance detailed in the EMP is maintained at all times.

The EPA has indicated it will require design and construction details, including material specifications prior to commencement of construction and receipt of material for composting. In addition, the EPA has indicated it will impose conditions of licence requiring reporting of construction results and the maintenance of all drains and ponds.

External Flood Risk

Flood risk exists from the wider catchment. Off site sources of flooding include, the Gawler River, the drains along the south and western boundaries carrying water from upslope of the development and runoff from adjacent local areas.

The composting facility is situated on land above the 100 year flood level of the Gawler River, this should provide more than adequate protection from floods. It is proposed to surround the site with a 2m high embankment.

5.1.7 Geology and Hydrogeology

Geology

Section 5.2.1 of the PER refers to geotechnical investigations undertaken on the site by Coffey Geosciences on behalf of the previous owner. However there were no details provided on the subsurface soil conditions. Similarly no additional information was provided in the Response Document.

Subsequent investigations, undertaken by Jeffries at the request of the EPA and Planning SA, indicate that unconsolidated Quaternary age sediments consisting of sands and clays of the Pooraka Formation and Hindmarsh Clay underlie the site. These sediments overlay the Tertiary age Hallett Cove Sandstone, Port Willunga Formation and South Maslin Sands. The near surface soils typically consisted of red-brown to orange brown clay soils of medium to high plasticity, underlain by grey and brown silty clay of high plasticity.

Geotechnical testing was undertaken by Coffey Geosciences as part of a previous assessment of the site and surrounding area. The results suggest that it is likely that the clay soil located on the Jeffries site should be suitable for constructing a low permeability liner, however specific sampling and testing would be required. The test results also indicate that the soils show partial dispersion and there is a high potential for erosion to occur where water flows over exposed surfaces.

Additional geotechnical investigations were undertaken at the site in July 2003 (section 4.2 of the Environment Management Plan (EMP)). The consultant concluded that, based on soil profiles at the test pit locations and the permeability test results, the clay underlying the topsoil is suitable for providing a clay liner with a permeability less than 1 x 10-9 m/sec.

Groundwater

Section 5.2.19 of the PER provided information on the status of groundwater at the site. This was obtained from a review of investigations undertaken on the adjacent Penrice property and from a study undertaken by the City of Playford in the Buckland Park area. This initial assessment suggested that shallow groundwater below the site may be located between 1-6m below ground level, has a general westerly flow direction and has a salinity ranging from 1,280 mg/L to 30,000 mg/l total dissolved solids (TDS).

Section 5.2.21 of the PER indicated that deeper aquifers are separated from the shallow aquifer by the low permeability Hindmarsh Clay.

In its response to the PER the EPA and DWLBC indicated that the information provided was of a general nature and did not enable an appropriate assessment of the risks of the project on groundwater. In its Response Document, Jeffries indicated that additional investigations would be undertaken if approval were granted for the development.

At the further request of EPA and Planning SA Jeffries undertook investigations at the site that included the installation of seven groundwater monitoring wells, logging of soil cores to assess the distribution of near surface soils, undertaking of permeability testing of all groundwater wells, and sampling and analysis of groundwater from all wells. In addition a review of the PIRSA groundwater database was undertaken by Jeffries to determine the location and status of existing groundwater wells.

Measurement of groundwater levels was undertaken over several months with the highest recorded levels ranging from 0.90m below the current ground surface in the southwest portion of the site to 1.75m in the eastern portion of the site. The investigations indicated that the shallow groundwater has a salinity ranging from 10,900 mg/L TDS to 58,900 mg/L TDS and on this basis would have limited industrial and stock watering uses. Elevated concentrations of total nitrogen, total phosphorus and high chemical oxygen demand were measured in the groundwater, which Jeffries has attributed to historic irrigation and application of fertilisers in the region or past uses of the site.

The PIRSA records indicate five historical wells located in close proximity to the site. Of these, three have been abandoned, one has been backfilled and one is operational. From the well construction details and water quality it appears the wells were installed in the deeper aquifers.

Management and Monitoring

The measures to protect and monitor groundwater quality below the site were discussed in section 5.2.21 of the PER and section 14.6 of the Response Document. In the Response Document Jeffries indicate the bio-mat system originally proposed in the PER (section 5.2.21), was no longer included in the proposal.

To reduce the potential for groundwater contamination, the windrow area will have a clay liner comprising of two layers each having a minimum compacted thickness of 150mm with a hydraulic conductivity of 1x 10-9m/s and a smooth final surface that is graded at a minimum of 2% towards drainage lines and 1% along drainage lines. The clay will be covered with a 200mm thick layer of compacted rubble and the final surface will be graded to a minimum of 2% towards drainage lines and 1% along drainage lines.

A minimum 1.00 m separation will be maintained between the highest standing groundwater level and the underside of the clay liner in every constructed area.

The EPA supports the proposed design and has indicated it will require full design and construction details, including material specification reports to be provided to the EPA for approval prior to material delivery to the site and commencement of construction on the site.

If approved an EPA licence condition (issued at the appropriate time) will be included regarding the monitoring of the separation distance between groundwater and underside of the clay liner. Measures will be required to be put in place to ensure corrective actions being activated prior to the separation distance being at or less than 1.00m. It is proposed to set a trigger level of 1.10m (separation distance) for more frequent level monitoring (minimum daily) and a second one at 1.05m (separation distance) to activate corrective actions. An EPA licence condition will require water levels to be measured weekly and assessed and reported monthly to the EPA for the first year of operation.

The receival area will be in an enclosed building with a concrete floor. Jeffries concluded that there was a low potential for windrow operations (including water stored in the pond) to significantly impact the environmental value of the groundwater resource in the area, due to the proposed management measures and the requirement to utilise water in the compost process.

In the EMP Jeffries has proposed a groundwater monitoring program that would involve sampling an analysis of 14 groundwater monitoring wells (7 existing wells and 7 new wells). Wells within the composting area are proposed to be sampled bi-annually and all wells annually. Jeffries has indicated (section 7.4 of the EMP) that a remediation plan, acceptable to the EPA, would be prepared and implemented if groundwater pollution was attributed to site activities.

Conclusions

The investigations have indicated elevated concentrations of nitrogen and phosphorus in the groundwater that Jeffries has attributed to either the regional use of fertilisers or past agricultural use of the site. On the basis of salinity shallow and expected low yields, groundwater below the site has limited uses, however it could provide a conduit to adjacent sites and the coastal ecosystem at the point of discharge.

The Jeffries compost facility has the potential to contaminate the shallow groundwater system by seepage from the surface water pond and by leachate from the windrow area.

The EPA indicated that surface water management measures should aim to prevent the contamination of groundwater beyond any existing pollution levels on site and beyond property boundaries. The proponent will also be required to comply with the EPA licence conditions.

The establishment of compacted clay liners will manage the potential for significant contamination of groundwater but given the shallow depth of groundwater in the surface water pond area, seepage is expected to intercept groundwater at some stage. Additional investigations to confirm the suitability of clay soil at the site for use in compacted clay liners for the pond and composting area should be undertaken in accordance with Level 1 Supervision in AS 3798 to ensure that the liner has permeability <1 x 10-9 m/sec.

The implementation of a groundwater monitoring program will enable the detection of impacts from the compost facility and implementation of appropriate management measures, which may include remediation.

The risk of contaminating deeper aquifers is considered acceptably low due to the significant thickness of low permeability Hindmarsh Clay. The exception to this is the potential transfer via corroded well casings from historical wells in the area. There will be a need to confirm the location and status of old wells located on the site and decommissioning of the operational well to ensure there are no risks of cross contamination from the shallow Quaternary aquifer to the deeper Tertiary aquifers.

The conclusion of the EPA and this AR is that if the construction of the stormwater ponds and drains are undertaken by Jeffries as outlined in the EMP, management of the ponds and drains is undertaken and monitoring of groundwater levels occurs as specified by EPA there should be no risk of further contamination to the underlying groundwater on the site. It should be noted that there has already been some contamination due to past practices on the site.

If approved, there will be EPA licence conditions relating to the maintenance of all drains and ponds.

5.2 BIOLOGICAL IMPACTS

5.2.1 Flora and Fauna

Existing Vegetation and Fauna

The site has been used for agriculture over many years and its indigenous habitat is therefore absent or severely degraded. No significant native flora and fauna exist on the site, except for visiting birds and other animals that may forage occasionally on it.

Aleppo pines and Athel trees are found on parts of the western and northern boundaries. Boxthorns and artichokes are commonly found. Marine Barley Grass is found on the lower lying south west of the site indicating low level salinity and/or waterlogging.

In the Response Document section 14.11, the Native Vegetation Council requested vegetation surveys be undertaken for road reserves to determine the presence of any native species and particularly *Gahnia filum* as it is habitat for the rare Skipper Butterfly. It also requested that at least 1ha of land be set aside for growing *Gahnia filum* to provide habitat for the Skipper butterfly as this area is part of its former range. This should be a note on any approval.

Landscaping

The landscaping plan prepared for this site will establish a densely planted vegetative screen along the eastern boundary of the depot. Trees and shrubs will also be planted within the site to aid air mixing and lower wind speed.

In addition to the 1.5m perimeter landscaping mound a 5 m high, 20m wide, mound is proposed immediately behind the perimeter landscaping. This mound will provide additional screening of the site, woodlotting for future harvesting and reduction of wind speed across the site. It will be constructed from soil and recycled organics. After harvesting of the trees, the mound will be recycled and composted and replaced with new material and replanted. Bolivar effluent water is available for the site and may be used for irrigation of the woodlot.

The objectives of the vegetative buffer are:

- Dust, noise and possibly odour reduction
- Reduction of wind speed over compost windrows
- Visual screening and amenity
- Firewood production
- Possible improvement of saline soils

At 1.5 m high *(2m high is quoted in the Response Document under Potential External Flood Risks and also on the plan Fig7.1 EMP)* and 5-7.5m wide landscaped boundary mound is to be established as a permanent buffer for the 5km property boundary. The mound will serve the following objectives:

- Noise, reduction from both the mound and covering vegetation acting as barrier and baffle
- Wind reducing moisture losses in the windrows and movement of dust

- Dust, filtered by the covering vegetation
- Visual impact, screening the site from outside view
- Surface water barrier, for retention of runoff on site and protection of the site from off site runoff
- Local biodiversity conservation, including plantings of Gahnia filum as habitat for the Skipper butterfly as appropriate

Landscaped buffers will also be provided between the composting and non composting areas and along the access road on the northern boundary of the composting and non-composting areas. Internal shelterbelts for the windrowing cells and native landscaping strips will grow on in situ soils not created mounds as elsewhere on the site.

Amongst the limiting factors for vegetation establishment is the relatively shallow (1.5-2m deep) highly saline water table, the exposure to salt laden winds and the sodic/saline surface soils. Some surface waterlogging is also apparent on the site following rain. The proposed mounding will enable the establishment of more species and more rapid growth than what would be expected on the natural soil levels.

Vegetation native to the area is to be planted on the road verges and permanent landscape mound. Powerlines restrict the height of roadside plantings to less than 3m on many road reserve verges. Vegetation on the landscape mound should grow up to 6m in coastal conditions. A mixture of vegetation types is to be used.

Woodlot plantings will be primarily Eucalyptus spp, She Oak and Swamp Oak. These will grow to heights varying from 7-20m.

The total width of the external belts (5-10m landscape mound and 20m woodlot mound) will provide effective screening and being relatively permeable to wind will reduce wind speed for about 10 times the vegetation height. Staggered plantings will assist in providing a baffle effect on wind penetrating the windbreaks. The sloping face of the windward sides will tend to direct wind up and over the belt also.

Firewood production from the 10ha woodlot is estimated to yield 200-600 air dry tonnes after 10 years. While irrigation from Bolivar water would likely double production, the expected increased returns are unlikely to pay for the set up and operating costs of irrigation. However irrigation at planting may be used to enhance survival and speed growth.

5.2.2 Pest Plants, Insects and Diseases

Summary of PER and Response Document

The PER guidelines required Jeffries to conduct as assessment of the risks of spreading pest plants, insects (particularly the western flower thrip and fruit fly) and diseases that could impact the adjacent horticulture industry. In addition, Jeffries were required to describe measures that would be adopted to minimise these risks, provide a risk management assessment, identify measures that would be adopted if the green waste is discovered to have been sourced from a quarantine area and prepare a contingency plan that would be adopted in the event of a fruit fly or any other pest, plant or disease outbreak. Jeffries' addressed these issues in sections 5.2.12 to 5.2.16 of the PER and are discussed below.

Jeffries considered that the high temperatures developed in the windrows and the frequency of turning would prevent the establishment of vermin and insects. In addition, the nature of the material being received was not conducive to attract vermin or insects.

Notwithstanding, Jeffries initially proposed to adopt the following measures:

- Primary processing of all material in an enclosed building within 60 hours;
- Receiving updates from PIRSA on the locality of any quarantine areas of pest plant and insect outbreaks;
- Establishing protocols for processing material from these areas; and
- Establishing a routine sampling and testing protocol to monitor the quality of incoming material.

Jeffries concluded that the risks would be negligible if covered trucks were used and processing of the material was undertaken according to the accepted Australian Standards.

In order to ensure effective management of fruit fly Jeffries developed a range of measures in conjunction with PIRSA and these included

- the nomination of a contact person,
- establishment and maintenance of communication with PIRSA and contractors supplying material,
- diversion to landfill of suspect material,
- enhancement of on-site traceability of delivery sources and materials,
- windrow and final product location,
- use of specific parts of the process,
- implementation of protocols to prevent cross contamination,
- processing within 60 hours and
- establishing pest plant monitoring stations in and around the facility.

These are further elaborated at the end of this section of the AR.

Jeffries undertook a risk management assessment of the various parts of the proposed operation, including nature of raw material, potential for contamination of raw material, delivery activities, processing and handling and composting process. The following conclusions were provided:

- The risks are negligible if covered trucks are used and processing of the materials is managed; and
- The intended management of vehicle movements, proposed handling of raw materials and contaminants and commitment to Australian Standards for composting, suggests that any plant pathogen and pest risk will be manageable and will not threaten the continued viability of any intensive horticulture in the area.

Jeffries has indicated that it will comply with and meet all government regulations relating to fruit fly, western flower thrip and other potential pests and become part of the monitoring and communication networks. It is Jeffries' view that the management, processing and monitoring measures indicated above will minimize the risk of infestation and off-site impacts. In addition, insecticides would be applied if required.

A number of submissions were received from the public and industry organisations following exhibition of the PER. These primarily related to the potential risk of fruit fly infestation, pathogens and other pest and insect diseases in the Virginia horticulture region, the lack of quantification of these risks, potential for introduction of phylloxera to the viticulture industry, and the financial implications to the horticulture industry should a quarantine area be declared.

The Department of Environment and Heritage raised concerns relating to, the establishment of the management measures to control the spread of Phytophthora, the need to control weeds and prevention of recycled organics for in-vessel composting becoming a food source for birds.

In it submission PIRSA raised several issues:

- The potential for fruit fly and exotic plant pests and diseases to be introduced through the NAWMA transfer facility that was proposed to be located on the site and the in-vessel composting of market waste material;
- The understatement in the PER of the economic impact to the horticulture industry if there was a pest or disease outbreak; and
- The proposed western thrip management measures proposed by Jeffries were too strict.

In addition PIRSA recommended that Jeffries:

- Revise the assessment of potential economic impact of pest or disease outbreak at the site;
- Provide information on the quality assurance mechanisms and contingency plans in the event of machinery breakdowns, and data on strong wind events which prevent processing of green waste and windrow turning;
- Consider the adoption of independent audits and oversight by a broadly representative committee;
- Provide details of response strategies/contingency plans in the event that fruit fly is detected in traps or other serious pests/diseases are detected; and
- Respond to other PIRSA comments, including cleaning routines in the receival area and proposed use of a bio-mat.

Jeffries' responses to public and Government submissions were provided in section 3 and 14 of the Response Document. There was a commitment by Jeffries that all incoming green organics would be unloaded and undergo initial processing within an enclosed building that had a concreted floor. The NAWMA facility and the bio-mat were deleted from the project and a compacted rubble base is to be installed over the compacted clay liner. On the additional advice of consultants Jeffries re-iterated its earlier assessment that there would be negligible risk of introducing pest and diseases if the material for composting was transported in covered trucks and processed in accordance with Australian Standards and the level of risk to the horticulture industry would be unchanged from the present situation. It was also considered that the use of a concrete floor in the receival building and use of a compacted hardstand would prevent fruit fly incubation.

Discussion

Of concern to the horticulture industry in the Virginia area is the potential economic impact if there is an outbreak of pest plants and diseases from the compost facility, particularly fruit fly. Jeffries has indicated that adherence to protocols in the relevant Australian Standards, AS 4419-1998 Soils for landscaping and garden use and AS 4454-1999 Composts, soil conditioners and mulches, would result in negligible risks.

AS 4454-1999 provides best practice guidelines for composting systems. These indicate that to kill plant and animal pathogens and weed propagules the compost process has to be maintained at a minimum temperature of 55 degrees C for at least three consecutive days. This requires appropriate turning (a minimum of three turns) so that there is thorough mixing to ensure that all material is exposed to the required temperature for pathogen and weed destruction. The standard indicates that front-end loader or similar equipment or a specific windrow turner can undertake turning and mixing.

In assessing the potential risks of establishing a compost facility at Buckland Park, Planning SA undertook a review of the literature. The following provides a summary of some relevant studies.

A study was undertaken between 1995 and 1999 by the Victorian Institute of Horticultural Development on behalf of EcoRecycle, Victoria to assess pest practice risks of use of green organics in horticulture. The study concluded that the content of green organics was consistent across seasons and localities in the Melbourne metropolitan area (variations being related to the presence or absence of grass clippings), weed species at the six sites inspected comprised 28% of the green organics and that the incidence of plant pathogens was low, with less than 5% of loads containing potentially serious plant pathogens. Composting trials were undertaken to assess the minimum requirement for elimination of weeds and plant pathogens. It was concluded that heat generated during the thermophilic phase of composting (above 45 degrees C) is the main mechanism for destruction of weeds and plant pathogens and these are more efficiently killed the longer they are exposed to temperatures above 55 degrees C. The study also indicated that temperatures within the windrows could be variable with pockets of hotter and cooler areas developing, highlighting the importance of regular turning. The study concluded the following minimum requirements; consistent with AS 4454-1999 should apply:

- Green organics should undergo a period of well regulated thermophilic composting to maximise elimination of plant pathogens and weeds;

- Optimise particle size and moisture content to ensure that thermophilic temperatures are reached;
- Piles should be maintained at 55 degrees C for at least 3 days each time before turning;
- The length of composting will depend on the desired product, but a minimum of 3 weeks after reaching 55 degrees C is recommended, incorporating at least three turns.

Meats, 1987 in *Fruit Flies: Biology, Natural Enemies and Control*, reported on the temperature mortality factors for fruit flies. On the basis of experiments it was concluded that mortality for the Queensland fruit fly zero survival would occur in egg to adult stages at maximum temperatures ranging from 32.5-41 degrees C.

A study by Bishop et al 2002 assessed the mortality of grape Phylloxera in composting organics by conducting experiments involving the placement of contaminated material at different levels in a compost windrow that was maintained in accordance with AS 4454 and turned with a front end loader. The study concluded the following:

- Phylloxera could enter the windrow from infested feedstock;
- Key factors in destroying Phylloxera are temperature, period of exposure and efficiency of turning of the windrow;
- Tests indicated that commercial composting procedures would produce zero survival of phylloxera.

Keen et al 2002 undertook a study into the effects of windrow temperatures and Phylloxera mortality. Temperature data was obtained from various levels of compost windrows. The study indicated that the upper survival of Phylloxera ranged between 36-40 degrees C, the thermophilic stage of composting occurred at temperatures greater than 45 degrees C and that windrows can reach temperatures in excess of 70 degrees C for several days. The following conclusions were provided:

- Critical factors influencing temperature profiles during composting include oxygen supply through aeration, moisture content, material composition, particle size and structure of compost pile;
- The temperature and time requirements of AS 4454 exceed those for heat treatment disinfestations procedures in the Australian National Management Phylloxera Protocols, 2000.
- There was a small risk that some Phylloxera may occasionally survive the composting process with static composting systems; and
- Phylloxera is not likely to survive temperatures reached during a compost process that complies with AS 4454.

It should be noted that Phylloxera does not currently exist in South Australia and could not, therefore, be transferred to the Buckland Park site from green materials collected for this development.

Environmental Management Plan

Additional information to address PIRSA's quality control, contingency and management concerns was provided by Jeffries in an Environmental Management Plan.

PIRSA conducted a review of relevant sections of the EMP as they related to pest plants and diseases and provided the following assessment.

Based on the information in the Public Environmental Report and the Response Document, the facility represents a possible additional risk of pests and disease threats to the Northern Adelaide Plains.

PIRSA noted that the risk mitigation measures for the proposed facility exceed those applying at other organics waste facilities in this state. PIRSA commented that it was aware that horticulture on the Northern Adelaide Plains is at risk from pests and diseases from current activities and practices. These include:

- Uncontrolled and indiscriminate dumping of plant material on roadsides and properties
- The movement along Port Wakefield Road, of waste from metropolitan Adelaide to land fill sites to the north
- The re-use, at the Adelaide Produce Market, of cartons and pallets brought in from interstate, and
- The importation of potatoes to processing plants on the Northern Adelaide Plains.

PIRSA concluded that provided the proposed risk mitigation measures listed below, are adopted; the proposed facility is no more likely to result in the introduction of plant pests and diseases to the Northern Adelaide Plains than current activities and practices.

Risk Mitigation Measures

The following risk mitigation measures were included in the EMP.

a) Design of the facility

- Deletion of the NAWMA recyclables organics transfer facility
- Location of the incoming materials receival area adjacent to the western boundary of the site being distant from the final product packaging area
- Compost material from the Adelaide Produce Market only within an in-vessel facility (not part of the current assessment).
- Receive incoming material in a fully enclosed building, constructed on a concrete slab and with all vehicle access points sealed using air curtains and all other openings covered by insect proof screens.
- Construction of a hardstand rubble base to windrow areas.
- Banning the planting of host plants for Mediterranean or Queensland fruit fly on the property.

b) Operation of the facility

- Process incoming material within 24 hours of receival
- Ensure internal windrow temperatures reach >50C within 24 hours of the windrow being formed
- Require all vehicles transporting material to the site to securely cover their loads
- Restrict access to the site to vehicles with a carrying capacity of 5 tonnes or more
- Undertake the housekeeping practices as detailed in Section 7.9 Housekeeping of the Environmental Management Plan 6 August 2003.
- Screen and shred incoming material to be taken to windrows before it is taken from the receival building
- Wash down all mobile plant before it enters or leaves the receival building
- Require all vehicles to pass through a wheel wash facility when entering and leaving the site
- Wash down the receival building weekly
- Undertake the measures detailed in Section 7.7 Plant pests and Diseases of the Environmental Management Plan 6 August 2003.
- Implement a site specific contingency plan for outbreak of quarantinable pests or diseases
- Divert material from fruit fly quarantine areas to land fill
- Dedicate plant and machinery to specific activity areas eg the receival building, the windrowing area or the final product area
- Clean plant and machinery prior to movement from one activity area to another
- Recover wash down water and solids and run off water and apply to compost windrows
- Implement a trace back system to sources of all material received
- Undertake weed management strategies to manage WFT on the property.

c) Monitoring

- Establish and maintain yellow stick traps within the receival building (and surrounds if necessary) with an appropriate monitoring program and take action if the traps indicate that the site is contributing significant WFT populations to the surrounding area
- Establish additional monitoring sites in order to extend the local PIRSA fruit fly monitoring grid to include the area around the facility.

d) Consultation arrangements

- Establish a community consultative committee with representatives of local government, Jeffries and the grower community to oversee the bio-security aspects of the facility.

e) Compliance assurance

- Undertake audits of relevant processes and incorporate into QA processes and assure this by the licensing regime
- Adhere to and meet the relevant Australian standards
- Enter into formal arrangements with PIRSA to monitor plant pest and disease risk minimisation and monitoring measures.

Conclusions

Concerns have been expressed by horticulturalists and regional organizations that the establishment of a compost facility in close proximity to Virginia would create an unacceptable risk to the local horticulture industry as a result of infestation of fruit fly and other insects, pest plants and diseases.

Jeffries undertakes its composting operations in accordance with AS 4454 and a Quality System that has been independently accredited to ISO 9001.

Technical studies reported by Meats 1987 indicate that temperature that would result in zero survival of fruit fly from egg to adult phase are achieved and exceeded during composting processes that comply with AS 4454. Other studies reported by Keen et al 2002, Bishop et al 2002 and EcoRecycle indicate that composting operations undertaken in accordance with AS 4454 would achieve destruction of weeds and pathogens, including Phylloxera.

PIRSA has advised that the proposed management measures and contingency plans proposed to be adopted by Jeffries are not likely to result in unacceptable risks to the horticulture industry at Virginia. This AR accepts their expert advice.

5.3 HAZARD RISK ASSESSMENT AND MANAGEMENT

5.3.1 Methodology and Hazard Identification

A hazard risk assessment was used by Jeffries throughout development of the project including, selection and design of processes, operating procedures, risk management procedures, layout, and the use of buffer zones to nearby residences. The assessment included the use of a rating system to assess the relative risks of components of the project.

Jeffries identified the potential risks of the Buckland Park operation in Section 5.6 of the PER. The rating hazards in the tables i.e. low, medium and high were determined by applying the qualitative methodology outlined in HB 203:2000, Environmental Risk Management – Principles and Processes, jointly published by Standards Australia and Standards New Zealand.

It should be noted in the case of odour and dust that it is now no longer proposed to only operate the windrows under certain wind conditions as stated in the tables in section 5.6 of the PER. It is intended that continuous operation is possible with the application of water to the windrows if needed to avoid dust and odour off site impacts. This approach is considered satisfactory by the

EPA. Other hazards identified in the table will be further reduced by processing in coming material within 24 hours in a contained receival building with a hard stand floor.

An Economic Risk Assessment was undertaken by Davidson Viticultural Consulting Services on behalf of Jeffries and concludes:

"the introduction of a waste treatment facility such as that proposed by Jeffries Soils is unlikely to increase the risk of a pest or disease outbreak on the NAP. Further it concludes that should an Organic Waste Treatment and Recycling Research Facility be established on the NAP, the level of economic risk to the horticultural industry would be unchanged from the present situation."

It should be noted that the report estimates that the cost of a simultaneous outbreak of Phylloxera, Fruit fly, Glassy Winged Sharp Shooter/Pierces Disease and Potato Cyst Nematode is $106.03m. It should also be noted that some of these pests/diseases do not currently exist in South Australia. This cost would translate to a cost of approximately $8,000 for each horticultural property on the NAP.

Public submissions to the PER disputed Jeffries' assessment of the income the area and the horticulture industry provided to the State and in exports. This was also confirmed by PIRSA in its submission,

Local industry groups and individual growers indicated in their submissions that the proposal should not be approved as there was no guarantee of "zero risk".

5.3.2 Conclusions

The risk assessment process involves establishing whether there is a potential hazard, then determining the level of risk and establishing management and monitoring measures to mitigate these risks.

As indicated above and in section 5.2.2 of this AR, Jeffries has established management and monitoring measures to ensure that there are negligible risks to the horticulture industry.

The composting process is well understood and research (refer section 5.2.2 of the AR) indicates that undertaking composting in accordance with Australian Standard AS 4454 will provide the necessary temperatures (greater than 50 degrees centigrade) to render inert weeds and pest plants and diseases that are of concern to the horticulture industry.

PIRSA has considered the proposal in detail and has carefully considered the proposed management and monitoring to be undertaken by Jeffries and indicated the facility represents a possible additional risk of pests and disease threats to the Northern Adelaide Plains. However, provided the proposed risk mitigation measures detailed in the EMP were adopted; the proposed facility is no more likely to result in the introduction of plant pests and diseases to the Northern Adelaide Plains than current activities and practices.

5.4 TRANSPORT ISSUES

Jeffries has negotiated with Transport SA regarding the construction of a new access junction between Port Wakefield Road (part of National Highway One) and McEvoy Road as the main access point to the site.

The PER (Section 5.5) states that an access road would be upgraded to enable safe and controlled access to and from the site. Slip-lanes would be provided on both sides of the proposed access road intersection with Port Wakefield Road. This intersection would be designed in accordance with Transport SA requirements.

Transport SA has indicated that the preliminary plans, as presented by Jeffries, are acceptable in principle. TSA further states that detailed design and construction should be to the satisfaction of Transport SA, with all costs being borne by the proponent.

It is suggested that should the Governor grant Development Authorisation to the proposal, final plans for the construction of the access junction to the plant from Port Wakefield Road need to be approved by Transport SA prior to the commencement of work.

McEvoy Road is presently unsealed and the proponent has come to an agreement with the Playford Council on the engineering standard required for the road to be sealed. It is proposed that the Council undertakes the work to the agreed standard and Jeffries will fund it.

5.5 SOCIAL AND CULTURAL IMPACTS

5.5.1 Human Health

Health Risk Assessment

The guidelines for the PER required Jeffries to conduct a health impact assessment and outline the known human health effects of micro-organisms that may reside in the feedstock, composting material and final product, and their likely impact on both site workers and residents in the area (including reference to the potential for exacerbating or causing asthma or other respiratory diseases). In addition, Jeffries were required to identify how the health of local residents and other land users is potentially affected.

These issues were discussed in sections 5.2.8 and 5.2.9 of the PER and section 2 of the Response Document. Dr Richard Bentham from the Flinders University Department of Environmental Health undertook the health impact assessment on behalf of Jeffries. The risk assessment process incorporated the USEPA methodology, which includes identification of the potential hazard, review of dose response data, potential receptors, exposure scenario and assessment of the risks. The principal health risks determined by Dr Bentham are related to opportunistic pathogenic organisms such as *Legionella* and *Mycobacterium spp.* and some fungi and Actinomycetes that may be transported in the forms of aerosols to potential receptors (i.e. Jeffries employees and residents located off-site). On the basis of Dr Bentham's report, Jeffries concluded that employees were the most likely receptors at risk with residents having a minimal health risk. It was also concluded that uncontained dust and odours could pose a nuisance.

A number of submissions were received following release of the PER and these raised issues relating to the health impacts of bacteria and fungi from the composting activities and the potential for allergic reactions.

The Environmental Health Service of the Department of Human Services (DHS) commented that the Jeffries assessment focused on health risk impacts due to transport of viable organisms and potentially infectious diseases, the assessment had not considered potential allergies and irritations of the respiratory tract and exacerbation of pre-existing respiratory conditions as a result of exposure to organic dust. Notwithstanding this comment, Environmental Health Services indicated that adverse respiratory effects would be restricted to workers at the site and that the buffer distances between the facility and residents would provide more than adequate protection of transmission of infectious organisms, with the likely adoption of appropriate management measures. Further it indicated that the likelihood of nuisance would be minimised with the proposed site management measures. The submission also indicated that to control risks to public health, all domestic wastewater collection treatment and disposal would require approval of the local council or the Department of Human Services.

Management and Monitoring

Section 5.2.9 of the PER and section 2 of the Response Document discusses management measures to ameliorate potential risk to the health of workers and the adjacent community. Jeffries has relocated the receival area to the western end of the site and deleted in-vessel composting and proposes the following management measures:

- Enclosed building for receival, initial storage and processing of material within 24 hours;
- Establishment of perimeter landscaping and bunding;
- Maintenance of windrow moisture content;
- Watering of access roads;
- Restriction of vehicle speeds to 10km/h;
- Installation of sprinklers; and
- Curtailing windrow turning, grinding and screening operations if watering does not control dust.

To ensure appropriate management of the windrow operations Jeffries will use continuous data loggers to record temperature and moisture and install a meteorological station and dust collectors.

Conclusions

The assessment concludes the proposed management measures are considered acceptable to mitigate any potential impacts on adjacent residences and other land users, and are consistent with comments from the DHS. Potential risks to employees are manageable with the adoption of appropriate occupational health and safety procedures.

5.5.2 Employment

At full production capacity of 150,000 tonnes, an additional 26 people will be employed by Jeffries. Furthermore, the jobs of the existing 40 employees will be made secure. The employment of 26 people is estimated by Jeffries to provide additional wages of $1,560,000 per annum (PER Section 5.3.3).

The Nolan ITU Report undertaken for DIT and the EPA stated that the current organic recycling industry generates about $12.2m per annum and directly employs the equivalent of 152 persons (taking into account part-time employment.

As outlined in Section 5.3.4 of the PER, Jeffries expect to maintain a high staff to manager ratio at Buckland Park and will be seeking to employ people in the region as skilled and semi-skilled workers.

Information obtained from the ABS for the statistical local division of Playford West indicate a steady rise in population to the year 2016 for all age groups except males and females in the 15-24 age range, who are tending to be more mobile in seeking employment. It is likely that those seeking jobs at this facility would be in this age range, which presently has a high unemployment rate close to 30%.

No public or Government submissions raised any further issues in relation to employment and therefore no further information was provided in the Response Document. Job creation during construction is outlined in Section 5.4.1 of the PER, although some of these items have been deleted in the Response such as the transfer facility and the in-vessel composting unit has no information provided in the PER on its function or size.

In assessing this issue of employment this Assessment Report concludes that there will be a benefit to the State in terms of jobs created and also the positive effect of flow on employment upstream and downstream of the Buckland Park operations.

5.5.3 Visual Effects

Jeffries has proposed a number of structures on the Buckland Park site. These are outlined in Section 5.4.5 of the PER. This was subsequently modified in the Response Document in Section 1.7. The incoming receival area has been re-located at the south western end of the facility, which will make the distance to the nearest dwelling more than 1,000 metres. The receival area will be enclosed in a building or shed which will be approximately 8-9 metres high and 1,000 square metres in size (pers comm. L Jeffries 26/6/03). It is expected that a colour suitable to the environment would be selected for the cladding material. Several other buildings would also be developed at the site including greenhouses and workshops. As all of these structures are part of the development of the proposal concept, they will need to be assessed separately for building rules compliance at a future time.

In terms of visual effects the buildings will be screened from the surrounding area by a 1.5m high mound on which trees will be established. It is expected that, depending on the species of trees selected, the trees should grow to four metres or more over a five year period. A woodlot will also be established inside the mound area for future harvesting. The woodlot is proposed to be established on a mound up to five metres high (Section 4.6) PER.

The compost mounds or windrows will be in the order of three metres high and approximately 150 metres long. It is considered they are not likely to be visually intrusive in the landscape although some of the operating machinery may be visible (and audible) close to the boundary of the site.

In summary, with the proposed mounding and screening, the visual effects of the facility are expected not to be intrusive in the landscape particularly as the site is very degraded in its present state. Existing derelict buildings from the old intensive dairy operation will be progressively demolished.

5.5.4 Neighbouring Land Uses

The Jeffries site is located approximately 2.5 kilometres to the south weest of Virginia. The Penrice salt evaporation ponds are located to the west and south. Land directly to the north and east is used for the growing of fodder crops. Further east land uses include horticulture, hobby farming and horse agistment.

5.5.5 Health Services

No additional health service provision is expected to be required as a result of this development. Health Services for employees of the company will be addressed by Jeffries as is required under occupational health, safety and welfare legislation.

5.5.6 Education and Child Care Services

No additional education or childcare services will be required for the modest increase in Jeffries employees in the area of the development. Existing facilities should be capable of accommodating any need arising from the additional staff at Buckland Park.

5.5.7 Housing and Accommodation

There is no need for the provision of extra housing or accommodation for the expanded Jeffries workforce. A house, which already exists on the site, will be used to accommodate a caretaker for the development.

5.5.8 Non-Indigenous Heritage

There are no sites of non-indigenous heritage on the site.

5.5.9 Aboriginal Heritage and Native Title Claims

Heritage

Jeffries has an obligation under the *Aboriginal Heritage Act 1988* that any "clearance" work, which may require obtaining permission to disturb, damage or destroy Aboriginal Sites, must be undertaken with the full authorisation of the Minister for Aboriginal Affairs, according to Section 23 of the Act.

Native Title

The majority of the land for the proposal is freehold land and as such Native Title is assumed to be extinguished.

Jeffries would have to meet the general requirements of the *Native Title Act 1999*, such as the appropriate advertising for expressions of interest in compensation from Native Title claimants.

5.6 CLOSURE AND POST CLOSURE

Jeffries, in its EMP (as attached) has indicated that if the composting facility is required to close for any reason, the following closure and post closure measures will be implemented:

- An environmental audit of the site will be undertaken to identify areas requiring rehabilitation
- If rehabilitation of the site is required, an action plan detailing the extent of the work required to address any problems identified in the environmental audit will be developed and implemented
- Site monitoring activities will be continued after closure of the facility, is completed until the monitoring results are acceptable to the EPA.

A Rehabilitation and Closure Plan as required by the EPA would be prepared covering progressive rehabilitation, decommissioning, maintenance and monitoring of the site.

It is expected that post closure, the site would be returned to horticultural/ agricultural use dependant on monitoring results.

6 CONFORMITY WITH LEGISLATION AND POLICIES

If the Governor approves this proposal, a Plan Amendment Report for the area should be undertaken by the relevant council in order to properly control development on the site.

Section 48(5) of the *Development Act, 1993*, requires that before the Governor approves a development that has been declared a Major Development, the Governor must have regard to, amongst other things, the provisions of the appropriate Development Plan and the regulations (so far as they are relevant) and the Planning Strategy. While the Governor must have regard to those matters set out in Section 48(5), the Governor is not bound by the relevant provisions of the appropriate Development Plan or the Planning Strategy when making the decision.

Appendix 17 of the PER is a Planning Assessment against the Development Plan and Planning Strategy that were current at the time the PER was prepared - *Playford (City) Consolidated – 28 March 2002 Development Plan* and the *Planning Strategy Metropolitan Adelaide January 1998* . The Crown Solicitor has advised that, in respect of applications being assessed as Major Developments under the Act, the appropriate Development Plan and Planning Strategy are those current at the time of the decision. The Development Plan and Planning Strategy have both been superseded since the PER was prepared.

6.1 DEVELOPMENT PLAN

The appropriate Development Plan is the *Playford (City) Consolidated – 11 September 2003 Development Plan.* The subject land is located in the Extractive Industry Zone and Horticulture West Zone as prescribed in Map Play/4 and Map Play/8 of the Development Plan. A small portion of the north western corner of the site is also located in the Gawler River Flood Plain Policy Area as prescribed in Map Play/28 of the Development Plan.

6.1.1 Relevant Policies

The relevant provisions of the Development Plan are those that apply Council wide and those specific to the Extractive Industry Zone and the Horticulture West Zone, so far as they are relevant.

<u>COUNCIL WIDE</u>

GENERAL

FORM OF DEVELOPMENT

General Objectives

Objective 1: *Orderly and economic development.*

Objective 2: *An urban area in which living, recreational, shopping, community, business and employment-generating activities, and modes of transport are:*

(a) efficiently integrated;

(b) rationally distributed to avoid incompatibility between uses;

(c) allocated to meet community needs; and which

(d) make optimum use of infrastructure facilities and community services.

6.1.2   Flood Protection Objectives

Objective 6: *The prevention of development which could lead to a potential hazard in the event of a major flood.*

Principles of Development Control

2 *Development should be undertaken:*

(a) in accord with the intended use and development character of that land; and
(b) in a manner appropriate to its location and the circumstances of surrounding land uses.

3 *Development should:*

(a) not interfere with the proper and effective use of that land;

(b) not create detriment to the intended use of land on neighbouring sites; and

(c) have regard in its siting and design to the possible impacts arising from uses and activities on neighbouring sites.

4 *Development of land should have due regard to the capability of land, its physical nature and any hazards posed, and the potential for environmental damage.*

TRANSPORTATION (MOVEMENT OF PEOPLE AND GOODS)

Objective 11: *A compatible arrangement between land uses and the transport system which will:*

(a) ensure minimal noise and air pollution;

(b) protect amenity of existing and future land uses;

(c) provide adequate access; and

(d) ensure maximum safety.

Principles of Development Control

16 *Development and associated points of access and egress should not create conditions that cause interference with the free flow of traffic on adjoining roads.*

17 Development should provide adequately for the parking, loading, unloading and manoeuvring of all the reasonable requirements of employee, visitor, service or emergency vehicles.

Comment

The Council wide provisions of the Development Plan encourage orderly and economic development in a manner that ensures compatibility of neighbouring land uses and adequate environmental and hazard protection. **It is concluded that the proposed development is not incompatible with surrounding horticulture and salt production and is sufficiently separated from existing residential uses within the Horticulture Zone.**

The site has sufficient space to ensure all activities associated with the facility are contained within the site. Proposed on-going management practices should ensure that off-site impacts are not significant or hazardous. Access to the site via McEvoy Road is considered appropriate, subject to proposed widening of the carriageway. The design of the intersection with Port Wakefield Road is appropriate for the number and type of vehicles expected to use the intersection.

EXTRACTIVE INDUSTRY ZONE

Objective 1: *A zone comprising solar evaporation pans for the extraction of salt.*

Objective 2: *Development compatible with core horticulture activities (eg irrigated and greenhouse horticulture and hydroponics) within the Horticulture West Zone.*

PRINCIPLES OF DEVELOPMENT CONTROL

1 *Development undertaken in the Extractive Industry Zone should comprise salt evaporation pans, and ancillary equipment and facilities required for the extraction, harvesting and storage of salt after its crystallisation.*

Comment

Although the proposed facility is not associated with salt production activities, subject to appropriate management practices, the development is not considered to be incompatible with salt production. The subject site is a relatively small parcel of land within the Zone and it is considered that the alienation of this land from future potential salt production activities is not significant and will not impact on the attainment of the broader objectives of the Zone.

HORTICULTURE WEST ZONE

Objective 1: *Retention of land for horticultural purposes.*

Objective 3: *Extensive employment opportunities in primary production and related industries.*

Objective 4: *Horticultural activities supported by horticultural related industrial and commercial activities such as packing sheds, cold storage facilities and small-scale processing facilities.*

Objective 5: *Intensive horticulture in appropriate locations and supported by adequate infrastructure and environmental management techniques.*

Objective 7: *Development which provides for the proper storage, collection and disposal of waste without environmental, health or water pollution risk.*

Objective 8: *Preservation and enhancement of rural character.*

Objective 9: *The Gawler River 100-year Average Return Interval Flood Plain kept free of development which could impede the flow of flood waters.*

Objective 11: *Development compatible with saltfields and saltfield operations.*

PRINCIPLES OF DEVELOPMENT CONTROL

6.1.3 General

1 *Land within the Horticulture West Zone should be retained for horticultural purposes.*

2 *Development should ensure that horticultural activities are compatible with intensive growing methods and in particular address stormwater, weed, pest and waste management issues.*

3 *Physical infrastructure required for development should:*

(a) be able to be economically provided;

(b) be of sufficient standard, design and capacity to accommodate the proposed development;

(c) not increase the level of risk to public health or threaten food quality; and

(d) not compromise the level of service to other existing users or place undue pressure on existing services so as to reduce their reliability.

5 *Sites should be provided with safe and convenient means of access which:*

(a) will avoid unreasonable interference with the flow of traffic on adjoining roads;

(b) will accommodate the type and volume of traffic likely to be generated by the development or land use; and

(c) will not create unsafe conditions or cause undue deterioration of road surfaces within the road network, particularly at intersections

__6__ Site access, parking and loading should:

(a) enable safe access and egress for all anticipated vehicle types in a forward direction and enable vehicles to pass in the driveway;

(b) provide an access way of at least 3 metres in width that provides access for emergency vehicles to the rear of the development;

(c) allow all loading and unloading of vehicles to take place on site;

(d) provide sufficient parking to reasonably cater for parking demand having regard to the average number of employees and number and type of commercial and industrial vehicles generated by the development; and

(e) provide parking to accommodate the majority of demand and avoid the need for vehicles to park in unsafe or inappropriate locations.

Impact Management

__7__ Development within the Horticulture West Zone should incorporate a site management plan which addresses the following:

(a) stormwater management and disposal or reuse;

(b) waste management and disposal;

(c) chemical storage and handling;

(d) pollution prevention;

(e) food safety; and

(f) weed and pest control that minimises the potential for spray drift.

7.2 Waste management and disposal, chemical storage and disposal, pollution prevention:

(a) all forms of waste stored in water proof facilities.

(b) stormwater run-off and disposed of off site;

(c) compost facilities provided to deal with organic wastes and constructed with concrete pads, set within bunded areas or roofed to prevent stormwater contamination;

(d) loading and unloading areas where chemicals or wastes are handled should be drained separately so that any spills can be contained separate to the stormwater system; and

7.3 Food safety and weed and pest control:

(a) ensure that organic waste and food products are stored in vermin proof containers.

8 *Development should take place in a manner which will minimise alteration to the existing land form.*

9 *Development which involves roofed areas, sheds or other forms of impervious surfaces or structures should manage stormwater runoff so that the:*

(a) total volume of runoff entering the public stormwater system is not increased; and

(b) quality of runoff entering the public stormwater system is not reduced.

by:

(i) providing stormwater detention areas;

(ii) separating clean and contaminated stormwater; and

(iii) incorporating stormwater storage and reuse systems.

10 *Development should provide adequate facilities for the storage, collection and disposal of wastes which are:*

(a) vermin proof;

(b) protected from stormwater and minimise the potential for stormwater contamination;

(c) screened from public view; and

(d) protected from the wind.

11 *The spraying of chemicals, emission of odour, dust or other airborne particles should not cause nuisance or threaten food quality external to the site of a proposed development.*

Saltfields Interface Minimization

17 *Development should not be undertaken where it would result in significant:*

(a) surface or ground water contamination of the saltfields; or

(b) wind borne contamination of saltfields.

Industrial, Commercial and Retail Development

20 *Industrial, commercial and retail development should not take place unless it is:*

(a) in the nature of a rural industry such as a fruit and vegetable packing storage or processing, or a winery;

(b) a plant nursery or land used for floriculture; or

(c) associated with the use of the land for horticultural purposes and the activity involves the handling, packaging, processing or sale of horticulture, viticulture or floriculture produce;

21 *Development that is not directly associated with the horticultural industry or the handling, packaging or processing of primary produce should not occur within the Horticulture West Zone.*

Comment

It is noted that the portion of the subject land that is within the Horticulture West Zone will be used primarily for demonstration horticultural production associated with the composting activities on the remainder of the site.

Proposed environmental management practices are considered adequate so as to present no significant risk to existing or future horticulture within the Zone.

The site layout is such that there will be no undue risk of flooding to the facility or aggravation of flooding risks for adjacent land.

6.2 PLANNING STRATEGY

In making a decision on the application, the Governor must have regard to the Planning Strategy. The Planning Strategy presents the State Government's policy for development and seeks to guide and co-ordinate State Government activity in construction and provision of services and infrastructure and guides the formulation of planning policy through the Development Plan.

The appropriate Planning Strategy is the *Planning Strategy for Metropolitan Adelaide January 2003.* The Strategy contains the following relevant provisions.

6.2.1 Economic Activity

Strategies

Protect areas of strategic significance close to Adelaide for primary industry.
a) Retain the vineyards of McLaren Vale, the Willunga Basin and the viticultural and horticultural areas of the Northern Adelaide Plains
b) Maintain the economic potential of agriculture, and protect rural character and amenity.
c) Identify land best suited to agriculture, and encourage its sustainable management for primary production.
d) Provide opportunities for the development of value adding activities in these localities.

6.2.2 Natural Resources

Goals

- *Waste minimised through a range of approaches.*
- *Protection of the community from hazards.*

Priorities

- *Upgrade standards and systems for waste disposal and reduction.*

Strategies

<u>Pollution</u>

Objective 21 Locate waste facilities in an orderly and rational manner.
a)…
b) Reduce the need for landfill by active encouragement of recycling and reduction of organic, construction and demolition waste.
c) Minimise the impact of waste operations on public and environmental health and safety.
d) Encourage, promote and coordinate efforts to improve efficiencies and economies of scale in solid waste management.
e)Ensure the protection of the community from liabilities arising from poor waste management practices by upgrading existing practices.
f) …

Objective 22 Minimise waste through a range of approaches including avoidance, reduction, recycling, reuse and recovery of materials.
…
c) Re-use specific materials including oil, waste tyres, green waste and demolition waste.
d) Develop new markets and strategies for collected materials.
…

Objective 23 Encourage and promote composting using best practice methods as a means of reducing waste disposed to landfill.
a) Identify suitable organic waste processing sites.
b) …

<u>Comment</u>

The Planning Strategy encourages the development of composting facilities in appropriate locations as a means of reducing waste to landfill. However, the strategy also places strong emphasis on protection of the northern Adelaide Plains horticultural regions from inappropriate development.

It is concluded that the proposed composting facility is not inappropriately located and will provide a necessary facility at a size that encourages economies of scale. Subject to appropriate on-going management as set out in this assessment, the proposed land use will not interfere with the region's horticultural uses.

6.3 WASTE POLICY

In late 2002, the Government initiated a review of waste management strategies for the State, based on its election platform of no more major landfills being established and more emphasis on recycling.

Zero Waste SA has been established to champion recycling and waste minimization issues in the state. The diversion of green organics to composting facilities, together with other initiatives, will reduce the volume of waste going to landfill and the need for new landfills.

Zero Waste has advised that if Jeffries is not able to receive green organics at Buckland Park before June 2004 they will be forced to shut down. This is likely to have a significant impact on existing kerbside collection services offered by nine councils in metropolitan Adelaide. This material will more than likely be diverted to landfill for disposal.

6.4 BUILDING RULES

This Assessment Report does not include specific assessment of the proposal against the provisions of the Building Rules under the Act. If the Governor grants Development Authorisation, it would be a condition of approval that no works may be commenced on the site unless and until a building certifier of the relevant council or a private certifier has certified to the Development Assessment Commission that any work that constitutes building work under the Act complies with the Building Rules. This would ensure safety (including fire safety) and stability of construction.

6.5 ENVIRONMENT PROTECTION ACT

The development involves activities of environmental significance as stated in the *Environment Protection Act 1993* (EP Act) and was formally referred to the EPA.

The proposed development involves and activity of major environmental significance as indicated in the Environment Protection Act 1993 (EP Act) and accordingly was referred to the EPA.

When proposals involve activities of major environmental significance the Governor, before making a decision on the development, must have regard to the objects of the EP Act, the general environmental duty and any relevant environment protection policies.

The objects of the EP Act are:

- *To promote the principles of ecologically sustainable development;*
- *To ensure that all reasonable and practicable measures are taken to protect, restore and enhance the quality of the environment having regard to the principles of ecological sustainable development, and to prevent, reduce, minimise and, where practicable, eliminate harm to the environment.*

In addition, proper weight should be given to both long and short term economic, environmental, social and equity considerations in deciding all matters relating to environmental protection, restoration and enhancement. The EPA is required to apply a precautionary approach to the assessment of risk of environmental harm and ensure that all aspects of environmental quality affected by pollution and waste are considered in decisions relating to the environment.

The proponent has given a commitment to meet the relevant noise criteria at all times. The proposed operation, management and monitoring of air emissions are considered to be consistent with the objects of the Air Quality Policy.

The main objective of the Water Quality Policy is to achieve the sustainable management of South Australia's waters by protecting or enhancing water quality while allowing economic and social development. The Jeffries proposal includes the storage of surface water in sumps, drains and surface storage ponds that are to be lined with low permeability compacted clay and a separation distance of greater than 1 metre from the base of the liner and the underlying groundwater. As far as practicable the collected water will be re-used in the composting process. Management and monitoring of the composting operations and surface management infrastructure will be undertaken to ensure that the separation distance is maintained and the underlying water quality is maintained. These measures are considered to be consistent with relevant provisions in the Water Quality Policy.

The EPA does not oppose establishment of the Jeffries Organic Waste Treatment and Research Facility at Buckland Park. The EPA provided comments on the PER and these are incorporated in appropriate sections of this report.

The EPA recommended a number of conditions that should form part of the authorisation. They have been included in the recommended decision notice.

Through the adoption of conditions of approval and subsequent licence conditions, the risk of creating environmental harm can be minimised to an acceptable level.

6.6 COMMONWEALTH LEGISLATION

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), an action, requires approval from the Minister for Environment and Heritage if the action, has, will have or is likely to have a significant impact on a matter of national environmental significance.

Matters of national environmental significance are defined by the Act as:

- World Heritage properties
- Ramsar wetlands of international importance
- Listed threatened species and communities
- Migratory species protected under international agreement
- Nuclear actions
- The Commonwealth marine environment

Jeffries sought a determination from the Minister for Environment and Heritage, on whether its proposal to establish the Organics Waste Treatment, Recycling and Research Facility at Buckland Park, was considered a controlled action under the EPBC Act.

On 29 July 2002 Jeffries received notification from the Commonwealth that its proposed development was not a controlled action and approval under Part 9 of the EPBC Act was not required.

6.7 STATE FOOD PLAN

In 1997 the State Government launched the State Food Plan – Towards 2010 (Food Plan). The mission of the Food Plan is to increase the Food Industry's contribution to the South Australian economy. In assessing its priorities it was noted that consumers in affluent markets were demanding fresh “natural” foods produced using environmentally responsible practices. In addition it was recognised that it was important to maintain the perception that Australian food is “clean and green”.

Industry priorities were developed and included environmental and social requirements. To this end it was noted that the industry had to develop integrity systems and certified environmentally sustainable production methods.

The production and use of recycled organic products as proposed by Jeffries is consistent with the aims and priorities of the State Food Plan. Recycled organic products can improve soil conditions and plant growth through a range of applications. Plant growth can be improved by better use of water, suppression of weeds and the provision of nutrients. The use of recycled organic products assists in this process by the retention of water in the soil, a lesser reliance on fertilisers and herbicide use. These practices are consistent with environmentally sustainable food production.

6.8 MANAGEMENT, MITIGATION AND MONITORING

The Guidelines require Jeffries to identify commitments to meet conditions to avoid, mitigate, satisfactorily manage and/or control any potentially adverse impacts of the development on the physical, social or economic environment.

From the investigations undertaken, and as a result of the design proposed on the subject land, Jeffries considers that the potential adverse impacts from the proposal as submitted can be managed and mitigated. As outlined in the PER, Response Document and EMP (attached), Jeffries is committed to achieving best practice in environmental performance through:

- management commitment
- ongoing monitoring and assessment of environmental impacts;
- selection of design, construction methods and operation to achieve best practicable outcomes;
- development and implementation of an ISO 14000 Environmental Management System; and
- an ongoing Environmental Management plan.

Jeffries Environmental Management Plan (attached) describes the objectives of management and actions in relation to each key environmental issue associated with the construction and operation of the Organics Waste Treatment and Resource Recycling Facility at Buckland Park. The EMP contains detailed management strategies and monitoring commitments as detailed below:

a) Design of the facility

- Location of the incoming materials receival area adjacent to the western boundary of the site distant from the final product packaging area.
- Reception of incoming material in a fully enclosed building, constructed on a concrete slab and with all vehicle access points sealed using air curtains and all other openings covered by insect proof screens.

- Construction of a hardstand rubble base to windrow areas over a compacted clay liner.
- Banning the planting of host plants for Mediterranean or Queensland fruit fly on the property.

b) Operation of the facility

- Process incoming material within 24 hours of receival.
- Ensure internal windrow temperatures reach >50C within 24 hours of the windrow being formed.
- Require all vehicles transporting material to the site securely covering their loads.
- Restrict access to the site to vehicles with a carrying capacity of 5 tonnes or more.
- Undertake the housekeeping practices.
- Screen and shred incoming material to be taken to windrows before it is taken from the receival building.
- Wash down all mobile plant before it enters or leaves the receival building.

- Require all vehicles to pass through a wheel wash facility when entering and leaving the site.
- Wash down the receival building weekly.
- Implement a site specific contingency plan for outbreak of quarantinable pests or diseases.
- Divert material from fruit fly quarantine areas to land fill.
- Dedicate plant and machinery to specific activity areas eg the receival building, the windrowing area or the final product area.
- Clean plant and machinery prior to movement from one activity area to another.
- Recover wash down water and solids and run off water and apply to compost windrows.
- Implement a trace back system to sources of all material received.
- Undertake weed management strategies to manage Western Flower Thrip on the property.

c) Monitoring

- Establish and maintain yellow stick traps within the receival building (and surrounds if necessary) with an appropriate monitoring program and take action if the traps indicate that the site is contributing significant WFT populations to the surrounding area.
- Establish additional monitoring sites in order to extend the local PIRSA fruit fly monitoring grid to include the area around the facility.
- Surface water management to ensure that there is separation between surface water from composting and non-composting areas. Monitoring of quality and appropriate treatment to be carried out.
- Monitoring of groundwater quality as part of the ongoing EPA licence requirements.

- Noise levels during construction and operation to prevent excess noise generation during construction; to ensure that noise levels from operation do not create a nuisance to adjacent land owners/users; to ensure that noise levels do not pose a health risk to adjacent land owners/users and/or on-site workers; and to ensure compliance with EPA licence conditions.

d) Consultation arrangements

- Establish a community consultative committee with representatives of local government, Jeffries and the grower community to oversee the bio-security aspects of the facility.

e) Compliance assurance

- Undertake audits of relevant processes and incorporate into QA processes and assure this by the licensing regime.
- Adhere to and meet the relevant Australian standards.
- Enter into formal arrangements with PIRSA to monitor plant pest and disease risk minimisation and monitoring measures.

The proposed facility would require licensing under the *Environment Protection Act 1993* as a result of scheduled activities of environmental significance as listed under the Act. Consequently Jeffries would be required to conform to conditions of a licence granted by the EPA.

7 CONCLUSIONS

The assessment of the proposed Jeffries Organics Waste Treatment and Recycling Research Facility has required the consideration of a range of social, economic and environmental issues. The proposal involves the treatment 150,000 tonnes per year of green organics and wet organics by way of windrow composting.

The detailed information on which the assessment is based is contained in the January 2003 PER prepared by Jeffries, public comments on the PER, Jeffries' responses to these comments in the Response Document prepared in May 2003, an EMP and revised development produced in September 2003. It also relies on information and comments provided in submissions through the consultation process and advice from relevant South Australian Government agencies;

- the Environment Protection Authority;
- the Department of Human Services;
- Transport SA;
- the Department for Land Water and Biodiversity Conservation;
- State Aboriginal Affairs;
- the Department for Environment and Heritage;
- Primary Industries and Resources SA;
- the Department for Administrative and Information Services;
- Department of the Premier and Cabinet;
- Department of Treasury and Finance;
- Department of Education, Training and Employment; and
- the City of Playford.

Major issues associated with the construction and operation of the proposed Jeffries Organics Waste Treatment and Research Recycling Facility and raised during the public comment period and Government consultation included:

- Health risks to nearby residents due to air emissions;
- Pest plants, insects and disease impacts on the Northern Adelaide Plains horticultural and viticulture area;
- Potential damage to nearby market gardens;
- Damage to marine ecosystem through discharges to Barker Inlet;
- Noise and odour impacts;
- Potential pollution of groundwater;
- Buffer zones; and
- Traffic impacts.

There has been a strong and sustained opposition to this development from residents, nearby landowners, horticulture and viticulture groups in the Virginia area, in relation to the siting of the facility. There is however support for the development of a composting facility further north, outside of the Virginia area.

Environmental Issues and Mitigation Measures

Air Quality

Potential air quality impacts from the Jeffries proposal would primarily be in the form of odour and dust from the composting operations, dust and chemical use from the horticultural operation and dust from any unsealed roads. The proponent has suggested strategies to reduce and confine impacts on air quality

The assessment concludes that with appropriate dust and odour management measures there should not be a nuisance created by this development.

Noise

Establishment and operation of the compost facility at Buckland Park has the potential to create noise impacts due to site activities and off-site due to traffic movements. The proposed management and monitoring measures as detailed by Jeffries in the EMP are considered reasonable to mitigate potential impacts and meet the relevant EPA Noise policy.

Water Management

The proposed management measures, include the retention of surface water within the site, incorporation of provisions for re-use and separation of clean water and water that has come into contact with compost material, the installation of low permeability liners to minimise the potential for groundwater contamination, and contain appropriately designed surface water storages.

The risk of contaminating deeper aquifers is considered acceptably low due to the significant thickness of low permeability Hindmarsh Clay.

The implementation of surface water and groundwater monitoring programs will enable the detection of impacts (should they occur) and implementation of appropriate management measures, which may include remediation.

The composting facility is situated on land above the 100 year flood level of the Gawler River, this should provide more than adequate protection from floods. It is proposed to surround the site with a 1.5m high embankment.

It is concluded that if the construction and management of the stormwater ponds and drains are undertaken by Jeffries as outlined in the EMP and in accordance with EPA provisions there should be no risk of further contamination to the underlying groundwater on the site. It should be noted that there has already been some contamination due to past practices on the site.

Biological Impacts

Pest Plants and Diseases

Concerns have been expressed by horticulturalists and regional organizations that the establishment of a compost facility in close proximity to Virginia would create an unacceptable risk to the local horticulture industry as a result of infestation of fruit fly and other insects, pest plants and diseases.

PIRSA has considered the proposal and has indicated that provided the proposed risk mitigation measures detailed in the EMP were adopted; the proposed facility is no more likely to result in the introduction of plant pests and diseases to the Northern Adelaide Plains than current activities and practices. This conclusion is supported by technical literature that indicates composting operations undertaken in accordance with AS 4454 (as is done by Jeffries) would achieve destruction of weeds and pathogens, including Phylloxera.

It is concluded that the risks of pest plant and diseases impacting the adjacent horticulture industry is acceptably low.

Flora and Fauna

The site has been used for agriculture over many years and its indigenous habitat is therefore absent or severely degraded. No significant native flora and fauna exist on the site, except for visiting birds and other animals that may forage occasionally on it.

The landscaping plan prepared for this site will establish a densely planted vegetative screen along the eastern boundary of the depot and additional screening will be established by the provision of a mound for establishing a woodlot. Landscaped buffers will also be provided between the composting and non-composting areas and along the access road on the northern boundary of the composting and non-composting areas. Vegetation native to the area is to be planted on the road verges and permanent landscape mound.

Hazard Risk Assessment and Management

The risk assessment process involves establishing whether there is a potential hazard, then determining the level of risk and establishing management and monitoring measures to mitigate these risks. Jeffries has established management and monitoring measures to ensure that there are negligible risks.

The composting process is well understood and research indicates that undertaking composting in accordance with Australian Standard AS 4454 will provide the necessary temperatures (greater than 50 degrees centigrade) to render inert weeds and pest plants and diseases that are of concern to the horticulture industry.

While, opponents to the proposal, indicate there are potential significant risks to the horticulture industry as a result of pest plants and diseases leading to the area being quarantined, as indicated above these risks can be managed to the satisfaction of PIRSA.

Transport Issues

As part of development there will be a need to upgrade the access road to enable safe and controlled access to and from the site. Slip-lanes would be provided on both sides of the proposed access road intersection with Port Wakefield Road.

Transport SA has indicated that the preliminary plans, as presented by Jeffries, are acceptable in principle. TSA further states that detailed design and construction should be to the satisfaction of Transport SA, with all costs being borne by the proponent and the proponent has accepted this.

McEvoy Road is presently unsealed and the proponent has come to an agreement with the Playford Council on the engineering standard required for the road to be sealed. It is proposed that the Council undertakes the work to the agreed standard and Jeffries will fund it.

Infrastructure

In addition to the road access described above, infrastructure requirements for the site include power, water, telephone and sewerage. The site currently has 3 phase power at the south western boundary. Recycled water is available from Bolivar and drinking water will be collected from rainfall captured on site. Sewage will be treated on site by a package treatment plant. The site has telephone connections and gas will not be required.

Social Impacts

The assessment concludes the proposed management measures and buffers are considered acceptable to mitigate any potential risk to the health of adjacent residents and other land users from air borne emissions.

In assessing the issue of employment this assessment concludes that there will be a benefit to the State in terms of jobs created and also the positive effect of flow on employment upstream and downstream of the Buckland Park operations.

It is concluded the proposed mounding and screening, the visual effects of the facility are expected not to be intrusive in the landscape particularly as the site is very degraded in its present state. Existing derelict buildings from the old intensive dairy operation will be progressively demolished.

There will not be additional need for the following services, health service provision, education or childcare services and extra housing or accommodation.

There are no sites of non-indigenous heritage and aboriginal heritage on the site. Jeffries has an obligation under the *Aboriginal Heritage Act 1988* that any “clearance” work, which may require obtaining permission to disturb, damage or destroy Aboriginal Sites, must be undertaken with the full authorisation of the Minister for Aboriginal Affairs, according to Section 23 of the Act.

Development Plan and Planning Strategy

The Council wide provisions of the Development Plan encourage orderly and economic development in a manner that ensures compatibility of neighbouring land uses and adequate environmental and hazard protection. It is concluded that the proposed development is not incompatible with surrounding horticulture and salt production and is sufficiently separated from existing residential uses within the Horticulture Zone.

The Planning Strategy encourages the development of composting facilities in appropriate locations as a means of reducing waste to landfill. However, the strategy also places strong emphasis on protection of the northern Adelaide Plains horticultural regions from inappropriate development.

It is concluded that the proposed composting facility is not inappropriately located and will provide a necessary facility at a size that encourages economies of scale. Subject to appropriate on-going management as set out in this assessment, the proposed land use will not interfere with the region’s horticultural uses.

In late 2002, the Government initiated a review of waste management strategies for the State, based on its election platform of no more major landfills being established and more emphasis on recycling. Zero Waste SA has been established to champion recycling and waste minimization issues in the state. The diversion of green organics to composting facilities, together with other initiatives, will reduce the volume of waste going to landfill and the need for new landfills.

The production and use of recycled organic products as proposed by Jeffries is consistent with the aims and priorities of the State Food Plan. Recycled organic products can improve soil conditions and plant growth through a range of applications. Plant growth can be improved by better use of water, suppression of weeds and the provision of nutrients. The use of recycled organic products assists in this process by the retention of water in the soil, a lesser reliance on fertilisers and herbicide use. These practices are consistent with environmentally sustainable food production.

8 RECOMMENDATIONS

This Assessment Report concludes that the proposed Jeffries Organics Waste Recycling and Research Facility will not have a detrimental environmental, social and economical impact. Accordingly it is recommended that the proposal be granted development approval.

If the Governor grants a development authorisation, the conditions should be based on the following requirements:

1. Jeffries shall undertake the development in accordance with the proposals contained in the Public Environmental Report and the Response, site layout plans and management measures indicated in the EMP dated 6 August 2003, Revision 1 and application dated September 2003.

2. The quantity of feedstock to be received or processed at the site must not exceed 150,000 tonnes per annum without additional development approval.

3. Unless additional development approval is granted, the raw materials for composting shall comprise green organics (foliage, grass cuttings, prunings, branches), saw dust, timber (pallets, boxes), and wet organics (processed grease trap residue, street sweepings).

4. All incoming feedstock material must be unloaded, stored and processed (screened and, shredded) in the receival shed within 24 hours.

5. The construction of the processing areas (windrowing and final product), wheel wash bay area and surface water storage area must be to the specifications listed in the "Environment Management Plan for a Recycled Organics Resource Centre at Buckland Park, dated 6 August 2003, Revision 1".

6. Construction of all stages for the windrowing areas and wastewater areas must be to Level 1 Supervision as set out in Australian Standard 3798-1996. Daily logs and the final supervision report must be forwarded to the EPA.

7. A minimum of one (1) metre separation distance must be maintained between the groundwater level and the underside of all liners on the site.

8. The location and decommission status of old wells located on the site should be confirmed and the operational well decommissioned in accordance with the requirements of the *Water Resources Act 1997*.

9. Work constituting building work under the *Development Act 1993*, must be certified by Council or a private certifier as complying with the Building Rules, prior to any building work commencing.

10. Design specification must be forwarded to the EPA prior to construction and approved by the Development Assessment Commission prior to construction of the receival shed. The receival shed must be fully enclosed and have a concrete floor.

11. The design and construction of the road access junction to the plant from Port Wakefield Road must be to the satisfaction of Transport SA, and at the cost of the proponent.

12. Prior to commencing operation at the site McEvoy Road must be sealed in accordance with the standard agreed with the City of Playford, and at the cost of the proponent.

13. Jeffries must install a meteorological monitoring station in accordance with *"Meteorological Monitoring Guidance for Regulatory Modelling Applications, US EPA, February 2000"*, and be operational before operations at the site commence. It shall be to such a standard that it produces data suitable for air pollution modelling and complaint resolution. The parameters that should be recorded are wind speed and direction at 10 m height, standard deviation of wind direction, temperature at both 2m and 10 m heights, solar radiation and rainfall.

NOTES

Jeffries has an obligation under the *Aboriginal Heritage Act 1988* whereby any "clearance" work, which may require permission to disturb, damage or destroy Aboriginal Sites, must be undertaken with the full authorisation of the Minister for Aboriginal Affairs, according to Section 23 of the Aboriginal Heritage Act.

The Environment Protection Authority recommends that the following notes and proposed license conditions be attached to any development authorisation which may be granted in relation to this proposal:

An environmental authorisation granted by the EPA will include conditions requiring compliance with the standards of site preparation, management and maintenance detailed in the Environment Management Plan, dated 6 August 2003.

- The monitoring of the separation distance between groundwater and underside of the clay liner. Measures will be required to be put in place to ensure corrective actions being activated prior to the separation distance being at or less than 1.00 m. It is proposed to set a trigger level at 1.10m separation distance for more frequent level monitoring (minimum daily) and a second one at 1.05m separation distance to activate corrective actions, The EPA licence condition will require water levels to be measured weekly and assessed and reported monthly to the EPA for the first year of operation.

- The maintenance of all drains and ponds.

- The specific nature and quantities of wastes to be composted on the site, including composting trials.

9 REFERENCES

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10 GLOSSARY/ABBREVIATIONS

AHD	Australian Height Datum. A standard mean sea level used in Australia for providing height information on maps etc. See http://auslig.gov.au/geodesy/datums/ahd.htm.
AR	Assessment Report - i.e. this document.
Bunded	(Of a storage area, eg for solids or liquids) - enclosed within an impervious floor and surrounded by walls or mounds high enough to completely contain a spillage of all the stored liquid or solid material.
Carbon Dioxide	A gaseous oxide of carbon produced by burning organic matter and by a number of biological processes including respiration. Carbon dioxide would also be produced in the decomposition process of the waste.
CH_4	Methane. A combustible gas that is the main constituent of natural gas. Methane is a *greenhouse gas* that has a global warming potential about twenty times that of carbon dioxide.
DEH	Department for Environment and Heritage.
EPA	South Australian Environment Protection Authority - a statutory body advised by the EPA Agency.
Greenhouse Gas	Greenhouse Gas is the term for gases which, when their concentration in the Earth's atmosphere increases, have the potential to cause global warming (climate change). The term is especially applied to gases produced by human activity, such as the burning of fossil fuels.
NEPM	National Environment Protection Measure. NEPMs are broad framework-setting statutory instruments defined in the National Environment Protection Council Service legislation. They outline agreed national objectives for protecting or managing particular aspects of the environment.
Particulate Matter	Dust. See also PM_{10} and $PM_{2.5}$.
PIRSA	Department of Primary Industries and Resources, South Australia.
PM_{10}	Particulate matter with an effective diameter of particles of 10 microns or less. One micron is equal to one millionth of a metre, or one thousandth of a millimetre. Both PM_{10} and $PM_{2.5}$ are considered to be respirable particles, i.e. dust that is fine enough to lodge in the lungs when breathed in. The concentration of PM_{10} dust is usually given in units of micrograms per cubic metre, i.e. $\mu g/m^3$.

APPENDIX 1

Public, Local Government and State Government summary of submissions to PER

SUMMARY OF PUBLIC SUBMISSIONS		
No	**Submittor**	**Issues**
1	Mr David Raphael	Public health, ie, respiratory related.
2	Quality Food Production	Plant pest/disease risks.
3	Mr Christopher Pyne , MP	Support for project.
4	Mr Brian King (NAWMA)	Support for project.
5	Mr John Phillips (KESAB)	Support for project.
6	Ms Lesley Jenkins-White	Public health, respiratory and allergy related.
7	Mr Pat Martin – The Palms Residential Village	Public health (respiratory), safety, noise, economics, wildlife.
8	Mr Allen Russell (LASA)	Support for project.
9	Mr John Rothwell (RAHSSA)	Support for project.
10	Ms Bernadetta Horne – Virginia Primary School Governing Council	Public health (respiratory), odour, wind, traffic.
11	N Femia – SA Muchrooms	Plant pest/disease risk.
12	Mr Peter Wadewitz (COMMPOST SA)	Support for project.
13	Mr Mark Baade – Connor Holmes Consulting	Odour, dust.
14	Ms Helen Tsinivits	Public health (respiratory), odour, wind, traffic, social justice
15	Mr Peter Willmott – Industry Dev. Board Horticulture	Plant pest/disease risk
16	Mr Geoffrey Fuller – (NGISA)	Support for project.
17	Mrs Barbara Hardy, AO	Support for project.
18	Ms Liz Trabilsie – Carrick Hill	Support for project.

SUMMARY OF PUBLIC SUBMISSIONS		
No	**Submittor**	**Issues**
19	Ms Maggie Papaydopoulos	Plant pest/disease risk.
20	Ms Nicky Kakamanoudis	Public health (respiratory), odour, wind, traffic, social justice.
21	Mr John Clark	Plant pest/disease, odour.
22	Ms HeatherCeravolo – St Andrews Estate	Social justice, site suitability, clean and green image of the NAP.
23	Dr Joe Ceravolo – Adelaide Plains Wine Region	Plant pest/disease, vermin, site suitability, odour.
24	Mr Nigel Horne	Public health, odour, wind.
25	Mr and Mrs Adrian and Michelle Pellicone	Public health, traffic, odour, wind, property value.
26	Mr Robert Segulin	Wind, traffic, property value, odour, dust, public health (respiratory), site suitability.
27	Mr and Mrs Rocco and Toni Richichi	Public health, traffic, alternative transport routes.
28	Ms Bronwyn Segulin	Traffic, property value, public health (respiratory), plant pest/disease, wind, odour.
29	Mr Paul Lightbody (WMAASA)	Support for project.
30	6 instructions to adopt and endorse Mr James Levinson's submission. See No 34 below	
31	Mr Keith Jones – SA Wine & Brandy Industry Association	Support for project along with plant pest/disease, risk assessment issues.
32	Ms Di Davidson – Davidson Viticultural Consulting	Support for project
33	Mr Rocco Musolino – Virginia Horticulture Centre	Plant pest/disease, risk assessment.

SUMMARY OF PUBLIC SUBMISSIONS		
No	**Submittor**	**Issues**
34	Mr James Levinson – Jamie Botten & Associates	Wide range of issues including statutory requirements, details of the proposal inadequate, economic impacts, quarantine/pest plants/disease issues, need for the location, odour and dust, traffic, risk assessment, planning strategy/development plan.
35	Mr Simon Divecha – Conservation council of SA	Support for project along with odour, groundwater, plant pest/disease issues.
36	Mr Angelo Demasi – Adelaide Produce Market	Plant pest/disease.
37	Mr Dino Musolino	Plant pest/disease, odour, risk.
38	Mr John Collins	Fruit Fly risks, composted materials, windrow operating conditions, odour modelling, dust, health impacts, biomat, risk management, development controls and other issues
39	Mr Jim Northey – BRL Hardy	Support for project.

SUMMARY OF GOVERNMENT / LOCAL GOVERNMENT SUBMISSIONS		
No	**Submittor**	**Issues**
1	Department of Treasury and Finance	No issues raised.
2	Department of Defence	Bird strike.
3	Commissioner of Highways	Road requirements.
4	Environmental Health Service	Public health.
5	Department of Administrative (Building Management of State Aboriginal Affairs)	Identification of non-complying materials, Aboriginal heritage.
6	Environment and Conservation Portfolio (Environment Protection Authority, Department of Water, Land and Biodiversity Conservation, Department of Environment and Heritage)	Odour and dust, water quality, noise, amenity, biodiversity.
7	Primary Industries and Resources SA	Plant pest/disease, value of horticultural production, production procedures, quality assurance, risk assessment.
8	Planning SA	Operational restrictions, compatibility of future development within the buffer area.
9	City of Playford	Traffic, dust, odour, plant/disease, groundwater.
10	City of Salisbury	Site suitability.
11	Native Vegetation Council	Biodiversity.

APPENDIX 2

Environmental Management Plan

Jeffries

Environment Management Plan
for a
Recycled Organics
Resource Centre
at
Buckland Park

Note to Readers
Some of the drawings/figures contained within this report were amended after the report was submitted (6 August 2003) in response to issues raised by the EPA as part of the assessment process. The changes are designed to improve the environmental performance of site activities.

Rodenburg Davey & Associates Pty Ltd
ABN 12 080 864 571

6 August 2003
Revision 1

Contents

Appendices

1. Introduction

Jeffries currently operate composting depots at 247 – 253 Cormack Road Wingfield and at the Adelaide City Council Wingfield Waste Management Centre. Both depots are licensed by the EPA.

Due to space constraints and a limited development approval period at the Wingfield site, Jeffries must establish a new site if it is to continue its composting activities.

It is under these circumstances that Jeffries is proposing to establish a recycled organics centre at Buckland Park. More specifically, Sections 138, 139, 142, 156 and 157, Hundred of Port Adelaide. The total site area is 122.7 Ha.

The site is located within the Northern Adelaide Plains horticultural district. One of the benefits of establishing a recycled organics centre at this location is that the horticultural industry is becoming a major user of compost products as it discovers the economic benefits of increasing organic content within soil.

Currently Jeffries is composting approximately 50 000 tonnes per year. Although this EMP has been prepared for a throughput of 75 000 tonnes per year (Stage1), the development application is based on an annual throughput of 150 000 tonnes. Most of the investigations associated with site activities, ie, plant pests and diseases, public health, odour, noise and traffic are based on the ultimate design capacity of the site, ie, 300 000 tonnes/year.

2. Statement of Environmental Objectives

The procedures outlined in this document have been designed to achieve the following environmental objectives:

- **Air Quality**
  Composting activities will be managed to ensure there is no adverse air quality impact on local residents.

- **Water Quality**
  To ensure activities within the depot do not impact adversely on local water resources.

- **Plant Pests and Diseases**
  The adoption of operational and monitoring practices that prevent the spread of plant pests and diseases.

- **Dust**
  Ensure that effective control measures are adopted to prevent dust from composting activities effecting adjoining landowners.

- **Vectors**
  To adopt operational practices that eliminate vectors

- **Traffic**
  To minimise the effect on the local community of vehicles using the site.

3. General Information

3.1 Location

The site for the proposed composting depot is on the western side of Brooks Road, in the vicinity of McEvoy Road, Buckland Park, i.e., Allotment 22, Part Section 139, Hundred of Port Adelaide. It covers an area of 25.8 Ha. Refer to Appendix A for land title details and Figures 3.1, 3.2 and 3.3 for additional location details

Land immediately north and east of the site is used for growing fodder crops and land to the south and west consists of salt evaporation ponds, which form part of the Penrice salt harvesting system. Other land uses in the area include horticulture, hobby farming, horse agistment, housing, car racing and a shooting range.

3.2 Depot Operator

Jeffries, ABN 38 498 297 669
247 – 253 Cormack Road
Wingfield SA 5013
Telephone 8349 5588

3.3 Depot Manager

Mr Lachlan Jeffries, Managing Director, Jeffries, will be responsible for management of the depot. His telephone numbers are 8349 5588/mobile 0412 805 798.

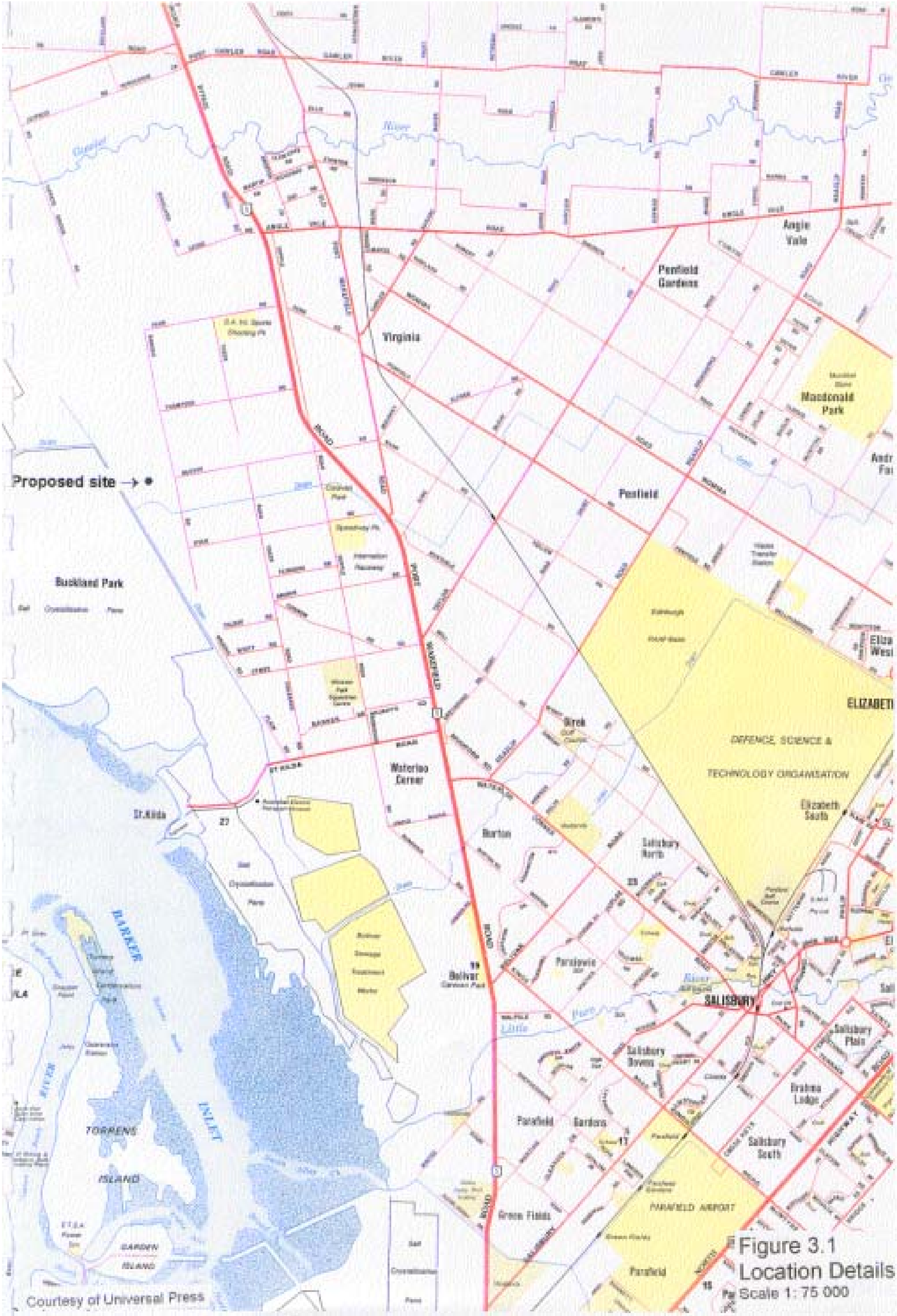

Figure 3.1
Location Details
Scale 1: 75 000

Figure 3.2
Aerial Photograph of Site
Scale 1: 6 900

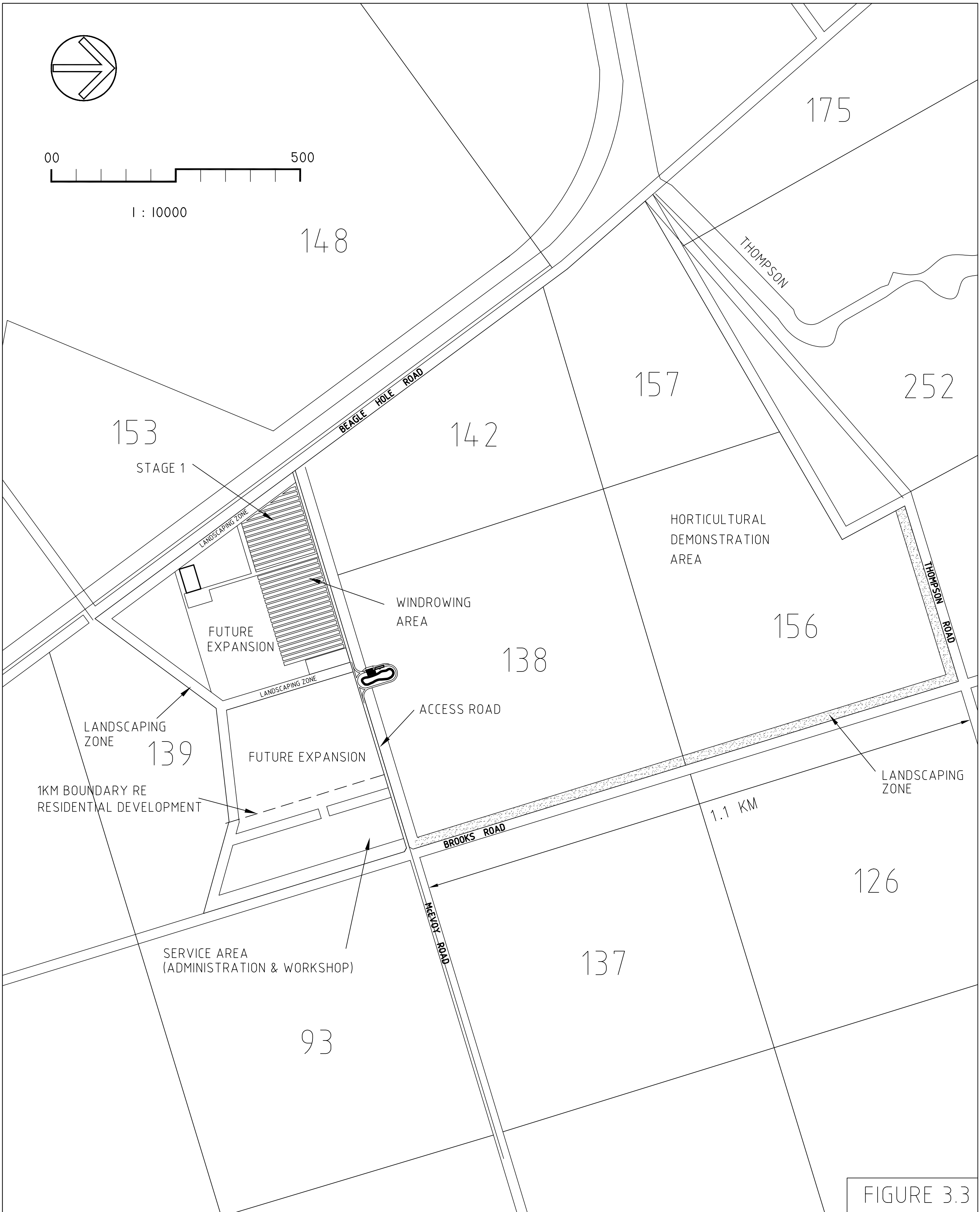

FIGURE 3.3

Client JEFFRIES Project RECYCLED ORGANICS RESOURCE CENTRE BUCKLAND PARK	RODENBURG DAVEY & ASSOCIATES UNIT 3, 73 KING WILLIAM ROAD, UNLEY, SA 5061 PH.: 82717122 FAX.: 82717133 INTERNET: roda@chariot.net.au Scales: AS SHOWN — Date: 10-7-03
Title GENERAL LAYOUT PLAN	Drawing No. JE-001 — Issue C

3.4 Depot Opening/Operating Hours

Opening Hours
Standard opening hours for the depot will be:
- Monday to Friday, 7.00 am – 5.00pm
- Saturday, 7.00 am – 4.00 pm
- Sunday, 10 am – 4 pm.

However due to the need to transport material out of hours to meet supplier and customer requirements, it is anticipated there may be some out of hours vehicle movements.

Operating Hours
Operating hours will generally exceed opening hours due to the need to optimise plant usage because of its capital intensive nature, i.e., plant investment exceeds $3 000 000. Thus plant operating hours must be flexible to ensure the business remains viable. Regardless of when activities are being undertaken on site, Jeffries **will** comply at all times with relevant legislative requirements, especially with regard to noise, ie, noise levels at the nearest house shall not exceed 40 dB(A) between the hours of 10.00 pm and 7.00 am.

3.5 Locality Description

The site is located within the Adelaide Plains region and so the topography is generally flat. Refer to Figure 3.4 for topographic details of the site. Adjoining land north and east of the site is used for growing fodder crops. Penrice uses land to the south and west for salt crystalisation ponds.

The local area has been extensively cleared and consists mainly of improved pastures, horticulture and hobby farming.

Residential development within the area is sparse. At present there is a house adjacent the northern boundary of the property (900 m north if the composting site). Jeffries has an agreement to purchase the property if the development application is approved. The next nearest house is in McEvoy Road, 1 000 m from the area proposed to be used for composting. Due to the large size of the property, there will be an internal buffer of 200 m between the area to be used for composting and the eastern boundary of the site (Brooks Road).

3.6 Visibility of Site Operations

Site activities will have minimal visual impact due to:
- The flat topography of the area,
- Distance to houses (1 000 m)
- Low height of most of the development

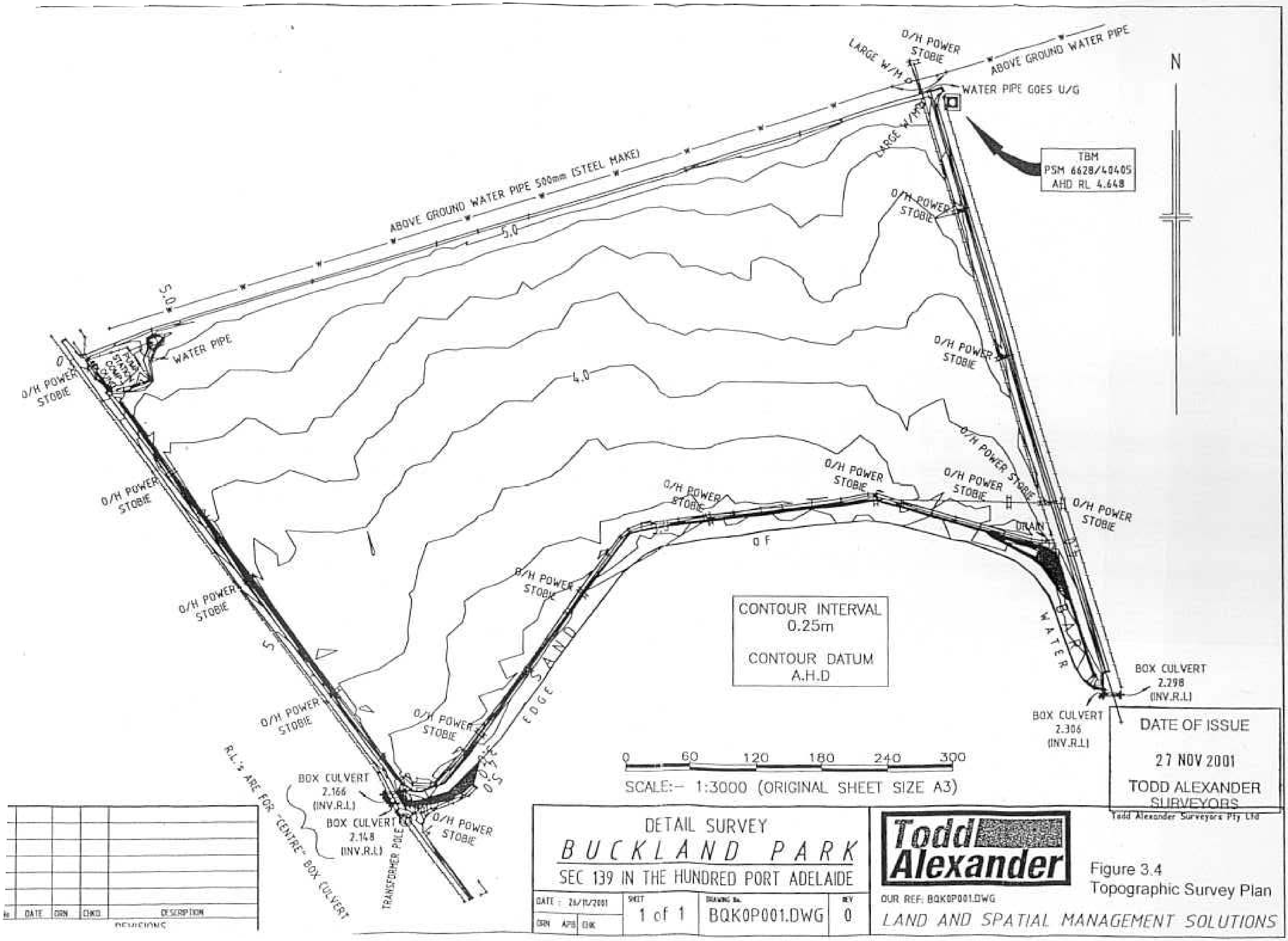

Figure 3.4
Topographic Survey Plan

Visibility of site operations will be further reduced when the extensive boundary landscaping proposed for the site is established.

3.7 Traffic Routes to the Site

Vehicles using the site will travel along the Port Wakefield Road and McEvoy Road. Jeffries has given a written undertaking to seal McEvoy Road if the proposal is accepted.

3.8 Traffic Impacts

Traffic impacts as presented in the Public Environmental Report (PER) were based on the ultimate capacity of the site, ie, 305 000 tonnes/year. However the information presented below is based on Stage 1 of the development, ie, the receival processing and dispatch of 75 000 T of organic materials per year. Vehicles transporting material to and from the depot will consist of trucks and semitrailers. Based on experience gained at their Wingfield site, Jeffries has estimated that 90% of all vehicles accessing the site will do so on weekdays. Tables 3.1 and 3.2 have been prepared to show how this translates into vehicle movements. The tables include the vehicles that will be transporting product from the site.

Table 3.1 Daily Truck and Semi-trailer Movements
(truck in + truck out = two vehicle movements)

Year	Rigid Body Trucks[1]		Semi-Trailers[1]		Total
	Week Days	Weekend	Week Days	Weekends	
0-1	18	2	10	2	32
1-2	22	4	16	2	42
2-3	30	4	18	4	56
3-4	36	6	26	4	72
4-5	48	6	30	6	90

Table 3.2, Daily Staff and Visitor Vehicle Movements
(vehicle in + vehicle out = two vehicle movements)

Year	Staff Movements[2]		Visitors		Total
	Week Days	Weekend	Week Days	Weekends	
0-1	14	2	12	2	30
1-2	20	2	12	2	36
2-3	24	4	14	2	44
3-4	32	4	14	2	52
4-5	40	4	14	2	60

Notes:
1, Carrying capacity of vehicles varies between 7.5 - 25.0 tonnes.
2, Assumes a pro-rata increase based on forecast increases in truck movements

3.9 Proximity to Houses

Apart from the house on the northern boundary of the property, which Jeffries has agreed to purchase, the nearest house to the area to be used for composting is 1 000 m east on McEvoy Road. Other houses are located north east of the site. Refer to Figure 3.5 for further details.

3.10 Water Supply

Treated effluent water from the Bolivar Waste Water Treatment Plant is available via the Virginia Pipeline. This will be the source of water used for composting activities. There is also an established bore on the site (no. 2393, Section 156). However it is low yielding (0.3 L/sec and saline (1 095 mg/L) and therefore it is not planned to use it. Rainwater will be harvested from all roofed areas and stored in tanks and used for non potable applications such as toilet cisterns, vehicle washing, etc.

3.11 Plant Pests and Diseases

The potential for transfer of plant pests and diseases to the Virginia horticultural region and the impact this may have on horticultural crops in the region is recognised by Jeffries. Jeffries commissioned two comprehensive studies to ascertain the nature and extent of the risk and to develop appropriate management strategies and operational procedures and practices. The studies were undertaken by Scholefield Robinson Horticultural Services and Davidson Viticultural Consulting. Copies of these reports are contained in Appendix B.

Having investigated the issue, Scholefield Robinson concluded that there is some risk of pest dispersal, associated with the pre-composting period of green organic matter, at the proposed site. However the risk associated with the dispersal of plant pathogens from the site is considered low. During the ambient temperature period, some active pests could move from this point source, but it is considered that the relative risk is negligible.

Jeffries recognises that any increase in current pest populations or point sources may impact on the control methods and timing employed by growers. But it is clear that point sources other than Jeffries, associated with existing horticultural activities, pose a significantly greater risk.

The intended management of vehicle movement, the outlined handling of raw materials and contaminants, and the proven commitment to meeting the requirements of Australian Standard AS 4454 for composting, suggest that any plant pathogen and pest risk created at the site, will be manageable and will not threaten the continued viability of any intensive horticulture in the area.

Davidson Viticultural Consulting concluded that if a composting facility such as

Figure 3.5
Housing Location Details
Scale 1:15 000
Date of Photograph, 6/10/99

described in the Jeffries proposal is constructed and operated at Buckland Park, the level of economic risk would be unchanged from the current status within the Northern Adelaide Plains (NAP) region.

Jeffries has a demonstrated record of adopting best practice composting methods. Evidence of this is their ISO 9000 accreditation, AS 4454:1999 product certification and NASAA registration (Appendix J). Jeffries has also committed to achieving ISO 14001 (environmental management) accreditation within six months of receiving development approval for the Buckland Park site. ISO 9000 and ISO 14001 accreditation requires Jeffries to demonstrate continuous improvement in their composting procedures and practices. This will include procedures and practices to minimise any potential risks associated with plant pests and diseases.

Plant pests and diseases control measures that will be adopted at Buckland Park will set new standards within the composting industry. They include:

- Installation of fruit fly traps at all facilities supplying green organics to Buckland Park (eg, waste transfer stations)
- Formal arrangements with PIRSA to monitor plant pests and diseases risk minimisation and monitoring measures, including procedures for diverting material from fruit fly quarantine areas
- All vehicles entering and leaving the site will pass through a wheel wash facility
- Recycled organics will be received within a fully enclosed building, constructed on a concrete slab
- All vehicle entry points will be fitted with an ‘air curtain’ to prevent insects entering or leaving the receival building
- Recycled organics will be screened and shredded before being taken from the receival building
- Mobile plant will be washed down before entering or leaving the receival building
- The receival building will be washed down weekly
- Insect traps will be established within the receival building, and around the composting site. A monitoring program, acceptable to PIRSA, will be established.

3.12 Public Health

A wide range of micro organisms occur naturally in the environment, many of which are found in compost. Studies undertaken overseas have demonstrated that risk exposure for workers at composting facilities and persons living near such facilities is no different to that faced by the wider community. A human health impact assessment, undertaken by Dr Richard Bentham from the Department of Environmental Health, School of Medicine, Flinders University, indicated microbial health risks associated with composted materials are most probably confined to employees or contractors working on the site who have immediate contact with the material. This risk is more properly described as an occupational health risk rather than a public health risk. Using Appendix 3 of AS4360:1999 this risk could be classified as L2, which is a low risk that could be managed by routine procedures.

Further information on this matter, including a copy of Dr Bentham's report, is included in Appendix C.

4. Environmental Information

4.1 Geology and Hydrogeology

The following information was provided by Water Search Pty Ltd, groundwater and geological consultants.

Geology
The property lies in the St. Vincent Basin, a sedimentary basin extending from the Clare Hills/Mt. Lofty Ranges in the east, Yorke Peninsula in the west, Snowtown/Red Hill in the north and Kangaroo Island in the south.

About 50 million years ago early in the Tertiary Period, the Adelaide area was dry land with subdued relief consisting of deeply weathered Precambrian rocks. Faulting caused by stresses associated with the final separation of Australia from Antartica resulted in the down faulted St. Vincent Basin. Sediments began to fill this basin initially in swamps and from streams draining the adjacent highlands. This was followed by various cycles of marine deposition as the sea advanced and retreated over the land surface. Simultaneous movement along the existing fault lines caused marked variations in the thickness of the deposited strata.

During the Quaternary Period over the past 2 million years major world-wide cyclic climatic changes caused waxing and waning of the polar ice-caps resulting in large sea level changes around the world. During the early Quaternary Period the Eden and Para Faults (the Adelaide Hills face) were reactivated with the uplift of the Mt. Lofty Ranges. These combined factors led to the deposition of riverine sands and gravel overlain by a thick sequence of alluvial clays with lenses of sand and gravel on the downthrow side of the faults.
A summary of the upper portion of the stratigraphic sequence is given in Table 4.1.

Hydrogeology
There are two distinct aquifer systems associated with the marine Tertiary and the fluviatile Quaternary sediments within the Northern Adelaide Plains region. These are shown in Table 4.1.

The upper Quaternary aquifer system comprises variable beds of silts, sands and gravels within the Hindmarsh Clay (aquifers Q1-Q3) and underlying Carisbrooke Sand (aquifer

Q4). The latter is tenuously connected to aquifer T1A in the Dry Creek Sands/Hallet Cove Sandstone and aquifer T1B in the upper part of the Port Willunga Formation above the Munno Para Clay confining bed. Below this the lower part of the Pt. Willunga Formation is designated as aquifer T2. A further confing bed in the Blanche Point Marls separates T2 from the highly saline T3 aquifer located within the deeper South Maslin Sands.

The water table/aquifer Q1 in the vicinity of the site is highly saline being greater than 10,000 mg/L hence is not used. The deeper Tertiary aquifers are of better quality and are effectively separated from the uppermost aquifer by the extensive and thick Hindmarsh Clay. Known wells within 1 km of the proposed windrow site are listed in Table 4.2.

Groundwater flow in the shallow aquifer is to the west to be lost as evaporative discharge in the coastal zone. Whilst the depth to the water within the local area varies between 0.5 – 5.0 m (due to topographical variation), site investigations undertaken by Soil and Groundwater Consultants (Appendix I) indicate that the depth to groundwater at the site is of the order of 1.0 - 2.0 metres.

Table 4.1, Geological and Groundwater Summary

Unit	Age	Lithology/ Thickness (m)	Groundwater Properties
Hindmarsh Clay	Pleistocene /Recent	Stiff mottled (red,brown,yellow, grey,green) clay with sig. sand & silt. Thickness, 50 - 60	Discontinuous, watertable /confined aquifer (Q1-Q3). Salinity 6000 to 20000 mg/L. *SWD 0.5 to 5m.
Carisbrook Sand	Pleistocene	Fine to coarse quartz sand with yellow, brown, white clay lenses Ferruginised near base. Thickness, 10 - 40.	Confined aquifer, little development, low yields. Salinity 3400 to 4900 mg/L. Aquifer Q4. SWD 10 to 12 m.
Dry Creek Sand	Early Pleistocene	Silt, sand, calcareous siltstone, bryozoal, partly shelly, glauconitic. Thickness, 10 - 30	Confined aquifer-part of aquifer T1A- extensive development. Salinity 600 to750 mg/L. SWD about 8 m.
Pt. Willunga Formation (upper)	Mid-Early Miocene	Fossiliferous sandy limestones. Thickness, 5 - 10	Confined aquifer - T1B. Transmissivity about 70 m^3/day/m.
Munno Para Clay	Early Miocene	Blue grey, sandy, shelly clays with indurated lenses. Thickness, 2 - 9	Confining bed between aquifers T1 & T2
Pt. Willunga Formation (lower)	Late Eocene to Early Miocene	Pale grey, glauconitic with bryozoa and shell fragments. Thickness, >15	Confined aquifer - aquifer T2. Salinity 1400 mg/L. SWD about 7 m.

- SWD = standing water depth below ground surface

Table 4.2, Known Wells within a Radius of 1 Km of Section 139, Hd. Port Adelaide

Well No.	Depth (m)	Standing Water Level (m)	Yield (L/sec)	Salinity (mg/L)	Status
2260	35	5	1.0	790	Backfilled
2300	32.9	1.8	1.0	981	Operational
2352	50.3	0	0.25	1 116	Backfilled
2353	76.2	10.6	11.4	849	Operational
2354	35	1.2	3.8	1284	Abandoned
2355	9.1	2.6	-	15 000	-
2356	19.8	1.2	1.7	-	-
2357	2.1	-	-	15 036	-
2358	-	1.0	-	13218	-
2359	-	-	-	11371	-
2360	-	-	-	15 000	-
2361	-	-	-	-	-
2362	-	-	-	15 000	-
2363	-	-	-	8 387	-
2364	-	-	-	13 218	-
4061	-	-	-	15 036	Operational
4064	-	-	-	19 244	Operational
4080	-	-		9 279	Operational
4081				12824	Operational
4082				8 532	Operational
4083				10 878	Operational
10966	10	3.0	-	-	-
12125	75	-	8	1 045	Backfilled
15533	110	8.0	12	1 138	-
16075	63	9.0	5	-	Operational
16691	24	7.0	-	-	Operational
10964	10	3.7	-	-	-
10965	10			-	-

4.2 Geotechnical Details

Coffey Geoscience carried out an extensive geotechnical investigation[1] within the Buckland Park area in December 1997. It included excavating five test pits within Section 139. Findings from these test pits are presented in Table 4.3(a) and (b).

[1] Seabreeze Farms Development, Virginia, Geotechnical Investigation, January 1998

Table 4.3(a), Findings from Test Pit Excavations – Soil

Test Pit No.	Ground Surface RL (AHD)	Soil Depth (m)	Description	Penetro-meter Rdg-KPa
73	4.7	0-4.2	Hard to very stiff silty clay, orange, red-brown, high plasticity	300- 350
74	4.7	0-1.8 1.8-3.0	Hard silty clay, red –brown, with sand and gravel Sand, fine to coarse grained	-
75	4.0	0-1.0 1.0-2.95	Silty clay, red-brown to grey brown, high plasticity Silty clay, grey-brown, with lime gravel and sand, high plasticity	
76	3.6	0-3.9	Hard to very stiff silty clay, high plasticity, lime gravel lenses intersected at 0.7, 1.3 and 2.4 m	300
77	3.6	0-1.5 1.5-1.8 1.8-4.2	Hard to very stiff, red-brown clay, high plasticity. Stiff silt Very stiff sandy clay, high plasticity	350

Table 4.3(b), Findings from Test Pit Excavations – Groundwater

Test Pit No.	Ground Surface RL (AHD)	Depth to Groundwater (m)	Groundwater RL (AHD)
73	4.7	2.9	1.8
74	4.7	2.8	1.9
75	4.0	2.8	1.2
76	3.6	3.7	-0.1
77	3.6	2.7	0.9

Soil Permeability

The Coffey investigations included soil permeability testing. The samples were remolded to a dry density ratio of 98%, based on Standard compaction (AS 1289, 5.1.1) and achieved a permeability of 4.00×10^{-10} m/sec. Seepage losses through these materials would be expected to be relatively small, provided they have been suitably compacted.

Additional geotechnical investigations were undertaken at the site by Coffey[2] on behalf of Kellogg Brown and Root (KBR) on 2 – 4 July 2003. The investigations involved excavating 24 test pits over the area to be used for open windrow composting. The test pits were excavated to depths ranging from 2 .0 – 2.8 m below the existing surface in the

[2] Kellogg Brown & Root P/L, Organic Waste Treatment And Recycling Facility, Buckland Park SA, Geotechnical Investigation, Coffey Geoscience Report No. A3848/1-AB, 24/7/03

full time presence of a geotechnical engineer who logged the soil profiles and collected representative soil samples.

The report concluded that, based on the soil profiles inspected at each test pit and the permeability test results, the clay immediately underlying the topsoil is suitable for providing a clay liner with a permeability less than that required by the EPA, ie, $< 10^{-9}$ m/sec.

4.3 Climate

4.3.1 Wind

The following general description of the wind regime for the area has been derived from records obtained from the Bureau of Meteorology, Edinburgh Airfield Meteorological Station.

Summer
The dominant wind regime in daylight hours is the sea breeze, with the predominant wind direction from the south south west to south west (70%). Wind speeds vary between 10 and 40 Km/h, but may peak between 55 to 65 Km/h between 8 to 12 times each year.

Overnight winds are lighter (less than 20 km/h) and generally from the north east to south east.

Autumn
Autumn winds in the morning are generally from the south west with speeds of between 20 and 30 km/h.

Afternoon and evening winds are predominantly from the north east, usually with greater velocity than those experienced in the morning.

Winter
Day-time winter winds are generally north westerly to south westerly. Speeds are predominantly between 10 and 40 km/h.

Overnight winds are primarily from the north east to north west. Velocities are generally below 20 km/h for 70% of the period.

Spring
Direction of morning winds vary between north east and south west. Wind speeds vary between 10 and 40 km/h.

Overnight winds are predominantly north east to north west with speeds of generally less than 20 km/h.

Summary
The wind climatology of the area is such that for much of the year some of the dwellings along Thompson Road are down wind of the subject land. However these dwellings are 1.4 Km from the site. Refer to Appendix D for further details.

4.3.2 Rainfall/Evaporation

Based on meteorological data from the Edinburgh RAAF weather station, annual rainfall in the region averages 435 mm and the average number of days per year that rain falls is 109. The wettest months are June, July and August (160 mm and 44 rain days).

Annual evaporation averages 2 098 mm per year. Evaporation generally exceeds rainfall for all but one month of the year, ie, June, when evaporation and rainfall are approximately the same. Refer to Table 4.4 for further details.

Table 4.4, Annual Rainfall and Evaporation

Month	Rainfall (mm)	Evaporation (mm)
January	23	316
February	15	272
March	26	226
April	30	144
May	43	87
June	53	54
July	56	60
August	52	167
September	48	117
October	43	121
November	25	240
December	23	294
Total	**437**	**2 098**

5. Description of Site Activities

5.1 Introduction

Jeffries produce quality accredited compost products and enjoy a reputation for success and innovation. Registration details of Jeffries' various quality systems are provided in Appendix J. Since it began its large scale composting activities in the mid eighties, Jeffries have provided an alternative to landfill for over 300 000 tonnes of organic materials.

In order to continue to recover and process recyclable organics and expand services to its customers, Jeffries will continue to offer a wide range of Australian Standard and NASAA quality accredited products. The site for the proposed composting depot provides Jeffries with the means to meet these needs, i.e., the land is appropriately zoned for composting activities.

5.2 Types and Quantities of Materials Received

Whilst Stage 1 of the facility is designed to compost up to 75 000 tonnes of recycled organics per year, the maximum amount of material being composted at any one time will be much less than this. The composting cycle takes between 8 – 12 weeks, thus the amount of material being composted will be in the range of 15 000 – 19 000 tonnes.

Jeffries has identified that the composts and mulches required by the market are made from approximately 80% green organics and timber and 20% wet organics.

Green Organics
Green organics comprises materials such as:

- Kerbside collected material
- Arboreal materials
- Herbaceous materials

Timber
Typically timber consists of packing crates, pallets, bark, sawdust and shavings.

Wet Organics
Wet Organics will consist of organic residues from food processing plants, processed grease trap waste and other similar materials. Figure 5.1 contains details of the chemical composition of the processed grease trap waste that is currently being received by Jeffries.

5.3 Technology Employed

Open Windrow Composting
Open, windrow composting is regarded world wide as an environmentally sound, cost effective means of processing recycled organics that have a low odour potential, eg., garden vegetation (green organics).

The windrow area is designed to prevent wastewater from the composting operations infiltrating the underlying soil. This is achieved through the following mechanisms:

- Constructing the windrow area to achieve a 2% transverse gradient and a 1% longitudinal gradient
- Constructing a system of drainage swales to collect surplus water
- Providing a clay lined, wastewater storage area for surplus runoff

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Quality Endorsed Company
ISO 9002 Lic QEC12270 Standards Australia

Certified Environmental Management
ISO 14001 C10118 Standards Australia

Attention: Don Addabbo
JEFFRIES GARDEN SOILS

Fax: 8349 4712

GREASE TRAP SLUDGE ANALYSES
AS 4439.3-1997
June 2003

Analyte mg/L	Week Ending 01/06/03	Week Ending 08/06/03	Week Ending 15/06/03	Week Ending 22/06/03	Week Ending 29/06/03
Arsenic	<0.10	<0.10	<0.10	<0.10	<0.10
Barium	0.11	0.15	0.21	0.14	<0.10
Cadmium	<0.10	<0.10	<0.10	<0.10	<0.10
Chromium	<0.10	<0.10	<0.10	<0.10	<0.10
Copper	0.19	0.41	0.38	0.24	0.24
Iron	<0.10	<0.10	0.11	0.27	0.22
Lead	<0.10	<0.10	<0.10	<0.10	<0.10
Manganese	<0.10	<0.10	<0.10	<0.10	<0.10
Nickel	<0.10	<0.10	<0.10	<0.10	<0.10
Silver	<0.10	<0.10	<0.10	<0.10	<0.10
Zinc	<0.10	<0.10	<0.10	<0.10	<0.10
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10

Regards
Nick Kopsaftis
Laboratory Manager

NATA Accredited Laboratory
Number: 14753

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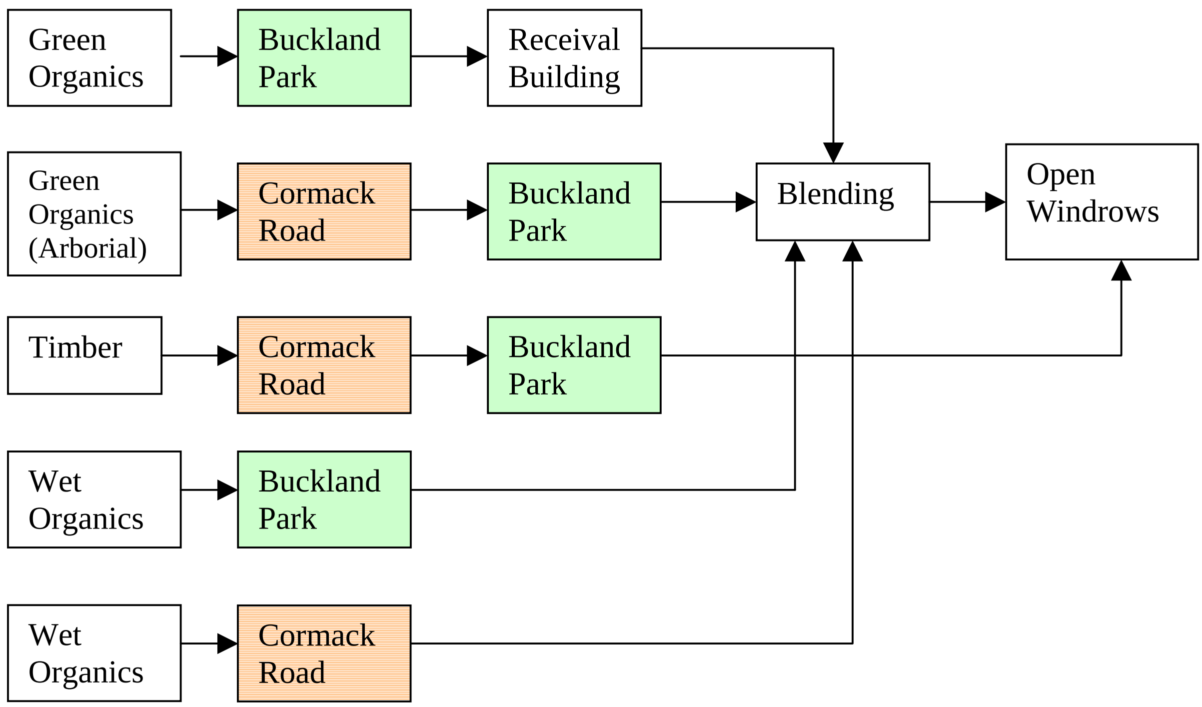
Figure 5.1

- Positioning the windrows so that there is no gap between adjoining windrows (except where a gap is required for drainage purposes). This will allow maximum absorption of rainwater by the windrows.

At Buckland Park, it will consist of forming recycled organics into windrows 3 metres high, 7 metres wide and approximately 120 m long. The composting process will be managed by maintaining windrow moisture content at between 40 –50 % and by frequent turning of the windrows, using a purpose built machine, to maintain aerobic conditions.

Figure 5.2, Incoming Materials Flow Diagram



5.4 Service Centre

The service centre will consist of the following:

- Office accommodation
- Workshop
- Employee amenities.

Design requirements for the centre will include the following

- All grey and black wastewater will be treated to EPA approved discharge standards and used for landscape irrigation
- All surface water from the workshop area to be recovered and stored on site.
- Under cover, bunded storage shall be provided for all fuel, lubricants, solvents and lead acid batteries

- Servicing and repair of plant shall be undertaken on a concrete, or similar, surface, which drains to an oil / water separator.

5.5 Irrigation Area

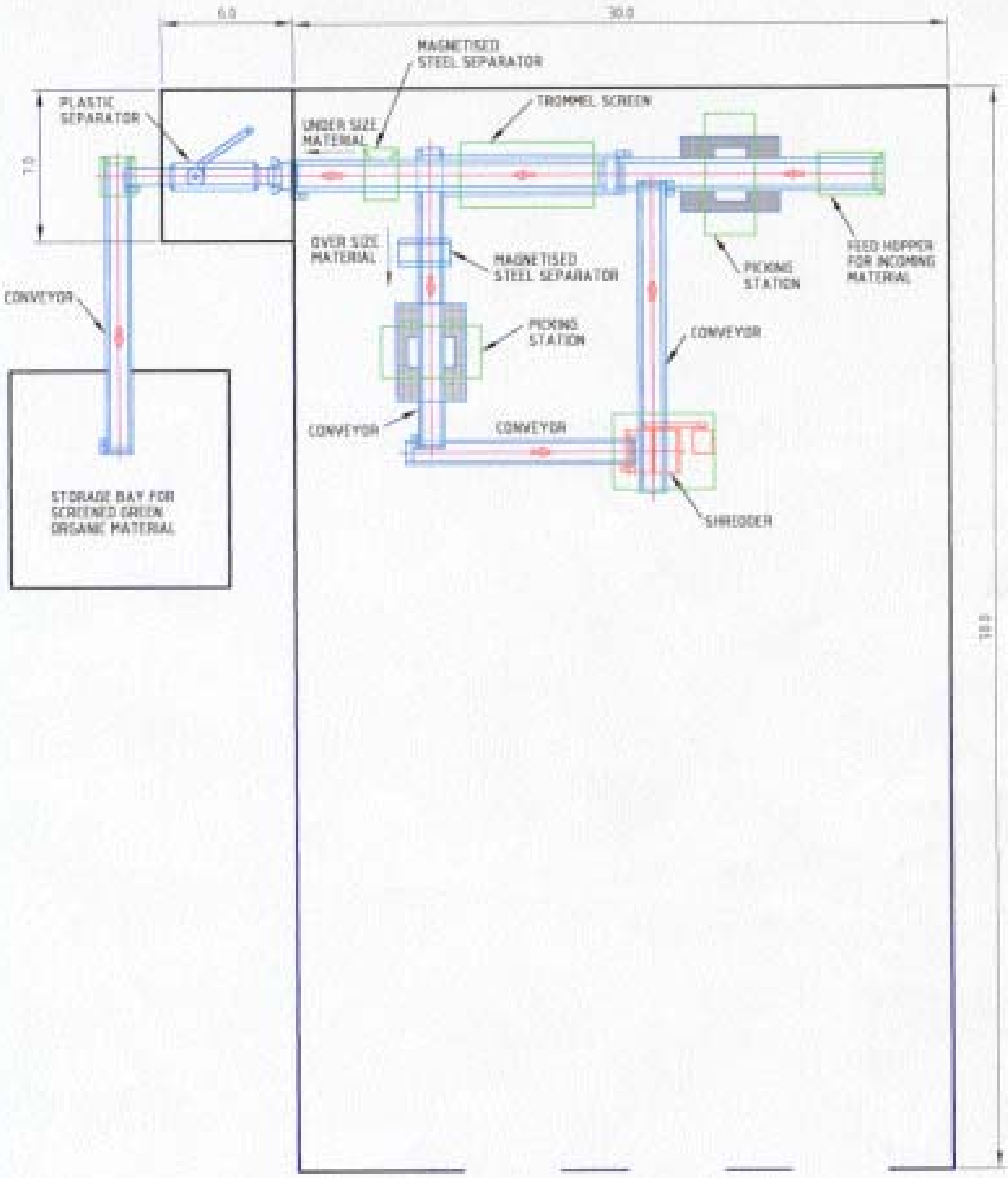
The irrigation area will be used for horticulture and for horticultural trials so that the beneficial properties of compost products can be demonstrated. There is also currently a three year agreement in place with a local grower for growing vegetables within this area.

6. Composting Depot Details

6.1 Design Details

The design is based on the following data:
- Composting is a net user of water
- Average monthly rainfall rarely exceeds evaporation, even during winter
- The local topography is flat
- Groundwater is approximately 1.0 - 2.0 m below natural surface and is saline.
- A minimum separation distance of 1.0 m will be maintained between the underside of all clay liners and groundwater.
- The local soil consists of a sandy clay which can be compacted to achieve a permeability of 10^{-9}m/sec
- Material suitable for open windrow composting is low in nitrogen
- Windrows will be turned at least weekly

To maximise the benefits offered by the site, the following design criteria have been adopted:
- Incoming materials will be received at the western end of the composting depot
  - Incoming material will be unloaded and undergo primary processing in a fully enclosed building (1 500 m^2 floor area) with a concrete floor. All vehicle entry/exit points will be fitted with air curtains to ensure that any insects contained within incoming material remain in the building.
  - Incoming material will be processed as it is unloaded (or within 24 hours)
  - Processing will consist of screening, contaminant removal, shredding blending and moisture adjustment. Figure 6.1 shows the layout of the primary processing plant
    - Removed contaminants will be stored in an in-situ compactor before removal to an EPA licensed waste depot
- Upon completion of preliminary processing, the material will be transported to the windrowing area. Refer to Figure 6.2 for details of this area.
- The north eastern end of the windrow area will be used for final processing of the mature compost, ie,
  - Screening



PLAN SCALE 1:350

FIGURE 6.1

Client
JEFFRIES
Project
RECYCLED ORGANICS RESOURCE CENTRE
BUCKLAND PARK
Title
PRIMARY PROCESSING PLANT LAYOUT

RODENBURG DAVEY & ASSOCIATES

Scales	Date
1:250	

Drawing No.
JE-003

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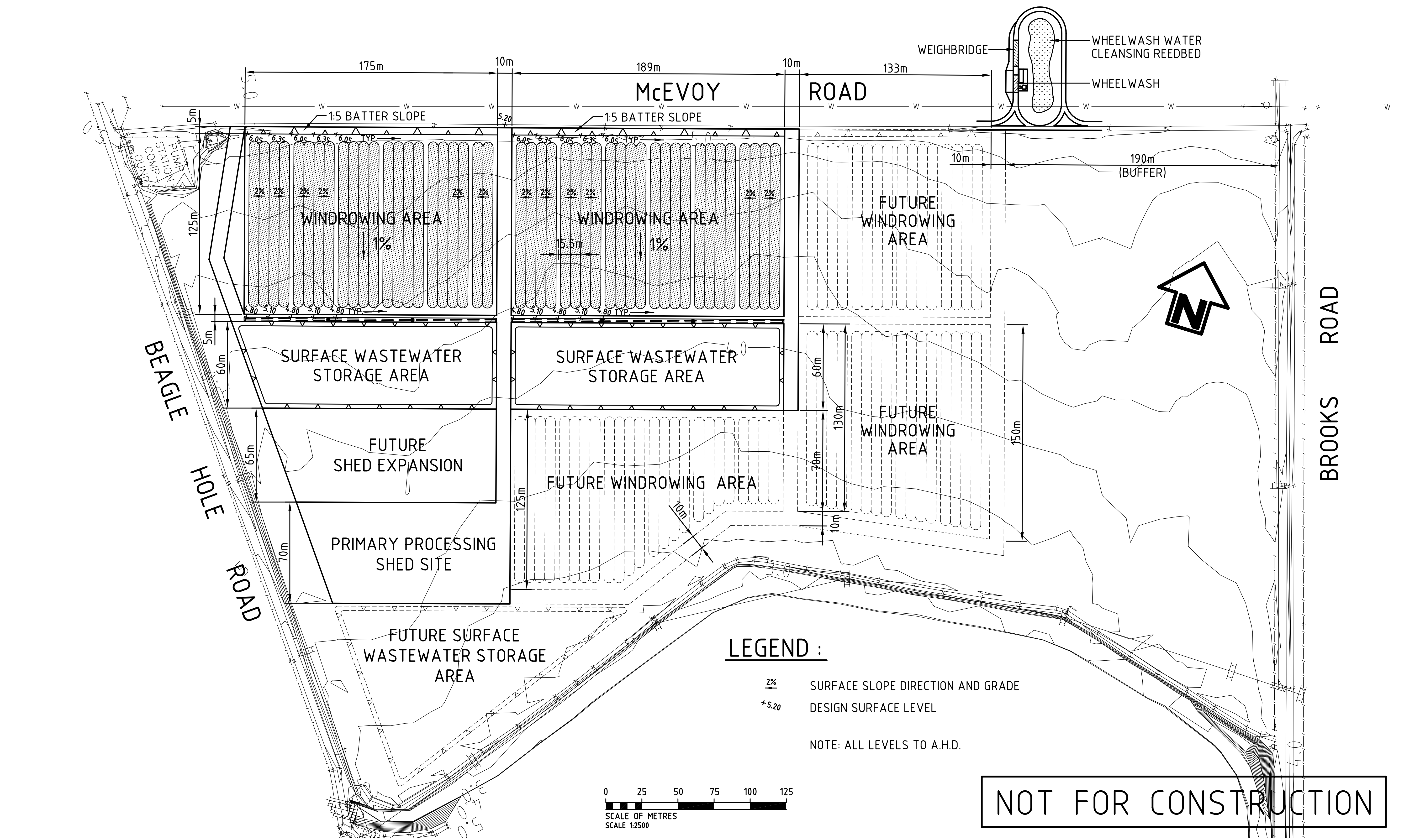

REV	DATE	DRAWN	DRAFT CHK'D	ENG CHK'D	TECH APPR.	PROJECT APPR.	DESCRIPTION
A	19.09.03	BF	DPC				ISSUED FOR INFORMATION

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35mm ON ORIGINAL DRAWING

FINAL APPROVALS	
ENGINEERING APPR.	DATE
TECHNICAL APPR.	DATE
PROJECT APPR.	DATE
CLIENT APPR.	DATE

Kellogg Brown & Root Pty Ltd

KBR

KELLOGG BROWN & ROOT Pty Ltd
ABN 91 007 660 317
186 Greenhill Road, Parkside,
South Australia 5063

TITLE
JEFFRIES GROUP, RECYCLED ORGANICS RESOURCE CENTRE, BUCKLAND PARK
SITE LEVELS PLAN
OPTION 3

DRAWING SCALE	PROJECT No.		DRAWING No.	REVISION
AS SHOWN	AEV318	A3	AEV318-C-SK-005	A

CAD FILE Name AEV318-C-SK-005.dwg

- Stockpiling prior to dispatch off site.

Preparation of the processing areas (windrowing and final product) will consist of:

- Removal of topsoil
- Reworking the underlying soil as follows:
  - Removal of the upper 200 mm layer of soil
  - Placement of fill material as required to achieve drainage grades and groundwater separation distance (minimum 1.0 m)
  - Placement and compaction of clay liner material in two layers, each layer to comprise of a compacted thickness of 150 mm, with a permeability of 10^{-9} m/sec and graded to achieve a 1.0 % longitudinal and 2% lateral drainage slope
  - All earthworks associated with the preparation of the base liner will be undertaken in accordance with the requirements of AS 3798. Supervision of the earthworks will comply with the requirements of level 1 supervision as set out in AS 3798, Appendix B.
- A 200 mm thick layer of low permeability (10^{-9} m/sec), compacted aggregate will be placed over the compacted soil to form a working surface
- Wastewater from composting activities will either drain to the drainage swale or, in the event of an extra-ordinary rainfall event, surplus wastewater will overflow from the swale to the surface wastewater storage area. Under ordinary conditions, the drainage swale will drain into one of four drainage sumps. Water from the drainage sumps will either be used to irrigate the compost windrows or pumped to the reed bed located within the vehicle washing facility. Refer to Figures 6.2 and 6.4 for further details.

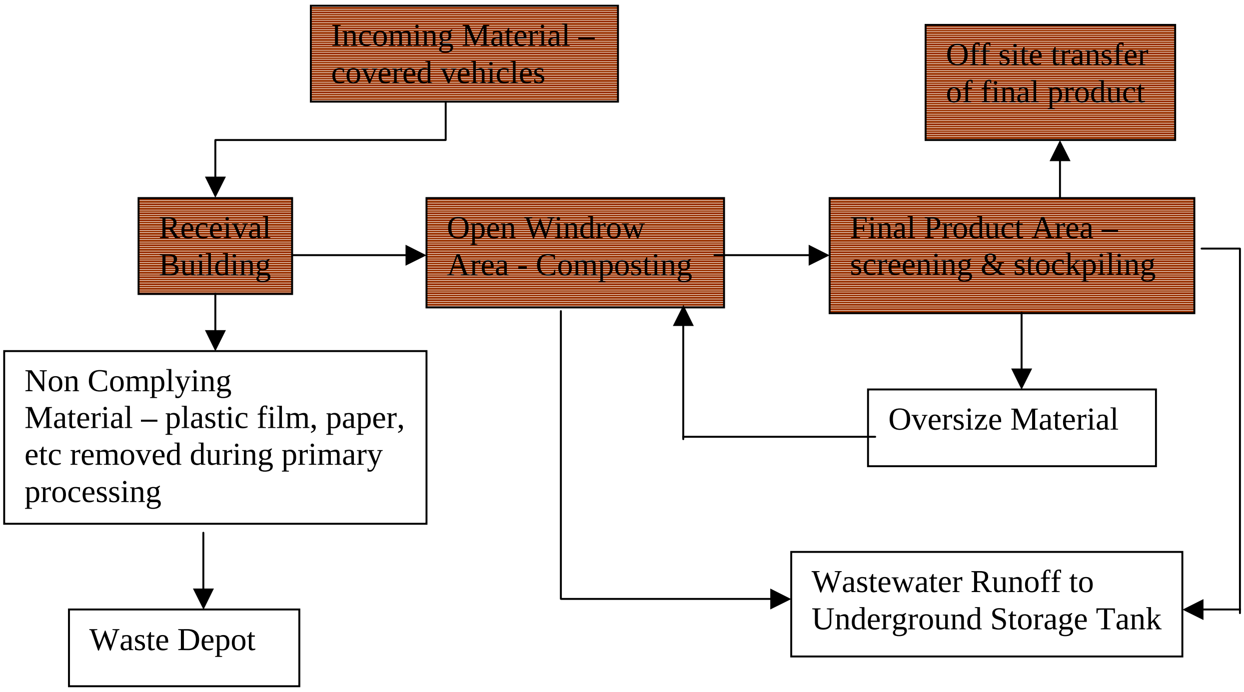
Full design and construction details are currently being produced by KBR and will be submitted to the EPA for approval prior to construction commencing.

Materials handling will occur in the following manner:

- Incoming vehicles will unload organic material within an enclosed receival building
- A front end loader will load the material into a feed hopper
- Material from the feed hopper will be released onto a conveyor belt to allow gross contaminants to be removed
- The material will then be screened to remove undersize material
- Undersize material from the screening plant will be transferred to a storage bay after passing through a plastics separator
- Oversize material will be discharged onto a conveyor to allow additional contaminant removal to be undertaken
- The sorted oversize material will pass through an electrically powered shredder to reduce its size and then redirected through the screening plant
- The undersize material will be transported to the windrow area for composting using a dump truck
- Windrow forming will be undertaken using an excavator and/or front end loader
- Windrow turning will be undertaken by a purpose built machine

- Mature compost will be loaded into a dump truck by an excavator and/or front end loader and transported to the screening plant for further processing.

Figure 6.3, Materials Processing Flow Diagram



6.2 Depot Infrastructure

6.2.1 Plant and Equipment

Size Reduction
Stationary Shredder

- Shreds incoming green organics

Van Gelder Grinding Mill and Peterson Grinding Mill

- Size reduces material.

Materials Handling
Front-End Loaders

- Stockpile and move materials.

Excavator

- Forms windrows and loads dump truck

Dump Trucks

- Move material to and from windrow area

Windrow Turning
Scat Windrow Turner
- Turns, mixes and aerates up to 2 000 m^3/hour

Screening
Incoming Materials Trommel Screen
- Screens all incoming green organics.

Finlay Trommel Screen
Turbo Chieftain Powerscreen
- Screens mature compost.

6.2.2 Buildings

The following buildings will be erected within the site:
- Incoming materials receival building, floor area 1 500 m^2, maximum height 9.0 m
- Office and employee amenities, floor area, 100 m^2, maximum height, 4.5 m
- Workshop, floor area, 300 m^2, maximum height, 6.0 m

6.2.3 Wheel Wash and Wash Bay

A combined wheel wash and wash bay will be installed within the facility for vehicles transporting materials and products to and from the facility and for the wash down of mobile plant within the facility. It will be located adjacent the access road leading off Brooks Road. Refer to Figure 6.2 for location details and Figure 6.4 for design details. It consists of the following elements:
- Fully automatic system activated by vehicle approach
- Choice of washing and washdown cycles
- 12 m long washing platform consisting of:
    - 3 m long entry and exit platforms fitted with rumble strips to dislodge soil from vehicle wheels
    - 6 m long central washing platform, also fitted with rumble strips, with 1.0 m high side walls
    - 100 water jets are positioned along the side walls to wash the sides and undersides of a vehicle as it passes through the wash bay
    - hand lance for manual washing
    - Flushing system to remove sediment from the wash bay to a settling pit
- Clay lined reed bed to allow further settlement of sediment and re-use of water
    - The clay lining for the reed bed will be 300 mm thick and constructed to the same specification as the clay lining for the open windrow compost area.

All vehicles entering and leaving the area west of the wheel wash will be required to pass through the wheel wash.

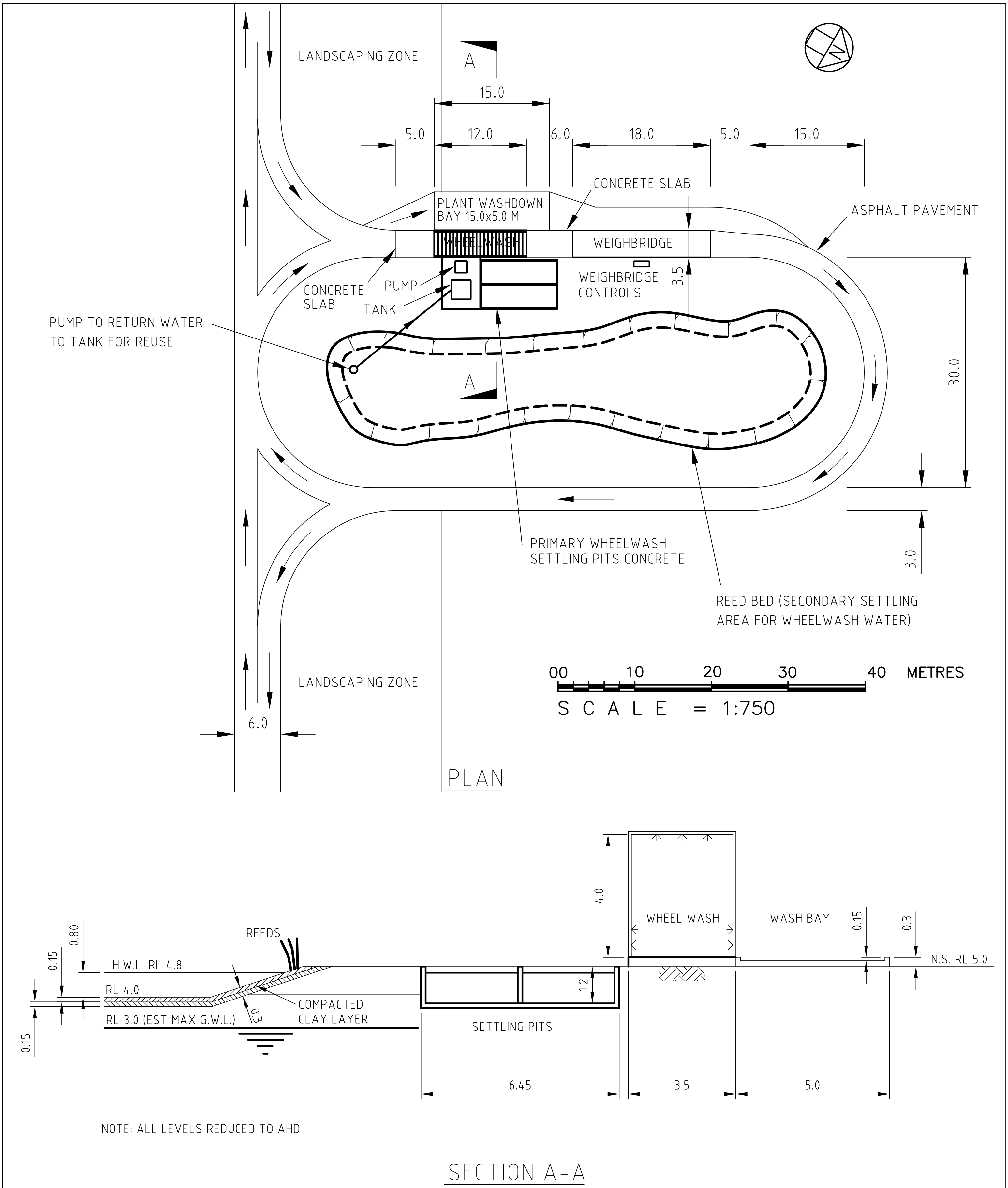


FIGURE 6.4

Client
JEFFRIES

Project
RECYCLED ORGANICS RESOURCE CENTRE
BUCKLAND PARK

Title
WEIGHBRIDGE & WHEELWASH LAYOUT PLAN

RODENBURG DAVEY & ASSOCIATES
UNIT 3, 73 KING WILLIAM ROAD, UNLEY, SA 5061
PH.: 82717122 FAX.: 82717133
INTERNET: roda@chariot.net.au

Scales	Date
AS SHOWN	9-8-03

Drawing No.	Issue
JE-004	C

All mobile plant moving from one activity area to another will be washed down at the wash bay before entering the new activity area.

Sediment from the wastewater treatment plant will be recovered and applied to the compost windrows.

6.3 Landscaping

A landscaping plan has been prepared for the site, refer to Appendix E for details. Implementation of the landscaping plan will result in the establishment of a densely planted vegetation screen along the eastern boundary of the depot. Trees and shrubs will also be planted within the site to lower wind speed and aid air mixing.

In addition to the perimeter landscaping mound, it is proposed to establish a 5 m high mound immediately behind the perimeter landscaping. The mound will have multiple purposes, ie,

- Additional screening of site activities
- Woodlotting, ie, planting of mound with selected species for later harvesting
- Reduction of wind speed across the site

Material for the mound will consist of a mixture of soil and composted recycled organics. All soil received at the site will be tested to ensure it is not sourced from a contaminated land site.

6.4 Fencing

The boundaries of the site will be fenced with a 1.2 m high stock fence. Chain wire security fencing, 2.4 m high, will be erected around the Jeffries Service Area and other areas as required.

6.5 Signage

Because access to the facility is restricted to Jeffries authorised vehicles, signage will be limited to one information sign at the eastern boundary of the facility displaying the following information.

- licensee’s name and licence number,
- after hours contact telephone number
- materials approved for receival
- emergency contact telephone number.

7. Environmental Controls and Corrective Actions

A risk assessment report (Appendix K) for the facility has been prepared by Parsons Brinckerhoff to assist Jeffries in identifying critical environmental risk issues and measures required to mitigate these risks. Information contained in the report was used to formulate the measures outlined below.

7.1 Quality Assurance and Quality Control

Jeffries has a demonstrated record of adopting best practice composting methods. Evidence of this is their ISO 9000 accreditation, AS 4454:1999 product certification and NASAA registration (Appendix J). Jeffries has also committed to achieving ISO 14001 accreditation within six months of receiving development approval for the Buckland Park site. The significance of ISO 9000 and ISO 14001 accreditation is that continued accreditation requires Jeffries to demonstrate continuous improvement in their composting procedures and practices. This will include procedures and practices to minimise any potential risks associated with plant pests and diseases.

ISO 14001 accreditation will also require Jeffries to develop an environmental management system (EMS) that covers all site activities with the potential to impact the environment. Development and implementation of environmental controls, corrective actions and process improvements are key requirements of ISO 14001 accreditation.

In order to achieve these requirements, Jeffries will appoint a site manager with responsibility for ensuring all activities on site comply with the environmental controls set out below, as well as assessing the effectiveness of these controls and monitoring the overall environmental performance of the site.

Common to all of the corrective actions set out below will be immediate notification to the relevant state government agency (eg, EPA, PIRSA) by telephone, facsimile and/or email of the nature of the problem and the actions being taken to resolve it. This initial notification will be followed up by a written report setting out the results of the investigation and the actions taken to avoid a recurrence of the problem. Unless advised otherwise, the relevant state government agency will receive the report within 28 days of being notified that an operational problem had occurred.

Jeffries recognises that measurement of the effectiveness of the environmental controls developed for the site, and upgrading them as required, will be an ongoing responsibility. Monitoring site performance and developing improvement programs will be undertaken in full consultation with the relevant state government agencies.

7.2 Odour

Odour modelling for the site has been undertaken using the Ausplume model (refer to Appendix G for details). The results show that odours produced from site activities should not impact adversely on the surrounding area if there is compliance with the requirements of AS4454.

Odour levels from depot activities will be monitored by comparing odours up wind and down wind of the depot when activities with the potential to cause strong odours are being undertaken.

The most likely source of odours is the windrow area. Odours should not reach nuisance level if effective windrowing practices are maintained. Jeffries will monitor odour levels continuously and if strong odours are produced, immediate corrective action will be taken to ensure the problem is remedied.

Corrective Action
Common to all of the following corrective actions will be notification to the EPA of the nature and extent of the problem and the action taken to rectify the problem.

Receival Building
- Application of odour neutralising aerosols
- Installation of a forced air ventilation system within the receival building, including the use of a biofilter to remove odour from the air being exhausted.
- Lessening the time material is stored prior to processing
- Removal of the material causing the odour problem to landfill

Windrowing Area
- Identification of the windrow(s) causing the problem
- Analysis of temperature records
- Analysis of moisture content
- Analysis of materials source and type
- Assessment of options to solve odour problem, ie,
  - More frequent turning of windrow(s)
  - Adjustment of moisture content
  - Addition of carbon based material, eg, timber shavings/sawdust
  - Removal of all, or part of, the windrow(s) to landfill
- Implementation of the preferred option.

These actions would then be followed by an investigation to establish the cause of the odour problem and, if required, the introduction of appropriate changes to operating practices.

7.3 Temperature

Windrow temperature is generally accepted as an appropriate performance indicator that aerobic conditions are being maintained within windrows. Windrows will be managed in such a way that all material within the window is subject to temperatures in the range of 55 - 70^{0}C for at least 12 consecutive days to destroy weed seeds and propagules and plant pathogens. Jeffries ensures compliance with this requirement through their windrow turning program and quality control procedures.

Windrow temperatures will be recorded continuously during critical stages of the windrowing process.

Corrective Action
If windrow temperatures of 55^0 C – 70^0 C are not being maintained for a minimum of 12 consecutive days, one or more of the following corrective actions will be taken:

- adjustment of the windrow moisture content (wetting/drying)
- modifying the windrow profile, i.e., increasing/decreasing the cross sectional area of the windrow and/or changing the shape of the windrow
- investigation and identification of the cause of temperatures being outside the specified range
- modification of windrow operational practices to avoid a recurrence of the problem.

7.4 Dust

The land on which the depot is located is entitled to a 511 ML water allocation from the Bolivar – Virginia pipeline. Thus there is an abundant supply of recycled water for dust control.

A study of wind data received from a Department of Environmental Health, Flinders University project at the SA Water Bolivar wastewater treatment plant has shown that wind speeds in the area rarely exceed 40 Km/h. Bureau of Meteorology records show that average wind speeds recorded at Adelaide Airport (coastal conditions) and Edinburgh RAAF (nearest local weather station) are in the range 11 – 20 Km/h.

In addition to investigating wind conditions, dust monitoring has been undertaken at Jeffries' Wingfield Waste Management Centre composting facility to obtain data on dust levels that could be expected from the proposed facility. Refer to Appendix F for full details. It can be seen from the report that dust fallout generally occurs within 150 m of the dust source. Given that composting activities are set back 200 m from Brooks Road, and that the nearest house is 800 m from the site boundary, dust from composting activities is not expected to be a problem.

In order to ensure dust is effectively managed,, ie, that it does not create an on site health hazard or an off site nuisance, the following measures will be implemented:

- A water truck will be available at all times at the depot to water trafficable surfaces
- Windrow moisture content shall be checked prior to turning being undertaken to ensure it is adequate to prevent dust becoming a problem
- A water tanker will apply water to windrows as they are being turned to maintain their moisture content between 40 – 50%
- Windrow turning and compost screening activities will be curtailed if watering is ineffective in controlling dust during dry, windy conditions
  - A weather station will be installed to assist staff assess whether to stop/defer windrow turning and/or compost screening. Details of the weather station are provided in Appendix D.

In order to demonstrate that dust is being effectively controlled, a dust monitoring program will be established at the depot. It will consist of the following:

- Installation of a plate collector at the following locations:
  - Brooks Road / Mc Evoy Road boundary of the property
  - Along the the southern boundary of the depot
  - Along the western boundary of the depot
- weekly removal and storage of the dust from the collector
- monthly analysis of the stored dust to ascertain the percentage of compost within the dust

If the percentage of compost within the stored dust exceeds 5% by weight, an investigation will be immediately undertaken to determine the cause of the problem and remedial action taken to ensure there is compliance with the target value of 5%.

Corrective Action
If dust from windrow turning activities is causing a nuisance off site, the moisture content of the windrows will be increased to a level where dust is no longer a problem.

If screening of the final product is found to be the cause of ongoing dust problems, the screening plant will be housed in an enclosed structure.

7.5 Surface Water Management

Surface water management issues have been investigated by a qualified hydrological engineer, Mr Richard Clark. Refer to Appendix H for a complete copy of his report.

Fundamental to surface water management at the depot will be:

1. Retaining all surface water within the site, and
2. Separation of wastewater from the composting area (ie, all areas associated the receival, processing, storage and dispatch of organic materials and products) and stormwater from the remaining areas within the site.

Wastewater from the composting area will be recovered and used to irrigate the compost windrows. The hydrological report prepared by Clark estimates that for average rainfall conditions, the windrow composting area may produce up to 210 Kl/year of runoff. This water will be diverted to the drainage sumps mentioned in Section 6.1 and then used to irrigate the compost windrows. Surplus water will be pumped to the reed bed forming part of the wheel wash facility.

Runoff from non composting areas, which is not classified as wastewater, will be stored within non lined areas of the depot.

For a one in 25 year storm event, it is estimated that the windrow composting area may produce up to 2 Ml of wastewater. This water will be stored in the surface wastewater storage area immediately south of the windrow area. It will be used to either irrigate compost windrows or it will be allowed to evaporate.

The soil lining for the surface wastewater storage area will be prepared in the following manner:
- topsoil will be removed to a depth of 200 mm
- the underlying clay will be removed and replaced with a clay liner. The clay liner will consist of two, 150 mm thick layers, each layer will be compacted to achieve a permeability of 10^{-9} m/sec
- topsoil will be replaced and grass cover established.

Refer to Figures 7.1(A) and (B) for additional information concerning surface water storage design details.

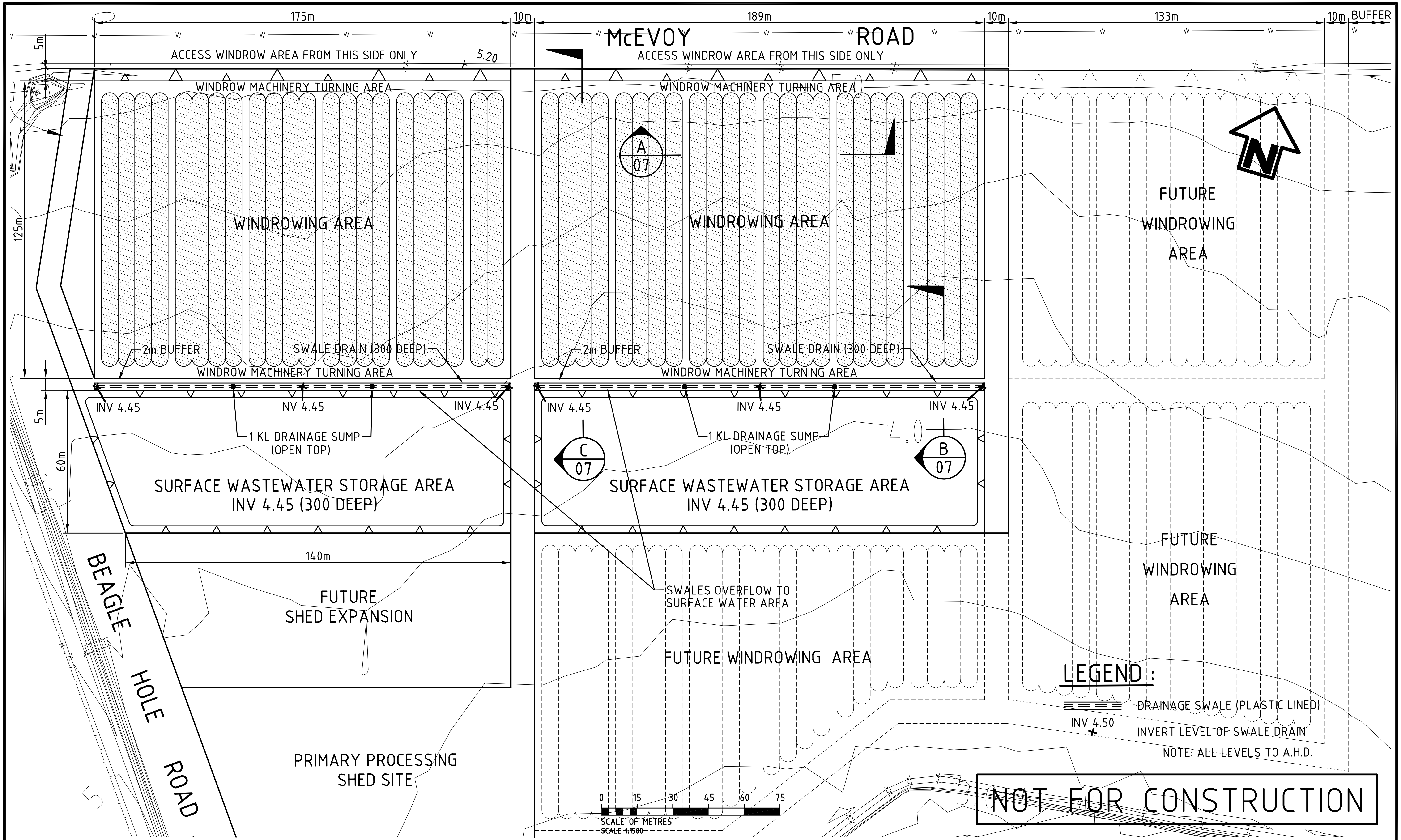
Surface water from the composting area will be sampled annually and tested for the presence of the analytes set out in Table 7.1.

Corrective Action
Stormwater modelling indicates that there will be 210 Kl of wastewater produced from an average rainfall event. There is sufficient capacity within the drainage system for this amount of wastewater. . However, if it is found that the amount of water recovered from the open windrow area during average rainfall events is greater than can be utilised by the compost windrows and the vehicle washing facility reed bed, an above ground polyethylene storage tank will be installed to store the surplus wastewater. Aeration devices will be installed within the tank(s) to ensure stored water is maintained in an aerobic condition.

7.6 Groundwater Management

Groundwater management is based on complying with the requirement that there is no deterioration in groundwater quality at the boundary of the property.

Due to groundwater being 1.0 – 2.0 m below natural surface, fluctuations due to seasonal conditions are experienced. In order to cope with a worst case scenario, a maximum



NOT FOR CONSTRUCTION

REV	DATE	DRAWN	DRAFT CHK'D	ENG CHK'D	TECH APPR.	PROJECT APPR.	DESCRIPTION
A	19.09.03	BF	DPC				ISSUED FOR INFORMATION

REVISIONS

35mm ON ORIGINAL DRAWING

FINAL APPROVALS	
ENGINEERING APPR.	DATE
TECHNICAL APPR.	DATE
PROJECT APPR.	DATE
CLIENT APPR.	DATE

Kellogg Brown & Root Pty Ltd

KBR

KELLOGG BROWN & ROOT Pty Ltd
ABN 91 007 660 317
186 Greenhill Road, Parkside,
South Australia 5063

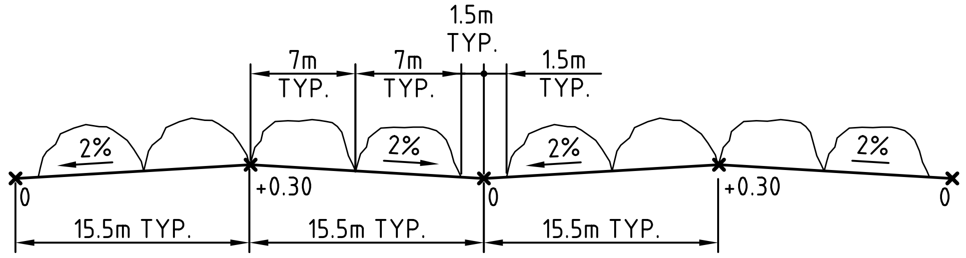
TITLE

JEFFRIES GROUP, RECYCLED ORGANICS RESOURCE CENTRE, BUCKLAND PARK

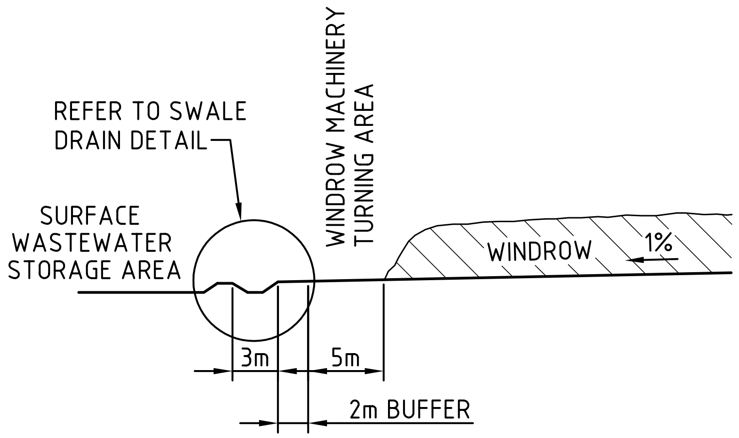
SITE DRAINAGE PLAN OPTION 3

DRAWING SCALE	PROJECT No.		DRAWING No.	REVISION
1:1500	AEV318	A3	AEV318-C-SK-006	A

CAD FILE Name AEV318-C-SK-006.dwg



SECTION A / 03
N.T.S.



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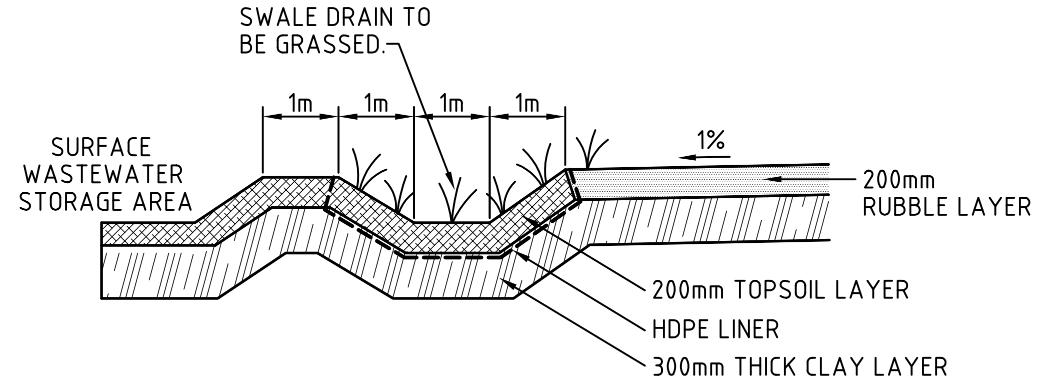

SWALE DRAIN DETAIL
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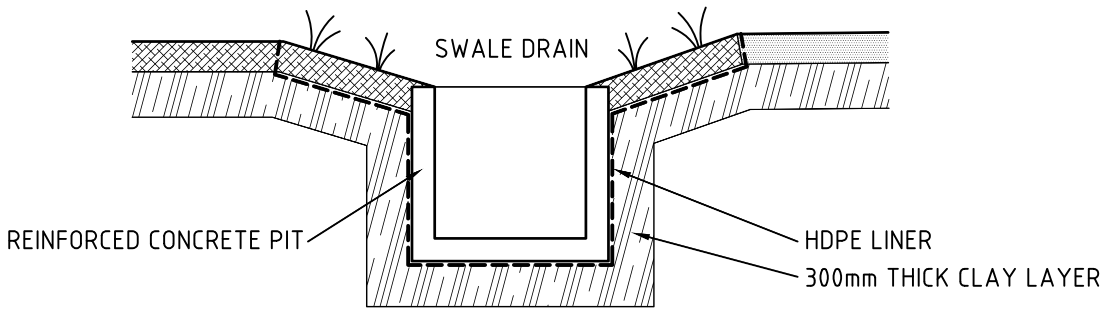

DRAINAGE SUMP (1 KL)
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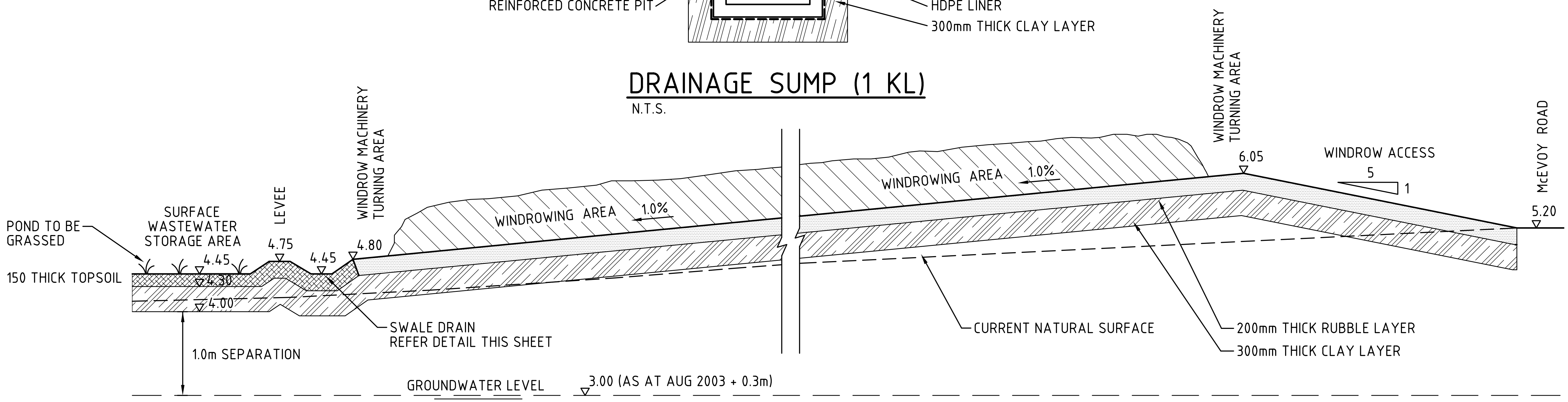

SECTION D / 03
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NOT FOR CONSTRUCTION

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A	19.09.03	BF	DPC				ISSUED FOR INFORMATION

REVISIONS

35mm ON ORIGINAL DRAWING

FINAL APPROVALS	
ENGINEERING APPR.	DATE
TECHNICAL APPR.	DATE
PROJECT APPR.	DATE
CLIENT APPR.	DATE

Kellogg Brown & Root Pty Ltd

KBR

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TITLE
JEFFRIES GROUP, RECYCLED ORGANICS RESOURCE CENTRE, BUCKLAND PARK
SITE DRAINAGE SECTIONS OPTION 3

DRAWING SCALE	PROJECT No.		DRAWING No.	REVISION
NOT TO SCALE	AEV318	A3	AEV318-C-SK-007	A

CAD FILE Name AEV318-C-SK-007.dwg

groundwater level of RL 3.0 has been assumed for the site. Site designs and groundwater management practices are based on this assumed value.

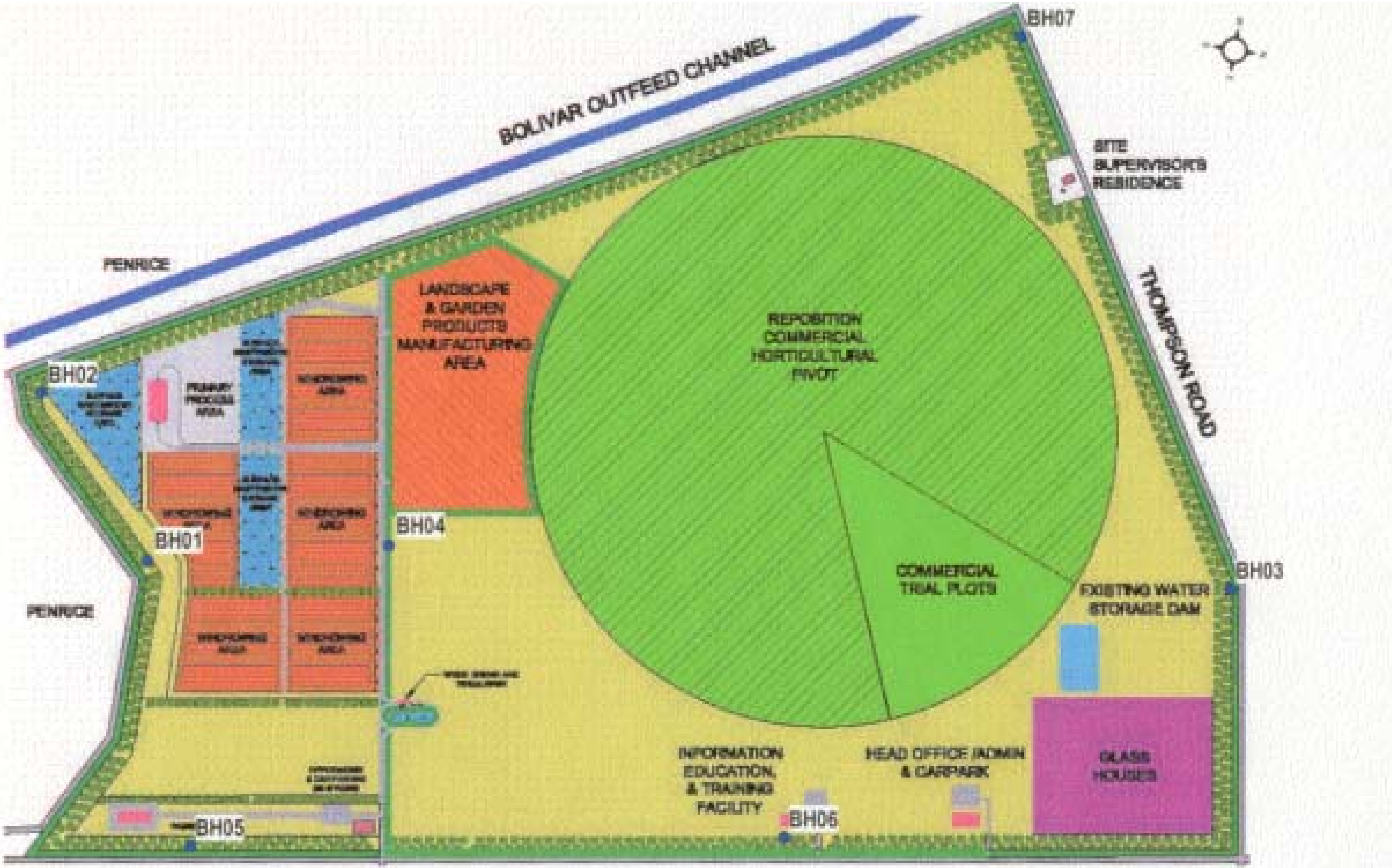
In order to monitor the performance of the groundwater protection measures, 14 monitoring bores will be installed (seven of which have already been installed) to provide upgradient, intermediate and down gradient water quality data. Refer to Figure 7.2 for location details and Figure 7.3 for bore construction details. Details of the groundwater monitoring program are provided in Appendix I.

Surface water from the composting area will be sampled annually and tested for the presence of the analytes set out in Table 7.1.

Table 7.1, Surface Water and Groundwater Monitoring Analytes

Analyte	Background Value
Field Measured Analytes	
Electrical Conductivity	
Dissolved Oxygen	
Redox Potential	
pH	
Temperature	
Laboratory Measured Analytes	
Sodium	
Potassium	
Magnesium	
Calcium	
Chloride	
Sulphate	
Bicarbonate	
Carbonate	
Total Alkalinity	
Nitrate and Nitrite	
Ammonia	
Kjeldahl Nitrogen	
Total Phosphorus	
Total Dissolved Solids	
Chemical Oxygen Demand (COD)	
Cadmium	
Chromium	
Copper	
Arsenic	
Nickel	
Lead	
Zinc	

FIGURE 7.2



LEGEND

BH01

● Groundwater Well

SCALE: 1 : 8 000

CLIENT: Jeffries Garden Soils

PROJECT NO.: SG031072

REPORT REF.: Buckland Park

DATE: October 2003

DOCUMENT REF NO.: Figure1

S&G SOIL & GROUNDWATER CONSULTING
First Floor 207 The Parade Norwood SA 5067
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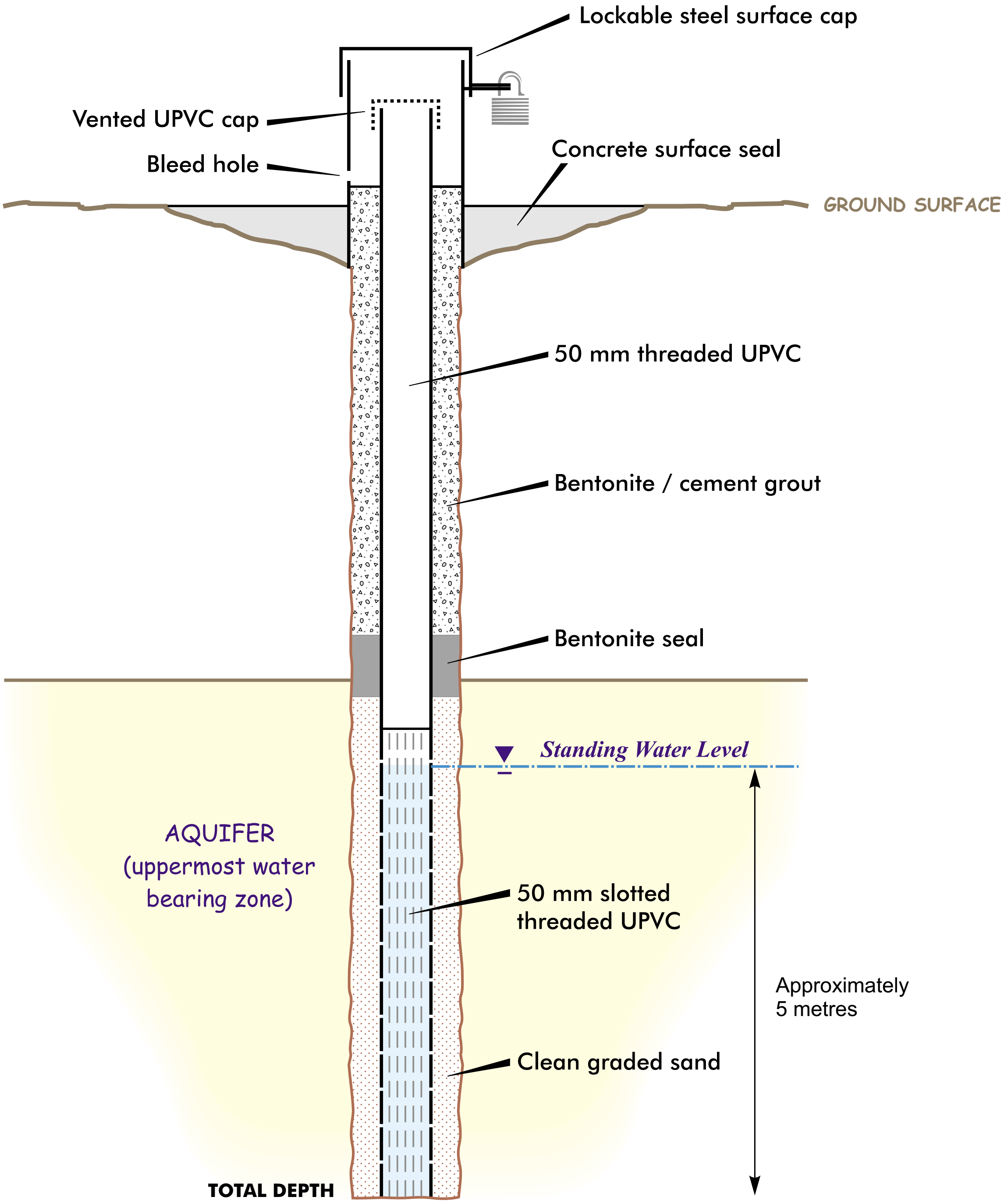
SITE LAYOUT & LOCATION OF MONIT0RING WELLS



WATER SEARCH *Groundwater & Geological Consultants*

GeoTech Graphics

GROUNDWATER MONITORING

MONITORING WELL CONSTRUCTION DETAILS

Corrective Action
Groundwater Level
If the monitoring program reveals that the 1.0 m separation distance between the underside of the clay liner and groundwater is not being maintained, the EPA will be notified within 24 hours and corrective action will be undertaken immediately.

7.7 Plant Pests and Diseases

7.7.1 Risk Management

Jeffries has already developed comprehensive plant pest and disease control measures for its current composting activities at the Wingfield Waste Management Centre. Due to the fact that the proposed composting depot is located within a horticultural zone, Jeffries engaged Scholefield Robinson Horticultural Services and Davidson Viticultural Consulting to investigate and identify the nature and scope of potential plant pests and diseases that may emanate from the composting activities, and the adequacy of Jeffries control measures. Refer to Appendix B for complete copies of their reports.

Details of identified risks and associated control measures, as assessed by Scholefield Robinson Horticultural Services, are set out below.

Identified Risk	Control Point	Comments
SITE HISTORY		
Presence of flowering weeds where problem plant pests, eg, WFT, are likely to harbour.	• Site preparation, removal of weeds, non-flowering barrier crops and windbreaks installed	
Residential gardens, near environs with flowering plants, weeds likely to harbour problem plant pests	• Councils contacted regarding roadside weed management in near environs.	• It is possible these will remain a source of plant pests.
INPUT MATERIAL		
Source and type of material	• High risk material such as fruit and vegetables will not be accepted • PIRSA approval before material from a new source is approved for receival	• To avoid the problem of receiving material with a high risk profile.

Identified Risk	Control Point	Comments
Material collected with pest or disease present, including fruit flies From waste transfer depots – quality of in-coming material unknown; material may have many contaminants An assessment procedure will be required for new sources and/or types of material	• No collection accepted from declared quarantine zones. • On-site quality assessment of in-coming material. • Reject high risk material from processing pathway. • Delivery in covered trucks. • Communication and awareness link with contract collectors	• Establishment of action network between Jeffries, councils and PIRSA and a materials tracking system • Installation of fruit fly traps at waste transfer depots • Inspection of control procedures by Jeffries at waste transfer depots • Covering trucks will minimise risk of spreading plant pests and diseases • Develop inspection procedures for material from waste transfer depots
Delivery trucks with attached soil on wheels	• Truck treatment – wheel wash; wash down protocols; receival area isolated from final product area	• All vehicles entering and leaving facility will pass through the wheel wash
PROCESSING		
Sorting and screening	• Fully enclosed receival building with concrete floor and air curtains on all vehicle/plant entry/exit points • Windbreaks established.	• Retain all delivered material within the receival area • Reduction in risk of windblown plant material and litter
Composting *Temperature Management*	• Commence within 24 hrs of delivery • Monitor temperature and maintain as per AS 4454. • Complete inversions of composting material.	Lethal temperatures for pests and disease-causing organisms < 50°C. This will be achieved within 12 hours of the material being windrowed
Blending	• Traceback systems to sources of all materials received at the composting depot. • Low-risk input materials. • Dedicated equipment.	Cross-contamination at any point can be controlled through effective operational practices and effective monitoring/testing programs.

Soil deliveries	• Source from low risk, accredited sites; pre-heat if any risk.	
Final Product	• Isolated from receival and composting areas.	• Avoid cross-contamination from partially composted materials.
FACILITY MANAGEMENT PRACTICES		
Location	• Assess existing WFT status. • Isolated from any known FF entry points.	• Facility not within a commercial fruit production area but close proximity to vegetable production
Site Design	• Separation of incoming materials, windrows and finished products. • Traffic management enforced.	
Equipment	• Machinery movement controlled. • Machinery washdown protocols established • Washdown area designated.	
Personnel	• Jeffries contact person appointed. • Employee induction program • On going employee training and awareness, • Materials tracking systems established • Comprehensive record-keeping given high priority. • On-going monitoring for WFT, FF	• Communication network between all parties will ensure early detections, notifications and delivery schedule changes

Identified Risk	Control Point	Comments
PRODUCT DELIVERIES		
Equipment	• Dedicated equipment for final product deliveries. • Washdown schedule established for delivery trucks. • Delivery/consignment tracking system in place • Protocols established for delivery sites in high risk (WFT, FF) areas.	

Other specific, risk reduction measures to be undertaken by Jeffries include:

- Consultation with PIRSA regarding installation of fruit fly traps at all waste transfer facilities supplying Jeffries with green organics
- Landfilling of all kerbside collected green organics collected from PIRSA nominated fruit fly quarantine areas
- No planting of susceptible host plants for Mediterranean fruit fly (Medfly)or Queensland fruit fly (Qfly) at the Jeffries facility.
- Increase the extent of windrow temperature monitoring.
- Establish a formal relationship with PIRSA (SA Fruit Fly Standing Committee and Community Liaison Officer), contractors providing councils with green organics collection services and metropolitan councils via the LGA.
- Educate all staff regarding operational protocols to avoid risks associated with Fruit Flies and Western Flower Thrip (WFT).
- Complying with the requirement to process raw material within 24 hours of delivery
- Provision of a fully enclosed receival building with a concrete floor to ensure no contact of recyclable organics with soil.
- All vehicle access points within the receival building shall be fitted with air curtains
- Jeffries will establish additional monitoring sites in order to extend the local PIRSA fruit fly monitoring grid to include the area around the Buckland Park facility.
- Establish a WFT monitoring system within the composting depot consisting of sticky traps, collection, diagnostic assessment and reporting.
- Implementation of a formal monitoring/auditing program approved by PIRSA.
- Register Jeffries in the PIRSA network for receipt of weekly updates on fruit fly status in the state.
- Establish protocols, inclusive of kerbside green organics collection contractors, LGA (through metropolitan councils) and landfill operators, that document and track diverted deliveries (i.e. green organics collections from quarantined fruit fly zones that were diverted to landfill).

- Establish protocols for tracking, monitoring and handling of recycled organics delivered to Jeffries, which contains sufficient details to allow identification and location of all source materials within each windrow.

7.7.2 Receival Building

All incoming green organics will be received in a fully enclosed building in order to provide the level of control required to avoid pest plant and disease problems. The receival building is an essential component of the program to avoid pest plant and disease problems. Its key features are:

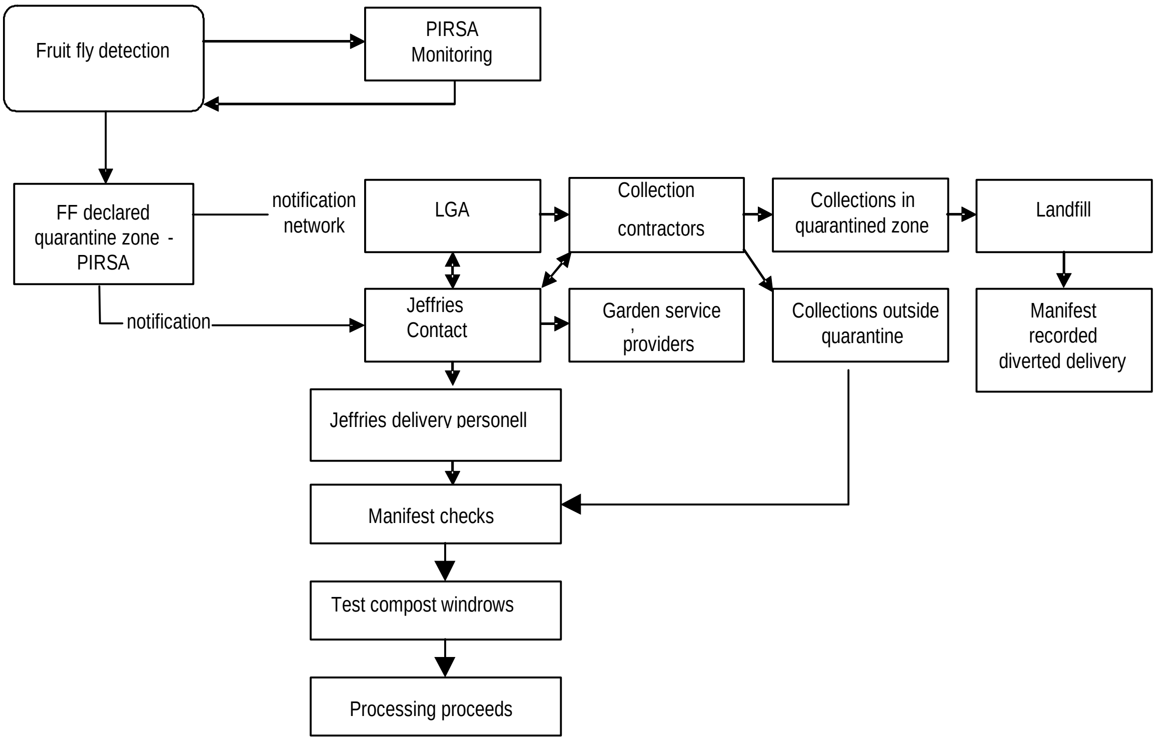
- Fully enclosed
- Constructed on a concrete slab
- All openings not fitted with air curtains to be fitted with screens capable of preventing the entry/exit of insects. Such openings to include doors, windows and vents

Fruit Fly

Fruit Fly has been identified as presenting the most concern to the local horticultural industry. Communication and risk minimisation are the fundamental requirements that Jeffries have incorporated into their control procedures.

At present there is close liaison between Jeffries and green organics collection contractors. However this communication network will be expanded due to the changed circumstances applying at Buckland Park, compared with current operations at the Wingfield Waste Management Centre. The flow chart below outlines the network links that need to be established to ensure quick response times in the event of a declared pest outbreak.

Figure 7.4, Communication Network



The procedures to be followed once a fruit fly quarantine zone is declared in metropolitan Adelaide are clearly outlined in the PIRSA document "*PIRSA Plant Health Operations Fruit Fly Detection and Eradication Manual*"

Jeffries recognises its responsibility to comply with these regulations and procedures. To do this efficiently Jeffries will:

a) Establish a contact person for exotic pests within their organisation (*Jeffries contact*) and ensure that all agencies and related parties are aware of this person and the need for dealings directly with that person.
b) Establish and continue direct, on-going contact between *Jeffries contact* and collection contractors, PIRSA (SA Fruit Fly Standing Committee and Community Liaison Officer).
c) Divert all kerbside collected green organics from PIRSA nominated quarantine zones to landfill.
d) Ensure collection contractors have a dedicated contact person charged with responsibility for contacting Jeffries re deliveries and diverted deliveries.
e) Ensure collection contractors' contacts and *Jeffries contact* cooperatively develop systems for:
   - communicating and directing delivery diversions;
   - recording diversion routes;
   - recording diverted delivery manifestos allowing tracking to source areas.

f) Enhance their on-site system of tracking material movements, ie, from delivery source to windrow locations to final product locations. Included in delivery manifestos should be the collection details (times, date and location (marked maps)) and a written statement that the area has not been declared a quarantine zone.
g) Provide separate areas for incoming recyclable organics, soils, windrows and final product.
h) Dedicate machinery and equipment to specific processing tasks.
i) Process all incoming material within 24 hours of receipt.

Compliance with PIRSA Procedures
PIRSA has clearly stated procedures for:

- monitoring for Qfly and Medfly.
- detecting Qfly and Medfly
- declaring an outbreak
- community awareness and liaison
- establishing and managing an eradication program

The procedures, roles and responsibilities are clearly outlined in PIRSA's *Plant Health Operations Fruit Fly Detection and Eradication Manual.* Jeffries will ensure they become an integral part of the informed network, by:

- *Jeffries contact* receiving formal training and becoming knowledgeable about fruit fly regulations and WFT management guidelines.
- *Jeffries contact* formally advising the members of the SA Fruit Fly Standing Committee of his responsibility within Jeffries and cooperating with PIRSA to ensure the network of monitoring and communication includes Jeffries as soon as possible.
- *Jeffries contact* ensuring, with PIRSA, that the monitoring grid is extended to Jeffries, Buckland Park and near environs.
- Jeffries contributing to the cost of any additions to the monitoring grid attributable to the establishment of the composting depot.
- *Jeffries contact* trained to carry out initial traps (fruit fly) and sticky card (WFT) inspections. *Jeffries contact* responsible for forwarding relevant cards and traps for expert diagnosis.
- *Jeffries contact* and PIRSA identifying commercial growers of fruit fly susceptible crops in near environs.
- Jeffries establishing systems and materials tracking protocols for each delivery, in cooperation with councils and collection contractors.
- Jeffries monitoring for WFT on-site and within windrows, according to recommendations of the Virginia Horticulture Centre (WFT Co-ordinator, SARDI) and PIRSA.
- *Jeffries contact* receiving training in identification of WFT.
- *Jeffries contact* maintaining close contact with WFT Coordinator (SARDI).

- *Jeffries contact* to be responsible for managing plants, including weeds, within the total Jeffries Buckland Park site to ensure exclusion of plants that may harbour WFT. Weed control must prevent weeds reaching the flowering stage.

Western Flower Thrip (WFT)
Jeffries will implement all relevant parts of the WFT management guidelines prepared for specific crops in the area. WFT no longer has quarantine status and it is already established within the NAP. It is generally accepted that the movement of infested plant material has accounted for the spread of WFT across Australia. On the NAP, the continual movement of equipment, personnel, produce and planting material has made it difficult to eradicate the pest. Many crop production management practices have also contributed to its continued presence. The greatest risks are associated with nursery plants, flower and leafy vegetable crops, tomatoes and capsicums in greenhouses. Significant losses have also been recorded in potato crops.

Jeffries' will adopt the following procedures to avoid adding to the existing WFT problem:

- Ensure no cross contamination between incoming material and final product by:
  - Designating separate activity and plant/machinery areas.
  - Managing movement of staff and vehicles within, and beyond, the property.
  - Implementing equipment wasshdown protocols.
- Commence monitoring on-site for WFT in order to establish the site's WFT status prior to development of the site.
- Collection vehicles diverted to landfill shall be washed down (pressure/ steam cleaning; disinfection as required, eg, Insectigas®).
- Continue to develop their association with the Virginia Horticulture Centre and attend regular updates on WFT. *Jeffries contact* to be trained in WFT identification and management (insecticide spraying included).
- Establish regular and frequent communication with Playford Council Animal and Plant Control Officer to ensure that weed control on the perimeter of Jeffries' property and near environs, is managed according to the WFT management guidelines for the area.
- In the event an insecticidal treatment is required in windrows, soft insecticides such as *Success or Biopest (paraffin oil)* are likely to be approved for use (with permit).
- Jeffries will implement the recommended chemical control strategies (as set out in *WFT Management Guidelines)* if WFT is not controlled by a soft insecticide.

Corrective Action/Contingency Plan
General
Identification of plant pests and diseases within the Jeffries composting depot would immediately trigger the following action by Jeffries:

- Notification by telephone/fax/email to PIRSA and EPA of the outbreak
- Spraying of the effected area with an appropriate chemical
- Removal of all effected material to landfill

- Sterilisation of mobile plant before movement to another area of the composting depot
- Sterilisation of all plant and machinery at the end of each day
- Identification and quarantining of the source of the material
- Inspection of surrounding areas to determine whether the plant pest/disease has spread beyond the composting depot
- Implementation of an appropriate eradication program
- A review of raw material sources to determine their continued suitability
- Preparation of a report to PIRSA and EPA setting out details of all actions taken within 28 days of the outbreak, or an alternative acceptable date.

Fruit Fly
The following corrective action will be followed if fruit flies are found in local traps. It is based on the life cycle of the fruit fly, as set out in PIRSA Fact Sheet 21/77/01, ie, "Adult flies lay eggs in developing fruit and vegetables. Maggots (larvae) hatch within the fruit. The infested fruit/vegetables fall or are discarded **and, if in contact with soil**, the larvae move into the soil, pupate and then emerge as adult flies, which mate and repeat the cycle. In the summer the complete cycle may take only 2 – 3 weeks."

Experience and systematic research has clearly shown that insect, fungal and bacterial pests cannot survive a composting process that conforms to the requirements and guidelines of the Australian Standard 4454 (1999) *Compost, Mulches and Soil Conditioners.*

Once temperatures exceed 40°C, the likelihood of viable insect larvae being present declines significantly. It is acknowledged that a risk period exists after the material is received and before it is processed (0 - 24 hours). Once the windrow temperature of 40°C is reached, ie, within 12 hours of material being placed in windrows, no stages in the fruit fly life cycle will remain viable. An additional control measure is the provision of a fully enclosed building with a concrete floor to receive incoming material.

Specific measures to be adopted if fruit flies are detected within the site include:
- Installation of additional fruit fly traps (as advised by PIRSA)
- Stop receival of all incoming material until PIRSA clearance granted
- Blending of any remaining primary processed materials into windrows with an internal temperature >60^0C to achieve an immediate kill of any fruit fly lavae present
- A review of fruit fly control measures to determine where and how the control system failed, and the measures required to avoid a recurrence of the problem.

7.8 Plant and Machinery

The continuous availability of plant and machinery is essential to ensure effective operational control of composting activities. If, for any reason, an item of plant or machinery is unavailable, the following measures will be implemented:

Stationary Shredder
- Replaced by the Van Gelder or Peterson grinding mill or by a hired grinding mill (hire grinding mills available within Adelaide). No delay in processing incoming material envisaged.

Van Gelder Grinding Mill and Peterson Grinding Mill
Both these machines will be used to size reduce mature compost. Based on the stable nature of this material, short term unavailability (up to 4 weeks) could be tolerated. If unavailability extended beyond 4 weeks, it may be necessary to hire a replacement.

Materials Handling
Front-End Loaders
- Replacement machines readily available

Excavator
- Replacement machine readily available

Dump Trucks
- Replacement vehicles readily available

Windrow Turning
Scat Windrow Turner
- Replace with front end loader and/or excavator

Screening
Incoming Materials Trommel Screen
- Replace with Finlay trommel screen or other mobile trommel screen

Finlay Trommel Screen
Turbo Chieftain Powerscreen
Both these machines will be used to screen mature compost. Based on the stable nature of this material, short term unavailability (up to 4 weeks) could be tolerated. If unavailability extended beyond 4 weeks, it may be necessary to hire replacement machinery.

7.9 Housekeeping

In order to maintain effective control over plant pests and diseases, and to maintain high operational standards, at the composting depot, the following practices will be adopted:

Receival Building
- No material to be stored in the receival building for longer than 24 hours
  - Any non compliance with this requirement will result in material being diverted to an alternative approved facility or landfill until there is compliance

- The receival building shall be free of incoming material at least once per week to allow the whole of the internal space to be cleaned down (using either wet and/or dry cleaning procedures)
- Wastewater produced during any cleaning process shall be recovered and applied to compost windrows
- Solids recovered from any cleaning processes will be recovered and blended with material that has undergone primary processing prior to windrowing.

Windrow Area
- All material in the windrow area to be stored in windrows
- Windrow shape and size to comply with the dimensions set out in Figure 6.2
- Trafficable areas between windrows to be kept free of recyclable organics
- Trafficable areas to be maintained free of corrugations and/or potholes

Final Product Area
- All final product to be stored in designated stockpiles
- Trafficable areas shall be kept free of final product
- Trafficable areas shall be maintained free of corrugations and potholes
- Trafficable areas shall be free draining, ie, there shall be no ponding of surface water.

Internal Roadways
- Internal roadways shall be kept free of recyclable organics
- Internal roadways shall be maintained free of corrugations and potholes
- Internal roadways shall be free draining
- There shall be no build up of loose material on the surface of internal roadways.

Drainage Swales
- Drainage swales shall be kept free of recyclable organics, litter or any other material
- Drainage swales shall be kept free of vegetation/weeds
- Drainage swales shall be maintained such that surface water drains freely.

7.10 Litter

The depot will be operated on the basis that no litter will leave the site. Whilst there may be some paper and plastics mixed with the material when it is initially received at the depot, material that is grossly contaminated will be rejected. In order to achieve the 'no litter leaving the site' requirement, the following measures will be implemented:

- incoming material will undergo a primary screening process to separate the coarse material from the fine material (any contaminants capable of causing a litter problem will be retained within the coarse material)
- the coarse material will then pass over a conveyor to enable manual removal of contaminants
- the above activities will be undertaken within an enclosed building
- sorted material will then be size reduced and windrowed
- any remaining paper and plastic will be removed when the mature compost is undergoing final screening.

Corrective Action
If litter is being blown from the Windrowing Area, transportable 2.4 m high, welded steel mesh litter screens will be installed to prevent litter leaving the area.

Longer term corrective action will focus on identifying the off site sources of the litter problem and putting measures in place to ensure more effective ‘at source’ quality control.

7.11 Vermin

Experience gained by Jeffries has shown that the material being composted in the Windrow Area does not attract vermin, provided that windrows are turned, on average, at least weekly.

Corrective Action
If there is evidence of vermin within the composting depot, a competent pest control person will be appointed immediately to implement an eradication program.

7.12 Flies

The windrows are a potential breeding ground for flies, however frequent turning of the windrows will ensure the breeding cycle is continuously interrupted. This action has proved to be effective at the current Jeffries composting facility at the Wingfield Waste Management Centre.

Fly numbers will be monitored by installing fly traps at specific locations and recording numbers caught.

Corrective Action
If there is evidence that fly numbers are increasing, a competent pest control person will be appointed to implement an intensive fly trapping program.

7.13 Fire

There are two potential sources of fire, ie.,
- Unprocessed material
- Windrows.

Unprocessed material will be stored within an enclosed building for a maximum period of 24 hours. The constant turnover of material means that there will be no opportunity for the material to dry out, and thus there will be minimal risk of a fire starting.

Although the risk of fire within windrows is slight due to the moist and relatively dense nature of the material within the windrows, a minimum distance of 3.0 m will be maintained between windrows to reduce the risk of fire spreading in the event that a windrow does catch fire.

Fire prevention measures to be provided include the following:

- A Fire Brigade approved fire service and hydrant will be available at all times within the receival building.
- A truck fitted with a 5 000 L water tank and water pump (with a minimum output of 200 L/minute) will be available on site at all times.
- Windrows will be placed such that forward access for fire fighting vehicles will be available at all times.

Corrective Action
If a fire occurs, the following action will be taken immediately:

- The Fire Brigade will be notified
- The water tanker will attend and commence to extinguish the fire
- Plant will be used to isolate the material that has ignited
- The EPA will be notified by telephone and facsimile

When the fire has been extinguished, an investigation will be undertaken to determine the cause of the fire. A report will be prepared and its recommendations implemented to prevent the problem recurring.

7.14 Noise

Sources and Location of Noise

- Vehicles transporting material to and from the site
    - All vehicles will be registered and must therefore be in a roadworthy condition, which means noise level less than permitted by regulation
    - These vehicles will be accessing the receival building and the final product area, refer to Figure 6.2 for location details
- Incoming materials trommel screen
    - The trommel screen is powered by an electric motor and will be located within the receival building. The barrier properties of the building will ensure there is minimal noise external to the building from this source
- Stationary shredder
    - The shredder will be located within the receival building
    - It will be electrically powered
    - The barrier properties of the building will ensure there is minimal noise external to the building from this source
- Front end loaders
    - Noise from properly maintained front end loaders can be effectively managed
    - Front end loaders will be used in all areas of the composting depot.
- Excavator
    - Noise from a properly maintained excavator can be effectively managed

  - The excavator will be located within the windrow area, refer to Figure 6.2 for location details
- Windrow turner
  - The windrow turner has noise characteristics similar to those of a front end loader
  - The windrow turner will be located within the windrow area
- Dump trucks
  - Dump trucks have noise characteristics similar to those of vehicles transporting materials to and from the site
  - Dump trucks will be used in all areas of the composting depot
- Grinding mills
  - Grinding mills have noise characteristics similar to those of an excavator
  - The grinding mills will be located within the windrow area
- Other screening plant
  - Other screening plant will be of a form currently on site at the Jeffries' Wingfield facility, ie, a mobile vibrating screen and a mobile trommel screen, both powered by internal combustion engines
  - The noise characteristics of these machines are similar to those of an excavator
  - Other screening plant will be located mainly within the windrow area, but may be required at the receival building if the trommel screen located there breaks down.

Jeffries has sufficient knowledge of the noise characteristics of all the above plant and machinery to state that there will be compliance with EPA noise requirements, ie, a maximum noise level of 47 dB(A) between the hours of 7.00 am and 10.00 pm, measured at the nearest residential premise.

The following measures will be taken to minimise noise emission from the site and to ensure noise levels lower than the EPA requirements are achieved:

- All plant and equipment operating on the site will be maintained in accordance with the manufacturers' requirements, especially exhaust mufflers fitted to internal combustion engines
- The composting area will be surrounded by a 5.0 m high mound within two years of site establishment. The mound will be densely planted with trees to intercept noise emanating from the site
- Use of excavators and dump trucks in lieu of front end loaders to load and transport material within the site (noise from these items of plant will be less than from a front end loader)
- Siting of the workshop and office between the area to be used for composting and the nearest houses to act as an additional noise barrier
- Monitoring of noise levels to establish a noise 'profile' for activities at the site.

Corrective Action
If there is non compliance with the noise requirements of the EMP, the following action will be taken immediately:

- Determine the source of the excessive noise emissions

- Determine the cause of the excessive noise emissions
- Implement changes that will result in compliance with required noise levels
- Forward a report to the EPA that provides details of the problem and the actions taken to remedy the problem

7.15 Facility Audits

Jeffries will undertake weekly inspections to assess compliance with EPA licence conditions and the depot's Composting Environment Management Plan. Refer to Appendix L for details of the inspection proforma. The inspection proforma includes a review of compliance with fruit fly control measures.

In addition to Jeffries' inspections, independent compliance audits will be undertaken monthly for the first six months of operation. If there is compliance with the environmental controls, then the audit frequency will be three monthly for the next twelve months. If there is continuing compliance, the audit frequency will thereafter be six monthly. Non compliance will result in the previous audit frequency being adopted and the process repeated.

The following items will be assessed:

Material Type and Quantity
Compliance with the requirements of Section 5.2

Depot Operations
Compliance with the requirements of Section 5.2, 5.4, 6.1, 6.2, 6.3, 6.4, 6.5, 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9, 7.10, 7.11, 7.12, 7.13, 7.14 and 7.15
Odour
Compliance with Section 7.2

Temperature
Compliance with Section 7.3

Dust
Compliance with Section 7.4

Surface Water Management
Compliance with Section 7.5

Groundwater Management
Compliance with Section 7.6

Plant Pests and Diseases
Compliance with Section 7.7

Plant and Machinery
Compliance with Section 7.8

Housekeeping
Compliance with Section 7.9

Litter
Compliance with Section 7.10

Vermin
Compliance with Section 7.11

Flies
Compliance with Section 7.12

Fire
Compliance with Section 7.13

Noise
Compliance with Section 7.14

Audit reports, including details of corrective action undertaken, will be forwarded to the EPA within four weeks of the audit date.

8. Composting Trials

There are many organic materials that are not currently being composted. From time to time, Jeffries will need to undertake composting trials to assess whether these materials are suitable for composting. Whenever a trial is required, Jeffries will seek EPA approval to undertake the trial in accordance with the following process:

- Provide the EPA with the source(s) and physical and chemical characteristics/ composition of the material(s) to be trialled
- Seek agreement on the amount of material to be included in the trial
- Seek agreement on the duration of the trial
- Provide a detailed description of the composting process/technology to be used in the trial, eg,
  - Open windrow composting
  - Open windrow, vacuum aeration composting
  - Enclosed vacuum aeration composting
- Treatment of the material(s) prior to composting
- Odour control measures
- Monitoring details
- Provide details of tests to be undertaken during the trial
- Provide details of information to be included in a report on the outcome of the trial

9. Closure and Post Closure

If the composting facility is required to close for any reason, the following closure and post closure measures will be implemented:
- an environmental audit of the site will be undertaken to identify areas requiring rehabilitation
- if rehabilitation of the site is required, an action plan detailing the extent of the work required to address any problems identified in the environmental audit will be developed and implemented
- site monitoring activities will be continued after closure of the facility is completed until the monitoring results are acceptable to the EPA.

10. Community Consultative Committee

Jeffries will establish a Community Consultative Committee to ensure effective communications with the local community is maintained. The Committee will be established in accordance with the following criteria:
- If development approval is granted, the Committee will be established within three months of the approval date
- The Committee shall consist of the following members:
  - An independent chairperson that is acceptable to Playford Council and Jeffries
  - Two residents from the McEvoy Road – Thompsons Road precinct
  - A Playford Councillor
  - A Jeffries representative
- The Committee shall meet on a quarterly basis to review depot performance and consider improvements to operating practices.
- Meetings shall be recorded and minutes circulated to all committee members.
  - Minutes shall also be available from Jeffries upon request.

11. Reporting

11.1 Routine Reporting

A written record shall be maintained for the following items/activities:

Daily
- weather conditions:
  - rainfall
  - morning and afternoon wind direction and strength
- details of organic materials received at the depot:
  - quantity received

- approximate composition of organic material
- windrow temperature details, including exception reports
- windrow turning details
- screening details
- details of any non compliance and/or complaints received

A daily report proforma is included as Appendix L

Monthly
- a summary of each of the items reported in the daily reports
- details of environmental monitoring undertaken in the previous month
- details of corrective actions undertaken during the previous month
- details of improvements investigated/developed/implemented/undertaken in the previous month

Yearly
- a summary of the items reported in the monthly reports
- details of improvements to be investigated/developed/implemented/undertaken in the proceeding 12 months.

Non Compliance

A written record shall be maintained of any non compliance with the requirements of the EMP. It shall include the following information:
- date of non compliance
- a description of the non compliance
- the cause of the non compliance
- remedial action taken
- process amendments implemented

All records will be available to the EPA for inspection.

11.2 Resolution of Complaints

To ensure all complaints received concerning activities at the site are recorded and responded to in an appropriate manner, the following complaint handling procedure has been developed:
- The person receiving the complaint shall enter the details on a "Complaints" form at the time the complaint is received, refer to Appendix M for details
- The completed form shall be sent to the EPA by facsimile to the facsimile number included on the form immediately the complaint has been received
- The person receiving the complaint shall advise the site supervisor within one hour that a complaint has been received and the supervisor shall be provided with a copy of the completed "Complaints" form

- The site supervisor shall investigate the complaint either personally or by delegation on the same day it is received, or within two hours of being notified, whichever is the sooner
- When the investigation has been completed, the site supervisor shall be responsible for developing and implementing corrective actions to remedy the complaint.
- The EPA shall be notified within seven days of any complaint being received, details of the corrective action being taken.

Appendix A

Lands Titles Information

Title Register Search

LANDS TITLES OFFICE, ADELAIDE

Issued pursuant to the Real Property Act 1886

REGISTER SEARCH OF CERTIFICATE OF TITLE * VOLUME 5148 FOLIO 136 *

COST : $13.00 (GST exempt)
REGION : FAX 83641960
AGENT : ACC4P BOX NO : 000
SEARCHED ON : 28/05/2001 AT : 10:45:06
CLIENT REF 1452 J

PARENT TITLE : CT 4051/643
AUTHORITY : CONVERTED TITLE
DATE OF ISSUE : 08/10/1993
EDITION : 3

REGISTERED PROPRIETOR IN FEE SIMPLE

SEABREEZE RESOURCES PTY. LTD. OF BROOKS ROAD VIRGINIA SA 5120

DESCRIPTION OF LAND

ALLOTMENT 22 FILED PLAN 104576
IN THE AREA NAMED BUCKLAND PARK
HUNDRED OF PORT ADELAIDE

EASEMENTS

SUBJECT TO THE EASEMENT OVER THE LAND MARKED A TO THE COUNCIL FOR THE AREA
(T 3791798)

SCHEDULE OF ENDORSEMENTS

8659697 MORTGAGE TO H.G. & R. NOMINEES PTY. LTD.

9004556 CAVEAT BY SOUTH AUSTRALIAN WATER CORPORATION

NOTATIONS

DOCUMENTS AFFECTING THIS TITLE

NIL

REGISTRAR-GENERAL'S NOTES

NIL

END OF TEXT.

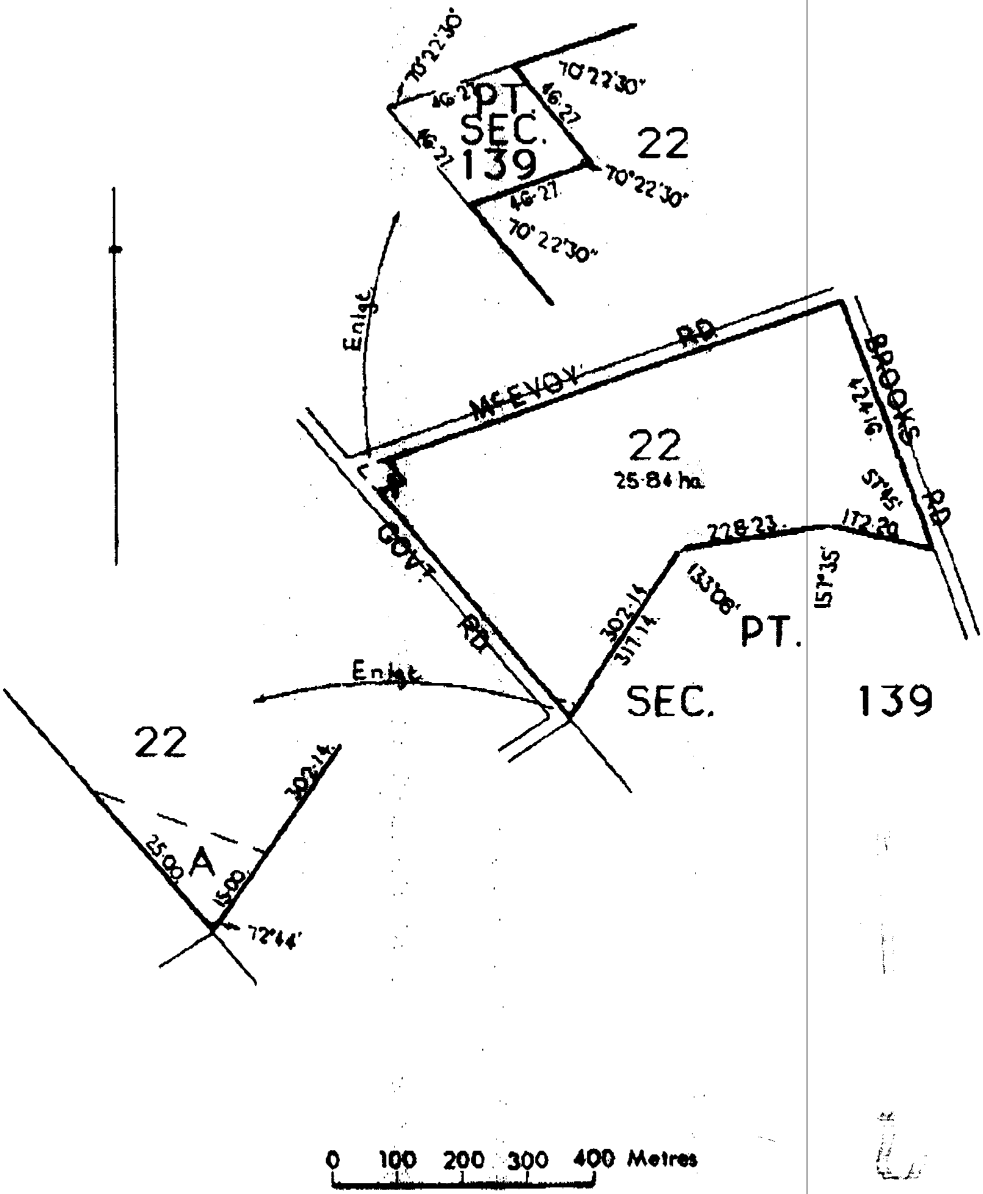
LANDS TITLES OFFICE ADELAIDE SOUTH AUSTRALIA

DIAGRAM FOR CERTIFICATE OF TITLE VOLUME 5148 FOLIO 136

SEARCH DATE : 28/05/2001 TIME: 10:45:06

This plan is scanned from Certificate of Title 4051/643

See title text for easement details.



Note: Subject to all lawfully existing plans of division

Appendix B

Plant Pests and Diseases Investigations

Assessment of Plant Disease and Pest Risks Associated with a Green Waste Composting Facility at Buckland Park, SA.

Prepared for	**:**	**Rodenburg Davey & Associates Pty Ltd**
By	**:**	**Dr Prue McMichael**
Date	**:**	**April 2002**

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Contents

BACKGROUND

Jeffries Garden Soils (Jeffries) has commissioned work to assess the potential risks associated with the movement of their composting facility to Buckland Park, SA. The new site is located on the Northern Adelaide Plains (NAP), an area of significant horticultural production.

Prue McMichael was retained by Rodenburg Davey & Associates Pty Ltd to assess the potential plant pathological and entomological risks associated with the introduction of green organics sourced from part of the Adelaide metropolitan area, to this horticultural area.

Specifically, the brief stated:

- *Identify the pest plants and plant diseases that may be associated with material being brought to, and stored, at the composting facility.*
- *Identify the nature of the risk.*
- *Liaising with local and interstate agricultural agencies familiar with the issues.*

PLANT PATHOLOGY

Plant Disease - Background

A diseased plant is any plant not growing, developing, and/or producing to its known potential. Plant diseases may be pathogenic or non-pathogenic in nature. Plant pathogens are a large and diverse group of organisms that include fungi, bacteria, viruses and viroids, phytoplasmas, parasitic higher plants, insects, nematodes, mites etc. In a broad sense they may be further categorised as those that live only on a living host (obligate) or not. Non-pathogenic causes include environmental stress (temperature, moisture, wind), chemical imbalances (nutrition, chemicals, salts, pollution) etc.

The presence of a plant pathogen in a field, greenhouse, water or soil does not, in itself, mean that it will cause disease. For disease development there must be interaction between the susceptible host plant and the pathogen. The environment within which the interaction occurs affects that interaction and therefore the potential for disease development. Disease incidence and severity of damage therefore are also limited by the host, pathogen and environment.

Pathogen/Pest Survival and Dissemination - Background

Viruses in general cannot survive outside a living host plant, but other pathogens may survive in a number of ways in dying or living hosts, in soil or in water, in the absence of a host plant.

Dissemination of plant pathogens and pests is via a number of methods. *Localised spread* is usually the result of introduced infested/infected plant/s, rain splash, surface water movement, wind, growth of the pest/pathogen. *Long-distance spread* may result from direct flights of insects or movement of them in dust or wind streams, but long-distance spread primarily results from human activity – the movement of tools and equipment from infected plants/sites, movement of infected seeds or plant parts; movement on clothing or through grafting or pruning operations. Animals and birds are also capable of dissemination of plant diseases and pests over larger areas.

Use of green ‘fresh’ organics on crop plants has the potential to spread plant pathogens, pests and weeds. This is also true, albeit to a lesser degree, for incompletely composted product. However, confidence in the complete composting process to eliminate of plant pathogens, pests and weed seeds is central to the accepted, widespread and beneficial use of composted soil amendments in landscaping and horticultural industries.

Despite many plant pathogens having various dissemination and survival mechanisms, broad experience and history has shown that plant pathogens do not survive aerobic, controlled composting, provided the process has been carried out according to ‘recognised standards’. *The Australian Standards for Soils, Conditioners and Mulches* (1) are considered as such. The lethal effect of the complete composting process on plant pathogens, weed seeds and pests is a function of temperature, aeration and time.

Jeffries Operations - Background

Prue McMichael inspected the current Jeffries composting operations and sites, at Wingfield. Notable features of the existing operation observed that day, were the lack of odour, lack of dust due to regular watering of the driveways and access routes; the arrival of covered trucks delivering domestic green material from local council areas, the lack of soil, crown, root or household waste material delivered, the variety of products in various stages of decomposition (potting mix, composts, mulches, and woodchips); the strategic placement of temperature recorders and the purpose-built machinery in operation.

Jeffries is recognised as an efficient producer of composted garden soil amendments. All Jeffries products are composted, even mulches which go through a minimum 6-week cycle.

Jeffries, as a company, is active in research both in-house and within the surrounding horticultural community. It is a sponsor and has been involved in the development of the greenhouse management project, in Virginia. Jeffries has achieved quality assurance and is operating in a manner that has allowed it to consistently meet the Australian Standards for Soils, Conditioners and Mulches.

The proposed site of the new Jeffries facilities is Buckland Park on the northern Adelaide Plains (NAP). Buckland Park is within a recognised horticultural area, namely the NAP. In this area a wide range of horticultural crops are grown year-round. These include both annuals and perennials. The annual crops are field grown or grown as protected (shadehouse or greenhouse) crops. They include: carrots, potatoes, onions, celery, lettuce, flowers, potted colour, Asian vegetables, *Brassica spp*., *Capsicum spp*, tomatoes and cucumbers. Almonds, olives and grapevines are the main perennial crops grown in the area. The NAP is significant to SA because of its productive capacity, its diversity of produce and its proximity to markets.

The Buckland Park site is clearly defined in the Environmental Management Plan prepared by Rodenburg Davey &Associates Pty Ltd. It is flat and currently abuts pasture, uncultivated land, a rural living area and the Penrice salt flats. Winds prevail from the west and the Buckland Park site is considered exposed (at present) and windy.

Risk Assessment - Background

The assessment of risk associated with the survival and dissemination of potential plant pathogens and pests is dynamic and dependent upon knowledge of specific conditions that may exist at any time. In a horticultural area, the mix of crops, the proximity of crops, their stage of development (and therefore potential susceptibility to attack), the existing disease/pest pressure and health of the crops, the stage of development of particular pests, and the local environmental conditions, are ever-changing components - each being complex individually, and in combination.

Quantification of ‘risk’ that may be attributable to the composting facility and its activities, is not possible. However, it is possible to identify potential risks associated with pests, plant pathogens and the composting process, and to determine if the intended Jeffries’ activities eliminate, exacerbate or minimize the perceived risks.

IDENTIFIED RISKS

Introduction of Plant Pathogens and Pests to the NAP

The introduction or transport of plant material, in its many forms, to – or through - the NAP is a hazard. This includes the delivery of nursery stock, seed potatoes, transplants from interstate, open trucks carrying produce to/from the markets, dumpster removals, and the removal or delivery of green organic matter to/from any site.

Horticultural personnel operating in and around the NAP are generally aware of these risks, but little is done in a formal sense to minimise them. The attention of growers, in particular, was refocused on such risks with the recent outbreak of Western Flower thrips on the NAP. This pest was reportedly introduced to SA on cut flowers and transplants.

Studies have been done on the presence of pests and pathogens in green organics and it has been shown in a Melbourne study that over 300 different plant species were delivered to green organic sites. Reportedly, plant pathogens of concern were detected in less than 5% of the loads (2).

Introduction of Plant Pathogens/Pests to Buckland Park.

The potential biological risks associated with the establishment of a composting site at Buckland Park may be categorised as risks associated with '*introduction*' and '*distribution/dissemination'* of plant pathogens, weeds and pests.

Raw Material

The green material intended for delivery to the new site will have the same origins as that being introduced currently at the Wingfield site. The green material is collected from curbside domestic green bins by metropolitan councils. The organic waste is comprised primarily of above ground plant parts, leaf matter, woody plant tissue and lawn clippings. There is little, or no, perennial tree crown and root material delivered to this site. No garden soil is delivered to the site.

Since collections are made fortnightly, the introduced green material is in various stages of decomposition at the time of delivery to the site. Some woody material is hard and dry while the majority is either dried leaves, or depending on the time of year, moist green matter. The composition of the green material changes slightly during the year, with lawn clippings being more prevalent in summer than winter.

It is expected that some plant pathogens will be present on the delivered green material. Given a general knowledge of the domestic plant life and local climate in and around Adelaide, and specific knowledge of plant pathogens in Adelaide and on the NAP, it is possible to predict the pathogens that are likely to be present in some green material, at some stage of each year (Table 1). Given that root and soil matter is limited, soilborne organisms are likely to be less prevalent. Studies have shown that very few serious pathogens are delivered in green garden waste. In these studies, the pathogens that produce airborne spores were considered low risk.

Some insect pests, including aphids and whiteflies, and other pests including mites and nematodes may also be present in the delivered green material. It is unlikely that nematodes and other soilborne pests, in the absence of soil deliveries, would be introduced. Some insects, although not directly damaging, are capable of vectoring plant pathogens.

The insect pests that may be delivered in domestically-sourced green material include: whiteflies (including ash white fly), mites, aphids, thrips (including WFT), earwigs, snails, slugs, moth larvae (caterpillars), mealybugs, beetles, citrus leaf miner, scale insects, flies and their larvae.

The Mediterranean fruit fly has not been detected on the NAP, although a number of outbreaks have been managed in the metropolitan areas during the last five years. Since these flies require such small pieces of fruit on which to lay their eggs, and outbreaks have occurred recently, it is considered that the introduction of this pest could inadvertently occur if household refuse from a quarantined zone were delivered to the site. Although the eggs would not survive the composting process and larvae would not complete their life cycle in the refuse pile, the risk should be managed through the refusal to accept incoming material from quarantined areas.

Table 1 : Some pest and disease organisms likely to be present in Garden Waste and their Methods of Dispersal

Disease/Pest Types	Potential Pathogenic/Pest Organisms	Methods of Dispersal
Root rots	*Pythium spp.* *Phytophthora spp.* *Rhizoctonia sp.* *Chalara sp.* *Fusarium spp.*	Soil and infected roots, plant material Soil and infected roots, water Soil and infected plant material Soil and infected plant material Soil and infected plant material
Wilts, blights	*Verticillium sp.* *Fusarium spp.* Bacteria	Soil and infected roots Soil and infected roots Soil, splash, infected plant material, equipment
Stem rots, crown, bulb rots; fruit rots	*Botrytis spp.* *Sclerotinia sp.* *Sclerotium spp*. *Rhizopus, Mucor spp*.	Air borne spores, infected plant material Air borne spores, soil Soil Airborne spores
Stem cankers	*Eutypa sp*. Elsinoe	Air borne spores, equipment Air borne spores, equipment
Wood rots	*Armillaria sp.* *Chondrostereum sp.* *Phellinus sp.*	Soil and infected roots Air borne spores Air borne spores
Mildews[*χ]	Powdery, downy	Air borne spores, water splash
Rusts[*χ]	Several	Airborne spores
Fruit rots	*Botrytis spp.* *Monilinia sp.* *Rhizopus sp.* *Colletotrichum spp*.	Air borne spores Air borne spores Air borne spores Water splash
Root knot / nematodes	*Meloidogyne sp*.	Soil and infected roots, equipment
Crown gall	*Agrobacterium sp.*	Equipment
Viruses *	TMV, CMV TSVVV Rose mosaic	Infected sap and insects, infected plant material, equipment
Leaf spots and blights; leaf curl	*Colletotrichum spp.* *Alternaria spp.* *Diplocarpon sp.* *Septoria sp.* Rusts[*ψ] Bacteria Viruses	Air- or splash dispersed spores Splash, equipment Equipment, insects, planting material
Mistletoe, dodder	Parasitic plants	Man, birds (as seeds)
Pests	Thrips Scale Mites Caterpillars Whiteflies Leaf miner Aphids Lawn pests, Bugs; Mealybugs	Man, animals, movement of planting material; active flight; Wind currents

* need a living plant reservoir
χ host specific (generally)

Contaminants in Raw Material

The level of contamination within each delivery is variable. Contamination is monitored and there is a feedback system in place capable of providing specific feedback to problem source areas (accurate to the street) via the Councils. The major contaminant is household waste - decomposing food scraps and plastic bags. Contaminants may also harbour some pests, human and plant pathogens.

For the purpose of this assessment, it is assumed that all material will be sourced from the general metropolitan area. Experience has shown that material collected by Councils who apply an additional fee (eg. member Councils of the Northern Adelaide Waste Management Authority) contains significantly less contamination.

Other information on the green waste source areas may be available from the Councils themselves. Councils do not direct industrial or household waste to Jeffries.

In their new facility Jeffries will remove all plastic prior to any size reduction of their incoming material. This will reduce the risk associated with wind-blown plastic pieces, leaving the site. Incoming materials will be stored for a maximum of two weeks before processing commences.

Of the potential pest/disease organisms noted, all are likely to be present, or have caused some crop losses in the NAP. Of the current crops grown, most are susceptible to at least three of these organisms. The most damaging and widespread of recent losses, have been those due to WFT and the tomato spotted wilt virus it vectors. Every season however losses attributable to *Botrytis sp*, anthracnose (*Colletotrichum spp*.), *Pythium spp.*, *Rhizoctonia sp.* and *Phytophthora spp*., viruses, bacterial rots etc, are reported.

The threat of introducing new diseases or pests to the area arises primarily from the regular deliveries of planting material, from other states. There are several organisms established in other horticultural districts in Australia that must be kept out of the NAP. They include: phylloxera, potato cyst nematode, Mediterranean (and other) fruit fly, silverleaf whitefly and bacterial wilt of potatoes. The opportunities for their introduction through any activities associated with the proposed Jeffries site, are considered negligible.

Delivery Vehicles

Covered compactor trucks will be used to collect and deliver green material to the Buckland Park site. Since these trucks collect routinely from domestic bins in the metropolitan area, it is unlikely they will introduce plant pathogens/pests in mud or dust adhered to tyres or undercarriage. Fully-enclosed semi-trailers will also be used to deliver material to the site.

A small percentage of green material, larger woody material, and other non-plant material (wooden pallets) will be delivered in other ways – gardening contractors, waste collection contractors etc. Some of these may be delivered in open trucks or trailers, but it is expected the Wingfield site will still receive the majority of private, irregular deliveries. All deliveries are monitored. Any green material transported to the area in open vehicles is considered a greater risk, than that delivered by enclosed transport.

The clean up of plant debris and weeds on the NAP remains a cornerstone in the WFT management plan and integrated pest management, especially for the protected horticulture sector. It has been recognised that a central NAP facility suitable for accepting crop debris and cull piles, originating in the area, is needed. Industry–wide consultation regarding the Jeffries facility should also recognise and consider this need.

Summary : Introduction of Pests/Diseases

Many pests and disease are routinely encountered by horticultural crop producers on the NAP. Although there is a risk associated with the introduction of any plant material to the district, the risks associated with the entry of partially decomposed and fresh green waste from metropolitan Adelaide, are considered negligible if covered trucks are used and processing of the material is managed according to the accepted Australian standards.

DISTRIBUTION OF PLANT PESTS/PATHOGENS

Implicit in the discussion of distribution or dispersal risks, is ‘survival’ of the organisms at various stages within the composting process from raw material to the fully composted, stable product. Dispersal processes have significant effects on the spatial and temporal components of disease development and/or epidemic development, provided a susceptible host is present.

Delivery Activities

The delivery process involves the opening of the compactor truck and release of the material to a stockpile of green waste. At the time of delivery, green material is at ambient temperature or above, depending on the stage of decomposition at the time of collection. The average time between collection and delivery to the Buckland Park site will vary depending on the mode of transport. Material delivered by collection vehicles will arrive at the facility within two hours of the last collection. Up to 48 hours may elapse before material that has initially been delivered to a transfer facility is received at Buckland Park. Raw material deliveries to the Buckland Park site are expected to occur continuously throughout the week.

The material at this time is loosely packed and it is possible that both plant pathogens/pests on the green material could be moved short distances from the delivery area, by wind.

If flying pests have survived the closed bin and delivery periods, it remains possible they could actively fly from the stockpiles. There is no practical method of controlling the flights of whiteflies, aphids, flies, thrips etc that may be present. However, it is unlikely that these insects will breed within the hot windrows, and that pest numbers in and around the Jeffries’ material would have any impact on the existing populations of these pests in the district.

Processes and Handling

At the new facility plastic bags will be removed from incoming material before any processing commences. Green material will be mechanically screened and the oversize material will be ground within 14 days of delivery. During this process there is opportunity for some pathogens/pests and loose contaminants to be dispersed locally, or further, if strong winds prevail. The temperature of the surface material at this stage remains close to ambient and it is possible some pests could lay eggs or advance their life cycle stage over this short period. Most of the organisms that could survive the pre-composting period are fungal or bacterial, or the more sedentary and resistant stages within insect life cycles.

Within 2-3 days however in the watered windrow, temperatures rise to a point that these activities would cease. Throughout the windrow period, contact with soil is negligible. Windrows are placed on a base of compacted coarse mulch, 500 mm thick. The opportunity for pest or disease organisms to infest soil through contact in the windrow, or leachate from the windrow, is negligible.

Vehicle movement within and around the windrows is limited. Specialised equipment is used to invert windrows and move mounds. These activities are reportedly not carried out in windy conditions and the potential for distribution of pathogens, by this means, is also considered negligible.

Composting Process

The composting process relies on microorganism presence and activity at every stage. Temperature monitoring is an indirect measure of microorganism activity. A range of microorganisms breakdown organic matter and in doing so produce CO_2 and heat. Water and aeration assist in managing the heat in each phase. As temperatures and the degree of decomposition change, so too does the composition of the microorganism populations.

There are three phases that green organic material passes through to reach a stable, fully composted product. The rapid temperature rise to 40°-60° C may occur within 2-3 days. This is the moderate temperature phase and some plant pathogens and pests are killed during this phase. The composting product however then advances to the high temperature phase that ensures pathogen and pest death. Temperatures in this phase are maintained at 60°-70° C for a minimum of 8 weeks. During the cooling or stabilising phase temperatures are lowered to below 40° C and recolonisation by many beneficial organisms occurs. At this same time it is possible for recontamination of the stable product, at its surface by organisms ubiquitous in dust. These may include some fungal spores.

Some studies have ‘planted’ pathogens at various positions within compost piles and assessed their survival over short periods of time. Numerous laboratory potting mix trials have determined lethal temperatures in dry and moist conditions. The lethal temperatures are lowered in moist conditions and it has been shown in many studies that pathogens do not survive the temperatures achieved in controlled, aerobic composting.

The methods of dissemination for the organisms of concern are noted in Table 1. Most fungi reproduce and are dispersed as spores – either in water splash, in surface water, and/or in air. The fungi may also actively grow to new substrates. Soilborne organisms that might be present in very low numbers in the material delivered to Jeffries include *Sclerotium spp.*, *Sclerotinia sp*, *Armillaria sp.*, *Rhizoctonia sp*, and nematodes. It is not expected that any of these would establish either within windrows or as new infections beyond. W*ater splash* dispersal may occur during rain events or windrow watering on a very localised scale (within the windrow), but the likelihood of a resultant new infection (ie from *Septoria sp*. *Phytophthora spp.* and *Colletotrichum spp)* developing on a commercial crop at a distance, is considered negligible. The potential for *aerial dispersal* of viable spores from stockpiles and new windrows, exists. This is relevant to organisms including the rust fungi, some *Phytophthora spp*, *Botrytis sp*. The relative risk is considered negligible however. It has not been shown that organisms ubiquitous in air – like some *Botrytis spp.* routinely cause disease outbreaks. Specific host and environmental conditions are needed, as for other diseases. The rust fungi, mildews, and many *Phytophthora spp.* and viruses have a limited and specific range of hosts on which their various spore types can establish. *Rhizopus* and *Mucor spp*. are generally post-harvest and storage problems.

Aerial spore dispersal from the stockpiles or windrows is a low risk for commercial, susceptible crops. From unmanaged cull piles and debris piles, on the edge of new crops however the threat of airborne disease spread is far greater. It is estimated that the regular inversion process and the proposed windbreak around the site will lessen the potential disease gradient for airborne spores from the Jeffries site to less than a hundred metres.

It is considered unlikely that any fungal, viral or bacterial organism present in refuse delivered to the new Jeffries site would contribute to a disease outbreak in the neighbouring horticultural district, on any crop. In considering risk district-wide, the isolated, windrow point source for any of the listed organisms, is a negligible relative risk.

Plant insect (and other) pests are generally spread through active flight, in wind currents, or by human activities. Most of the pests of concern have the ability to fly. Pests like WFT have been spread on imported planting material or products, and by people moving between infested and clean areas. Aphid and mite populations in the area are variable and seasonal. Ash whitefly, although troublesome in some metropolitan Council areas is unlikely to establish on hosts other than ash trees. Whiteflies, especially the greenhouse whitefly, are commonly encountered in NAP crops. The Silverleaf whitefly has been found in SA on two occasions, in nurseries, but has been eradicated. It is unlikely that this pest would be encountered during any Jeffries' activity.

Growers are fully aware of the impact of weeds, overlapping susceptible crops and transport of pests on their person and in planting material. Although they may be present in delivered materials, it is highly unlikely that the impact of any of these pests on the NAP, will be altered by the presence of the Jeffries composting facility. Control of roadside verge vegetation and weed growth in and around the proposed Jeffries site, may in fact benefit neighbouring growers, by reducing sites in which insect pests are harboured.

Summary – Dissemination of Plant Pathogens and Pests

There is some risk of pest dispersal, associated with the delivery and pre-composting periods, at the proposed site. The risk associated with the dispersal of plant pathogens from the site is considered lower than that for flying pests. It is considered however that the relative risk is negligible.

It is recognised that any increase in current pest populations or point sources may impact on the control methods and timing employed by growers, but it is clear that point sources closer to existing horticultural crops and the continual introduction of new planting material to the area, pose a significantly greater risk.

The intended management of vehicle movement, the outlined handling of raw materials and contaminants, and the proven commitment to meeting Australian standards for composting, give us confidence that any plant pathogen and pest risk created at the site, will be manageable and will not threaten the continued viability of any intensive horticulture in the area.

ASSESSMENT OF JEFFRIES' ACTIVITIES RELEVANT TO IDENTIFIED RISKS

Activities Minimizing Risks (At Proposed Site)

- Adherence to, and meeting of, the relevant Australian Standards;
- Complete and regular inversion of windrows,
- Consistent (place and time) temperature and moisture monitoring.
- Delivery of green material in covered trucks.
- Rapid start to composting process – no longer than 14 days (and usually within 7 days).
- Area to be kept weed-free.
- Establishment of windbreak and solid structure positioned on eastern side.
- Distance to nearest cultivated crop not less than 300 m.
- Plastic and contaminant removal from incoming material before shredding.
- Watering of tracks, stockpiles and windrows, to reduce dust.

Activities Contributing to, or Creating Risk

- Delivery of green material of unknown weed, pathogen/pest status.
- Site - exposed with strong westerly prevailing winds.
- Dust creation and movement from site.
- Acceptance of some plant material in open trucks.

Recommendations to Further Minimise Risk

- **Access Routes**
    - ī Pave all access routes.
    - ī Manage incoming and exiting traffic.
    - ī Consider installing a tyre dip for incoming and outgoing trucks.
    - ī Enforce low speed limit on access roads.
    - ī Install cleaning area for specialised equipment.
    - ī Ensure delivery trucks used for delivery of green matter are not also used to deliver final product.
    - ī Ensure floodwater, water runoff (resulting from normal composting, road grading and paving), or leachate from compost piles, is not diverted away from the property.

- **Vegetation**
    - ī Encourage Council to assist with roadside verge management.
    - ī Discourage use of fresh, chopped organic material on roadside verge landscaping, in the neighbouring area.
    - ī Plant windbreak as planned.
    - ī Ensure area is maintained weed-free, but not vegetation –free, especially in that area east of the windbreak.

- **Raw Materials**
  - Mandate delivery by covered trucks.
  - Mandate deliveries from quarantined fruit fly areas cannot be accepted.
  - Monitor water quality (presence of pathogens) used for windrow watering, if sourced as surface water from the site.
  - Investigate options for protected holding area/s for delivered and uncomposted material – surrounding or on eastern side of stockpiles, moveable fence or screen?
  - Position delivery areas to the far west of the proposed site.

- **Composting Process**
  - Minimise time between delivery and initial moderate temperature range.
  - Maintain high temperature composting phase (over 60°) for minimum of 3 days, before turning, for all material within the windrow. This will necessitate a minimum of 3 inversions of each windrow once the high temperature phase has been reached.
  - Continue to monitor, with consistency (position and time), temperature and moisture of decomposing matter.
  - Monitor insect populations (with sticky cards) at windrow surface (30-70 cm above) and beyond windbreak. Consider weekly monitoring from stockpiles and new windrows; others, monthly.
  - Minimise dust by ensuring no movement of piles in conditions exceeding a nominated wind strength, and through strategic watering of stockpiles and windrows.

RELEVANT REFERENCES

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10th April, 2002

Davidson
Viticultural
Consulting

ECONOMIC RISK ASSESSMENT

JEFFRIES GARDEN SOILS

ORGANICS WASTE TREATMENT & RECYCLING RESEARCH FACILITY

AT

BUCKLAND PARK

March 2003

Prepared by Davidson Viticultural Consulting Services

A division of Kirklinton Pty Ltd as trustee for Davidson Viticultural Consulting Trust

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

This report presents an Economic Risk Assessment relating to the possible establishment of an Organics and Waste Treatment Recycling and Research Facility at Buckland Park on the Northern Adelaide Plains (NAP).

The report reviews the current NAP Horticultural Industry in both physical and economic terms, and discusses the infesting pests and diseases known to be present in the NAP horticultural region. The major pests and diseases currently of concern to producers are Western Flower Thrip, Mediterranean Fruit Fly and Queensland Fruit Fly; the report details the management practices and quarantine protocols which are required for the management of these existing pests.

The report further addresses other pests and diseases which are considered to be a risk by some producers on the NAP, as detailed in the Submissions to the Public Environmental Report released by Jeffries Soils in January 2003. These additional pests and diseases are Phylloxera, Pierces Disease (vector, Glassy Winged Sharp Shooter) and Potato Cyst Nematode. The report details the protocols for control of these diseases – in the case of Phylloxera and Potato Cyst Nematode, the Australian protocols and management plans are discussed. Pierces Disease is currently not present in Australia and Australian Quarantine Information Service guidelines relating to importation of Californian tablegrapes are the relevant regulations.

The economic risk assessment estimates that the cost of a worst case scenario of the simultaneous development of Phylloxera, Fruit Fly, Glassy Winged Sharp Shooter/Pierces Disease and Potato Cyst Nematode, is **currently** $106.03m.

The report concludes that the introduction of a waste treatment facility such as that proposed by Jeffries Soils is unlikely to increase the risk of a pest or disease outbreak on the NAP. Further it concludes that should an Organic Waste Treatment and Recycling Research Facility be established on the NAP, the level of economic risk to the horticultural industry would be unchanged from the present situation.

2.0 INTRODUCTION AND TERMS OF REFERENCE

This report has been prepared by Davidson Viticultural Consulting Services (DVCS) for Jeffries Soils as part of their research into the feasibility of establishing an Organics Waste Treatment and Recycling Research Facility at Buckland Park on the Northern Adelaide Plains. In January 2003 Jeffries Soils released a Public Environmental Report (PER) which has undergone public discussion; Jeffries have subsequently received several submissions. Many of these submissions dealt with the increased risk of introduction and outbreak of disease; in order to address these submissions Jeffries carried out an Economic Risk Assessment.

This report has been prepared by Mr Michael Lowe and Ms Sarah Dalkin of DVCS who researched all of the diseases of concern, and consulted with a wide range of regulatory bodies as well as members of the Virginia Horticulture Centre.

The terms of reference for the report as provided by Jeffries Soils follow:

Terms of Reference

1. Identify the types of pest and disease risks which could have an economic impact on the Northern Adelaide Plains (NAP).

2. Quantify the economic risk of a pest or disease outbreak in the Northern Adelaide Plains (NAP).

3.0 DESCRIPTION OF NAP HORTICULTURAL REGION

3.1 Crops currently grown in the Northern Adelaide Plains (NAP)

The NAP currently has a population of 87,300[1] residents. Information from the Virginia Horticulture Centre[2] indicates that horticultural activities cover almost 7,000ha within NAP, as show in Figure 1. We have been advised by the Virginia Horticulture Centre that there is potential for the area of land utilised for horticulture to increase by a further approximately 30% or approximately 2000ha[3].

Horticultural products are the major contributors to the agri-food produced in the NAP making up 85% of the region's output. The balance comes from field crops, dairy and livestock.

Figure 1: Areas of crops grown in the NAP region
(Source Virginia Horticulture Centre website 2003)

Crop Type	Produce	Area (Ha)
Broadacre	Potato, onions, carrots, Brassica	4388
Greenhouse	Tomatoes, capsicums, cucumber	597
Tree Crops	Almonds, olives	857
Vineyards	Wine grapes	528 *

* Note: The Phylloxera and Grape Industry Board (SA) Annual 2002 Wine Grape Survey shows 427ha.

3.2 Value of horticultural production in the NAP region

The NAP Regional Scorecard shows the NAP Gross Food Value (GFV); excluding the contribution of wine, to be valued at $265m, or 17.5% of South Australia's total GFV of $1.508 Billion. The inclusion of the wine industry increases the GFV to $295m or 6.9% of the State's $4.309 Billion. The Gross Farm Gate value of horticulture and winegrapes in the NAP for the 2001/2002 financial year was $79.9m.

In addition to the local horticultural produce grown on-farm, $59.3m worth of vegetables are imported to the region; these products are primarily potatoes ($38.1m), mushrooms ($7.5m), and carrots/onions ($7.6m).

The processing of this additional produce enables the associated pack houses in the region to obtain economies of scale by using their facilities and workforce on a year round basis. Stable employment conditions and skilled long-term employees are essential for the long-term viability of rural businesses and, by extension, the local community. It also provides the opportunity for the packhouse/processor to improve its return on capital and provide opportunity for further growth.

The scope of this investigation did not allow full evaluation of all economic benefits to the community; however, the impact of these major pack houses on the local economy should not be underestimated.

Examples of the economic benefit of imported horticultural produce of some selected crops to the NAP is shown in Figure 2.

Figure 2: Examples of Benefits of Some Horticultural Imports to Processing Activities in the NAP
(Source: Virginia Horticulture Centre website March 2003[2])

Major Crop	NAP Production (t)	Farm Gate Value	Processed in NAP (t)	Gross Value FOB
Potato	9,900t	$2.94m	136,944t	$59.9m
Onion	4,200t	$1.89m	25,800t	$14.2m
Capsicum	3,892t	$6.23m	6,650t	$18.6m
Mushroom	816t	$3.18m	2,704t	$12.2m

Other produce which is processed in the region includes winegrapes, carrots and olives, but there are many other farm based small value adding enterprises. Overall, 95% of the $139m of horticultural produce and wine grapes either grown or imported into the region, is sold after processing (grading, packaging) is undertaken. Only $4.1m of other horticultural produce ($4.0m unshelled almonds) is sold on a non-processed commodity basis. The Wholesale, or Free on Board (FOB), value of horticultural production, including processing is $233m, which in turn translates to a Gross Revenue of $280.0m to South Australia.

The breakdown of the markets for the horticultural output from the NAP[2] is:

- 75% South Australian consumption,
- 20% Interstate, and,
- 5% overseas to countries such as Hong Kong, Malaysia, Korea, Taiwan and the United States.

The value of horticultural production in the NAP is depicted in Figure 3. The value of processed horticultural product in the NAP is show in Figure 4.

Figure 3: Horticulture (including wine grapes) Farm Gate Values, Northern Adelaide Plains 2001-2002.
Total Farm Gate Value = $79.9m[4]

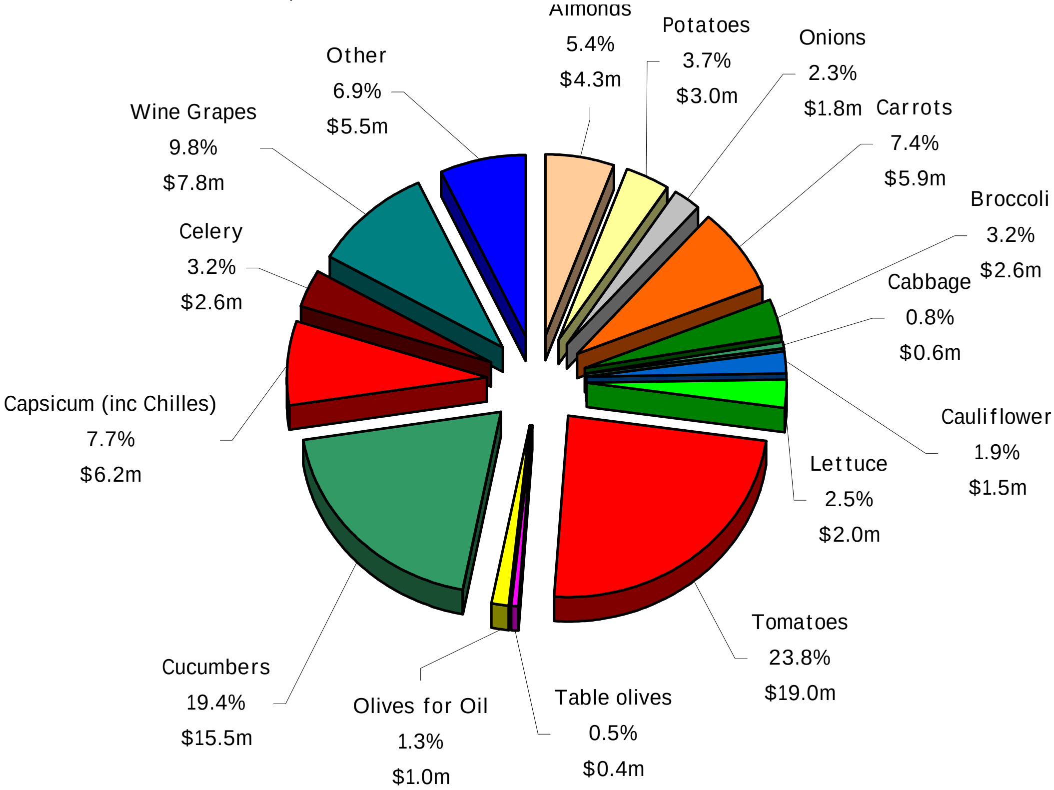
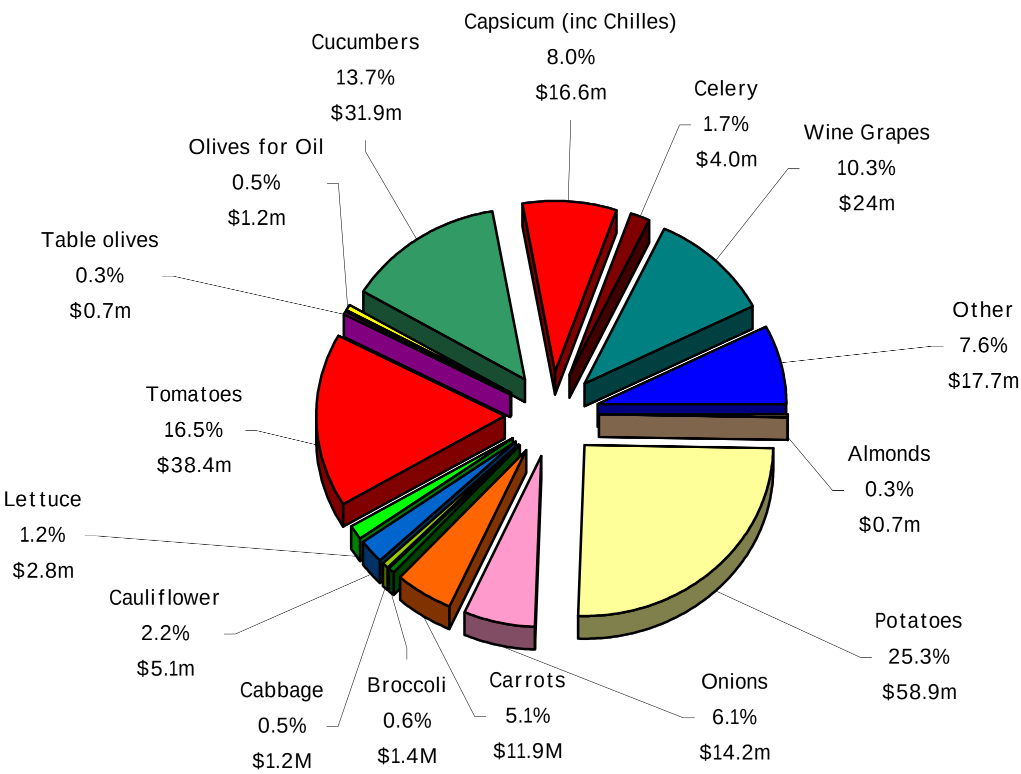


Figure 4: Horticulture (Including wine grapes) Processed Values Northern Adelaide Plains 2001-2002 = $233m[4]



3.3 Pests/Diseases known to occur in the NAP, and their control measures

The NAP is similar to intensive agricultural regions throughout Australia because it has, over the years, been subjected to many introductions of pest and disease. Many of these have been suppressed by improved management techniques aided by improved knowledge and better understanding of the mechanism and ecology of the pest, as well as by the availability of better tools, such as modern chemicals. Other pests such as Western Flower Thrip, have made their mark and many growers have had to alter their growing practices and crop type in order to continue viable businesses.

3.3.1 Western Flower Thrip (WFT)

WFT *(Frankiniella occidentalis)* is a current threat to tomato and cucumber crops and to ornamental cut flowers in the NAP region, but is controlled by grower's current management practices.

It can be a major pest to horticultural crops grown in glasshouses but can also cause significant damage to field crops. The thrips not only affect the plant, but are also vectors for several viral diseases of plants including Tomato Spotted Wilt Virus.

WFT affects many crops and causes discoloration of foliage, surface scarring, stunting, and plant deformity.[5] WFT can be blown long distances by wind and can be transported on clothing, plant material and machinery.

Control measures:
Chemical control of WFT is difficult due to the onset of resistance to many insecticides. A series of three strategically spaced sprays of an appropriate chemical should be effective in killing most WFT.[6] Once WFT enters a crop it is very difficult to eradicate, therefore, an integrated disease management strategy should be used in order to prevent WFT from entering crops, as well as to eliminate any WFT already in crops.[7]

Growers are advised to avoid bringing plant material and produce from unknown sources onto their property. Growers should ensure that seedlings are only bought from a reliable supplier and that cuttings are taken from healthy plants.[8] Yellow sticky traps[8] can be used to monitor crops on a regular basis.

3.3.2 Fruit Fly

The Queensland fruit fly- QFly (*Bactrocera tryoni*) and Mediterranean fruit fly – MedFly (*Ceratitis capitata*) pose constant threats to the NAP although commercial infestations have not been recorded, despite home garden outbreaks. The fruit fly has various hosts including citrus, pome, stone fruit, and fruiting vegetables such as capsicum, eggplant and tomatoes.[9] The preferred hosts of stone fruit, especially apricots, citrus and pome fruit, are not grown commercially in the NAP but are seen in home gardens.

The female fruit fly lays her eggs in fruit; these develop into maggots making the fruit unpalatable as it rots.[10] The life cycle can only be complete if the maggots or larvae make contact with the ground in order to pupate.

Control measures:
The management of prevention and eradication of fruit fly is controlled by legislation[11] although cooperation from the local community is essential in order to prevent further outbreaks. Fruit fly trapping stations are located at 3,800 sites around South Australia. Early detection of flies will minimise the risk of commercial crops becoming infected.

If an outbreak is detected rigorous procedures are put in place by Primary Industry and Resources South Australia (PIRSA) to ensure that spread of fruit fly is minimised. The Fruit Fly Detection and Eradication Manual[12] outlines the procedures which are put in place if outbreaks are declared in residential or commercial fruit growing situations.

An outbreak in a residential area will have a quarantine area of 1.5 kilometres from the original outbreak zone imposed. Although the current protocol [12] states that an outbreak of MedFly and/or QFly in a **commercial fruit growing area** will have a 15km suspension area, we have been advised that this is being amended to 6 km for QFly and 3 km for MedFly [14].

Provided that host produce is given the appropriate post harvest chemical treatment,[12] it can be issued with certification by the Senior Plant Health Inspector allowing it to leave the property.

3.4 Pests/Diseases not found in the NAP which are of Current Concern

There are several pests and diseases which commercial growers consider to threaten their livelihood seriously should an outbreak occur. These have been identified in the Submissions to the PER and we have addressed them below.

3.4.1 Phylloxera

Phylloxera (*Daktulosphaira vitifolii*) is a pest which has the potential to cause considerable loss to the Wine Industry in Australia. Currently the occurrence of Phylloxera is limited to a few wine grape-growing regions within Australia – parts of Victoria and an area south west of Sydney. All other grape growing regions in Australia, including NAP, are free of Phylloxera.

Phylloxera is an aphid which lives on the roots of grapevines. It feeds by sucking fluids from the grapevine and causes vine decline, yield loss, and ultimately vine death.[13]

The dispersive stage of Phylloxera is the winged aphids and crawlers which can be spread by wind.[13] Phylloxera is more often spread by the movement of grapevine rootlings and equipment which has been used in an infested vineyard, especially if it carries soil.

Control measures:

Adherence to the guidelines set out in the National Phylloxera Management Protocol[31] will significantly minimise the risk of Phylloxera entering the NAP region. These protocols have been developed by the entire Australian Wine Industry over a period of many years, after consultation with all peak bodies. The Industry self regulates and is confident that grape growers and wine companies are complying with the protocols. These protocols prevent movement of winegrapes and tablegrapes, must, propagation material and equipment from Phylloxera Infected Zones (PIZ) to Phylloxera Exclusion Zones (PEZ) such as the NAP.

3.4.2 Glassy Winged Sharp Shooter - Pierces disease

The Glassy Winged Sharp Shooter insect[15 16 17 18] is the main vector for the spread of Pierces Disease (*Xylella fastidiosa*), a bacterial disease that has caused severe devastation to vineyards in California. Pierces Disease (PD) does not occur in Australia, but is a recognised threat to the Australian Wine Industry and to other horticultural industries including citrus and stone fruits, especially as tablegrapes are now a permitted import from California to Australia. The Australian Quarantine Inspection Service (AQIS) has not reported presence of the GWSS or PD in Australia.

Importation of Californian table grapes, potentially harbouring the GWSS, into Australia has raised concerns of Australian wine grape growers. AQIS confirms that there is no longer a quarantine concern with imports of Californian table grapes to Australia. Australian market access and bio-security import guidelines state that quarantine import permits must be obtained for all products derived from plants and micro organisms.[19] Australia is a signatory to the World Trade Organization Sanitary and Phytosanitary agreement and is therefore obliged to adhere to these quarantine guidelines.

PD blocks water movement within the xylem of the plant causing infected plants to become non-productive and die within one to two years. There is currently no known cure for PD. The vector, the GWSS, is a strong flier and can breed in citrus and avocado crops while also feeding on dormant grapevines throughout winter. Vine to vine spread of PD is currently increasing dramatically in Californian vineyards.

Control measures:

At present, management of the spread of the GWSS in the United States of America is through biological control, vine removal, weed management and use of insecticides. Together with quarantine measures, these management practices should minimise the likelihood that PD will enter Australia.

3.4.3 Potato Cyst Nematode

Potato Cyst Nematode (*Globodera rostochiensis*) is regarded as the most serious exotic pest threatening the Australian Potato Industry [20]. It is distributed widely throughout the world, and recognised as one of the most difficult of all crop pests to control. Potato Cyst Nematode (PCN) is not currently present in South Australia, but has been found in parts of Western Australia and Victoria. PCN affects potato crops but can also infect eggplant and tomato crops and other root vegetables, fruit crops, and ornamental nursery stock. Hosts of PCN include blackberry nightshade and Solanaceous weed species.

PCN causes cysts on potato roots at flowering time, leading to nutrient deficiencies and poor plant growth and wilting. The nematode attacks the roots of the potato plant and feeds on the root juices. Yields are seriously affected, and may fall by 70 per cent within five years of an infestation.[21] Plants affected by PCN are also more susceptible to other fungal pathogens. The cyst of this nematode is very persistent in soil and may survive for as long as 30 years, even in the absence of potato crops.

An outbreak of PCN in a horticultural region such as the NAP would result in crop losses and losses associated with produce quarantines. While there have been no reported outbreaks of PCN in South Australia, recent outbreaks in Western Australia and Victoria led to significant economic and social implications arising from quarantine restrictions and reduced profitability of potato production.[22]

Control measures:

The Australian PCN Management Plan[22] was developed to establish a nationally agreed plan for the management of PCN. It highlights protocol which must be followed. These protocols are relevant to all of the potatoes which are currently imported to the NAP.

At present there are strict guidelines in place to prevent PCN from entering potato crops in South Australia. Imports of potatoes from within 20km of a known infestation are prohibited and ongoing soil tests are required in order to declare areas free of PCN.

4.0 ASSESSMENT OF RISK

4.1 Existing situation

Pests and diseases exist in the NAP horticultural region, and there is a risk of an outbreak of other diseases. However, it is our view that this risk is minimal if growers continue to comply with existing protocols.

Sources of current risk:

- Home gardens containing various fruit and vegetable crops that may not be appropriately managed.
- Ongoing movement of fruit and vegetable produce by careless individuals; especially between the metropolitan areas and rural areas.
- Produce sold at markets and supermarkets in the NAP region and within metropolitan Adelaide poses a real threat as the source and supply of this produce is often unknown, and possibly unpoliced.
- Management practices: Property protection and crop hygiene varies from grower to grower. For example, glasshouses and shadehouses within the region have varying levels of enclosure and quarantine. This is especially relevant to the control of WFT as it can be easily spread to adjoining crops.
- The production of crops within glasshouses/shadehouses vs. field production of these crops, influences the level of control which growers have over various pests and diseases.

4.2 Introduction of the proposed Jeffries Organics Waste Treatment and Recycling Research Facility, Buckland Park

4.2.1 Existing Pest/Diseases

An assessment of plant disease and pest risks associated with the proposed Jeffries facility carried out by Dr Prue McMichael of Scholefield Robinson [23] [24] concludes that there will be negligible threat to the current viability of the NAP region if the proposed Jeffries Facility was to be developed based on knowledge of current pest and disease risks and their management.

WFT

WFT is a pest known to the growers on the NAP. Many growers are actively managing their risk of introduction and spread of the pest on the their farms through integrated pest management practices. In our professional opinion, the proposed Jeffries facility will have no impact on the current status of this pest within the region.

Fruit Fly

There have been several documented outbreaks of Fruit Fly in the NAP region.[25] Of most significance is the outbreak documented on July 7, 2000. A 15 km suspension zone was put in place by PIRSA which resulted in the quarantine of a large majority of the NAP region as shown on the map.[26]

4.2.2 Other Potential Pest/Diseases

Submissions have drawn attention to concerns that the proposed Jeffries composting facility would provide an avenue for the introduction of some pests and diseases currently not in the NAP, such as Phylloxera, Glassy Winged Sharp Shooter (Pierces Disease) and Potato Cyst Nematode.

Phylloxera

With Phylloxera, the careless movement of potentially infested vine material, machinery or equipment into the region could cause an outbreak regardless of whether the proposed Jeffries facility is located within the NAP region. The protocols described in 3.4.1 minimise the risk of such movement.

In our opinion, the increased movement of vehicles carrying green waste to the proposed Jeffries site should not increase the risk of Phylloxera to the NAP region because similar risks currently exist with increased visitation to the growing wine region and expansion of the immediate urban areas.

Studies have shown that temperatures lethal to Phylloxera are achieved in composting windrows.[27] Assuming that the management practices of Jeffries comply with the Australian Standards for Compost, Mulches, and Soils Conditioners (AS 4454), there should be no added risk of the spread of Phylloxera once material has entered the proposed Jeffries facility.

Glassy Winged Sharp Shooter/Pierces Disease

Assuming that the relevant AQIS quarantine protocols are followed, there will be no change to the current risk of the introduction of the GWSS or PD into the NAP region following the development of the proposed Jeffries facility. The risk of the GWSS and PD entering Australia is a current threat to the entire Australian Wine Industry.

Potato Cyst Nematode

Guidelines regarding the importation of potatoes into South Australia prohibit any potatoes entering South Australia from properties within 20 km from a known infestation of PCN [28] [22]. Adherence to these guidelines and observance of the Australian PCN Management Plan will help to minimise the risk of PCN entering the NAP region. These guidelines are already relied upon by potato growers in the NAP.

4.3 Quantification of the Economic Risk of a Pest or Disease Outbreak

The issue of economic impact caused by an infestation or outbreak of a one of the major pests or diseases which have been identified is not simply one of total crop wipe-out for the farmers. Quarantine has potential for far greater impact on the region as a whole.

All producers and processors growing or packing host produce within a quarantine area, will be subject to the same protocols and restrictions.

All of these affected growers/processors incur additional costs associated with meeting the quarantine requirements. These costs may include chemical treatment, destruction of produce, restrictions on movement of product outside the quarantine area and additional staff and equipment to carry out required work.

There is also the issue of the cost to the State of administering the quarantine. Under South Australia's Fruit and Plant Protection Act 1992 Government agencies have the power to recover costs incurred in controlling a pest/disease outbreak; we have not factored such costs into our calculations as we were unable to determine whether such costs have ever been recovered.

Quarantine protocols vary for the different pests but the imposition of quarantine conditions may also have longer-term impacts well after quarantine conditions have been lifted. Some concerns which have been expressed include:

- Market perception of the region as a source of "safe" food, even after quarantine is lifted
- Access to overseas markets denied because of the perceived risk and resultant trade barriers.
- Loss of bargaining power with the supermarket chains.
- NAP Processors/Packhouses lose source of product to competitors located outside the region.

All of these issues raised represent potential real economic impacts which could be caused by a quarantine condition being imposed. The quantum of the impact will of course vary with the pest/disease. **However the NAP is similar to all other horticultural regions across Australia in that there is always the potential for serious economic impact, both at the farm gate and on a regional level, should an infestation by specific pests or diseases result in a quarantine situation.**

4.3.1 Current Economic Risk

The Gross Farm Gate value of Horticulture and Wine Grapes in the Northern Adelaide Plains for the 2001/2002 financial year was $79.9m.

An outbreak of a specific pest or disease may or may not directly affect all crops in the region

Figure 5 outlines the current economic risk for the pest/diseases under discussion.

Figure 5: Economic Impact

Disease/Pest	Hosts	Economic Value $	Current Status	Detected in NAP	Quarantine Issues
MedFly/QFly	Tomato Cucumber Capsicums Eggplant Olives Grapes	Farm gate $50.7m Processed $116.6m	Clean	Yes	State protocols are in place For commercial growers Quarantine area is officially 15km from outbreak area. We have been advised that it is proposed the area be reduced to 6km for QFly and 3km for MedFly 15km quarantine area would cover nearly all the NAP Sales of Host produce can be made after treatment. Fruit fly pest free status is suspended for 1 generation and 12 weeks or 12 weeks after the last fly capture in traps or last larvae is found, which ever is the longer.
Phylloxera	Grapes	Farm gate $7.9m Processed $24.0m	Clean	No	State and Australia protocols in place. Currently isolated to parts of Victoria and NSW, which are quarantined.
Pierces Disease	Grapes	Farm gate $7.9m Processed $24.0m	Clean	No	Currently not in Australia, but major pest of vineyards in California. Subject to intensive studies by AQIS with significant input from wine industry, table grape and dried fruit industry prior to allowing importation of table grapes from California
Potato Cyst Nematode	Potatoes	Farm gate $2.97m Processed $58.9m	Clean	No	State and Australian Protocols in place

4.3.1.1 Western Flower Thrip

The WFT is already entrenched in the NAP region and being managed by a range of practices. There is no basis, within the scope of this report, to further analyse the economic risk for the pest as the impact is already being felt at the farm gate.

4.3.1.2 Fruit Fly

The crops commercially grown in the NAP region which could be affected directly by a MedFly/QFly outbreak, tomato, cucumber, grapes and olives have a farm gate value of $50.7m.

We have not, however, been able to find any record for South Australia of Fruit Fly infestation in commercially grown crops of tomato, cucumber, grapes nor olives, nor city backyard vegetable gardens for the 10 year period from 1991.[25] Indeed, all infestations recorded during that period were in fruit trees, none of which appear to be grown commercially in the NAP area but all of which may be present in household backyards. Nevertheless, discovery of Fruit Fly in the region would result in a quarantine of all potential host crops, regardless of whether the infestation was in a commercial or domestic situation.

Under the current quarantine protocol the suspension area covers a radius of 15km from the outbreak. Depending on the actual site of the infestation, this would effectively enclose the entire NAP region, therefore would affect all the growers of host plants. We note that the protocol does not seem to differentiate between growers. A grower with well managed, fully isolated glasshouse facility is deemed to be at the same level of risk as one who is growing susceptible crops in a field situation.

Length of quarantine is dependent on outcomes of the monitoring. A minimum period would be of the order of 12 weeks, although continued detection of infestation through either reintroduction or failure of the control measures could, in theory, extend this several times over. For our purposes we have assumed the unlikely scenario of quarantine lasting one full year.

Therefore in terms of potential current economic loss it could be argued that the entire host plant farm gate value of $50.7m (see Fig. 5) is at risk. However, produce in quarantine can be sold after treatment and certification and there has been no evidence presented that chemical treatment of host produce will reduce its market value. **Therefore, it appears that the only direct impost of an outbreak of Fruit Fly on a grower or growers in the region would be the cost of chemical treatment, and possibly, a charge to recover quarantine expenses by the government agencies.**

The cost to the South Australian government to control and eradicate an outbreak of Fruit Fly in a residential area has been estimated at $500,000 per 1.5 outbreaks.[29] It has not been possible within the limitations of this report to source or quantify the costs associated with controlling an outbreak in a commercial crop located in a rural setting.

Assuming a farm gate treatment cost of, say $0.05 per kg of produce, the cost to the growers would be about $2.35m, or 4% of the Gross Farm Gate Value. This treatment cost would be very similar for the processed product and would represent about 1.8% of the $116.6m.

An additional concern could be the impact on the expanding export market. We are advised that South Australia's and the NAP region's "Fruit Fly Free Status" has enabled producers to gain access to markets in Asia and America. The value of these exports currently makes up less that 5% of production but there is the potential for this to increase. An outbreak of Fruit Fly and loss of the NAP's "Fruit Fly Free Status" may jeopardise exports currently worth $1.93m at farm gate or $5.83m in processed value.

Based on the information available our assessment of the current economic risk to the NAP region as a result of an outbreak of Fruit Fly in the region is:

• **Cost of increased operational expenditure**	**$2.35 m**
• **Loss of ongoing export revenue (processed value)**	**$5.83 m**
	$8.18 m

4.3.1.3 Phylloxera

Phylloxera would impact on the wine grape industry which had a farm gate value of $7.9m in 2001-2002, and a processed value of $24.0m. The area of wine grapes in the NAP is 427ha producing 6757 tonnes in the 2002 vintage,[30] which was 20% more than required by the wineries. Wineries produced only 8% of the total crush from their own vineyards indicating a major reliance on contracted growers.

Going forward both wineries and growers forecast a balanced production/intake position of about 4000 tonnes by 2007.

In terms of economic risk the introduction of Phylloxera is unlikely to result in the total wipe-out of the industry – Phylloxera does not “kill” immediately. Some vineyards may also be planted using resistant rootstock and while restrictions would be made on the movement of produce and equipment out of the region, vineyards and wineries could continue to operate, albeit under strict adherence to the quarantine protocol.

Failure to contain any outbreak would of course result in ongoing production losses and the replanting of affected vineyards with resistant planting material.

While whole grapes, pre-fermentation marc and planting material can not be moved from an infested region, (Phylloxera Infested Zone or PIZ) finished wine has no restriction. Similarly there is no restriction on equipment, whole grapes, pre-fermentation marc or planting material moving into the area from non-affected regions (Phylloxera Exclusion Zone or PEZ).

It could be assumed that wine grape supplies to wineries are not at risk as fruit could be sourced from other regions should production levels drop below required intake levels. Issues for the winery in this case would be the additional cost of transporting fruit and implication on wine label as a result of purchasing fruit from outside the Geographical Indication (GI).

The impact would be more serious at the vineyard level. At the first level an outbreak could result in loss of income due to reduced production. Over the longer term it may be necessary to replant the entire vineyard on resistant rootstock. In our experience, we allow $8 to remove, replant and retrain a vine to maturity. This equates to $14,400/ha for 1,800 vines/ha. This assumes that existing infrastructure such as trellis and irrigations system can be re-used.

Based on the information available our assessment of the current economic risk to the NAP region as a result of an outbreak of Phylloxera in the region is:

• **Additional transport costs for winery (over 4 year period)**	**$0.60 m**
• **Loss of industry income over 4 years due to replanting – allowing for vines to reach mature bearing, and deducting growing costs**	**$8.20 m**
• **Cost of replanting with resistant rootstock (current area recorded 427ha)[31]**	**$6.15 m**
	$14.95 m

4.3.1.4 Glassy Winged Sharp Shooter (Pierces Disease)

Should the GWSS/PD enter Australia and the NAP region, wine and table grapes will be the crops most at risk.

Based on the information available our assessment of the current economic risk to the NAP region as a result of an outbreak of GWSS/PD is:

• **Processed value winegrapes (see Fig. 5)**	**$24.0 m**
	$24.0 m

4.3.1.5 Potato Cyst Nematode

In 2001-2002 9.9m tonnes of potatoes were grown in the NAP region with a farm gate value of $2.97m, however 136.9 million tonnes were processed (graded and packed) to generate a processed value of $58.9m. Further analysis reveals that these potatoes generated $75.4m in food value to the South Australian economy comprising $57.7m in inter-regional sales (at wholesale value), $13.5m in retail sales and $4.2m being consumed in the hospitality industry.

Clearly an outbreak of PCN in the NAP would have a serious economic impact both on the local and state economy. We were unable to determine whether any product was exported internationally although the inter-regional sales may result in some repacking from NSW going to overseas markets. Although the quarantine restrictions vary slightly between states the seriousness of the disease is such that an outbreak could potentially isolate the NAP from all markets other than those open to it within South Australia

Industry is in the process of developing a uniform national plan to tackle an outbreak of PCN. Our comments are based on the protocols outlined in the September 2002 draft of the Australian Potato Cyst Nematode Management Plan [22].

At the farm gate once an infestation is detected there is a series of management practices which are required to be put in place. The use of "PCN infested paddocks" for the growth of potato or other Solanaceous crops is prohibited and no potato, or other host crop, can be grown within 25m of the site. Potato production on all other paddocks is only permitted with the approval of state regulatory authorities and is restricted to resistant cultivars. We have not been able to determine whether the use of these resistant cultivars will result in additional costs or reduced margins for the producer. The resistant cultivars are not infallible and they may not be resistant to all species of PCN. Chemical control is possible but is both expensive (it is reported that UK growers use about $775/ha per annum of nematicides)[22] and not environmentally sustainable because of the type of pesticide currently being used.

It takes approximately 6-7 years from its introduction into a potato paddock before numbers of the potato cyst nematode reach a detectable level.[22] Locally, PCN is usually dispersed by farming activities such as sharing farm equipment contaminated with infested soil.

Given the variation in possible impact on individual farms depending on proximity to a PCN infestation, it is not possible to quantify absolutely the possible economic impact on the NAP region.

The proposed protocols for pack houses and processor are less well defined than for growers. It would appear that these would not be shut down per se but would need to operate under "stricter" hygiene and compliance measures. Trade outside the region would also be subject to tighter controls.

There are also costs associated with keeping PCN populations absent, or low, through stringent quarantine and other controls. In Australia, there have been significant costs to both Government and Industry associated with PCN sampling for seed certification schemes, as well as costs associated with controls and monitoring in areas where PCN was detected in the 1990's.[22]

Based on the information available our assessment of the current economic risk to the NAP region as a result of an outbreak of PCN is not able to be quantified accurately but we consider the processing value of $58.9m as a reasonable figure given the level of processing and compliance costs.

- **Farm gate and processing risk (see Fig. 5)** **$58.9m**

$58.9m

In summary, the worst case scenario of the simultaneous development of Phylloxera, Fruit Fly, Glassy Winged Sharp Shooter/Pierces Disease and Potato Cyst Nematode, is currently approximately $105.63m.

• **Fruit Fly**	**$8.18**	**m**
• **Phylloxera**	**$14.95**	**m**
• **Glassy Winged Sharp Shooter/Pierces Disease**	**$24.0**	**m**
• **Potato Cyst Nematode**	**$58.90**	**m**
	$106.03	**m**

4.3.2 Potential Increase in Economic Risk to the NAP Region Due to Organics Waste Treatment Facility

The potential sources of pest and diseases which pose risks to producers and their crops have been discussed earlier in this report. Economic values have been applied to **the current risk profile** for each pest and disease under discussion.

We conclude that the introduction of a waste treatment facility such as that proposed by Jeffries is unlikely to increase the risk of disease outbreak.

It is our professional opinion that should a recycling facility such as described in the Jeffries proposal be constructed and operated at Buckland Park, the level of economic risk as a result of the introduction of any of the pests and diseases discussed in this report would be unchanged from the current status within the NAP region, provided that all growers and producers continue to comply with industry protocols.

APPENDIX A

REFERENCES

REFERENCES.

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5. WA Agriculture (February 2001), Factsheet – *Western Flower Thrips*

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25. PIRSA (March 26, 2003) Fruit fly larvae infestations detected, as supplied by David Heaven, Plant Health Operations.

26. PIRSA (March 27, 2003) Map- 15km Suspension Zone from fruit fly outbreak in Virginia, 7/1/2000, as supplied by Bruce Baker, State Quarantine Inspection Services.

27. Keen et al (2002) Phylloxera mortality and temperature profiles in compost. Aust. J. Grape & Wine Research: 8, 56-61.

28. (June 1998) Plant Quarantine Standards- South Australia- Condition 18: Potatoes.

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31. National Vine Health Steering Committee (2000) National Phylloxera Management Protocol.

Appendix C

Public Health Issues Associated With Composting

THE FLINDERS UNIVERSITY OF SOUTH AUSTRALIA

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Dr Richard Bentham
Department of Environmental Health
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Rob Rodenberg
Rodenberg Davey and Associates Pty Ltd
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Unley
SA 5061

Dear Rob,

RE: Human Health Impact Assessment Jeffries Buckland Park

In producing this report and conducting my health impact assessment I have used the current risk assessment model used by the US EPA. This framework involves hazard identification, review of known dose response data, exposure assessment and risk assessment and management.

In making the assessment it is necessary to identify the exposed populations, these can be divided into 2 categories 1) Jeffries employees, and 2) Residents. Health risk assessments to each of these populations and risk management recommendations have been prepared separately for each of the exposure scenarios listed above. Should you wish I would be happy to discuss the contents of this report, or matters pertaining to it, at your convenience.

Yours sincerely,

Richard Bentham

1. Exposed Populations.

There are two distinct populations at Buckland Park that can be considered separately according to their potential for exposure to airborne microbial contaminants.

1) Jeffries Employees. These individuals are the highest risk group as they work in close proximity to the woodchips and are therefore most likely to be exposed. Employees should follow appropriate Occupational Health and Safety guidelines with regard to airborne emissions. Their exposure is an Occupational Health and Safety rather than a Public Health issue.

2) Residents. This is the low risk population. The likelihood of viable micro-organisms being transmitted in sufficient quantities to impact health to residential areas greater than 1000m away is very low.

2. Climatic Considerations.

The transfer of viable (live) micro-organisms over significant distances in the air is highly dependent upon ambient conditions. Water droplets containing bacteria and of the size necessary to be inhaled into the lungs will not travel significant distances in dry conditions. In dry conditions with high incident UV light (sunshine) bacteria held in droplets will be rapidly killed by combined effects of desiccation (drying out) and irradiation. Available information relating to *Legionella longbeachae* infection has shown the disease to be associated with direct exposure of gardeners handling and using potting mixtures. Fungal spores are likely to travel further then bacteria held in aerosol but their survival will still be affected by relative humidity and incident UV light.

The environmental conditions most suitable for transfer of micro-organisms are cool, humid, and cloudy (low sunlight) days. Published reports of outbreaks of airborne disease have demonstrated these three conditions to be important factors in the spread of the disease. The environmental conditions associated with the generation and dispersal of dust and debris are likely to be detrimental to the spread of micro organisms and vice versa.

3. Dose Response.

The principle health risks that could be considered to be associated with feedstock, composting material and final composted products would be the transmission of opportunistic pathogenic organisms such as *Legionella* and *Mycobacterium spp.* and some Fungi and Actinomycetes (filamentous bacteria). *Legionella* bacteria may cause a form of pneumonia, known as Legionnaires' disease.

Mycobacterium species occasionally cause pneumonic infection; those that might be associated with composted materials (non-tuberculous or atypical Mycobacteria) are generally restricted to persons with compromised immune systems. Fungal and Actinomycete infections may also result in pneumonic disease similar to tuberculosis, or in hypersensitive immune responses. The route of transmission for all of these infections is most likely to be the inhalation of bacteria suspended in fine water particles (aerosol) or inhalation of fungal or Actinomycete spores. There is no available information regarding this route for disease transmission from composted materials, and there is insufficient information to form a strong opinion as to whether this route is probable or possible. There is little evidence for the person to person (transmission) as a route of infection for any of these diseases. Infected individuals are not considered to be a health risk to other healthy people. Little is known of the doses of bacteria or fungi required to cause infection but general opinion is that significant numbers of the organisms must be delivered to the lung of a susceptible individual for disease to result. The ability of these organisms to cause disease is more probably dependent upon the health status of the exposed population.

Previous studies have shown that the generation of fine particulates (PM10) from composting facilities is low. The potential for these fine particles to be released in the quantity and size range associated with triggering of asthmatic symptoms is minimal. Such particle sizes are more usually associated with combustion of wood products and fossil fuels.

4 .Risk Assessment.

Microbial health risks associated with the composted materials are most probably confined to employees or contractors working on the site who have immediate contact. The available evidence suggests that there is a small risk of contraction of disease by inhalation of airborne fungal spores. This risk is more properly described as an occupational health risk rather than a public health risk. Using AS4360:1999 Appendix 3 this risk could be classified as L2, a low risk that could be managed by routine procedures.

Human health risks to the resident population are minimal though uncontained dust and odour emissions may present a nuisance. These are best controlled by good management practices. The large buffer zone around the facility will prevent or greatly reduce concentrations of micro-organisms released from the facility.

5. Risk Management.

Employees or contractors involved in or exposed to the stockpiling process should wear appropriate protective respiratory equipment. This should include as a minimum half piece Class P1 or Class P2 particulate filter, and work clothing. Preferably low loader operators moving feedstock or composted material should have a fully enclosed and air-conditioned cab. Workers should be aware of wind direction during loading and delivery and, where possible, keep up-wind of any dust or vapour emissions. Turning and screening of compost chips should be avoided when wind force and directions are likely to carry dust off the premises towards residential areas. Workers should also avoid hand to mouth contact whilst working with or using the material, wear gloves when using or handling material, and wash hands immediately after using or handling wood chips.

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11th July, 2000

TO WHOM IT MAY CONCERN

FARMER'S LUNG AND THE COMPOSTING OF GREEN ORGANICS

I have been asked by Rodenburg, Davey and Associates to provide information on the disease Farmer's Lung and on the level of hazard of contracting this disease from a green organics composting facility.

Farmer's Lung

The term Farmer's Lung arose a long ago as a means of referring to allergic attacks experienced by farmers after they had handled mouldy hay in their barns. The allergic reaction is caused by inhalation of spores and other parts of various fungi and actinomycetes that grow on damp hay during storage. It has been found that if the moisture content of the hay is less than about 15% at the start of storage, there is little or no mould growth. A moisture content of around 25% allows various low-temperature fungi of the *Aspergillus glaucus* group to grow in the hay. Moisture contents above 35% allow more vigorous fungal growth, to the extent that the hay heats up, so allowing heat-loving fungi and actinomycetes to dominate. These organisms have names such as *Aspergillus fumigatus*, *Micropolyspora faeni* and *Thermopolyspora vulgaris*. It would be expected that a farmer who worked every day in an enclosed barn in which mouldy hay was being handled would inhale huge doses of these organisms.

Farmer's Lung is characterised by difficulty in breathing, fever, a general unwell feeling and spasms of the bronchial system. Repeated exposure results in progressive worsening of attacks in susceptible people and lung damage. As with all allergic reactions, individuals differ greatly in their response to a particular exposure or to continued exposure, with response ranging from nil to acute. Thus, individuals whose immune systems are damaged through the taking of immuno-suppressive drugs, antibiotics or steroids, or because of other diseases such as diabetes are much more likely to be affected by the organisms associated with Farmer's Lung than are healthy individuals.

In more recent times it has been recognised that many other agents can produce similar symptoms. One list I have seen gives bird droppings, mushroom dust, grain dust, malt dust, sugar cane dust, paprika dust and cheese dust as being allergens for some people.

Composting facilities

In recent years, concerns have been expressed that respiratory diseases of the Farmer's Lung type might be produced in persons living near composting facilities. These concerns led to the formation of a scientific review workshop by the United States Department of Agriculture (USDA), the USEPA and The (US) Composting Council. Their report was published in 1994 (Compost Science and Utilization Vol. 2, No. 4, pp. 6-57 (1994). This report summarises information about the types of allergens that might be present in the dust (bioaerosols) generated by composting facilities, the types of diseases that could be produced by them and presents and comments on the results of all studies of composting facilities known to them at that time.

It was considered that three types of bioaerosols could be of concern. One was the fungus *Aspergillus fumigatus*, another the cell walls of various bacteria and fungi, some of which are known to contain toxins, and various other toxins from fungi.

All of these biological materials are found in aerosols generated from a wide variety of organic wastes, including lawn clippings, wood chips, mulches produced from tree trimmings, rotting food and household organic wastes, agricultural materials and sewage sludge. These bioaerosol materials are therefore universal in the air. They are a natural component of all air in both urban and rural areas.

Measurements made within composting facilities and outside them led the workshop to conclude that "**the expert participants did not find epidemiological evidence to support the suggestions of allergic, asthmatic, or acute or chronic respiratory diseases in the general public at or around the several open air and one enclosed composting sites evaluated**."

Put more briefly, their answer to the question "Do bioaerosols associated with the operation of biosolids or solid waste composting facilities endanger the health and welfare of the general public and the environment?" **was: "Composting facilities do not pose any unique endangerment to the health and welfare of the general public."** In this statement, "general public" included workers at the composting facilities.

They further concluded that the airborne concentrations of bioaerosols were not significantly different from background in residential zones around composting facilities. The workshop failed to find any report of disease that could be attributed to bioaerosols emanating from composting facilities.

Despite the lack of evidence for any diseases associated with composting facilities, the workshop report suggested that various actions should be taken by compost facility managers.

- Monitor the health of their workers
- Screen potential workers to ensure that those on immuno-suppressive medication or who are insulin-dependent diabetics or who had a history of severe allergic reactions on exposure to dusts and aerosols should not be employed.
- Dust generation should be minimised through water spraying.
- Have a buffer zone around the facility that was at least 200 metre wide.

The size of the buffer zones required around composting facilities in Australia should ensure that the concentration of bioaerosols outside the facility are not raised above normal background levels.

Kevin Handreck, BSc, MAgSc, FAIH

Appendix D

Climate Data
and
Weather Station Details

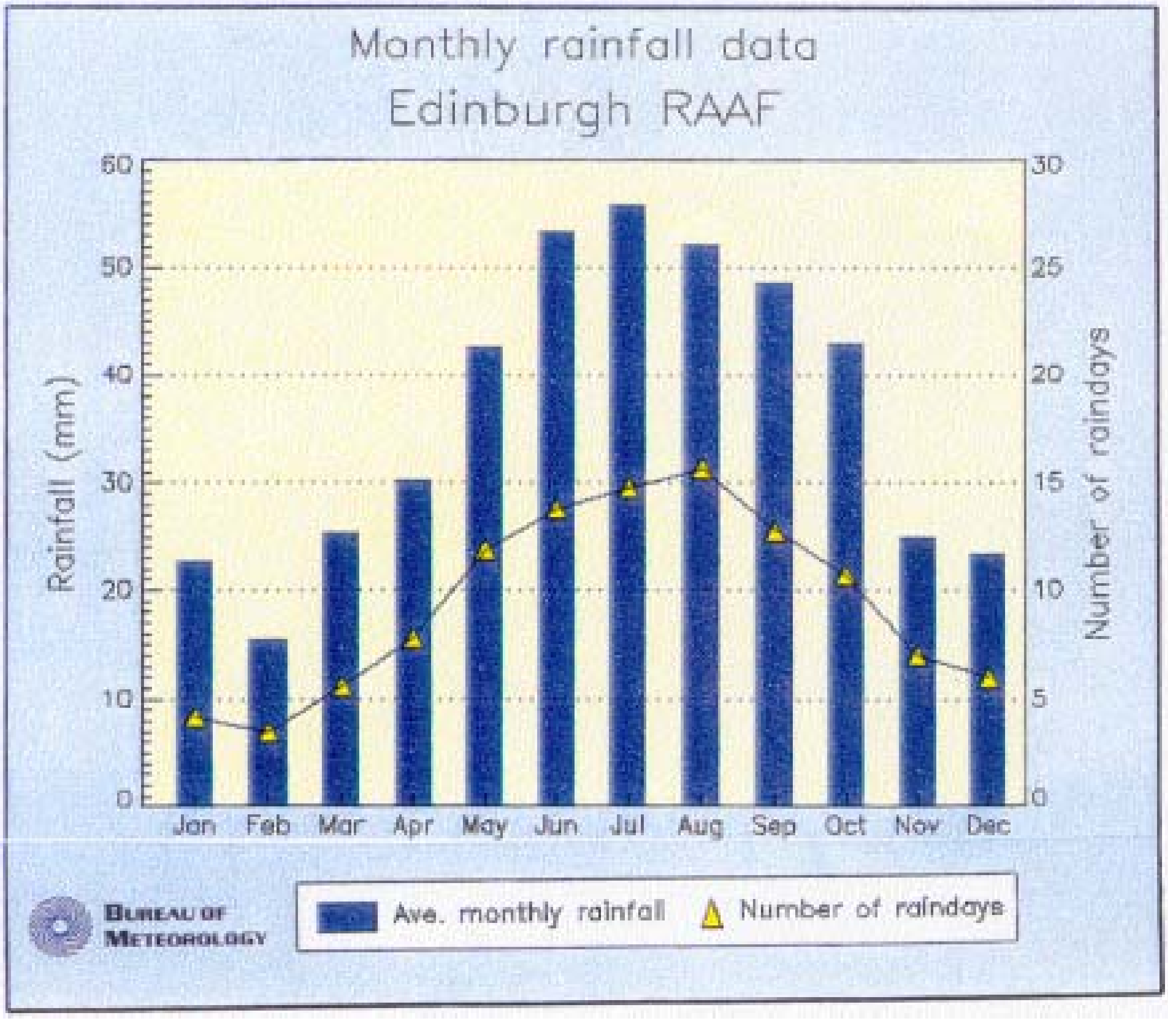
Station name : Edinburgh RAAF (23083)

Elevation : 18 metres

Latitude : 34.70 South

Longitude : 138.62 East

Monthly Rainfall and Raindays



Wind Frequency Analyses and Wind Roses

The included set of wind frequency analysis tables or wind roses show the frequency with which winds of various strengths have been observed coming from various directions. These notes should help you to use the information.

Data

Wind speed and direction are measured by a number of means. In some cases, they are only estimated. To find out exactly which method has been used, a search of the appropriate station history file would be required.

Wind measurement is particularly sensitive to changes in site, exposure and instrumentation. Observations from a site may differ significantly from the conditions in the surrounding area, and past records are not always directly comparable with current measurements.

The data are collected by the National Climate Centre in the Bureau of Meteorology's Melbourne head office. They are stored in ADAM (the Australian Data Archive for Meteorology), an extensive computer database of meteorological observations. As the observations are stored, basic checks are performed. Any observations that fail these tests (specifically, any whose quality flag is poorer than "4 - estimated, medium certainty") are excluded from the frequency analyses that follow.

Analysis

The data are collated in a number of ways, depending on the nature of your request.

To group by hour, the observations are assigned to the closest standard three-hour reporting time. For example, all observations between 7:30 am and 10:30 am local standard time are labeled "9 am". If a seasonal grouping has been requested, then "autumn" is March, April and May, "winter" is June, July and August, "spring" is September, October and November, and "summer" is December, January and February.

The observations are then grouped by speed. The exact number of speed ranges and their size depends on your request. When the speed ranges are labelled, "1 - 10" is used for all speeds greater than 0 but less than or equal to 10. "11 - 20" means greater than 10 but less than or equal to 20.

The data are then grouped by direction; into 8 or 16 bins as requested. When doing this, observations that fall on bin boundaries are split equally between the two bins. For example, when grouping into 8 bins, a direction of "NE" covers all observations with directions strictly between NNE and ENE; "E" covers from ENE to ESE. If the direction is exactly ENE (67.5°), then it will be placed half in the "NE" bin and half in the "E" one.

Tables

If you have requested wind frequency tables, you will get a separate table for each time group. Each table shows the time to which it applies, and the total number of observations used at that time. The percentage frequency with which calm conditions (that is, no wind) are observed are displayed at the top left of the table.

The rest of the table is laid out with directions across and speeds down. To find the frequency with which winds of a given speed and direction occur, follow down the appropriate direction column and across the speed row until they intersect. The value printed there is the frequency you require. For example, a value of "14" indicates that this speed/direction group occur about 14% of the time. "*" indicates the range has occurred but less than 0.5% of the time.

The last column, labeled "All", gives the frequency of each speed range regardless of direction. Similarly, the last row gives the frequency of each direction, regardless of speed.

Roses

Wind Roses seek to make the data in a wind frequency table easier to digest. Although not ideal for quantitative work, they are good for providing a quick visual impression of the wind regime.

Like the tables, there is one wind rose for each time group that you requested. Each rose consist of a central circle, surrounded by branches, each made up of a number of petals.

The circle represents the frequency of calm conditions. The size of the circle is proportional to the number of calms; a scale is given in the legend at the top of the page.

Each branch represents the wind coming from that direction. North is to the top, and the other directions are shown in the legend. In each case, the wind is blowing from that direction toward the calms circle. Each petal corresponds to a speed range from that direction. The length of the petal is proportional to the frequency of that wind; the scale is shown in the legend. The thickness of the petal is used to indicate which speed range it represents.

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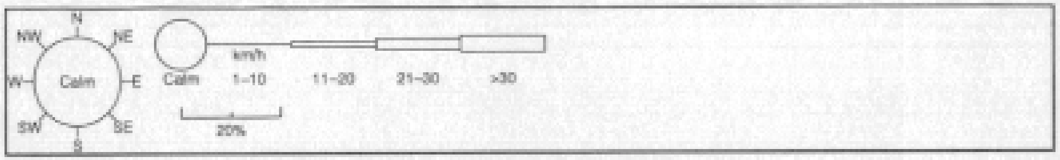
More Information

Prepared by Climate and Consultancy Section in the South Australian Office of the Bureau of Meteorology
Contact us by phone on (08) 8366 2600, by fax on (08) 8366 2693, or by email on climate.sa@bom.gov.au

Wind Roses using available data between 1955 and 2002 for

Adelaide Airport

Site Number 023034 • Locality: Adelaide • Opened Jan 1955 • Still Open
Latitude 34°57'29"S • Longitude 138°32'03"E • Elevation 6m



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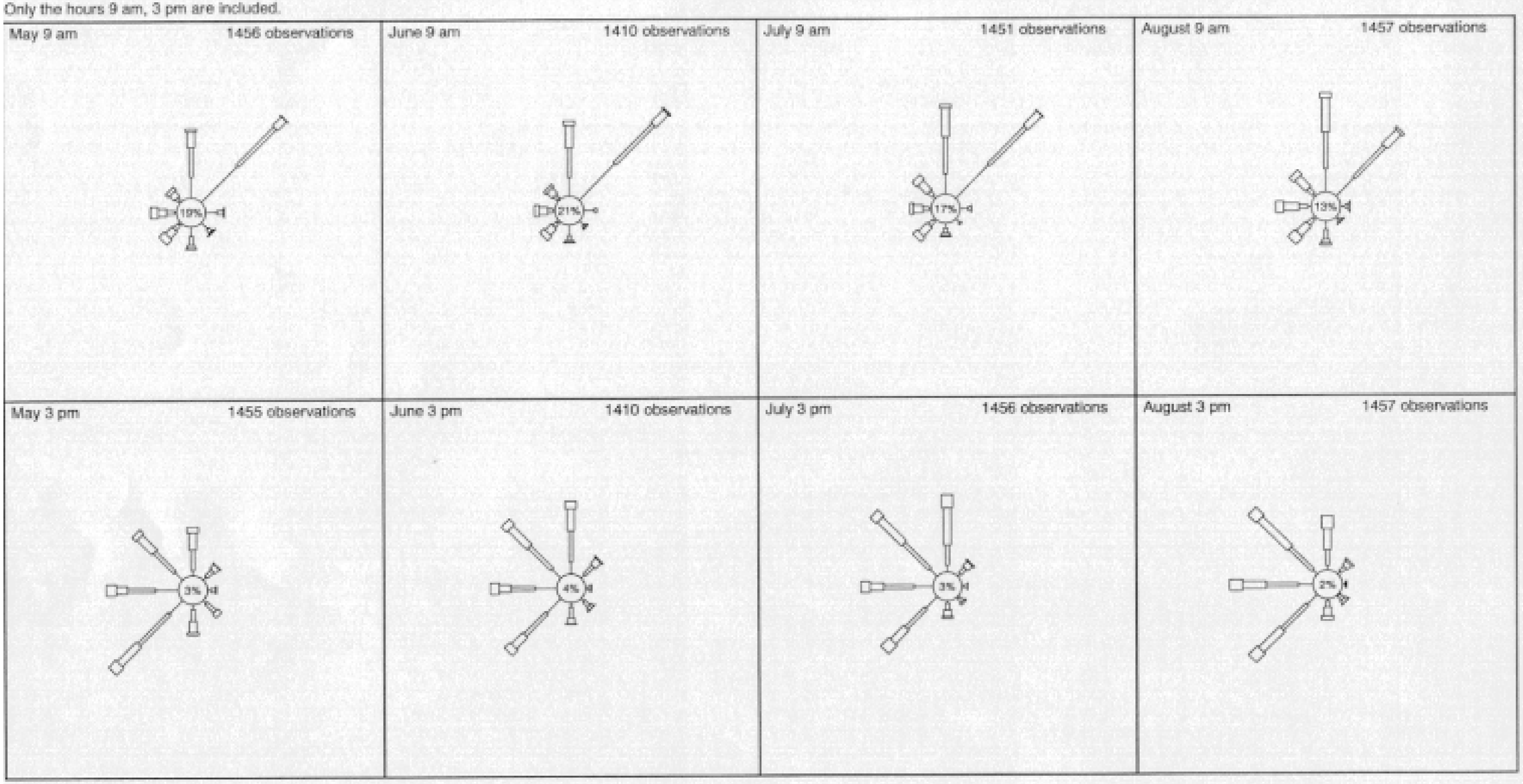

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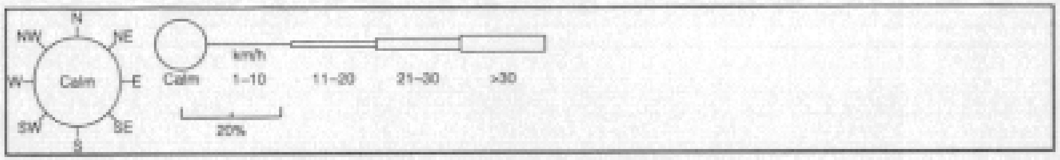

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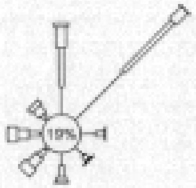
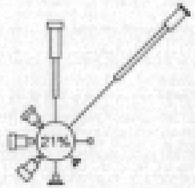
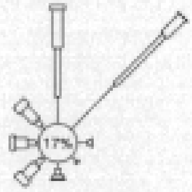
May 9 am — 1456 observations



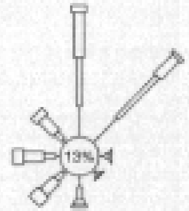
June 9 am — 1410 observations



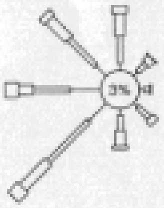
July 9 am — 1451 observations



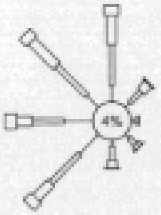
August 9 am — 1457 observations



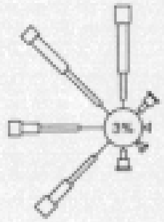
May 3 pm — 1455 observations



June 3 pm — 1410 observations



July 3 pm — 1456 observations



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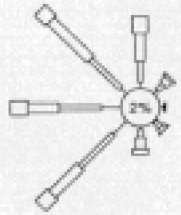

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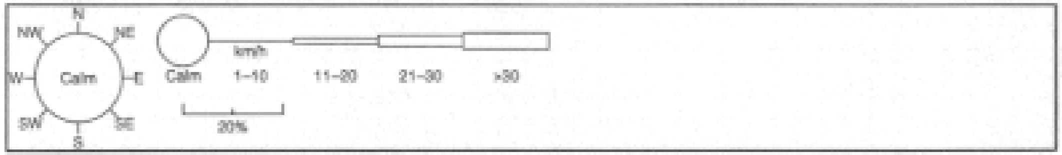
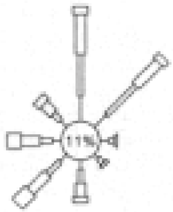
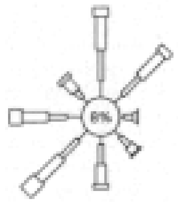


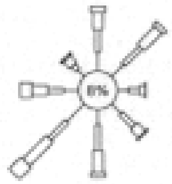
September 9 am — 1409 observations



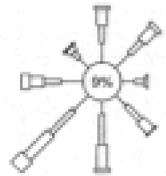
October 9 am — 1456 observations



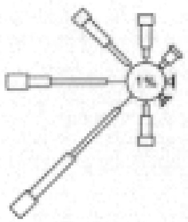
November 9 am — 1406 observations



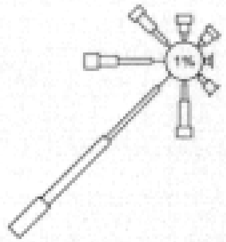
December 9 am — 1457 observations



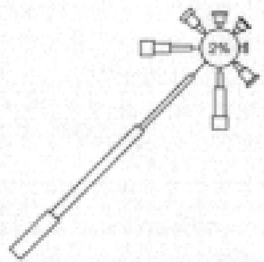
September 3 pm — 1408 observations



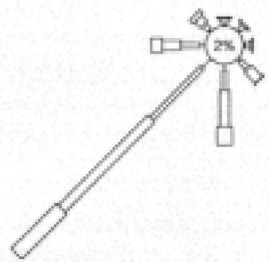
October 3 pm — 1456 observations



November 3 pm — 1410 observations



December 3 pm — 1457 observations



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January 9 am

Calm 15 — 1436 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	5	3	2	3	3	4	4	2	27
11–20	3	4	2	5	6	6	2	1	30
21–30	3	3	1	4	5	5	2	*	23
>30	*	*	*	1	1	2	1	*	5
All	11	10	6	13	15	17	10	3	100

January 3 pm

Calm 1 — 1436 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	*	*	*	*	1	3	1	*	6
11–20	*	1	1	3	4	15	4	1	29
21–30	*	1	1	5	10	25	3	2	47
>30	*	*	*	*	3	12	1	*	17
All	1	1	2	8	17	55	10	4	100

February 9 am

Calm 21 — 1312 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	3	5	3	3	4	3	4	2	26
11–20	4	7	3	7	7	3	1	1	33
21–30	2	2	1	3	5	3	1	*	18
>30	*	*	*	*	*	1	*	*	3
All	9	14	7	15	16	10	6	3	100

February 3 pm

Calm 1 — 1313 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	*	*	*	1	1	3	2	*	7
11–20	*	1	1	4	5	16	6	2	35
21–30	*	*	1	5	9	24	3	2	44
>30	*	*	*	1	3	8	1	1	13
All	1	1	2	10	17	50	11	5	100

March 9 am

Calm 21 — 1455 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	4	6	3	3	4	2	2	1	26
11–20	4	7	3	6	7	2	1	*	30
21–30	2	3	2	4	4	3	2	1	19
>30	*	*	*	*	*	2	1	*	4
All	10	15	8	14	14	9	6	3	100

March 3 pm

Calm 2 — 1457 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	*	*	*	1	1	4	2	1	10
11–20	1	1	1	4	5	16	6	2	36
21–30	*	*	1	5	8	21	4	2	40
>30	*		*	1	2	7	1	1	12
All	2	2	2	10	16	48	12	6	100

April 9 am

Calm 20 — 1409 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	5	8	3	3	3	1	1	1	25
11–20	7	11	3	4	4	2	1	1	32
21–30	4	4	1	1	2	3	3	1	18
>30	*	*		*	*	2	2	1	6
All	16	23	7	7	10	7	7	3	100

April 3 pm

Calm 3 — 1410 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	*	1	1	2	5	4	2	16
11–20	2	2	2	3	5	17	6	5	42
21–30	2	1	*	3	5	13	3	4	31
>30	1	*		*	1	4	2	2	10
All	5	3	3	8	13	39	15	13	100

May 9 am

Calm 19 — 1456 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	5	13	3	2	2	*	1	1	28
11–20	8	14	2	1	2	2	2	1	32
21–30	4	3	*	*	1	2	2	2	15
>30	1	*	*	*	*	2	2	1	6
All	18	31	5	4	6	7	7	4	100

May 3 pm

Calm 3 — 1455 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	1	1	1	1	5	6	3	19
11–20	5	2	1	3	3	12	7	8	42
21–30	4	2	*	1	3	7	3	5	27
>30	2	*			1	3	3	1	9
All	13	5	2	6	8	27	19	17	100

June 9 am

Calm 21 — 1410 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	5	13	3	1	3	1	*	*	27
11–20	8	14	1	1	1	1	1	1	29
21–30	6	5		*	1	2	2	2	18
>30	1	*			*	2	1	1	6
All	20	33	4	2	5	6	6	4	100

June 3 pm

Calm 4 — 1410 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	3	1	1	1	1	5	6	3	22
11–20	8	3	1	2	3	8	6	9	40
21–30	6	2	*	1	2	4	3	7	25
>30	2	*		*	*	2	2	2	9
All	19	7	2	4	6	20	18	21	100

July 9 am

Calm 17 — 1451 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	5	12	2	1	1	1	1	1	24
11–20	10	14	1	1	1	2	2	2	31
21–30	8	5	*		1	3	2	3	22
>30	1	*			*	2	1	2	6
All	24	31	3	2	3	7	6	7	100

July 3 pm

Calm 3 — 1456 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	2	1	1	*	1	4	5	3	16
11–20	5	2	1	1	2	7	8	10	37
21–30	10	2	*	1	2	5	4	9	32
>30	4	*			*	3	2	2	12
All	21	5	2	2	5	20	19	24	100

August 9 am

Calm 13 — 1457 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	6	7	1	1	2	1	1	1	18
11–20	10	12	1	1	3	2	2	2	32
21–30	9	5	*	*	1	4	4	4	27
>30	1	1	*	*	1	3	2	2	9
All	26	24	3	2	6	9	9	8	100

August 3 pm

Calm 2 — 1457 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	1	1	*	*	4	4	1	12
11–20	4	2	*	1	2	9	8	8	36
21–30	6	1	*	1	2	8	6	11	35
>30	4	1		*	1	3	3	3	15
All	14	5	1	3	6	24	22	24	100

September 9 am

Calm 11 — 1409 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	5	3	2	1	2	2	2	2	18
11–20	8	8	1	1	3	4	2	2	30
21–30	8	6	1	1	3	5	4	3	30
>30	1	1	*		1	4	3	2	12
All	23	19	3	3	8	14	11	8	100

September 3 pm

Calm 1 — 1408 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	*	*	*	1	4	4	1	11
11–20	2	2	1	1	2	13	11	6	38
21–30	5	2	*	1	4	11	5	6	34
>30	2	1	*	*	2	5	4	2	16
All	9	5	2	2	9	33	24	15	100

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October 9 am

Calm 8 — 1456 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	3	2	1	2	1	3	3	1	17
11–20	6	5	2	2	4	5	4	2	30
21–30	7	6	1	2	4	6	5	3	34
>30	2	1	*	*	1	4	3	1	12
All	18	15	4	6	10	17	14	7	100

October 3 pm

Calm 1 — 1456 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	1	*	*	1	4	3	1	10
11–20	1	1	1	2	3	15	7	4	34
21–30	2	2	1	2	5	16	4	4	37
>30	2	1	*	*	2	9	3	2	18
All	5	5	2	5	11	44	16	10	100

November 9 am

Calm 8 — 1406 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	4	3	2	3	3	5	3	2	24
11–20	4	5	2	4	5	5	3	1	30
21–30	3	5	1	2	5	7	3	2	28
>30	1	1	*	*	1	3	2	*	9
All	13	14	6	9	14	20	12	5	100

November 3 pm

Calm 2 — 1410 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	*	*	*	1	1	4	2	1	9
11–20	1	1	1	2	3	15	4	2	29
21–30	1	1	*	3	6	25	3	2	42
>30	1	*		1	3	11	3	1	19
All	3	3	2	6	12	54	12	6	100

December 9 am

Calm 9 — 1457 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	4	4	3	3	3	4	4	3	27
11–20	3	3	2	4	6	6	3	2	31
21–30	3	3	1	3	5	7	3	1	26
>30	1	1	*	*	1	3	2	*	8
All	11	12	5	10	14	20	12	6	100

December 3 pm

Calm 2 — 1457 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	*	*	*	*	1	2	1	*	6
11–20	1	1	1	2	4	14	4	2	29
21–30	1	*	*	3	7	25	4	2	43
>30	*	*	*	*	4	13	2	1	20
All	2	2	2	6	16	55	11	5	100

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Edinburgh RAAF

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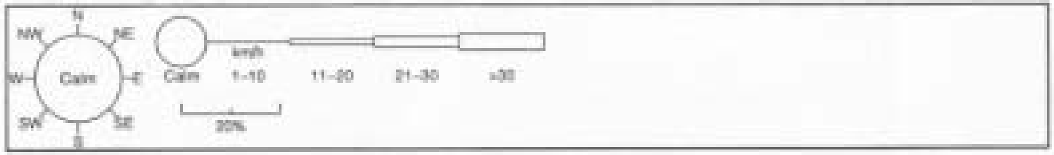

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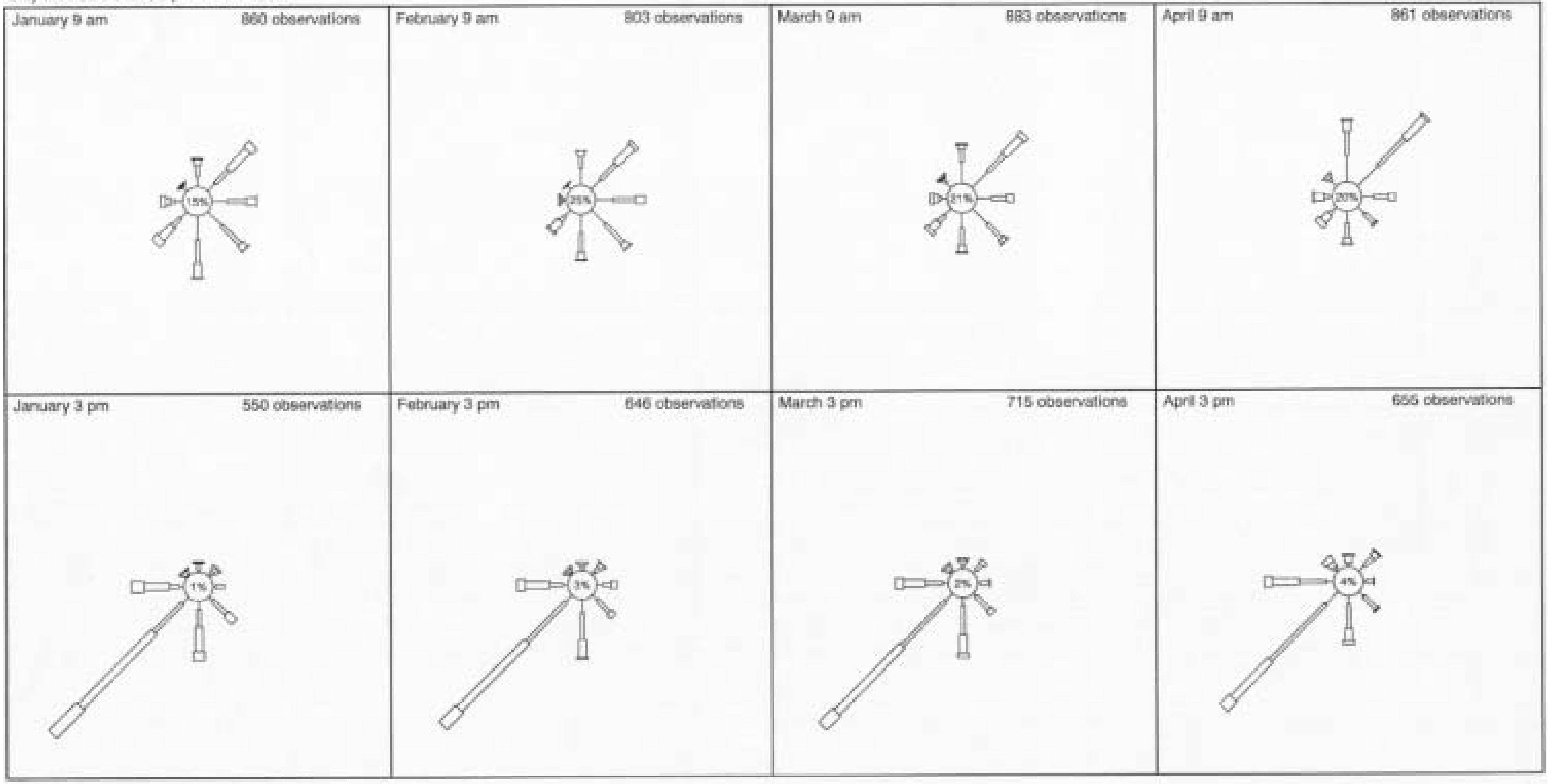

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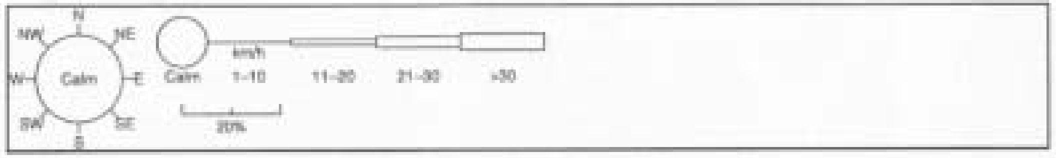

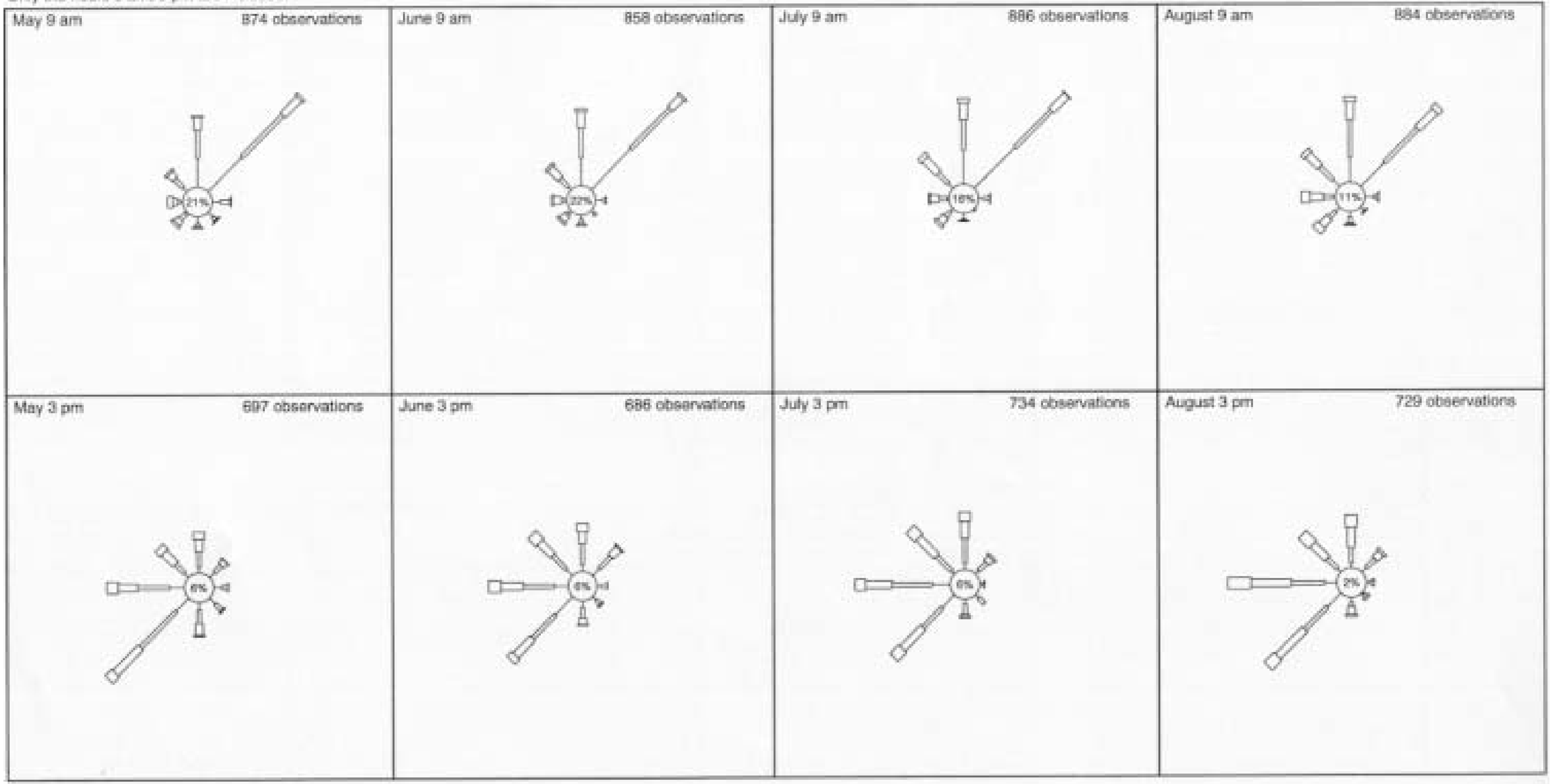

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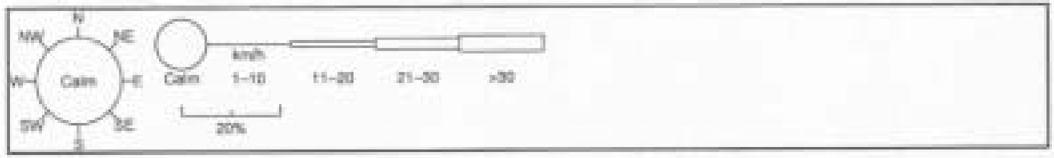

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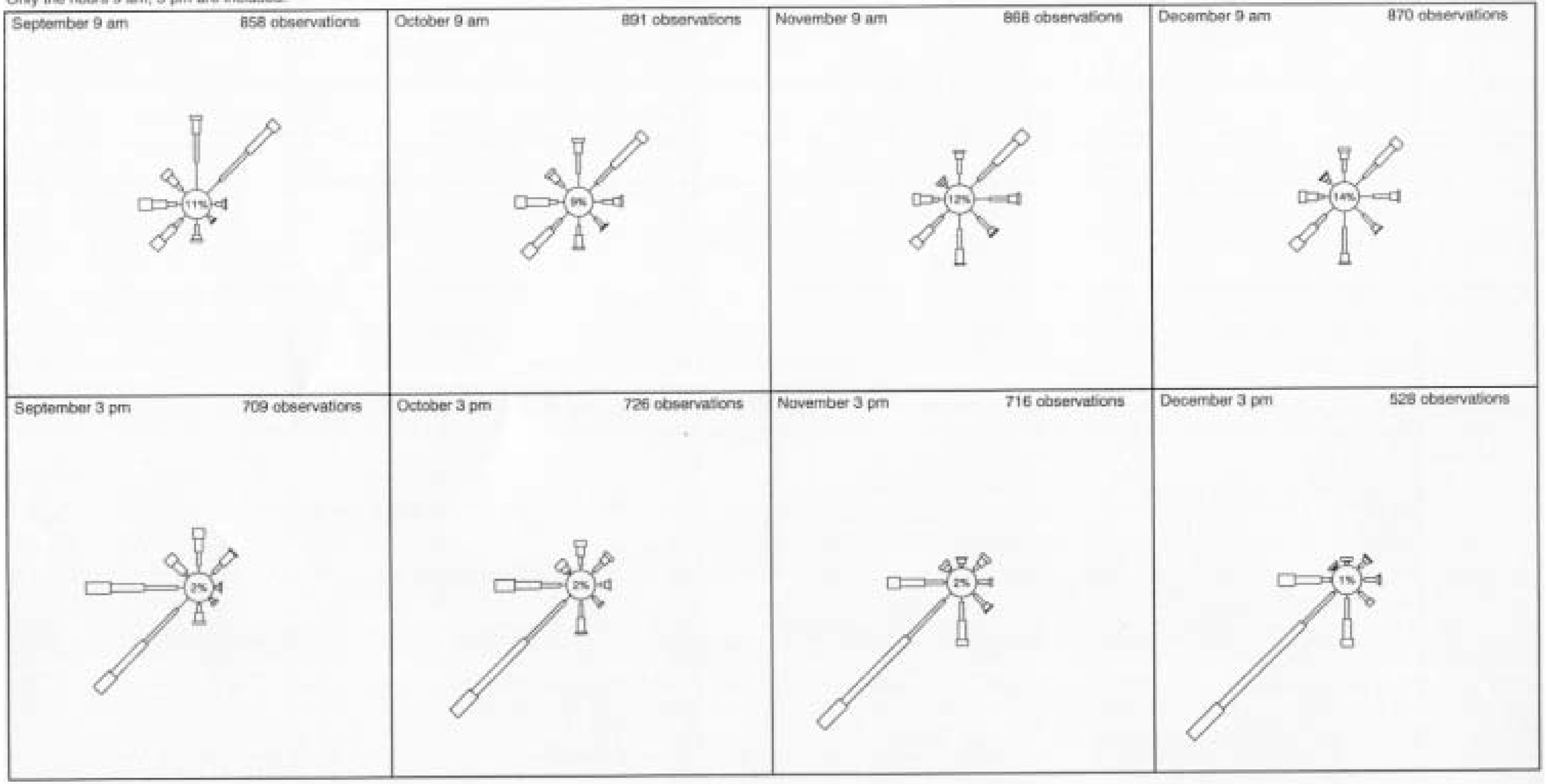

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January 9 am

Calm 15 — 860 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	3	3	4	5	6	2	2	1	26
11–20	3	5	5	7	6	3	1	*	30
21–30	1	7	3	2	4	4	1	*	23
>30	*	2	*	*	*	2	1	*	6
All	7	17	12	14	16	11	6	2	100

January 3 pm

Calm 1 — 550 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	*	1	1	2	2	1	*	8
11–20	2	1	2	5	5	11	3	*	28
21–30	*	1		3	6	27	7	1	45
>30	*	1			2	10	3	*	17
All	3	3	3	9	15	50	14	2	100

February 9 am

Calm 25 — 803 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	5	3	5	5	5	2	1	1	27
11–20	3	6	6	7	5	2	*	*	29
21–30	1	6	3	2	2	3	1	*	17
>30	*	1		*	*	1	*	*	3
All	9	16	13	14	12	8	2	2	100

February 3 pm

Calm 3 — 646 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	*	1	2	2	3	2	1	*	11
11–20	1	2	2	5	7	14	3	*	35
21–30	*	1	2	1	5	25	6	1	41
>30	1	*			*	6	2	1	10
All	2	4	5	8	15	48	13	2	100

March 9 am

Calm 21 — 883 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	5	6	4	6	4	2	1	2	30
11–20	3	6	4	5	4	2	1	1	27
21–30	1	6	2	1	2	3	1	*	16
>30	*	1		*	*	1	1	*	5
All	10	19	10	12	10	8	4	4	100

March 3 pm

Calm 2 — 715 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	1	1	1	2	3	1	*	9
11–20	1	2	2	5	8	16	5	1	39
21–30	1	1	*	1	5	24	6	1	40
>30	*				1	5	2	1	10
All	3	4	3	7	16	48	14	3	100

April 9 am

Calm 20 — 861 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	7	7	3	2	3	1	1	2	26
11–20	6	10	4	3	4	1	1	1	30
21–30	3	7	2	*	2	2	3	1	20
>30	*	1			*	1	1	*	4
All	16	25	9	6	9	6	5	4	100

April 3 pm

Calm 4 — 655 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	2	1	2	2	4	2	*	13
11–20	1	3	2	4	6	21	7	1	45
21–30	2	1	*	*	3	14	7	2	29
>30	1	*			1	4	2	2	9
All	3	7	3	7	12	42	18	4	100

May 9 am

Calm 21 — 874 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	7	12	2	2	2	*	1	1	28
11–20	7	15	2	1	1	2	1	3	33
21–30	3	6	*	*	*	1	1	2	15
>30	1	1	*	*	*	1	1	1	4
All	18	34	5	3	3	5	4	7	100

May 3 pm

Calm 6 — 697 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	2	2	2	2	5	4	2	19
11–20	4	3	1	2	4	13	8	3	39
21–30	3	1	1	*	3	9	5	4	27
>30	2	*			*	2	3	2	10
All	11	6	4	5	9	30	20	11	100

June 9 am

Calm 22 — 858 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	7	15	2	1	1	1	*	1	28
11–20	8	15	1	1	1	1	1	3	30
21–30	4	4	*		*	2	2	4	16
>30	1	1			*	1	1	1	4
All	20	34	3	2	3	4	4	8	100

June 3 pm

Calm 6 — 686 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	2	2	1	1	2	6	4	2	20
11–20	5	4	2	1	3	8	8	5	38
21–30	3	3	*	*	2	6	6	5	25
>30	2	*			*	2	3	3	11
All	12	10	3	3	6	23	21	15	100

July 9 am

Calm 16 — 886 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	9	15	1	*	1	1	*	2	29
11–20	8	13	2	*	*	2	2	4	31
21–30	4	6	*		*	2	2	5	20
>30	1	*	*		*	1	*	1	4
All	22	34	3	*	2	6	5	12	100

July 3 pm

Calm 6 — 734 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	2	1	1	1	1	5	5	1	16
11–20	6	3	1	2	3	7	11	6	38
21–30	4	1	*		1	8	7	7	28
>30	2	1			*	3	3	3	12
All	15	6	1	3	5	23	25	16	100

August 9 am

Calm 11 — 884 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	6	8	2	1	1	1	*	2	23
11–20	10	12	1	*	2	2	3	5	35
21–30	5	6	*	*	*	3	3	4	23
>30	1	2	*		*	2	2	1	8
All	22	29	4	2	4	8	9	13	100

August 3 pm

Calm 2 — 729 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	2	1	*	1	5	3	1	14
11–20	4	3	1	1	1	8	9	4	31
21–30	5	2	1	1	2	10	10	5	36
>30	3	1			1	4	6	4	18
All	14	7	2	2	5	26	28	14	100

September 9 am

Calm 11 — 858 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	7	5	1	1	1	2	1	1	19
11–20	8	10	2	1	3	3	3	2	31
21–30	4	8	1	*	1	4	4	3	26
>30	1	2	*		1	3	3	2	13
All	19	26	4	3	6	12	11	8	100

September 3 pm

Calm 2 — 709 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	2	1	*	*	*	4	2	*	11
11–20	4	3	1	1	2	12	9	1	33
21–30	4	4	*	1	2	12	9	4	36
>30	3	*	*		1	6	7	2	19
All	12	9	2	2	6	34	26	7	100

Prepared by Climate and Consultancy Section in the South Australian Office of the Bureau of Meteorology
Contact us by phone on (08) 8366 2600, by fax on (08) 8366 2693, or by email on climate.sa@bom.gov.au

Wind Frequency analysis using available data between 1972 and 2002 for

Edinburgh RAAF

Site Number 023083 • Locality: Edinburgh • Opened Jan 1972 • Still Open • Latitude 34°42'15"S • Longitude 138°37'10"E • Elevation 16.5m

Only the hours 9 am, 3 pm are included.

Values are percentage frequencies; * indicates the range occurred but with a frequency of less than 0.5%.

October 9 am

Calm 9 — 891 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	3	3	2	2	2	3	2	2	20
11–20	5	6	3	3	2	4	2	2	27
21–30	3	10	2	*	3	6	6	2	33
>30	1	2	1	*	1	3	3	1	12
All	13	21	8	6	9	16	13	7	100

October 3 pm

Calm 2 — 726 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	1	1	1	1	2	1	*	9
11–20	3	3	1	3	4	14	5	1	33
21–30	3	2	1	1	4	20	7	1	38
>30	2	1	*		*	7	5	2	18
All	8	7	4	4	9	43	19	4	100

November 9 am

Calm 12 — 868 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	3	3	4	3	4	2	2	1	21
11–20	4	6	5	4	5	4	2	1	31
21–30	2	8	2	1	4	4	3	1	26
>30	*	3	1	*	*	2	2	1	10
All	9	20	12	9	13	13	8	3	100

November 3 pm

Calm 2 — 716 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	*	1	1	1	1	3	1	*	7
11–20	1	2	3	4	5	14	5	1	34
21–30	1	2	1	1	5	24	7	1	42
>30	*	1		*	2	8	3	1	16
All	3	5	4	6	13	49	16	3	100

December 9 am

Calm 14 — 870 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	3	3	4	3	4	3	2	1	23
11–20	3	5	4	4	7	4	1	1	30
21–30	2	6	2	2	2	5	3	1	24
>30	1	2	1	*	*	3	2	*	10
All	9	17	11	9	14	15	8	4	100

December 3 pm

Calm 1 — 528 observations

km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	*	1	1	1	1	1	*	*	5
11–20	1	2	3	3	5	11	2	*	29
21–30	*	1	1	1	5	30	7	*	46
>30	1	*	*		2	11	4	1	20
All	2	4	5	5	14	54	14	2	100

Prepared by Climate and Consultancy Section in the South Australian Office of the Bureau of Meteorology
Contact us by phone on (08) 8366 2600, by fax on (08) 8366 2693, or by email on climate.sa@bom.gov.au

Weather Station Features

Description	Standard
Logger type	Starlogger
Mast	Ten metres freestanding
Solar power	Standard
Software	Magpie
Warranty	12 months
Climate sensor options	
Air temperature	-40 to +60°C; ±0.2°C
Relative humidity	0-90%; ±2%RH
	90-100%; ±3%RH
Rainfall	0.2mm tips, 2% accuracy
Solar radiation	0 - 2000 W/m^2 ±5%
Wind speed & direction	0 to 69m/s
	speed ±1%
	direction ±4°
Barometric pressure	800-1100hPa < ±0.25%FS
Other sensors	Wide range
Soil moisture options	
GBLink	Yes
TPLink	Yes
Communication options	
Data storage capacity	50 days
Onsite download	Yes
Digital cellular phone	Yes
Radio	Yes
Removable logger	Yes
Alarms capability	Yes
Mast options	2 metres to 40 metres

Appendix E

Landscaping Plan

Buffer planting & landscaping design report

Jeffries Garden Soils

Buckland Park site

July 2002

Farm Tree Systems

Buffer planting & landscaping design report

Jeffries Garden Soils – **Buckland Park site**

Table of contents

The brief

Jeffries Garden Soils require a vegetative buffer to be designed for the composting and recycling site at Buckland Park. The coastal site is believed to have a relatively shallow highly saline water table.

A professionally presented design is required for incorporation in the development application.

The desired functions for the buffer include:

∉ Dust, noise and possibly odour reduction

∉ Amelioration of windspeed in the windrow composting cells

∉ Visual amenity

∉ Firewood production

∉ Possible amelioration of the saline soils

On the 5km-property boundary, there is to be a 5–10 metre wide, 1.5 metre high mound as a permanent landscaped buffer. Use of local native species will complement local biodiversity conservation initiatives such as planting *Gahnia filum* for the Skipper butterfly where appropriate.

On the inside of this buffer, there will be a 20 metre wide, 5–7 metre high mound constructed with humus rich material.

Estimates of costs, yields and returns are required for growing a firewood crop on this mound.

After harvesting the trees, the mound will be recovered for use in Jeffries' products, the tree stumps will be chipped ready for composting and the mound replaced with new humus rich material — ready for replanting. Nothing will be wasted.

The design of the buffer will need to change from location to location — according to the degree of coastal exposure and depth to the saline water table.

Bolivar effluent is available for use on the site and could be used for irrigating trees. An estimate of likely growth responses to irrigation is required.

Site description

The site receives an average annual rainfall of 400–450 mm. The prevailing winds are south-westerlies, however the site is also subject to periodic strong northwesterly winds that precede cold changes.

The degree of exposure to salt-laden winds is the greatest and the depth to saline groundwater is least on the west and south of the site. Marine barley grass on the low-lying areas on the SW of the site indicates salinity and/or water logging (bottom right photo).

The alkaline soils are medium to heavy textured and overly a shallow highly saline groundwater. The clay subsoil is expected to be sodic.

The proposed mounding will improve the site's capacity to support plant growth.

Powerlines are located on most of the roadsides.

Boxthorns and to a lesser degree artichokes abound.

Aleppo pines and athel trees are located on part of the western and northern boundaries (see below).

Zones

The first three planting zones are based on the degree of exposure, orientation of the planting and depth to saline groundwater: Zones 4 & 5 define the areas for internal shelterbelts and landscape strips.

1. Along the southern and western boundary — greatest exposure to salt-laden winds and least depth to saline groundwater
2. The eastern boundary (Brooks Rd) — the least exposure to salt-laden winds and greatest depth to saline groundwater
3. The northern boundary (Thompson Rd) — intermediate exposure to salt-laden winds and depth to saline groundwater
4. Internal shelterbelts for windrowing cells growing on in-situ soils
5. Native landscape strips growing on in-situ soils

Different designs are required for each zone and the belt orientation.

Species selection

Local native species have been selected for a narrow planting strip on the roadside verge where appropriate. They are all less than three metres tall as required by powerlines regulations.

Road verge

The following local native species grow to less than 3 metres and can be planted at 1.5–2.5 metre centres.

Hakea wattle	*Acacia hakeoides*
Umbrella wattle	*Acacia ligulata*
Christmas bush	*Bursaria spinosa*
Ruby salt bush	*Enchylaena tomentosa*
Emu bush	*Eremophila maculata*
Coastal paper bark	*Melaleuca halmaturorum*
Nodding salt bush	*Einadia nutans ssp nutans*
Fragrant salt bush	*Rhagodia parabolica*
Punty bush	*Senna artemisiodes ssp artemisiodes*

Permanent landscape mound

As above plus the following species should grow to less than 3 metres in these coastal conditions and can be planted at 2–3 metre centres to heighten visual amenity:

Golden grey mulga	*Acacia argyrophylla*	Attractive foliage
Old man saltbush	*Atriplex nummularia*	Attractive foliage
Red bottlebrush	*Callistemon citrinus*	Red bottlebrush flowers
Scarlet bottlebrush	*Callistemon macropunctatus*	Red bottlebrush flowers
Pin-cushion hakea	*Hakea laurina*	Showy flowers
Boobialla	*Myoporum insulare*	Dark green foliage
Red Templetonia	*Templetonia retusa*	Showy flowers

As above plus the following species should grow to less than 6 metres in these coastal conditions and can be planted 6.5 metres or more from the powerlines at 3–5 metre centres with smaller shrubs interspersed:

Drooping sheoak	*Allocasuarina verticillata*	Attractive foliage
Mallee Box	*Eucalyptus porosa*	Bright green leaves – may be taller than 6m in Zone 3
Coastal tea tree	*Leptospermum laevigatum*	Hardy
Dryland tea tree	*Melaleuca lanceolata*	Hardy
Western honey myrtle	*Melaleuca nesophila*	Purple terminal flowers
NZ Christmas tree	*Metrosideros excelsa*	Showy red flowers
Native apricot	*Pittosporum phylliraeoides*	Weeping habit and attractive bright orange fruit

Cutting grass (*Gahnia filum*), the habitat of the Skipper butterfly, is likely to be successfully incorporated into plantings in the lower-lying south and south western parts of the site.

Woodlot mound

The criteria for selecting species for firewood production on the temporary mound are presented in the following table.

	Height (m)	*Tolerance to exposure*	*Growth rate*	*Firewood quality*	*Salinity & drought tolerance*	*Other factors and comments*
Swamp oak (*Casuarina glauca & obesa*)	7–15	Very good	Mod	Good	High	*Cas glauca* suckers but *obesa* does not; *C obesa's* growth rate is generally slower than *glauca*; performance of different seed sources is highly variable
Tuart (*Euc gomphocephala*)	7–20	Very good	Fast	Good	Mod	Subject to borers when stressed and rainfall inadequate for long–term suitability, but still should be robust enough to be suitable for harvesting after 10–15 years
Flat–topped yate (*Euc occidentalis*)	7–15	Poor	Fast	Good	High	Very suitable when primary shelter afforded
Mallee box (*Euc porosa*)	5–10	Good	Slow	Very good	Mod	
Sugar gum (*Euc cladocalyx*)	7–15	Poor	Fast	Very good	Low	Suitable when primary shelter afforded, but rainfall inadequate for long–term suitability
Rib–fruited mallee (*Euc incrassata*)	3–7	Good	Mod	Good	High	
Drooping sheoak (*Allocasuarina verticillata*)	5–8	Good	Slow	Very good	Mod	
River oak (*Casuarina cunninghamiana*)	5–15	Mod	Mod	Good	Low	Rainfall, salt tolerance and exposure limiting
Coastal mallee (*Euc diversifolia*)	2–10	Good	Slow	Good	Mod	
Yate (*Euc cornuta*)	5–15	Mod??	Mod	Good	Mod	Not in evidence locally (source Simpfendorfer); consider for inclusion in trial planting
Athel tree (Tamarix aphylla)	5–20	Very good	Mod	Poor	High	Valuable primary shelter, but salt accumulation in wood reputedly causes firebox corrosion
Round–leaved moort (*Euc platypus*)	3–8	Good	Fast	Good	Mod	Becomes unstable and is too dense
Pyramid tree (*Lagunaria patersonii*)	5–15	Good	Slow	?	Mod??	
Macrocarpa cypress (*Cupressus macrocarpa*)	5–15	Good	Mod	Poor	Low	Wood density too low and inadequate rainfall
Aleppo pine (*Pinus halepensis*)	5–12	Very good	Slow	Poor	Mod	Wood density too low
Maritime pine (*Pinus pinaster*)	5–15	Very good	Slow	Poor	Low	Wood density too low and inadequate rainfall

Buffer designs

Powerlines are located on the roadsides on the eastern, southern, western and northwest boundaries of the site. Prescribed distances apply according to the voltage of the line. 66Kv lines require plants less than 3 metres tall for the first 6.5 metres and plants less than 6 metres tall for the next 6.5 metres from the line.

Shelter design principles

Area sheltered is proportional to the height (H) of the shelterbelt — the taller the belt, the greater the area sheltered. The elevation created by the mounds will increase the overall tree height, hence the area sheltered.

The total width of the external belts (5–10 metre landscape mound and 20 metre temporary mound) will provide very effective visual screening. The belt will be relatively impermeable to the wind, creating a very quiet zone up to about 10 heights (H) away from the belt, but turbulence and rapidly increasing windspeed from thereon.

The high degree of exposure on the windward sides and use of shrubs in the permanent landscape mounds will create a sloping face on the key shelterbelts (1). This sloping face will tend to deflect the wind up and over the belt rather than have the wind slow down as it is passing through the belt (as it would do with a more permeable belt with a vertical face).

An indication of the area sheltered from northwesterly and southwesterly winds respectively are shown below.

Zone 1

The southern and western boundaries are the most challenging in terms of salinity and exposure warranting selection of swamp oak for the temporary mound. The photo on the right indicates the impact of comparable exposure to Zone 1 on the plant growth of swamp oak.

An inter-row or 2.4 to 3.0 metres and intra-row spacing of approximately 2.2–2.8 metres should suffice.

Zone 2

The east-west orientation of this mound requires the most exposure tolerant species (swamp oak and tuart) to be on the southern side. The primary shelter and less exposed location should enable sugar gum and / or flat-topped yate to be grown for firewood in the middle rows.

An inter-row or 2.4 to 3.0 metres and intra-row spacing of approximately 2.0–2.8 metres should suffice. The intra-row spacing is a little closer because there are only two rows in the landscape belt.

Where there are powerlines along the roadside, the taller trees will not be able to be planted closer than 13 m from the powerlines. Exposure from hot dry northwesterly winds on the landscape mix and flat-topped yate should not be a problem.

Boobialla

Zone 3

The north-south orientation of this mound requires the most exposure tolerant species (swamp oak and tuart) to be on the western side. The primary shelter and less exposed location should enable sugar gum and / or flat-topped yate to be grown for firewood in the middle rows.

An inter-row or 2.4 to 3.0 metres and intra-row spacing of approximately 2.0–2.8 metres should suffice. Where there are powerlines along the roadside, the taller trees will not be able to be planted closer than 13 m from the powerlines.

Zone 4

The internal shelterbelts are designed to occupy as little space as possible by using two closely spaced rows of swamp oak (see photo on right). The vertical profile and medium porosity should provide high-quality protection for the compost windrow operations. Treatment with gypsum at up to $1kg/m^2$ may be warranted if soil dispersion tests indicate that the clay subsoil is sodic.

Zone 5

These three or four-row native landscape strips growing on in-situ soils should include swamp oak to provide the linking theme between all plantings and species included in the permanent mound list for show and colour. Treatment with gypsum at up to $1kg/m^2$ may be warranted if soil dispersion tests indicate that the clay is sodic.

Firewood production estimates

Assuming an approximate total of five kilometres of 20-metre wide mounds (10 hectares) planted as the firewood woodlot growing at between 2–6 air-dry tonnes per hectare per year will yield 200– 600 air dry tonnes after 10 years. Within this range, the yields in Zone 1 will be less than in Zones 2 & 3.

On current day prices ($120–$140 per air-dry tonne), the wholesale value of this wood is approximately $24,000– $84,000. [The retail value to Jeffries would be $36,000– $108,000.]

Production costs to get the wood from the stump to the retailer would be expected to be less than $70 per tonne leaving a net margin of approximately $60 per tonne and total net returns of $12,000–36,000.

Increasing the time until harvest from 10 years to 12 or more years would allow the trees to attain greater diameter and reduce unit-harvesting costs.

The wholesale value of this wood would then be approximately $31,200–$93,600 in current day dollars. Lower production costs to get the wood from the stump to the retailer would be expected — $50–$60 per tonne leaving a net margin of approximately $70 per tonne and total net returns of more than $22,400–$57,600.

Irrigation

Optimal irrigation via the use of dripper system and management practice as demonstrated at the Bolivar *Hardwood Afforestation Irrigation Trials* (HIAT) would be expected to more than double the wood production of the species in question. The photo shows effluent irrigated swamp oak still persisting at the now unirrigated HIAT trial. This would increase the returns, but not in direction proportion to the increased production because handling costs per dry tonne increase due to the lower density of irrigated wood.

The set up costs for on-ground reticulation of an effluent irrigated woodlot cost approximately $10,000 per hectare plus head works. The annual running costs including chlorine injection to help keep the dripper lines clear were about $1000 per hectare for a 30 hectare project in the Riverland. On this basis the total cost would be approximately $100,000 for reticulation and 10 years running cost would be at least $100,000 plus head works of say $20,000.

If the additional returns from wood were only worth $30,000, this would still be well short of the set up and operating costs of approximately $220,000. This is less than a compelling case for irrigating the woodlot for wood returns, however, some areas may warrant the expenditure on irrigation for the amenity associated with higher survival and faster growth.

Forming bowls for each seedling and manually watering could only be contemplated if considered necessary to ensure seedling survival over the first summer.

Forming a depression in the top of the mound and flood irrigating is unlikely to be effective even if the mound was surfaced with clay. Water delivery and distribution would be most uneven to say the least.

Swamp oak (Casuarina glauca)
from Tuross Lakes NSW

Implementation

The plan is to be progressively implemented as outlined on the master plan produced by *resource*:

1. the permanent landscape mound along the southern part of Brooks Rd and the eastern belts of Zone 4
2. the remainder of the permanent landscape mound along the Brooks Rd, the permanent landscape mound and the temporary mound along the southern boundary and south of McEvoy Rd on the western boundary plus an extra shelterbelt in the windrowing area
3. the remainder of the permanent landscape mound along the western boundary and along Thompson Rd plus the temporary mound along Brooks Rd
4. the remainder of the temporary mound on the western boundary and along Thompson Rd plus the internal native landscape strip (Zone 5)

Purchasing the majority of the planting stock in cell trays and applying standard forestry establishment practices can be expected to keep costs to a minimum.

Estimation of total plant numbers

The table below summarises the plant numbers and areas for each of the zones.

		Landcape mound		Inter row 2.4			Woodlot mound		Inter row 3.0		
	Length (m)	Width (m)	Area (ha)	# of rows	Av intra row (m)	Plant #s	Width (m)	Area (ha)	# of rows	Av intra row (m)	Plant #s
1a	1630	12	2.0	3	2.2	2220	20	3.3	6	2.8	3490
1b	900	12	1.1	3	2.2	1230	20	1.8	6	2.8	1930
2	1390	7	1.0	2	2	1390	20	2.8	6	2.8	2980
3	1830	12	2.2	3	2.2	2500	20	3.7	6	2.8	3920
			6.2			7340		11.5			12320
		Shelterbelts		Inter row 1.5							
4a	310	4.5	0.1	2	2.5	250					
4b	310	4.5	0.1	2	2.5	250					
4c	340	4.5	0.2	2	2.5	270					
4d	400	4.5	0.2	2	2.5	320					
			0.6			1090					
		Landscape strips		Inter row 2.5							
5a	930	10.5	1.0	4	2.4	1550					
5b	870	10.5	0.9	4	2.4	1450					
			1.9			3000					

Preliminary cost estimation (excluding mound construction costs)

Woodlots

A reasonable cost for establishing the woodlots using forestry techniques (cultivation, spraying and planting) would be $1500–$2000 per hectare or $17,000–$23,000 for the 11.5 hectares of woodlot. A contingency allowance of 50% would be prudent considering that the project will be done in stages with smaller areas bringing the total cost estimate to $26,000–$35,000. Follow up weed control in the first and second growing seasons is paramount to successful establishment and might be expected to cost up to approximately $120–200 per hectare per application, totalling up to $5000. This calculates out to cost from $31,000–$40,000 or $2.50–$3.20 per plant for the 12,320 plants.

Shelterbelts

Working on the same cost per plant as for the woodlots, 1090 seedlings for shelterbelts would cost $2800–$3500.

Landscape mounds and strips

Typical establishment practice used by landscaping contractors involves gypsum application, pre planting weed control, basin making, double planting, irrigation, mulching, post planting weed control, refilling and supervision. Cost per plant for the landscape mounds can be expected to be approximately $24 or a total of approximately $178,000 for 7340 plants. The equivalent cost for the 3000 plants for the landscape strips is $72,000.

The total cost estimate is $285,000–$295,000. There should be scope to reduce the cost of establishing the landscaping mounds and strips to some degree by adopting the some of the less intensive forestry practices.

Appendix F

Dust and Noise Monitoring Report

Dust and Noise Survey
Wingfield Composting Operation
April 2001

Report 01/ 307

Prepared for: Rodenburg Davey & Associates Pty Ltd.
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Date: 5th May 2001

CONTENTS

1. INTRODUCTION

Jeffries Soils currently operate a large composting facility at the Wingfield Waste Management Centre. It is proposed to relocate this activity to a new site at Buckland Park where a buffer zone will separate the nearest residential area one kilometre to the northeast and east. Other industrial activity will also be conducted in this area including salt harvesting.

The dust levels around the existing Wingfield compost operation were monitored over a one month period to determine the fallout pattern of compost dust. Noise levels were also measured around the composting plant and along the perimeter of the woodrow area.
The dust and noise survey was carried out between 16^{th} March and 17^{th} April 2001.

2. DUST DEPOSITION

A High Volume air sampler was set up 350 metres east of the composting area in the Wingfield Waste Management Centre. The unit (Ecotech Model 2000 TSP) sampled ambient air at $70m^3$/hr. Dust was determined as Total Suspended Particulates (TSP) by Australian Standard 2724.3 – 1984.
A Hioki 8206 Data Logger recorded start and end times for each sampling period to ensure accurate correlation of air sampling times with local hourly meteorological data.
The TSP dust sampler was set up in a secure yard at the northern end of Hanson Street. The sampler was operated from mains supply via a 50 meter power lead across a vehicular yard. Open flat-lying land, partially protected with a discontinuous ground cover extends northwards for over a kilometre to the North Arm mangrove estuary.
Meteorological data was provided by Raya Giffard, of the Wingfield Waste Management Centre and included rainfall, wind speed, wind direction, temperature and barometric pressure on an hourly basis.

The TSP dust sampler was operated continuously at $70m^3$/hour for 3 to 6 days at a time over a one-month period, as tabulated below.

On the 12^{th} April the TSP sampler was moved closer to the Jeffries composting area whilst an easterly wind prevailed, to acquire dust data at distances of 120 and 220 meters downwind from the composting area.

Two composting activities were observed to generate compost dust, viz. Dry-screening of the final product and rotation of the compost windrows. Both operations involve machinery to elevate the compost to 5 meters above ground level, whereon winds were observed to disperse compost dust over surrounding areas for distances of a hundred meters or more.

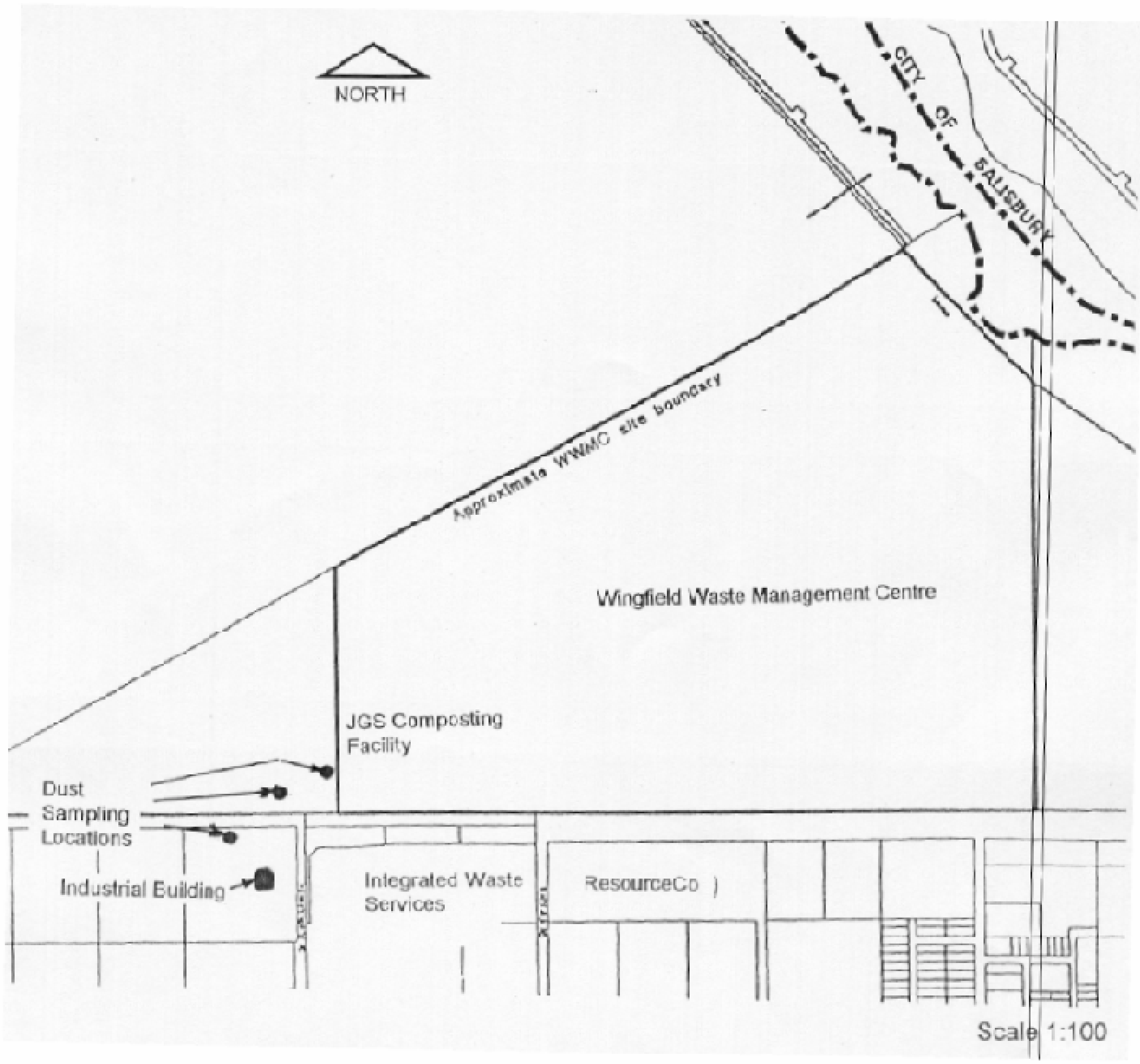

Figure 1 Sketch map of Dust sampler locations with respect to Jeffries Composting Operation

Sampling Period	Distance (m) from Jeffries	Dust fallout mg/m^3	Wind speed and direction			Rain (mm)
			m/s	Easterly ……………………%	Easterly …….8am - 4pm	
19 to25 Mar.	350	0.27	3	18%	3 hr	12
26 to 29 Mar.	350	0.48	3	52%	12 hr	8
29 to 3 Apr.	350	0.34	2	48%	13 hr	1
4 to 7 April	350	0.23	3	17%	0 hr	1
7 to 12 April	350	0.13	4	33%	3 hr	8
12 to 17 April	350	0.29	3	18%	0 hr	0
12 April 0900-1300	220	0.24	3	100%	6 hr	0
12 April 1300-1600	120	1.08	3	100%	6 hr	0

The dust levels 350 metres west of the composting area ranged from 0.13 to 0.48 mg/m^3 during the one month survey. The colour of the dust layer collected on the high volume filters was a uniform khaki-grey.
Dust levels seem independent of wind direction, speed and rainfall, although coarse dust or fine sand (>100 micron) was noticeably higher with mean wind speeds above 3 m/s.

These dust levels are similar to TSP levels reported at Cormack Road in 1999 where levels ranged from 0.14 to 0.55mg/m^3 (Enviroscan Rept. 99-206).

Compost dust was only recognised on the TSP filter sample(1.08 mg/m^3) at the site closest (120 meters) to the composting area, with characteristic brown-black fibres up to a millimeter in length. However with greater distance downwind, at 220 meters, the compost material was no longer visible and TSP dust was at a local background level of 0.24 mg/m^3.

The amount of dust generated from the composting site depends on the composting activity. Most dust is generated by the mechanical screening operation with lesser amounts from the elevator rotating the compost windrows and the bucket loader vehicles. This acitivity is restricted to the dayshift operation during week days.
Dust dispersion from this composting activity is restricted to within a few hundred meters of the screening plant. This dispersion could be reduced by shielding the screening plant with wind breaks.

4 NOISE SURVEY

An integrating sound level meter IEC 651 Type 2 (MVI Technologies) with 1/1 octave filter and calibrator was used to acquire data as per AS 1055.1-1989.
Noise levels were measured near working equipment at the screening plant and the elevator turning over the compost windrows.
Front-end bucket loaders were operating during the noise survey which was carried out on a dry day with light winds (<2 m/s).
The noise data is tabulated below and includes percentile levels L_{10} and L_{90} as well as L_{Aeq}.

Location	**L_{10}**	**L_{95}**	**L_{Aeq}**
Screening plant, including mobile plant	75	70	73
Ecoteck mulcher, including mobile plant	73	71	71
Southern boundary, 50 meters distance	73	71	72
Western boundary, 150 meters distance	64	42	53
Eastern boundary , 100 meters distance	69	65	69
Northern boundary , 100 meters distance	44	40	42

These noise levels are compatible with the 70 dB(A) limit for industrial areas.
Measurements were also made around the perimeter of the windrow area at distances of 50 to 100 meters from the screening plant and mobile elevator.
These data indicate that boundary noise levels at the Wingfield site conform with the South Australian EPP (Industrial Noise) Policy 1994 for industrial areas. The proposed relocation of this composting operation to the Buckland Park site was also assessed for noise. This is a rural area where the maximum permissible noise level between 7am and 10pm is 47 dB(A) at a receptor location. The nearest house to the proposed development is a thousand meters away. An earth embankment, two meters high and covered with trees and shrubs will enclose the composting site. Consequently, the noise level will be attenuated by the buffer zone distance to below the 47 dB(A) limit. The table(above) illustrates how boundary noise can be attenuated to below 47 dB(A) at only 100 meters distance.


Fig 1A. Compost dust concentration contours (24 hour avg.)
6160000m
6159500m
6159000m
6158500m
6158000m
6157500m
6157000m
6156500m
272500m
273000m
273500m
274000m
274500m
275000m
50ug/m3
100ug/m3
50ug/m3
50ug/m3
100ug/m3
50ug/m3
0m
500m
NEPM goal 50 ug/m3 5 days per annum

Fig 1B. Compost dust frequency plot (>50ug/m3, 24 hour avg.)

NEPM goal 50 ug/m3 5 days per annum

Fig2A. Compost dust concentration (ug/m3) 1 hour avg.

Fig 2B. Compost dust frequency plot (>300ug/m3, 1 hour

Appendix G

Odour Modelling Report

Odour modelling Buckland Park Organic Composting Facility

Report 03 - 0933

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Date: 24th September 2003

CONTENTS

LIST OF FIGURES

1. INTRODUCTION

Odour dispersion modelling was carried out to determine the odour impact from a proposed composting operation at Buckland Park. Modelling parameters were based on the existing Jeffries Garden Soils composting operation at Wingfield with guidance from the on-site operator Mr Rob McConnell.
The proposed composting operation involves 12 windrows within an operational area of 300 x 500 meters, with a net windrow area of 70,560m^2.
The initial analysis indicated that the Buckland Park proposal with a one kilometre buffer zone would not impact on residential development areas.
The SA EPA requested additional information in October 2001 on the odour modelling parameters and other reviewers also queried the modelling with regard to choice of meteorological file and the limited amount of sampling.
Since that time additional odour sampling has been completed with duplicate odour analyses to obtain a reliable conversion factor from the previous Vic EPA B2 odour unit to the current Australian Standard odour unit (AS 4323.3-2001).
This report has been expanded to include an odour plot at 98%ile as requested by the SA EPA. Ground-level odour maps are shown in AS 4323.3 odour units as specified by SA EPA Technical Bulletin 25 (TB25).

2. AUSPLUME MODELLING

Ausplume modeling was carried out with Ausplume version 5.4. Odour was modelled per TB 25 using conventional criteria including the 99.9 percentile level and a three-minute averaging period. An additional plot was also compiled at 98%ile with 1-hour averaging period, as suggested by SA EPA.

Meteorology
The meteorological data was collected for Year 2000 at Edinburgh RAAF base (located 8 kilometres from the proposed development) and compiled by the Victorian EPA as an Ausplume met.file for Enviroscan in January 2001 on a fee basis.

Raw Materials
The raw materials that will be composted at Buckland Park will be of the same type and proportion as currently being received at Jeffries Wingfield composting facility. Details of these materials are set out below:

Green Organics (80% by weight)
Green organics comprises materials such as:

- Kerbside collected material
- Arboreal materials
- Herbaceous materials

Wet Organics (20% by weight)
Wet Organics will consist of organic residues from food processing plants, processed grease trap waste and other similar materials.

Odour Emission rates

Duplicate odour analysis of windrow samples, during 2001, was carried out by dynamic olfactometry with the Vic EPA B2 method, and also the AS 4323.3-2001 method which was introduced during the course of this survey. Odour analyses were performed on the same samples by ETC, a NATA laboratory accredited for both odour methods, to derive a conversion factor of 1.26. This factor is used to convert Vic B2 data to the AS4323.3 odour unit as specified by TB25.

All odour data in this report are expressed in AS4323.3 odour units.

Composting windrows were sampled (Vic EPA flux hood Method B22) to obtain an odour emission flux of 26.46 and 30.87 OUV/m^2/minute for undisturbed and recently disturbed windrows respectively. Recently disturbed Windrows are defined as being ‘turned’ by tractor-mounted conveyor within the past two hours, amounting to 100x5m^2.

The odour emission rates from these windrow sources are respectively 31,116 and 258 OUV/s.

Discrete odour sources, typically 20 meters square or less, were observed at the Wingfield site, associated with compost screening and windrow turning activities. Duplicate sampling of these areas provided an average odour emission of 131 and 2066 OUV/s during working hours of 7am to 4pm.

Composting Operating Hours

Windrows are composted continuously over a twelve-week cycle with regular ‘windrow turning’ for temperature control. The localised ‘turning’ and screening operations are ordinarily restricted to daylight hours of 7am to 4pm. Odour dispersion modelling was carried out for a five-day week operation covering an 8 hour period (7am to 4pm) from Monday to Thursday and 16 hours (6am to 12 midnight on Friday), recognising four odour sources including windrows(disturbed and undisturbed), screening and windrow turning. A variable emission source file was compiled to cover this operating scenario.

ODOUR DISPERSION MODELLING RESULTS

Figure 1 (below) illustrates the predicted ground level odour (99.9%ile) for a weekly operation of 7am to 4pm Monday to Thursday, and 6am to midnight on Friday, totalling 48 hours per week. A variable emission source file was compiled for this scenario with the local Edinburgh meteorological datafile.

The 5 OU contour is restricted to within 500m of the site boundary. The nearest dwelling (sensitive receptor) is within the range of 1 to 2 OU, which is well below the 10 OU specified in TB25.

Figure 2 indicates the frequency of odour exceedances (more than 1 OU) with contours at 12, 26, 52 and 365 to indicate average monthly, weekly and daily events. This suggests odour recognition(>1 OU) at sensitive receptors on a weekly rather than daily basis, but at levels below the local rural community nuisance threshold.

Figure 3 shows the 1 OU contour is restricted to within 500m of the site boundary when modelled at the 98%ile level.

CONCLUSIONS

The proposed composting facility at Buckland Park is planned to operate in a similar manner to the current Wingfield operation and is surrounded by a one-kilometer buffer zone. The Ausplume modelling indicates that the buffer zone provides adequate odour dispersion to ensure that odour concentrations in residential areas will conform with the criteria for acceptable odour as set out in SA EPA Technical Bulletin No. 25 (TB25) and odour assessment guidelines.

Figure 1 demonstrates that the buffer zone around the composting site is more than adequate to ensure predicted odour (3-minute mean) for 99.9% of the time does not exceed 5 OU at single residences. This represents a substantial safety margin with respect to EPA TB25 guidelines.

The low frequency of these odour levels is unlikely to generate odour complaints in this rural area, located a few kilometers north of the Bolivar Sewage Treatment Plant.

Figure 3 indicates odour levels will be <1 OU (98%ile, 1-hr) at residences.

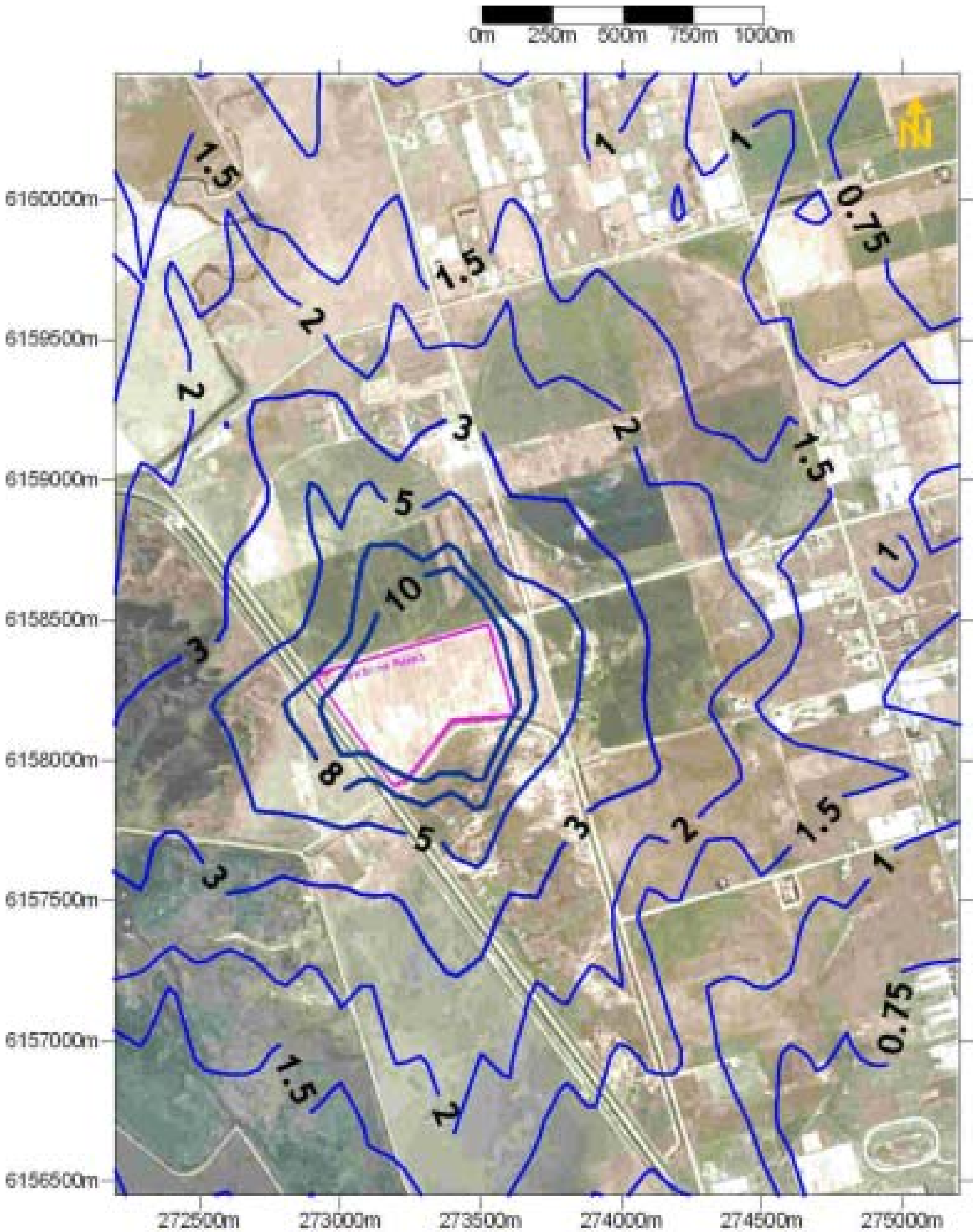

Fig.1 - Odour Ground level Concentrations (3 Min. 99.9%ile)
Contours at 0.75,1, 1.5, 2, 3, 4, 5, 8 and 10 OU

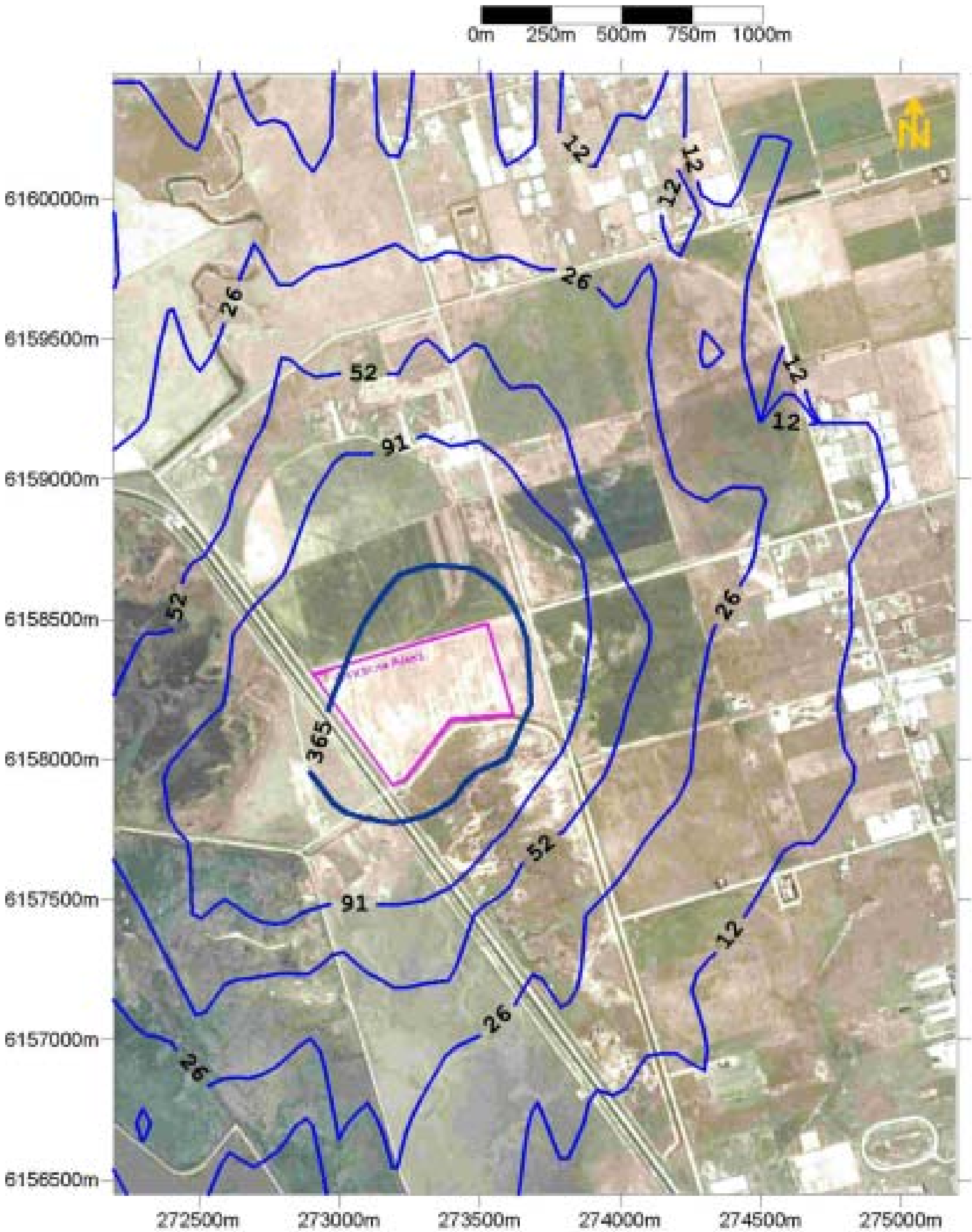

Fig.2 - Odour Frequency Plot with exceedances (> 1 OU)
contours at 12, 26, 52, 91 and 365 (3-Min.,99.9%ile)

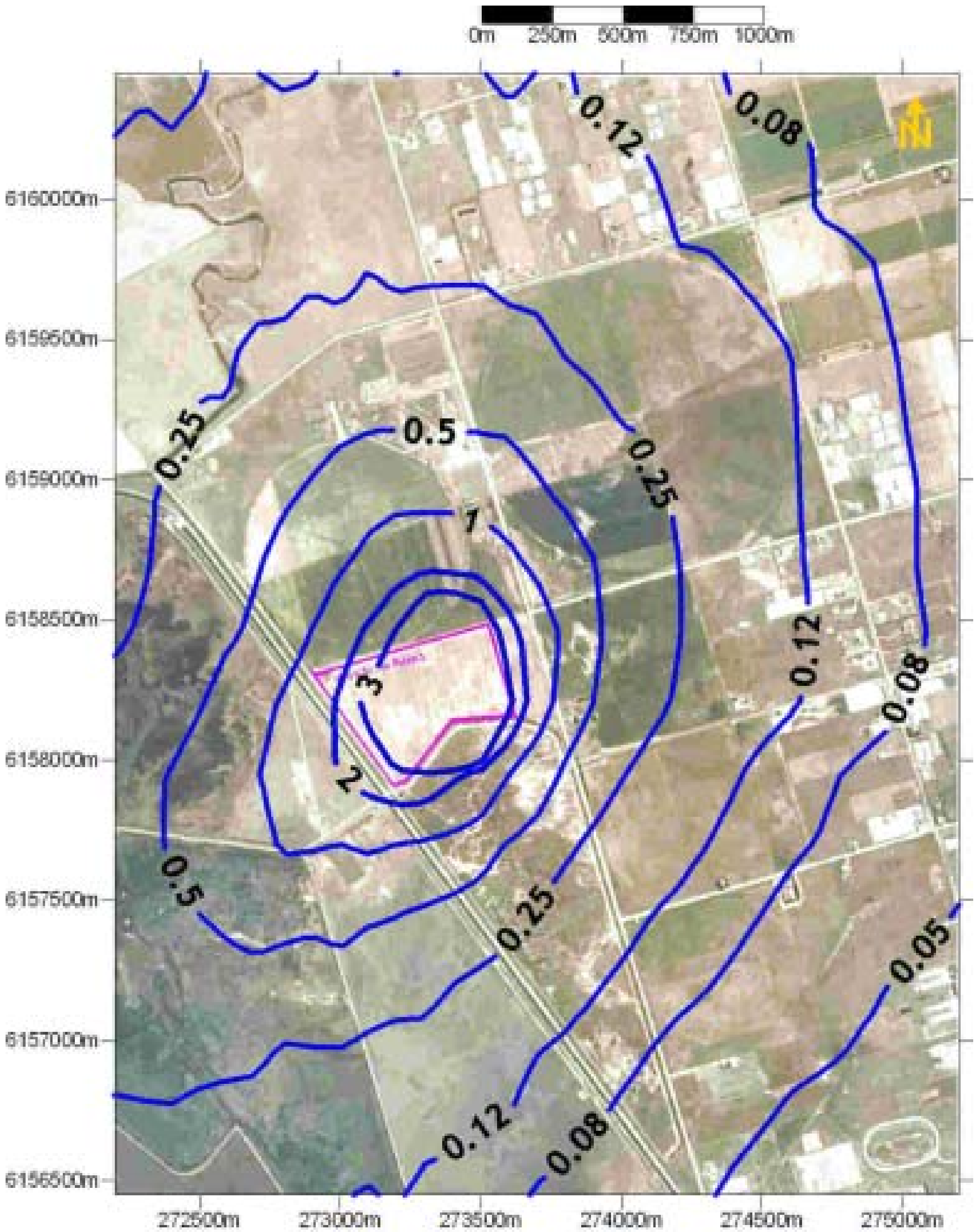

Fig.3 - Odour Ground level Concentrations (1 Hour. 98%ile)
contours at 0.05, 0.08, 0.12, 0.25, 0.5, 1, 2 and 3 OU.

Buckland Park Composting Site

Concentration or deposition	Concentration
Emission rate units	OUV/second
Concentration units	Odour_Units
Units conversion factor	1.00E+00
Constant background concentration	0.00E+00
Terrain effects	None
Smooth stability class changes?	No
Other stability class adjustments ("urban modes")	None
Ignore building wake effects?	Yes
Decay coefficient (unless overridden by met. file)	0.000
Anemometer height	10 m
Roughness height at the wind vane site	0.300 m

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high	Pasquill-Gifford
Vertical dispersion curves for sources <100m high	Pasquill-Gifford
Horizontal dispersion curves for sources >100m high	Briggs Rural
Vertical dispersion curves for sources >100m high	Briggs Rural
Enhance horizontal plume spreads for buoyancy?	Yes
Enhance vertical plume spreads for buoyancy?	Yes
Adjust horizontal P-G formulae for roughness height?	Yes
Adjust vertical P-G formulae for roughness height?	Yes
Roughness height	0.400m
Adjustment for wind directional shear	None

PLUME RISE OPTIONS

Gradual plume rise?	Yes
Stack-tip downwash included?	Yes
Building downwash algorithm:	PRIME method.
Entrainment coeff. for neutral & stable lapse rates	0.60,0.60
Partial penetration of elevated inversions?	No
Disregard temp. gradients in the hourly met. file?	No

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIME: 3 minutes.

SOURCE CHARACTERISTICS

VOLUME SOURCE: UNDISTURBED WINDROW

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
273400	6158250	0m	2m	100m	1m

(Constant) emission rate = 3.11E+04 OUV/second
Hourly multiplicative factors will be used with this emission factor.
No gravitational settling or scavenging.

VOLUME SOURCE: DISTURBED WINDROW

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
273500	6158250	0m	2m	25m	1m

(Constant) emission rate = 2.57E+02 OUV/second
Hourly multiplicative factors will be used with this emission factor.
No gravitational settling or scavenging.

VOLUME SOURCE: SCREENING PLANT

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
273455	6158270	0m	2m	1m	1m

(Constant) emission rate = 1.31E+02 OUV/second
Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

VOLUME SOURCE: WINDROW TURNING

X(m)	Y(m)	Ground Elevation	Height	Hor. spread	Vert. spread
273450	6158260	0m	2m	1m	1m

(Constant) emission rate = 2.07E+03 OUV/second
Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
272200.m 272300.m 272400.m 272500.m 272600.m 272700.m 272800.m
272900.m 273000.m 273100.m 273200.m 273300.m 273400.m 273500.m
273600.m 273700.m 273800.m 273900.m 274000.m 274100.m 274200.m
274300.m 274400.m 274500.m 274600.m 274700.m 274800.m 274900.m
275000.m 275100.m 275200.m

and these y-values (or northings):
6156450.m 6156700.m 6156950.m 6157200.m 6157450.m 6157700.m 6157950.m
6158200.m 6158450.m 6158700.m 6158950.m 6159200.m 6159450.m 6159700.m
6159950.m 6160200.m 6160450.m

METEOROLOGICAL DATA : BoM Edinburgh DATA Adelaide clouds and Upperair Rough

HOURLY VARIABLE EMISSION FACTOR INFORMATION

The input emission rates specfied above will be multiplied by hourly varying factors entered via the input file:
C:\AUSPLUME\03-0415_Buckland\Data\buckland.src
For each stack source, hourly values within this file will be added to each declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Variable Emission Compost

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

Prefix UNDIST allocated: UNDIST
Prefix DIST allocated: DISTUR
Prefix SCREEN allocated: SCREEN
Prefix WTURN allocated: WTURN

Peak values for the 10 worst cases (in Odour_Units)
99.9%ile, Averaging time = 3 minutes

Rank	Value	Time Recorded hour,date	Coordinates (* denotes polar)
1	4.98E+01	22,12/03/00	(273400, 6158200, 0.0)
2	4.98E+01	23,12/03/00	(273400, 6158200, 0.0)
3	4.90E+01	24,02/07/00	(273400, 6158200, 0.0)
4	4.64E+01	06,21/05/00	(273300, 6158200, 0.0)
5	4.58E+01	01,31/05/00	(273400, 6158200, 0.0)
6	4.58E+01	22,05/06/00	(273400, 6158200, 0.0)
7	4.58E+01	03,26/10/00	(273400, 6158200, 0.0)
8	4.58E+01	04,26/10/00	(273400, 6158200, 0.0)
9	4.54E+01	02,17/03/00	(273400, 6158200, 0.0)
10	4.54E+01	21,17/05/00	(273400, 6158200, 0.0)

Peak values for the 10 worst cases (in Odour_Units)
98.0%ile, Averaging time = 1 Hour

Rank	Value	Time Recorded hour,date	Coordinates (* denotes polar)
1	5.65E+01	22,12/03/00	(273400, 6158200, 0.0)
2	5.65E+01	23,12/03/00	(273400, 6158200, 0.0)
3	4.50E+01	01,31/05/00	(273400, 6158200, 0.0)
4	4.50E+01	22,05/06/00	(273400, 6158200, 0.0)
5	4.50E+01	03,26/10/00	(273400, 6158200, 0.0)
6	4.50E+01	04,26/10/00	(273400, 6158200, 0.0)
7	4.47E+01	05,14/02/00	(273400, 6158200, 0.0)
8	4.47E+01	06,14/02/00	(273400, 6158200, 0.0)
9	4.47E+01	22,31/03/00	(273400, 6158200, 0.0)
10	4.47E+01	19,17/05/00	(273400, 6158200, 0.0)

Appendix H

Storm Water Management Report

Prepared by:
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Hydrologist & Water Systems Planner

STORMWATER MANAGEMENT REPORT
FOR
PROPOSED RECYCLABLE ORGANICS FACILITY
AT
BUCKLAND PARK

(Plus Addendum)

Prepared by: Richard Clark, M.A., D.I.C. (Hydrology), Richard Clark & Associates, 18 July 2003

6 August 2003

STORMWATER MANAGEMENT REPORT

1. Objectives and Strategy

Runoff from the site will be collected in excavated storage basins to avoid off site discharges and to assist in meeting on-site water demands (particularly for irrigation of the windrows to maintain their optimum moisture content).

It is necessary to determine the minimum size of the storages to ensure that off-site discharge does not occur in any storm with an average probability of recurrence of more than once in any 100 year period.

The nature of the surfaces on the site makes estimation of the amount of runoff uncertain. Since the site will be developed in stages a conservative estimate has been made of the system design for the first stage. Monitoring of the system performance will enable more accurate estimates to be made for the adjustment of the design when later stages are added.

2. Site Levels

The northern boundary of the site is close to the highest point of a low ridge running E-W. The site slopes gently to the SSW towards a main regional drain which follows the E-W southern boundary. An embankment will be constructed parallel to this drain so that any site runoff will collect against the embankment and will not enter the drain.

Groundwater levels beneath the site are 1.5 to 2 m below natural surface. A pond could therefore be excavated on the lowest land in the SSW corner of the site, near the southern drain, but its deepest part should not be greater than about 0.5 m below the invert of the drain without risk of draining highly saline groundwater into the pond. A pond in this vicinity with average depth of 1 m would have a top surface area in m^2 equal to its volume in Kl. An area of 25,000 m^2 has been allocated in the SSW corner for water storage which implies a storage of approximately 25,000 Kl or 25 Ml.

3. Potential External Flood Risk Sources

The risk of flooding on the site has been assessed in terms of runoff generated from areas external to the site and from runoff from within the site itself.

Potential external sources of flooding are identified as:

- The Gawler River
- Runoff carried by the drains along the S and W boundaries of the site from upstream areas
- Runoff from local areas around the site

With respect to these:

- The site is on land designated as above the 100 year flood level of the Gawler River. Due to its extensive inland catchment, under normal rainfall conditions, flood peaks on the Gawler River will generally lag behind rainfall occurring in the vicinity of the development site by 1 to 2 days. Hence flood flows from the Gawler River are unlikely to coincide with local flood peaks.

- Flow carried by the drain along the southern boundary is generated from:
  i) hillsface and urban areas in the Smithfield area, and
  ii) rural runoff and groundwater drainage in its lower reaches.

  The Fradd Road and Andrews Farm stormwater storage basins have been designed to mitigate the upstream hills face and urban flood contributions, up to the once in 100 year level. Due to the low slopes and large areas of soil tillage, runoff from the downstream rural areas is rare. Due to the topography and capacity restrictions of the drain, it is likely that any major flood flows in excess of the capacity of the drain will overflow the drain well above the site and flood out over the surrounding land. Thus the drain is not expected to carry water to any depth in excess of its bank height in the vicinity of the site. In view of the additional embankments to be constructed on the site, flooding from this source is deemed to not be likely to occur for events with an average probability of recurrence of more than once in 100 years.

- Local flooding (eg via local heavy rainfall on land to the south of the site) may pond on the surface and move slowly north to lower lying land just to the south of the site. This ponded water will drain slowly via culverts through the Government road embankment into the north flowing drain. The embankment along the southern boundary plus the greater drain depth along the western boundary will protect the site from inundation in severe flood events.

The site is elevated relative to surrounding areas and is therefore not subject to ponding from external runoff. The existence of the drains, embankments and the proximity to the Thompson Creek and sea outlet provide well defined paths for drainage of flood waters away from the vicinity of the site. Moreover, the existence of the 2 m high embankment surrounding the site will exclude external flood waters from entry.

4. Internal Area Runoff Surfaces, Drainage, Collection and Storage.

The site is 25.8 ha (258,000 m^2). The natural soils are described as sandy clays. The area will be developed in stages with the soils being replaced by modified surfaces. The surface types and areas for Stage 1 have been split into two zones, ie, the Composting Zone to the west and the Non Composting Zone to the east. Runoff and infiltration from the Composting Zone are of greater concern in water management because of the potentially higher organic content of this water.

The composting zone will be totally underlain by compacted rubble (over compacted soil). The parallel windrows will each be about 3 m high, 7 m across the base and about 270 m long. Access roads between the windrows will be 3 m wide.

From the viewpoint of modelling the runoff from the site, the surfaces and areas within the two Zones are assumed to comprise:

Composting Zone

- The 3 m wide access roads between the windrows and around the edges. The areas are 24,000 m^2 between the windrows and 3,000 m^2 for edge roads (total 27,000 m^2). To be conservative it is assumed that these will be free of compost, which would otherwise may soak up initial rainfalls and reduce the amount of runoff generated from these areas.
- The 3 m high , 270 m long windrows with 7 m wide bases will be stacked N-S on the rubble base. The plan area of the windrows is 56,000 m^2.

Non-Composting Zone

- Roofs associated with the administration, workshop and receival areas: 3,000 m^2.
- Compacted rubble areas for general traffic/ pre-processing works/ admin/ maintenance areas, access outside the windrow area (approx 7,500 m^2 in Stage 1)
- Surrounding landscaped areas, embankments, swales (approx 92,000 m^2).
- Undeveloped remaining ‘natural’ areas (74,000 m^2). This includes the area set aside for water storage (25,000 m^2).

These areas will shed water in different amounts and at different rates. The quality of the water is expected to be suitable for use on the site.

The runoff from the Composting and Non-Composting Zones will be initially collected in separate storage basins, partly excavated and partly formed by embankments. The pond containing runoff from the Non-Composting area will be at a higher elevation. Under normal circumstances runoff will be directed to the Composting Zone (larger) basin.

Initial investigations have shown that the greatest requirement for storage capacity will arise from the accumulative effects of winter runoff over several months during which time inflow to the storage basins would be greater than the offtake for irrigation of the windrows.

The WaterCress model (Reference) has been used to generate estimates of daily runoff from the surfaces and hence to calculate the required storage volumes of the basins, after removal of evaporation and withdrawals of water for irrigation. The model facility to vary the withdrawal rate according to season and the current moisture status has been used. In order to obtain indications of the moisture holding capacity and rate of movement of water through the compost an experiment was undertaken as described in Section 5 below.

In general the sum of the annual evaporation and withdrawals for irrigation from the basins is greatly in excess of the inflows. However during some winters the rates of inflow exceed the offtakes. The model has been used to run 113 years of daily rainfall through the water balance model in order to investigate the size and frequency of the periods of excess inflow and to determine the maximum storages that occurred. The size of the storage basins to be established will be based upon the largest volumes that are indicated by the modelling.

5. Results of Experiment.

Compost was placed into a 1.6 m high 0.57 m dia drum with drain holes at the base. The compost was taken from an 'active' pile and had been subject to relatively heavy rainfall over the previous days. The moisture content varied from dry (and hot) to moist but not saturated. A measured flow rate was applied at the top of the drum and it was noted that it took 18 minutes before there was flow from the base of the drum. The flow rate and volume from the base was then measured over the next 1.5 hours to the point that the outflow had virtually ceased. The difference between the input and output volumes represented 12.7 % of the volume or about 200 mm of moisture over the depth of the column. The rate of flow through the compost was of the order of 9 m^3/min.

The results were used to assist with the establishment of a model procedure to estimate runoff from the compost piles under heavy rainfall conditions.

6. Rainfall and evaporation

A daily rainfall record from 1884 to 1996 has been prepared by combining two records from the Virginia area. The rainfall over the period modelled is 436.7 mm/a. The records used have had all gaps filled and all weekend totals disaggregated.

The evaporation (mm/day) for Adelaide is shown below. This has been assumed in runoff modelling.

J	F	M	A	M	J	J	A	S	O	N	D
8.1	8.1	5.7	4.2	2.8	2.1	2.0	2.2	3.0	4.4	6.3	7.5

The loss from moisture contained within the compost pile is assumed to be twice that above.

7. Calculation of Daily Flows

For the purpose of runoff calculation five different surface types and two different runoff models have been used. The different surface are identified below in decreasing runoff potential:

- Roofs
- Compacted rubble
- Landscaped areas
- Natural soil areas
- Compost piles

Because of the relatively impervious nature of the roof and rubble surfaces, a simple model can be used. Runoff is calculated as:

Runoff (Kl) = (Rainfall (mm) – IL)*Area (m^2)*CL/1000 when rainfall > IL
Or Runoff = 0 when rainfall < IL
Where IL is an initial loss from rainfall for surface wetting and filling depressions and CL is a continuing loss after runoff is initiated. With values of IL of about 1-3 mm/day, CL of about 0.9, and typical rainfalls up to 10 mm/day (and more), these surfaces provide relatively large volumes of runoff.

The calculation of runoff from the other surfaces is complicated by their much more pervious nature. The surfaces only runoff when they have become sufficiently wetted to form areas of saturation. These typically take long periods of rainfall to become fully established. Because of the intermittent nature of the rainfall and effects of draining to lower levels and drying by evaporation, a complex calculation involving up to 12 coefficients is used. The more pervious is the surface (and the less potential for runoff) the more complex becomes the calculation method.

The coefficients in all models have been chosen to give values expected for that type of surface under local conditions for the expected:

- average runoff depth over the surface over the period of modelling, and
- distribution of flow rates across the range of flows and at expected frequencies.

The results of modelling are given below:

Surface	Area m^2	Runoff Volume Kl	Runoff Depth mm	Runoff as % of Rainfall
Composting Zone				
Rubble	27,000	6750	250	57
Windrows	56,000	210	3.8	0.9
Non-Composting Zone				

Roofs	3,000	1190	396	91
Rubble	7,500	1875	250	57
Undeveloped areas	74,000	350	4.8	1.1
Landscaped areas	90,500	90	1.0	0.2
Total	258,000	10,465		

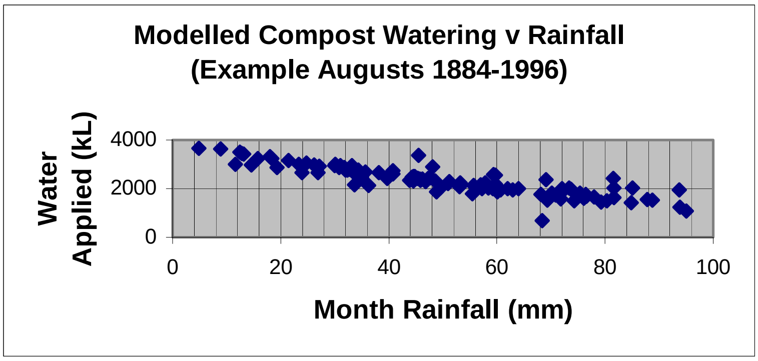
8. Irrigation Water Use

Water will be pumped out of the Compost and Non-Compost Zone ponds for irrigation of the windrows. An average rate of moisture supplement is taken as 0.25 Kl/m^3 of compost over the 12 week composting cycle. For 80,000 m^3 of compost (which represents the design storage capacity for Stage 1) over 4 composting cycles per year, the requirement is 80,000 Kl/a. A seasonal irrigation-type pattern has been assumed as given in the table below.

J	F	M	A	M	J	J	A	S	O	N	D
.125	.125	.100	.065	.060	.050	.050	.060	.065	.080	.100	.125

The winter rate of irrigation is high because the internal heating caused by the compost degradation still exists in winter. However part of the irrigation requirement at this time of year is provided by rainfall. For this reasons the amount of irrigation water supplied is made a function of rainfall. The variation in the amounts applied in the model system simulation under different rainfalls for the month August is shown in Figure 1. Other months will have similar relations between rainfall and amounts of irrigation water applied.

Figure 1



The rate of irrigation has a significant impact on the amount of storage capacity required in the ponds. The assumption of an inverse relation between the amount of irrigation water to be supplied and the amount of rainfall increases the amount of storage space required.

9. Storage Capacity Required.

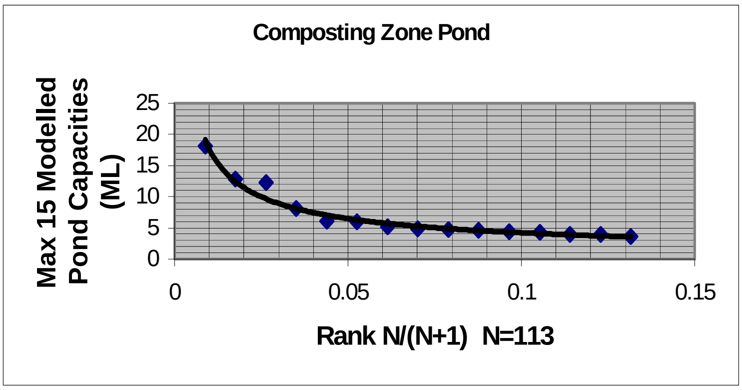
Estimation of the 25 year ARI Storage Pond Capacity

The model was run using the historic rainfall record on the assumption that this will provide results that will represent future probabilities of occurrences. It was run over 113 years, thus 113 values of the annual maximum pond capacities for the two ponds are available. These have been ranked from largest to smallest and the 15 largest are shown in Table 1.

Table 1, 15 Largest Storages Calculated, Ranked in Descending Order

	Non-Composting Zone Pond		Composting Zone Pond			
Rank	Ml	Year	Ml	Year	N/(N+1)	Ml
1	5	1889	18.12	1923	0.008772	18.12
2	5	1890	12.83	1890	0.017544	12.83
3	5	1909	12.29	1889	0.026316	12.29
4	5	1910	8.15	1996	0.035088	8.15
5	5	1923	6.12	1941	0.04386	6.12
6	4.9	1916	6.01	1966	0.052632	6.01
7	4.58	1942	5.19	1916	0.061404	5.19
8	3.53	1951	4.81	1974	0.070175	4.81
9	3.36	1978	4.78	1909	0.078947	4.78
10	3.2	1992	4.58	1930	0.087719	4.58
11	2.62	1893	4.38	1929	0.096491	4.38
12	2.54	1963	4.24	1951	0.105263	4.24
13	2.51	1906	3.96	1946	0.114035	3.96
14	2.35	1996	3.95	1910	0.122807	3.95
15	1.95	1986	3.65	1893	0.131579	3.65

Graph 1, 15 Largest Annual Composting Zone Storages



Graph 1 shows the capacities of the 15 largest capacities for the Composting Zone Storage plotted against proportional rank order N/(N+1), where N = 113. On this scale the 25 year ARI event will plot at 1/26 = 0.0385. A fitted curve (Capacity = 1.0072*(Rank N/(N+1)) ^ -0.6217) is shown fitted to these points. A capacity of 7.5 Ml is indicated as required for the 1 in 25 ARI event.

The 5 largest capacities for the Non-Composting Zone pond are all equal to the maximum assumed design capacity of 5 Ml. When the same process is applied to these results the 25 year ARI event will still remain at 5 Ml.

Hence the total storage required at the 1 in 25 ARI level is 12.5 Ml.

10. Conclusions and Recommendations

The amount of on site storage capacity to be provided for a 1 in 25 ARI to ensure that no stormwater discharges from the site is of the order of 12.5 Ml. The calculations made have assumed that 5 Ml of this is allocated to capturing runoff from the Non-Composting Zone and of the order of 7.5 Ml should be allocated to capturing runoff from the Composting Zone.

The runoff from the site is highly variable. In the median year the storage required is only 1.5 Ml in the Composting Zone Pond and 0.75 Ml in the Non-Composting Zone. For many years the amounts entering the storage basin will be small. It is only in infrequent years that the storage required is at the high levels calculated.

It is recommended that the volume to depth relation for the two ponds be accurately surveyed and the level of the water in the basins be recorded and reported as part of the licencing regime for the undertaking. The amounts running off from the site can then be checked against the amounts calculated and presented here-in. The storage basins should be resurveyed every 5 years to ascertain whether siltation has occurred.

ADDENDUM

The following information was provided by the author in response to the changed windrow configuration, ie, no gap between adjoining windrows (apart from those required for drainage)

Revised Areas and Layout

Previous areas and calculated runoff were:

Surface	Area m2	Runoff Volume kL/a	Runoff Depth mm	Runoff as % of Rainfall
Composting Zone				
Rubble	27,000	6750	250	57
Windrows	56,000	210	3.8	0.9
Non-Composting Zone				
Roofs	3,000	1190	396	91
Rubble	7,500	1875	250	57
Undeveloped areas	74,000	350	4.8	1.1
Landscaped areas	90,500	90	1.0	0.2
Total	258,000	10,465		

The revised areas within the Composting Zone are now Rubble = 3640 m2 and Windrows = 45,500 m2. The windrows are now to be packed closely with no rubble access road between.

The reduction in area contributing to the main drainage pond (33860 m2) is assumed to be compensated by an equal increase in the Undeveloped (natural soil/vegetation) area draining to the Non-Composting Zone drainage pond which will therefore now be 107,860 m2.

The effect of the changes will be:

- A reduction in total runoff and in typical peak runoff rates due to the reduction in area of the rubble surface, which has the greatest runoff efficiency (other than the small area of roofs). However the enlarged Undeveloped area will still produce infrequent but high runoff rates in extreme rainfall situations (eg events with ARI 1 greater than 1 in say 50 years). The increase in the Undeveloped area at the expense of Rubble area increases the variability of runoff, thus the storage capacity required in the main storage pond to cater for extreme events is still high.
- The close packing of the windrows will restrict their ability to drain laterally (over the 3.5m half width of the windrow) into and then down the previous ‘open’ access roads. The effect of ‘choking’ these free drainage paths will be to hold back any rainfall infiltrating through the windrows in heavy and prolonged rainfall events (particularly

through the shallower adjacent windrow edges) and thus to increase the water held in storage within the windrows. The rate of drainage out of the windrows will therefore be considerably restricted to the circumference only.

Thus, except for the Windrows area, the previous runoff models were adopted and re-run with the same assumptions for conversion of rainfall to runoff, but with revised areas. For the Windrows the runoff model was revised to reduce the rate of drainage from the infiltrated water reaching the base of the windrows by 5 times and to add a requirement for the storage in the base of the windrows to reach an additional 50 mm greater depth before drainage commenced. These changes have the effect of reducing and slowing the drainage from the Windrow area.

The revised runoff figures are:

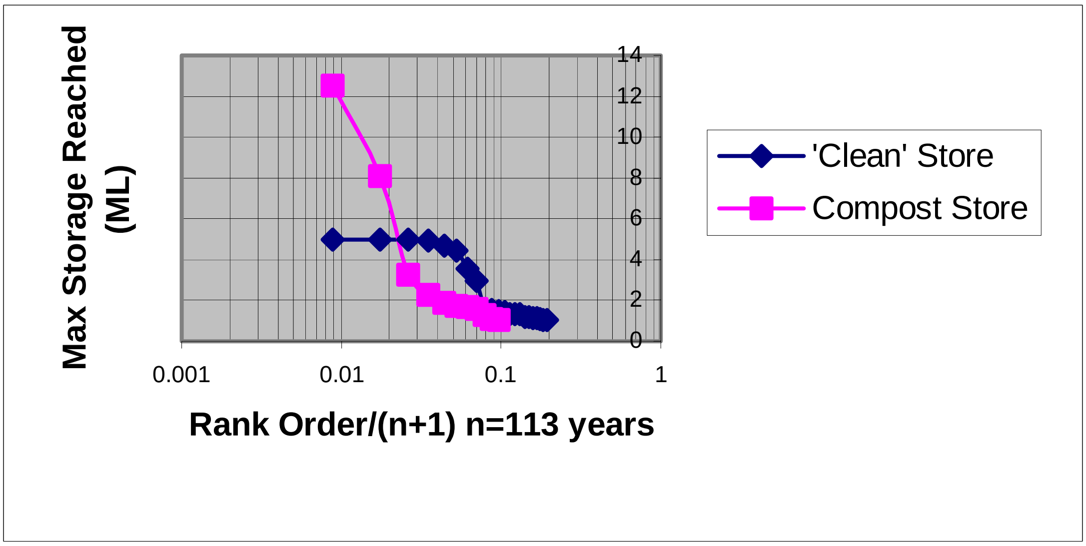
Surface	**Area m2**	**Runoff Volume kL/a**	**Runoff Depth mm**	**Runoff as % of Rainfall**
Composting Zone				
Rubble	3640	910	250	57
Windrows	45,500	98	3.8	0.9
Non-Composting Zone				
Roofs	3,000	1190	396	91
Rubble	7,500	1875	250	57
Undeveloped areas	107,860	511	4.8	1.1
Landscaped areas	90,500	90	1.0	0.2
Total	258,000	4674		

It can be seen that the total runoff has been more than halved, although the runoff from the Non-Composting Zone has risen slightly.

The attached Table and Graph shows the maximum storage attained within the Main (Composting) and Sub (Non-Composting) Stores. It can be seen that the Sub-Store will now contain storage more often than the Main-Store. The Main Store only rarely fills greater than 1 ML.

The calculations of storage assume that irrigation of the windrows is as before (no reduction has been made in the rate of removal of irrigation water from the storages.

SubStr Search Max's	Date	MainStr Search Max's	Date	n = 113 n/n+1	SubStr Max's	MainStr Max's
5	17-6-1889	12.54	1/10/23	0.008772	5	12.54
5	8-7-1890	8.08	27-8-1890	0.017544	5	8.08
5	17/07/23	3.23	13-9-1889	0.026316	5	3.23
4.91	15/09/09	2.28	8/01/96	0.035088	4.91	2.28
4.67	23/09/42	1.86	1-1-1884	0.04386	4.67	1.86
4.43	29/08/16	1.75	30/08/09	0.052632	4.43	1.75
3.57	11/08/51	1.67	31/01/41	0.061404	3.57	1.67
2.97	10/08/10	1.56	5/08/16	0.070175	2.97	1.56
1.53	30-6-1893	1.29	5/02/74	0.078947	1.53	1.29
1.51	2/02/41	1.06	2/01/30	0.087719	1.51	1.06
1.48	11/10/92	1.03	22/11/64	0.096491	1.48	1.03
1.41	1/02/74			0.105263	1.41	
1.35	1/08/96			0.114035	1.35	
1.34	19/06/52			0.122807	1.34	
1.31	11/07/20			0.131579	1.31	
1.19	4/12/66			0.140351	1.19	
1.18	28/12/29			0.149123	1.18	
1.15	7/11/39			0.157895	1.15	
1.11	21/06/88			0.166667	1.11	
1.06	25/08/86			0.175439	1.06	
1.02	19/02/46			0.184211	1.02	
1.02	17/09/60			0.192982	1.02	



Appendix I

Groundwater Investigation Report
and
Groundwater Monitoring Program

REPORT

CONCEPTUAL HYDROGEOLOGICAL MODEL

ORGANIC RECYCLING FACILITY

BUCKLAND PARK

10 OCTOBER 2003

DOC. NO.: SG031072

REVISION 2

FOR

JEFFRIES

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EXECUTIVE SUMMARY

Soil and Groundwater Pty Ltd (S&G) was appointed by Jeffries Pty Ltd to undertake a groundwater investigation and develop a conceptual understanding of the hydrogeology at the proposed organic recycling facility at Buckland Park, South Australia. The aims and objectives of the assessment were to:

- Assess the 'baseline' groundwater quality at the site prior to occupation by Jeffries;
- Develop a conceptual understanding of the hydrogeology at the site;
- Consider possible impact of infiltration of surface waters to groundwater; and
- Provide recommendations for on-going monitoring and management.

A total of seven groundwater monitoring wells were installed at the site into the shallow aquifer. A range of physical and chemical tests was performed, at these sampling locations, to measure the baseline conditions and gain an understanding of the hydrogeological conditions at the site.

Baseline Groundwater Quality

Elevated concentrations of total nitrogen and phosphorus were measured in wells across the site, suggesting the likely effect of historic irrigation and application of fertilizers in the region, or associated with the former use of the site for dairying. At most locations, the dominant form of nitrogen was nitrate and the dominant form of reduced nitrogen was organic nitrogen. At two locations, ammonia was found to be the dominant reduced form of nitrogen.

Chemical Oxygen Demand (COD) is elevated in all wells while BOD is very low. This indicates that there is a low biological demand for the material dissolved in the groundwater but that these compounds, while not biodegradable, have a high oxygen demand for their chemical degradation. The source of the elevated COD was not apparent.

Concentrations of pesticides in groundwater at the site were below the laboratory detection limits and heavy metals are at low concentrations and are consistent in all wells, indicating these may be representative of background aquifer conditions.

The total dissolved solids (TDS) ranged between 10,900 mg/L to 58,900 mg/L. TDS concentrations greater than 20,000 mg/L were reported along the southwestern site boundary, where the site is bordered by Penrice.

Conceptual Hydrogeological Model

The results provided the following understanding of the hydrogeology at the site:

- The underlying soil profile consists of Quaternary aged sediments including interbedded sands and clays, but predominantly clay (Hindmarsh Clay unit).

- Whilst other aquifers are present at greater depths, it is considered that this shallow aquifer is the most relevant for monitoring for potential groundwater contamination issues associated with proposed surface activities at the site.

- The shallow groundwater quality is brackish to saline and therefore is likely to be limited to predominantly maintenance of ecosystems and possibly some limited irrigation or industrial uses.

- The high salinity of the groundwater, particularly along the southwestern corner of the site, is likely to be related to the evaporation ponds operated by Penrice, and indicates that the potential salinisation risks in the area must be carefully managed.

- The TDS concentrations for the remainder of the site is generally greater than 10,000 and less than 20,000 mg/L.

- The watertable is shallow and typically occurs at a depth of less than 2.0 m below surface. Lower relative water levels were measured in well BH04 (approximately 2 to 3 m below water levels in surrounding wells). The available data does not resolve the reason for the low groundwater levels encountered in this well. Further monitoring will be required to establish if this is temporal variation relative to other wells or if this behavior is persistent.

- The groundwater flow direction is generally from the north to the south with components of flow both to the south east and south west. The hydraulic gradient is estimated to be in the range of 0.0002 m/m (0.02%) to 0.0005 m/m (0.05%) indicating a very low hydraulic gradient through the site.

- A stormwater drain is located on the southern portion of the site. It is our understanding that the earthen drain located at the southern boundary of the site is for stormwater management. Based on survey measurements taken of the base of the drain, the drain invert is approximately 1 m above the groundwater table. Therefore, groundwater is unlikely to discharge to this drain unless the significant increases in groundwater levels are observed. The regional receiving surface water body is considered to be Gulf St. Vincent, which is located approximately 5 km to the south southwest, (hydraulically down gradient) of the site.

- The estimated hydraulic conductivity results indicate a range of aquifer conditions across the site, with hydraulic conductivity in the range of 0.07 to 2.3 m/day. The calculated hydraulic conductivities are consistent with observations made during the purging and sampling of the wells. The high aquifer hydraulic conductivity noted at BH07 was consistent with the sandy formation noted at this location. Only relatively small volumes of water were extracted from well BH05 and BH06, consistent with the low hydraulic conductivities estimated at these locations.

- The porosity of the matrix was assumed to be 0.25 based on literature values for this material. Based on the available data, the seepage velocity of the groundwater was estimated to be between approximately 0.02 and 1.6 m/year.

- Analyses of major ion chemistry between the wells also indicates that the groundwater across the site is of the same composition.

Possible Impact of Infiltration of Surface Waters

The proposed dams at the site are to be constructed with an engineered low permeability liner. This will restrict the leakage of water from the dam and minimise the potential for groundwater mounding to develop.

It is noted that a dam currently exists on the northeastern portion of the site. Whilst it is acknowledged that there is no groundwater monitoring well located directly adjacent to the existing dam, there is no visual evidence that leakage from this dam is causing groundwater mounding in the immediate area leading to degradation of the land adjacent to the dam. The proposed dam will be constructed within a similar geological and hydrogeological environment. Since the proposed dam will have an engineered low permeability liner, which would be expected to be superior to that in the existing dam, the potential for the proposed dam to significantly impact of the environmental value of the groundwater resource in the area is considered to be low.

The re-circulation of water from the proposed dam to the compost windrows will serve to keep the level of water in the dam at its lowest possible level, thereby further minimizing any potential for water infiltration through the engineered liner.

Recommendations for On-going Monitoring and Management

It is suggested that an agreed groundwater monitoring program be established and implemented to monitor the shallow groundwater system following any topside development.

This would provide additional time series data on the influence of the existing dam, and the proposed stormwater dams, as well as an understanding of temporal groundwater and hydrochemistry trends at the site. Analytes should include as a minimum nutrients (ammonia, total N, total P and TKN), COD and TDS.

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

DOCUMENT INFORMATION

Rev.	Status	Date	Company	Name
0	Draft	July 2003	Jeffries	Mr Lachlan Jeffries
			Soil & Groundwater Consulting	File
1	Final	August 2003	Jeffries	Mr Lachlan Jeffries
			Rodenburg Davey & Associates	Mr Rob Rodenburg
			Soil & Groundwater Consulting	File
2	Final (minor amendments)	10 October 2003	Jeffries	Mr Lachlan Jeffries
			Rodenburg Davey & Associates	Mr Rob Rodenburg
			Soil & Groundwater Consulting	File

1. INTRODUCTION

Soil and Groundwater Pty Ltd (S&G) was appointed by Jeffries Pty Ltd (Jeffries) to undertake a groundwater investigation and develop a conceptual understanding of the hydrogeology at the proposed organic recycling facility at Buckland Park, South Australia.

1.1 Aims & Objectives

The aims and objectives of the assessment were to:

- Assess the 'baseline' groundwater quality at the site prior to occupation by Jeffries;
- Develop a conceptual understanding of the hydrogeology at the site;
- Consider possible impact of infiltration of surface waters to groundwater; and
- Provide recommendations for on-going monitoring and management.

2. BACKGROUND INFORMATION

2.1 Site Layout

The site is bounded by Thompson, Brooks and Beagle Hole Roads to the north, east and west respectively and by a drain to the south. The site is transected from east to west by McEvoy Road, which provides the entrance to the southern section of the property where the organic recycling operation is proposed to be located. The remainder of the site, to the north of McEvoy Road, currently comprises a centre pivot irrigator and a water storage dam.

The neighboring site features include:

- Southern and western site boundaries are occupied by Penrice. The Bolivar outfeed channel traverses parallel to Beagle Hole Road.

- Properties to the north and east of the site are used for agricultural use. Thompson Creek is located along the northwestern corner of Thompson Road.

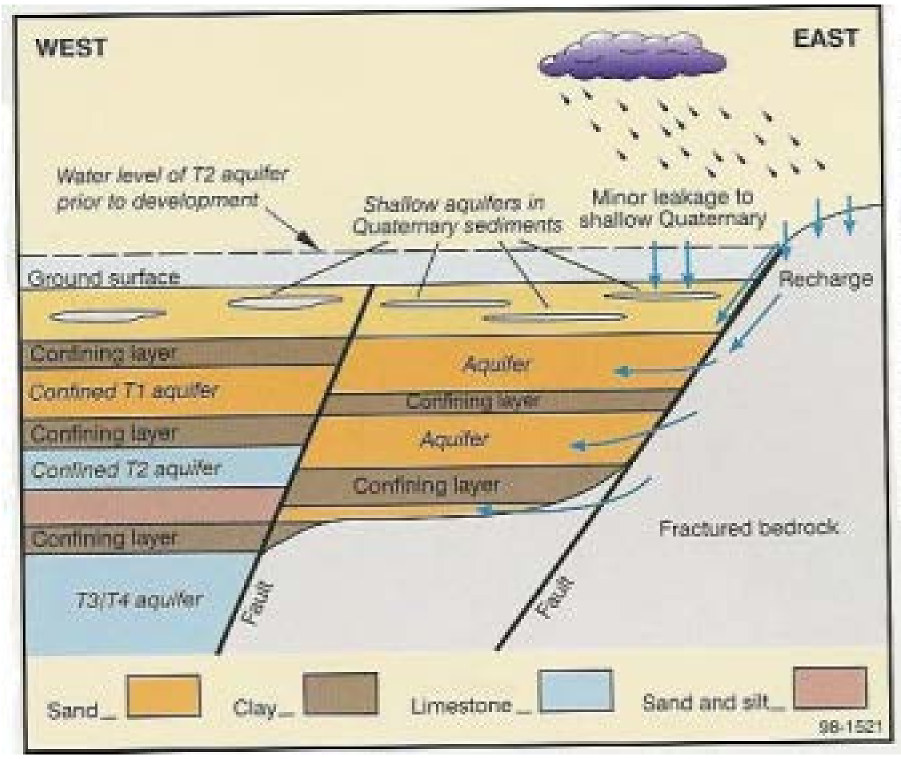
2.2 Site Geology & Hydrogeology

The site is located within the Northern Adelaide Plains geological province. The geology of the plains consists of unconsolidated Quaternary age sediments comprising sands and clays of the Pooraka Formation and Hindmarsh Clays.

The Quaternary aged sediments generally comprise of a sequence of thin interbedded coarse-grained units within an overall low permeability clayey matrix. The sequence is typically mottled red brown sandy clay with sand and gravel lenses. The Hindmarsh Clay is early to late Pleistocene in age and was formed from alluvial fan, fluvial and continental lacustrine deposits. The coarse-grained horizons form local aquifers and are typically referred to as the Q1 to Q6 aquifers, with the number designation increasing with depth. The salinity in the Quaternary aquifers is generally quite saline, except near the Little Para and Gawler Rivers, which provide local recharge of freshwater.

The Quaternary sediments overly Tertiary age limestones and sandstones (Hallett Cove Sandstone, Port Willunga Formation and the South Maslin Sands) that form the most significant aquifers in this region. These deep aquifers, occurring at depths typically greater than 100 m below the surface, are referred to as the T1 and T2 aquifers. These deep Tertiary aquifers are separated from the shallower aquifer sequences by the confining layer of the Hindmarsh Clay.

A diagrammatic cross section of the Northern Adelaide Plains showing the regional aquifers and confining layers is shown in the diagram below (Department of Water Resources, Sept 2001).



The 1: 50,000 scale 'Gawler' geological map indicates that the geology in the vicinity of the site is clays and sands of the Pooraka Formation with small areas of Hindmarsh Clay exposed in the south eastern corner of the site. The Pooraka Formation is a red brown sandy clay and micaceous clayey sand, Late Pleistocene in age, being derived from fluvial and alluvial deposits and abandoned stream channels.

3. GROUNDWATER INVESTIGATION

3.1 Field Work

Field investigations were undertaken by Environmental Engineers from S&G between 13 and 24 June 2003. The following scope of groundwater investigation was undertaken:

- Review of the regional groundwater information from the Department of Land Water and Biodiversity Conservation (DLWBC) and other sources;
- Ordering groundwater well permits from DLWBC for the construction of the proposed groundwater monitoring wells;
- Location and installation of a total of seven groundwater monitoring wells into the shallow aquifer at the site (wells approximately 4.0 m depth);
- Obtain undisturbed soil cores from three selected locations and logging in general accordance with the Unified Soil Classification System (USCS);
- Development of each well through removal of 3 to 5 well volumes following installation to ensure adequate connection to the aquifer;
- Surveying the monitoring wells to an Australian Height Datum (AHD);
- Purging and sampling of all monitoring wells;
- Transport of samples to a NATA accredited laboratory and analyse samples for the following parameters:
  - Total dissolved solids (TDS), pH and major ions;
  - Total nitrogen (total N), total phosphorous (total P), total kjeldahl nitrogen (TKN) and ammonia;
  - Chemical oxygen demand (COD) and biological oxygen demand (BOD);
  - Phenolics and heavy metals; and
  - Organochlorine and organophosphorous pesticides (OCPs and OPPs).
- Undertake permeability testing on all groundwater monitoring wells (slug tests using data loggers) to record the change in water levels.

3.2 Local Geology

Seven soil bores have been drilled at the site and groundwater wells have been installed at these locations as shown in Figure 1.

The lithological logs obtained during the drilling of these wells are included as Appendix A together with the well permits obtained from the DLWBC.

The logs indicate that the majority of site surface soils are red brown earth (RB7) soils. This is underlain by the Pooraka Formation and in turn by the Hindmarsh Clay.

The upper soil profile at locations BH01, BH02 and BH03 was clayey and at the remaining four locations was sandy. At BH04 and BH05, the sandy horizon was underlain by clayey materials at a depth of 0.5 m. At the remaining locations, the profile was found to be sandy to a depth of 3 m below surface. Investigations typically encountered red-brown to orange brown clay soils of medium to high plasticity, underlain by grey and brown silty to sandy clays of high plasticity.

Soils have been found to be variable with sandier horizons within the soil profile and dominant within localized areas. Clay was identified as the dominant lithology within the area proposed for the organic recycling facility (BH01, BH02 and BH05).

The seven wells at the site were screened within the upper 2 m of the Q1 aquifer.

3.3 Standing Water Levels & Hydraulic Gradient

The watertable is shallow and typically occurs at a depth of less than 2.5 m below surface. The standing water levels have been gauged and the water levels reduced to Australian Height Datum (AHD) to determine groundwater flow direction and hydraulic gradient.

Groundwater levels have been measured on four occasions from June to September 2003. Table 1 provides a summary of the results.

TABLE 1
Groundwater Levels – June to September 2003
Proposed Jeffries Organic Recycling Facility - Buckland Park

Well ID	Reduced Level Top of Casing (m AHD)	TOC stickup above ground level (m)	24-Jun-03			16-Jul-03			27-Aug-03			24-Sep-03		
			Depth to SWL (m bTOC)	Depth to SWL (m bgl)	Reduced Water Level (m AHD)	Depth to SWL (m bTOC)	Depth to SWL (m bgl)	Reduced Water Level (m AHD)	Depth to SWL (m bTOC)	Depth to SWL (m bgl)	Reduced Water Level (m AHD)	Depth to SWL (m bTOC)	Depth to SWL (m bgl)	Reduced Water Level (m AHD)
BH1	3.91	0.30	1.64	1.34	2.27	1.47	1.17	2.44	1.2	0.90	2.71	1.388	1.09	2.52
BH2	3.88	0.42	1.72	1.30	2.16	1.56	1.14	2.32	1.352	0.93	2.52	1.498	1.08	2.38
BH3	4.64	0.37	2.01	1.64	2.63	1.81	1.44	2.83	1.485	1.12	3.15	1.409	1.04	3.23
BH4	5.74	0.42	4.77	4.35	0.97	4.63	4.21	1.11	4.456	4.04	1.28	4.388	3.97	1.35
BH5	4.41	0.11	2.30	2.19	2.11	2.07	1.96	2.34	1.858	1.75	2.55	1.915	1.81	2.49
BH6	7.54	0.35	5.20	4.85	2.34	5.11	4.76	2.43	4.918	4.57	2.62	4.836	4.49	2.70
BH7	4.44	0.44	2.10	1.66	2.34	1.9	1.46	2.54	1.673	1.23	2.76	1.72	1.28	2.72

* Reduced level for BH4 appears anomalous – not included in elevation contours

m AHD - metres Australian Height Datum
m bTOC - metres below top of casing
m bgl - metres below groun level
SWL - standing water level

LEGEND

BH01
\# Groundwater Well

SCALE: 1 : 8 000

CLIENT: Jeffries Garden Soils

PROJECT NO.: SG031072

REPORT REF.: Buckland Park

DATE: October 2003

DOCUMENT REF NO.: Figure1.

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FIGURE 1
SITE LAYOUT & LOCATION OF MONIT0RING WELLS

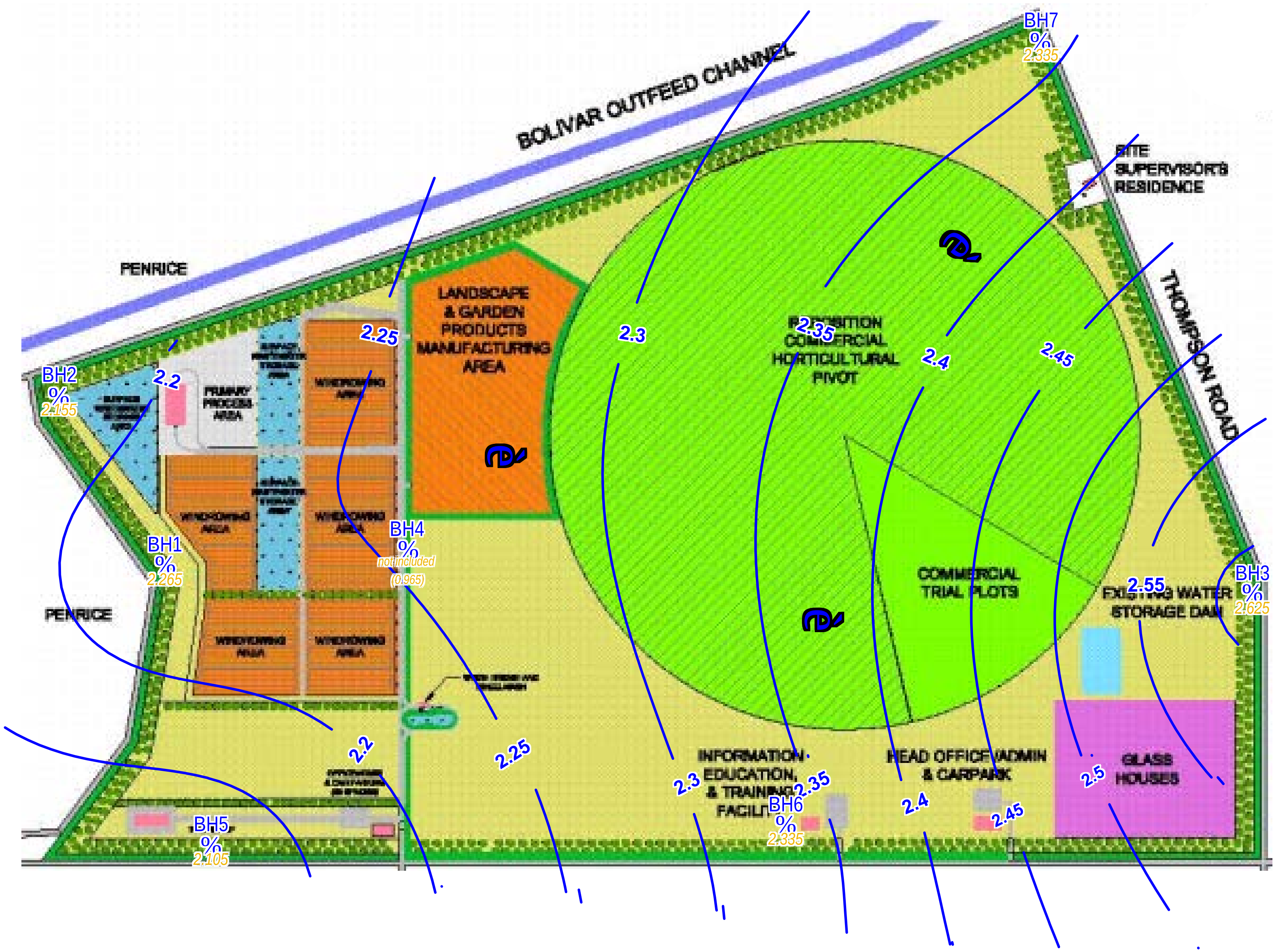
Figures 2 and 3 show the inferred groundwater flow direction for the June and July 2003 gauging events.

The groundwater flow direction is generally from the north to the south with components of flow both to the south east and south west. The hydraulic gradient is estimated to be in the range of 0.0002 to 0.0005 indicating a very low hydraulic gradient through the site. Lower gradients are noted in the southern section of the site.

In generating these plots, the water levels at BH04 have been ignored. The gauging results obtained from BH04 appear anomalous and may be the result of local variations in the geology or hydrogeology. During the drilling and installation of BH04, high drilling resistance was encountered in dry very stiff clay materials (also encountered at BH06) but inconsistent with the other boreholes. The available data does not conclusively indicate the reason for the low groundwater levels encountered in this well but high strength, dry, lower permeability clay soils encountered at the location of BH04 are considered to contribute to the groundwater level anomaly. Further monitoring will be required to establish if this is temporal variation relative to other wells or if this behavior is persistent. This issue is discussed in later sections of this report.

A series of stormwater drains are located on the southern portion of the site. It is our understanding that the earthen drain located at the southern boundary of the site is for stormwater management. Based on a survey measurement taken at the base of the drain (adjacent to the southwestern corner of the site), suggests that the drain invert is approximately 1 m above the groundwater table. Therefore, groundwater is unlikely to discharge to this drain unless significant increases in groundwater levels occur.

The nearest surface water body is the adjacent brine evaporation concentrating ponds operated by Penrice to harvest salt. However, groundwater is not considered likely to discharge to these ponds but to the Gulf of St. Vincent, which is located approximately 5 km to the south (hydraulically down gradient) of the site.



LEGEND

BH1
% Groundwater Well
8.331 & Elevation (m AHD)

Inferred Groundwater Flow Direction

SCALE: 1 : 8000

CLIENT: Jeffries Garden Soils

PROJECT NO.: SG031072

REPORT REF.: Buckland Park

DATE: October 2003

DOCUMENT REF NO.: Figure2.wor

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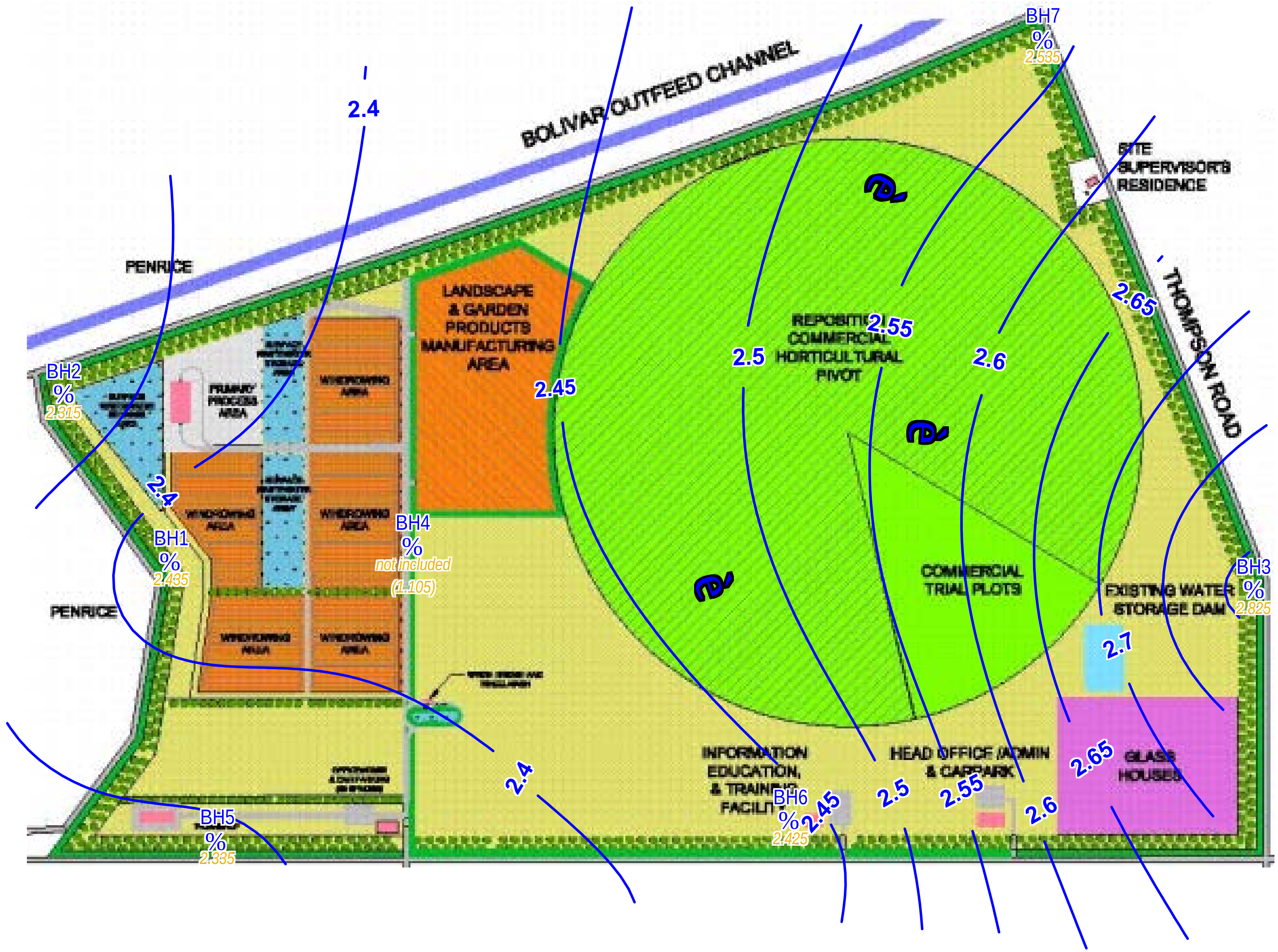
FIGURE 2
JUNE 2003 - GROUNDWATER ELEVATIONS & INFERRED GROUNDWATER FLOW DIRECTION



LEGEND

BH1 % 8.33 Groundwater Well & Elevation (m AHD)

æ Inferred Groundwater Flow Direction

N

SCALE: 1 : 8000

CLIENT: Jeffries Garden Soils

PROJECT NO.: SG031072

REPORT REF.: Buckland Park

DATE: October 2003

DOCUMENT REF NO.: Figure3.wor

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FIGURE 3
JULY 2003 - GROUNDWATER ELEVATIONS & GROUNDWATER FLOW DIRECTION

3.4 Groundwater Salinity and Protected Uses

The total dissolved solids (TDS) content of the groundwater is used to assess the relevant environmental values of the aquifer.

In accordance with the Australian Drinking Water Guidelines, NHMRC & ARMCANZ 1996, water with a TDS concentration less than 1,000 mg/L is potentially suitable for potable use. However, the SA EPA generally considers that groundwater with TDS concentration of less than 3,000 mg/L should be considered as potentially potable.

The groundwater encountered at this site ranged in TDS concentrations from 10,900 to 58,900 mg/L (Figure 4). TDS concentrations greater than 20,000 mg/L have been reported near the southwestern portion of the site at monitoring locations BH01 and BH02. BH01 and BH02 are located near the adjacent brine evaporation concentrating ponds operated by Penrice to harvest salt.

Groundwater of this quality has limited environmental value and is likely to be most relevant for maintenance of ecosystems, as well as some possible irrigation and industrial uses.

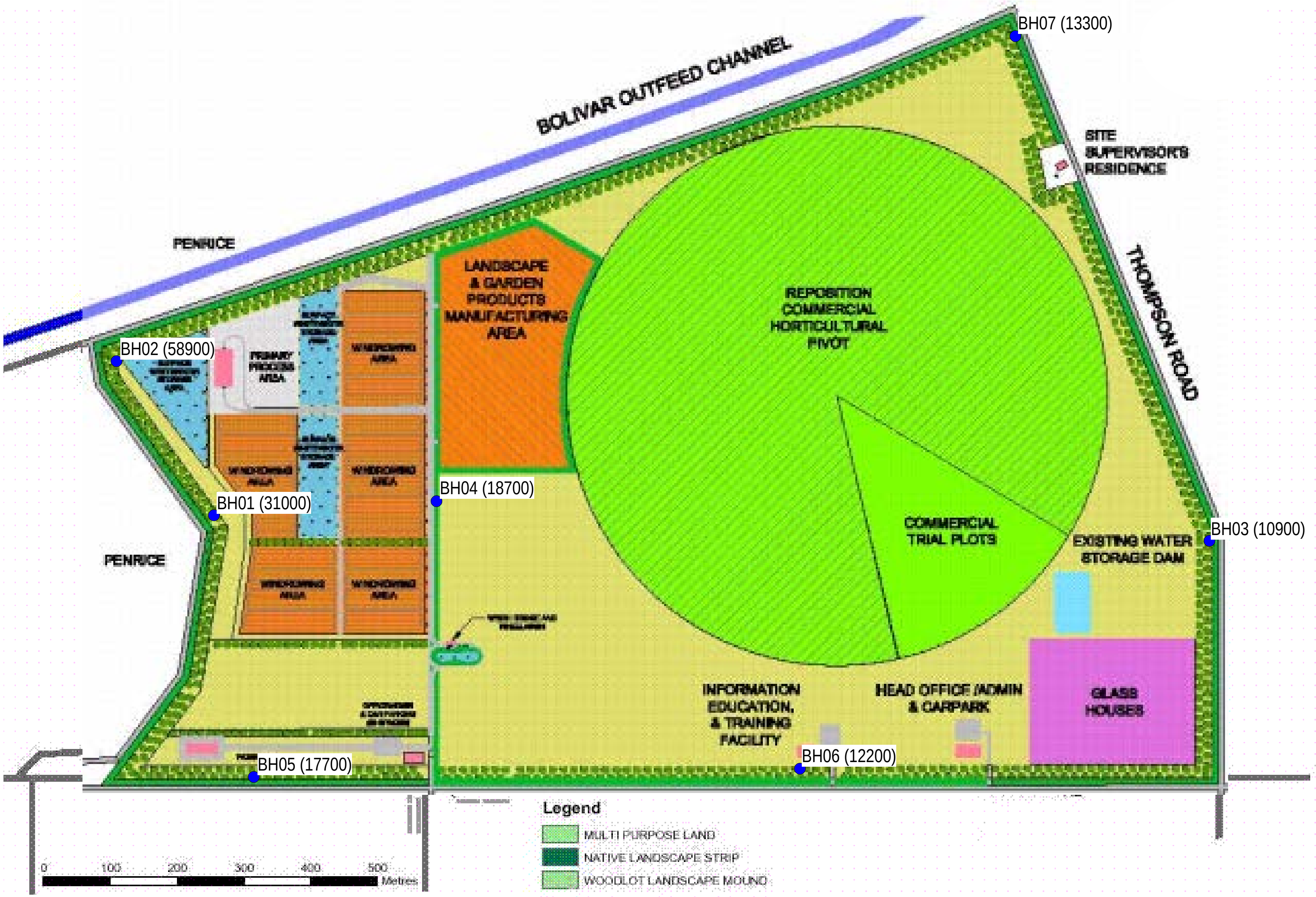
3.5 Surrounding Groundwater Use

A search was undertaken of the DLWBC database for registered wells near the site. The search revealed nine wells in the immediate area, with five wells appearing to be located within the site boundaries.

Three of the nine wells had been abandoned and only one well (located near the centre pivot) was reported as operational. Of the nine wells, five reported total depth and of these, only two were shallow (less than 20 m deep). The deep wells were likely to be screened in the deeper T1 or T2 aquifers.

The water quality reported in the DLWBC data for the two shallow wells is much fresher than that measured in the wells on site. This result may be due to local infiltration near the wells or a change in the aquifer conditions over time (potentially seasonal). Both shallow wells are old, having been drilled in 1949 and 1969, and therefore the reliability and representativeness of this information is questionable.

The DLWBC data and a map of well locations are included in Appendix C.



LEGEND

BH04 (18700)
Groundwater Well (TDS, mg/L)

SCALE: 1 : 8500

CLIENT: Jeffries Garden Soils

PROJECT NO.: SG031072

REPORT REF.: Buckland Park

DATE: July 2003

DOCUMENT REF NO.: Figure4.wor

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FIGURE 4
TOTAL DISSOLVED SOLIDS (mg/L)

3.6 Hydraulic Conductivity Assessment

The seven wells were tested to estimate the hydraulic conductivity of the aquifer at each location. Both a rising head and a falling head test were undertaken in each well using a pressure transducer and data logger. The water level data obtained from the tests was analysed using both the Hvorslev method and the Bouwer & Rice method. The results are summarised in Table 2.

Table 2 - Hydraulic Conductivity Test Results

Well	Test type	Hvorslev Method			Bouwer & Rice Method		
		m/sec	Average m/sec	Average m/day	m/sec	Average m/sec	Average m/day
BH01	Falling	6.51E-06	4.09E-06	0.353	4.30E-06	2.69E-06	0.232
	Rising	1.66E-06			1.08E-06		
BH02	Falling	1.31E-06	2.93E-06	0.253	9.66E-06	6.34E-06	0.548
	Rising	4.55E-06			3.02E-06		
BH03	Falling	1.86E-05	2.67E-05	2.303	9.66E-06	1.54E-05	1.333
	Rising	3.47E-05			2.12E-05		
BH04	Falling	7.75E-07	1.34E-06	0.116	5.08E-07	8.94E-07	0.077
	Rising	1.91E-06			1.28E-06		
BH05	Falling	7.36E-07	8.51E-07	0.073	4.49E-07	5.23E-07	0.045
	Rising	9.65E-07			5.97E-07		
BH06	Falling	4.33E-08	3.21E-07	0.028	2.34E-08	1.58E-07	0.014
	Rising	5.99E-07			2.93E-07		
BH07	Falling	1.67E-05	1.75E-05	1.512	9.62E-06	1.02E-05	0.878
	Rising	1.83E-05			1.07E-05		

The results indicate a range of aquifer hydraulic conductivities across the site. Generally, a zone of low hydraulic conductivities was observed within the south eastern portion of the site (BH04, BH05 and BH06)

The calculated hydraulic conductivities were consistent with observations made during the purging and sampling of the wells and were consistent with the lithology encountered during the drilling of the bores. The high aquifer hydraulic conductivity estimated for BH07 was consistent with the sandy formation noted at this location and the good recovery of water observed from the well, during development. Only relatively small volumes of water were extracted from wells BH05 and BH06, consistent with the low hydraulic conductivity and the clayey aquifer material.

The estimated hydraulic conductivity results obtained for BH04 appeared similar to other results at the site. The lower water level noted at BH04 does not appear to be the result of variation in hydraulic conductivity relative to other wells.

The porosity of the matrix was assumed to be 0.25 based on literature values for this material. Based on the available data, the seepage velocity of the groundwater was estimated to be between approximately 0.02 m/year and 1.6 m/year.

3.7 Groundwater Quality

3.7.1 Field Measurements

During the purging and sampling of the wells, a range of field parameters were recorded. These are typically unstable parameters that cannot be accurately measured by the laboratory due to chemical and physical changes that occur in the samples when exposed to the surface environment and are therefore recorded in the field. These parameters include dissolved oxygen (DO), redox potential, pH and temperature. Electrical conductivity (EC – a measure of the salts in the water) is commonly included as it is readily measured in the field.

The field measurements are recorded in the field sampling sheets included as Appendix B.

Low DO concentrations and redox potential results were noted at BH03 and BH07. These results are indicative of reducing chemical conditions in the aquifer at these locations. Both wells are located along the up-gradient hydraulic boundary of the site suggesting that there may be a source of organic contamination in the groundwater up gradient of the site (to the north) leading to a depletion in the groundwater oxygen through microbial activity. Other DO and redox results suggest mildly oxidizing conditions across the remainder of the site.

Groundwater pH is neutral across the site.

The field based EC results are broadly consistent with the TDS results obtained by the laboratory.

3.7.2 Laboratory Testing

Groundwater samples were also analysed by a NATA certified laboratory (ALS Melbourne) for a range of parameters as noted in Section 3.1. The results of the analyses are included in Table 3 and the laboratory certificates and chain of custody documentation are included in Appendix D.

The results indicate that there are no concentrations of pesticides in groundwater at the site above the laboratory detection limits.

The heavy metals are at low concentrations and consistent concentrations are noted across the site indicating they may be representative of background aquifer conditions.

Total nitrogen and phosphorus are encountered across the site. These elevated results may be due to historic irrigation and application of fertilizers more regionally, or as a result of former use of the site for dairying.

Total Kjeldahl Nitrogen (TKN – a measure of reduced nitrogen) was found to be generally higher than the ammonia concentration indicating that a major component of reduced nitrogen was in the form of organic nitrogen. The exception was BH02 where ammonia dominated the reduced nitrogen forms.

The difference between total nitrogen and TKN is typically the oxidised forms of nitrogen. Nitrate is generally the dominant oxidised form of nitrogen in groundwater. At all locations except BH02 and BH07, nitrate is the dominant form of nitrogen in the groundwater.

Therefore, groundwater analytical results suggest there are significant concentrations of nitrogen in various forms across the site likely to be resulting from historic application of fertilisers or former dairying activities.

COD is elevated in all wells while BOD is very low. This indicates that there is a low biological demand for the material dissolved in the groundwater but that these compounds, while not biodegradable, have a high oxygen demand for their chemical degradation. The source of the elevated COD is not apparent from the chemical analyses undertaken.

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Table 3 – Summary of Analytical Results

TDS, Metals, Anions & Cations, Nutrients, BOD & COD

	Analyte / Date	Units	LOR	BH01 24/06/2003	BH02 24/06/2003	BH03 24/06/2003	BH04 24/06/2003	BH05 24/06/2003	BH06 24/06/2003	BH07 24/06/2003	*DUP1 24/06/2003*	*RPD %*
	Total Dissolved Solids (TDS)	mg/L	1	31000	58900	10900	18700	17700	12200	13300	*13600*	*2%*
Metals	Arsenic - Filtered	mg/L	0.001	<0.001	<0.010	<0.001	<0.001	<0.001	0.002	0.022	*0.02*	*10%*
	Cadmium - Filtered	mg/L	0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	*<0.0001*	*-*
	Chromium - Filtered	mg/L	0.001	0.003	<0.005	0.003	0.008	0.003	0.002	0.002	*0.002*	*0%*
	Copper - Filtered	mg/L	0.001	0.008	<0.020	0.005	0.007	0.008	0.006	0.004	*0.004*	*0%*
	Nickel - Filtered	mg/L	0.001	0.015	0.022	0.003	0.003	0.01	0.004	0.009	*0.009*	*0%*
	Lead - Filtered	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	*<0.001*	*-*
	Zinc - Filtered	mg/L	0.005	0.015	<0.020	0.013	0.011	0.008	0.018	0.018	*0.016*	*12%*
	Mercury - Filtered	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	*<0.001*	*-*
Anions & Cations	Calcium - Filtered	mg/L	1	104	524	55	141	59	419	130	*153*	*16%*
	Magnesium - Filtered	mg/L	1	108	1200	24	92	32	284	65	*88*	*30%*
	Sodium - Filtered	mg/L	1	4650	12000	2580	4550	4290	2170	3340	*3930*	*16%*
	Potassium - Filtered	mg/L	1	184	512	60	82	70	95	71	*95*	*29%*
	Bicarbonate as CaCO3	mg/L	1	506	450	767	576	878	423	788	*800*	*2%*
	Alkalinity as CaCO3	mg/L	1	506	450	767	576	878	423	788	*800*	*2%*
	Sulphate - Filtered	mg/L	1	1000	3300	688	1660	1520	1000	965	*1140*	*17%*
	Chloride - Filtered	mg/L	1	7500	23000	2900	6710	4500	3500	4820	*5620*	*15%*
Nutrients	Ammonia as N	mg/L	0.01	0.05	1.98	<0.01	<0.01	<0.01	0.16	0.45	*0.32*	*34%*
	Total Kjeldahl Nitrogen as N	mg/L	0.1	0.8	2.9	0.2	<0.1	0.6	0.5	1	*2.6*	*89%*
	Total Nitrogen as N	mg/L	0.1	1.9	2.9	3.6	6.6	10.4	16.3	1	*2.6*	*89%*
	Phosphorus as P - total	mg/L	0.01	1.63	2.36	1.13	0.42	0.34	0.96	0.88	*1.03*	*16%*
BOD + COD	Chemical Oxygen Demand	mg/L	1	2240	4840	929	1420	1590	590	1470	*1830*	*22%*
	Biochemical Oxygen Demand	mg/L	2	2	2	2	4	4	4	4	*4*	*0%*

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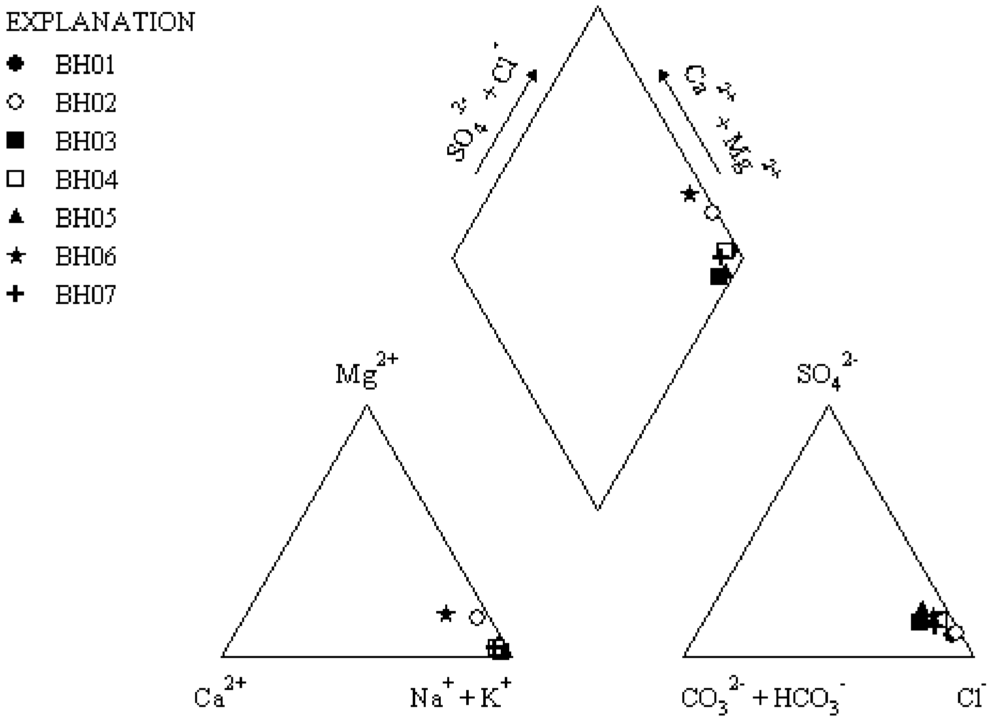
Table 3 cont – Summary of Analytical Results
OCPs, OPPs & Phenols

	Analyte	Units	LOR	BH01	BH02	BH03	BH04	BH05	BH06	BH07	*DUP1*	*RPD %*
	Date			24/06/2003	24/06/2003	24/06/2003	24/06/2003	24/06/2003	24/06/2003	24/06/2003	*24/06/2003*	
	alpha-BHC	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	HCB	ug/L	1	<1	<1	<1	<1	<1	<1	<1	*<1*	-
	beta-BHC & gamma-BH(	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	delta-BHC	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Heptachlor	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Aldrin	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Heptachlor epoxide	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	chlordane - trans	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
OCPs	Dieldrin	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	DDE	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Endrin	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Endosulfan 2	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	DDD	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Endrin aldehyde	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Endosulfan sulfate	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	DDT	ug/L	2	<2	<2	<2	<2	<2	<2	<2	*<2*	-
	Endrin ketone	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Methoxychlor	ug/L	2	<2	<2	<2	<2	<2	<2	<2	*<2*	-
	Diichlorvos	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Demeton-S-methyl	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Monocroptophos	ug/L	2	<2	<2	<2	<2	<2	<2	<2	*<2*	-
	Dimethate	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Diazinon	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Chlorpyrifos-methyl	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Parathion-methyl	ug/L	2	<2	<2	<2	<2	<2	<2	<2	*<2*	-
	Malathion	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Fenthion	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
OPPs	Chlorpyrifos	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Parathion	ug/L	2	<2	<2	<2	<2	<2	<2	<2	*<2*	-
	Pirimiphos-ethyl	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Chlorfenvinphos E	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Chlorfenvinphos Z	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Bromophos-ethyl	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Fenamiphos	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Prothiofos	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Ethion	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Carbophenothion	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Azinphos-methyl	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*<0.5*	-
	Phenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	*<2*	-
	2-Chlorophenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	*<2*	-
	2-Methylphenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	*<2*	-
	3- & 4-Methylphenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	*<2*	-
	2-Nitrophenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	*<2*	-
Phenols	2,4-Dimethylphenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	*<2*	-
	2,4-Dichlorophenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	*<2*	-
	2,6-Dichlorophenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	*<2*	-
	4-Chloro-3-methylpheno	ug/L	2	<2	<2	<2	<2	<2	<2	<2	*<2*	-
	2,4,6-Trichlorophenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	*<2*	-
	2,4,5-Trichlorophenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	*<2*	-
	Pentachlorophenol	ug/L	4	<4	<4	<4	<4	<4	<4	<4	*<4*	-

3.8 Major Ion Chemistry

The major ions were analysed in order to characterise the groundwater and determine if the groundwater source was consistent across the site. The major ion chemistry at each location assessed using the Piper Tri-linear plotting method. This method plots the milli-equivalent concentration of each major cation and anion and allows the ionic chemistry between wells to be compared independent of the salinity of the water. Figure 5 shows the Piper tri-linear data for the seven wells at the site.

Figure 5 – Piper Tri-linear Plot



The plot indicates that all points occur in approximately the same region of the diamond, which suggests that the groundwater across the site is of the sodium chloride type and that it is likely that the waters are from the same source. The water chemistry at BH04 was noted to be similar to that encountered elsewhere on the site.

4. CONCEPTUAL HYDROGEOLOGICAL MODEL

4.1 Purpose of the Conceptual Hydrogeological Model

The Conceptual Hydrogeological Model (CHM) provides a basis for understanding the hydrogeology of the site and the potential migration and fate of contaminants in the groundwater. In most cases, the CHM will provide a simplified overview of the key hydrogeological processes occurring at the site. It is by nature, a macro scale understanding of the hydrogeological conditions.

Due to the simplifications required to derive such a model, a number of assumptions are included in its development. An understanding of these assumptions is important in assessing if the model provides a suitable representation of the site conditions. If the assumptions are invalid or unfounded, then the model may provide a poor representation of the conditions at the site.

The model is built from a sound understanding of the site geology. The geological description of the site is obtained from bore logs and other published and unpublished information sources. The hydrogeology of the site, that is the aquifers and aquitards, are then assigned based on field observations and investigations, published information and hydrogeological inference. The hydrogeology component also includes identification of groundwater recharge and discharge areas, the hydraulic properties of the aquifer that control groundwater flow and velocity and consideration of the groundwater flow direction. The physical properties of the aquifers and aquitards will also be important with respect to the rate of migration and the potential for attenuation of various contaminants.

The development of a CHM is typically an iterative process. The process of model development identifies gaps in the knowledge base and further investigations can be undertaken to resolve these issues. The additional information obtained through these investigations may either confirm or alter the previous conceptual model. Eventually a model will be developed that is suitably representative of the site for the purpose. The number of iterations required depends on the complexity of the site and the extent of investigations undertaken at each step.

Once developed the model can be used for a range of purposes including:

- Providing a comprehensive and fixed interpretation of the site for discussion and agreement with regulatory authorities;
- Clear identification of assumptions used in model development;
- Determining data gaps in the well monitoring network;
- Identifying the location of additional targeted monitoring wells for assessing both groundwater hydraulics and contaminant transport;

- Qualitative assessment of the impacts and risk to various receptors based on the source-pathway-exposure model;

- Assessing potential risk of impact on groundwater receiving environments;

- Providing the basis for analytical calculations regarding groundwater flow and contaminant transport; and

- Providing the structural basis for a numerical groundwater model, and if required, a contaminant fate and transport numerical model.

4.2 Conceptual Hydrogeological Model – Summary

The key aspects of the CHM are as follows:

- The underlying soil profile consists of Quaternary aged sediments including interbedded sands and clays, but predominantly clay (Hindmarsh Clay unit).

- Whilst other aquifers are present at greater depths, it is considered that this shallow aquifer is the most relevant for monitoring for potential groundwater contamination issues associated with proposed surface activities at the site.

- The shallow groundwater quality is brackish to saline and therefore is likely to be limited to predominantly maintenance of ecosystems and possibly some limited irrigation or industrial uses.

- The high salinity of the groundwater, particularly along the southwestern corner of the site, is likely to be related to the evaporation ponds operated by Penrice, and indicates that the potential salinisation risks in the area must be carefully managed.

- The TDS concentrations for the remainder of the site is generally greater than 10,000 and less than 20,000 mg/L.

- The watertable is shallow and typically occurs at a depth of less than 2.0 m below surface. Lower relative water levels were measured in well BH04 (approximately 2 to 3 m below water levels in surrounding wells). The available data does not resolve the reason for the low groundwater levels encountered in this well. Further monitoring will be required to establish if this is temporal variation relative to other wells or if this behavior is persistent.

- The groundwater flow direction is generally from the north to the south with components of flow both to the south east and south west. The hydraulic gradient is estimated to be in the range of 0.0002 m/m (0.02%) to 0.0005 m/m (0.05%) indicating a very low hydraulic gradient through the site.

- A stormwater drain is located on the southern portion of the site. It is our understanding that the earthen drain located at the southern boundary of the site is for stormwater management. Based on survey measurements taken of the base of the drain, the drain invert is approximately 1 m above the groundwater table. Therefore, groundwater is unlikely to discharge to this drain unless the significant increases in groundwater levels are observed. The regional receiving surface water body is considered to be Gulf of St. Vincent, which is located approximately 5 km to the south southwest, (hydraulically down gradient) of the site.

- The estimated hydraulic conductivity results indicate a range of aquifer conditions across the site, with hydraulic conductivity in the range of 0.07 to 2.3 m/day. The calculated hydraulic conductivities are consistent with observations made during the purging and sampling of the wells. The high aquifer hydraulic conductivity noted at BH07 was consistent with the sandy formation noted at this location. Only relatively small volumes of water were extracted from well BH05 and BH06, consistent with the low hydraulic conductivities estimated at these locations.

- The porosity of the matrix was assumed to be 0.25 based on literature values for this material. Based on the available data, the seepage velocity of the groundwater was estimated to be between approximately 0.02 and 1.6 m/year.

- Analyses of major ion chemistry between the wells also indicates that the groundwater across the site is of the same composition.

4.3 Potential Impacts Associated with Storage Dams

It is understood that the proposed stormwater dam will be constructed into the clay and have an engineered low permeability liner. The proposed location of the dam is on the down hydraulic gradient portion of the site to the south of the proposed organic recycling facility.

It is considered that there is potential for some hydraulic loading of the aquifer system as a result of leakage from the dam. It is noted however that the dam will be large to accommodate peak surface flows (1 in 100 year events) and therefore the head on the liner at most times is likely to be low (except in exceptionally wet years).

Experience with other investigations of dams and landfill liners suggest that the leakage rates from the dam will be low (typically in the order of a few millimetres infiltration per year). Whilst some localised mounding may occur directly beneath the dam, the hydraulic conductivity of the aquifer is many orders of magnitude higher than that of the landfill liner. Therefore, the potential for an extensive mound to develop in response to any dam leakage is considered low. This is especially true given intermittent head pressure expected on the liner.

It is noted that a large dam currently exists on the northern portion of the site. This dam is used in conjunction with the centre pivot irrigator. Whilst it is acknowledged that there is no groundwater monitoring well directly adjacent to the existing dam, the dam has been operational for many years at the site and shows no visual evidence of local land salinisation or other effects typical of mounding, such as water logging or springing of surrounding soils. This provides an ideal opportunity to view the potential performance of the proposed dam that will be developed within a similar hydrogeological setting.

Since there is no evidence that the existing dam is causing significant changes to the underlying shallow aquifer, the proposed dam would not be expected to result in any significant impact on the land in its vicinity.

Additionally, the re-circulation of water from the proposed dam to the compost windrows will serve to keep the level of water in the dam at its lowest possible level, thereby further minimizing any potential for water infiltration through the engineered liner.

A one dimensional vertical leakage model referred to as the HELP (Hydrologic Evaluation of Landfill Performance) model could be used to support the qualitative assessment provided. It is noted, however, that the model is highly conservative in its prediction of infiltration resulting from leakage.

It is proposed that the impact of the dam be monitored routinely over the life of the operations. This may require the installation of additional groundwater monitoring wells around the dam to provide a suitable degree of hydraulic coverage. The wells should be gauged routinely, and sampled and analysed regularly for the primary contaminants of concern (nutrients, pH). The regular monitoring of the wells will provide sufficient temporal information to discern any significant trends in the data and allow the influences of climatic variations to be isolated from the data.

5. CONCLUSIONS & RECOMMENDATIONS

5.1 Conclusions

A groundwater investigation was undertaken at the proposed location of the organic recycling facility at Buckland Park involving the installation of seven groundwater monitoring wells. The wells were gauged on two occasions and the groundwater flow direction inferred to be broadly from north to south. An anomalously low groundwater level was reported in BH04 over both gauging rounds. Further monitoring will be required to establish if this is a temporal variation relative to other wells or if this behavior is persistent and the result of local geological or hydrogeological variations.

The wells were tested to determine the hydraulic conductivity of the aquifer and then purged and sampled. The samples were submitted to a NATA certified laboratory and analysed for a range of organic and inorganic parameters comprising the contaminants of concern based on the site history and the intended use of the site for an organic recycling facility.

The results of 'baseline' analytical testing indicate that the groundwater already contains considerable concentrations of nutrients (ammonia, TKN, nitrate and phosphorus). The groundwater has an elevated COD but low BOD. The analyses also indicates that the groundwater across the site is of the same composition and therefore is likely to be derived from a similar source. TDS concentrations generally range between 10,000 and 60,000 mg/L. TDS concentrations greater than 20,000 mg/L were reported near the southwestern portion of the site, likely to be associated with the adjacent evaporation ponds operated by Penrice.

The groundwater quality is typically poor and has limited environmental value. The most likely use of the shallow groundwater is for maintenance of ecosystems or possibly limited irrigation or industrial use.

The proposed dam is to be constructed with an engineered low permeability liner. This will restrict the leakage of water from the dam and minimise the potential for groundwater mounding to develop. It is noted that an existing dam occurs on the northern portion of the site. There is no visual evidence that leakage from this dam is causing groundwater mounding leading to degradation of the land adjacent to the dam. The proposed dam will be constructed within a similar geological and hydrogeological environment. Since the proposed dam will have an engineered low permeability liner which would be expected to be superior to that in the existing dam, the potential for the proposed dam to degrade the environment a result of groundwater mounding is considered to be low.

A conceptual hydrogeological model was developed for the site to provide a generalised understanding of the groundwater flow regime at the site.

5.2 Recommendations

It is suggested that an agreed groundwater monitoring program be established and implemented to monitor the shallow groundwater system following any topside development.

This would provide additional time series data on the influence of the existing dam, and the proposed stormwater dams, as well as an understanding of temporal groundwater and hydrochemistry trends at the site. Analytes should include as a minimum nutrients (ammonia, total N, total P and TKN), COD and TDS.

Appendix A

Borelogs, Well Construction Details and Well Permits

GROUNDWATER WELL REPORT

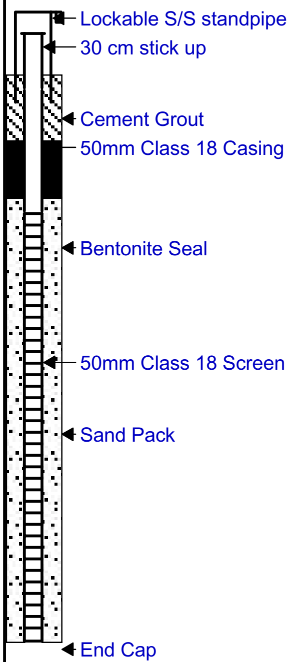
WELL NUMBER: BH01

First Floor 207 The Parade
NORWOOD SA 5067

Client: Jeffries Gardens Soils		
Project: Organic Recycling Facility	Checked by: AKW	
Location: Buckland Park	Datum: Arbitrary	Logged by: ACS
Project No: SG031072	Easting: 1001.99	Contractor: Drillmax
Date Comenced: 13/6/03	Northing: 994.93	Operator: John
Date Completed: 13/6/03	R.L. surface: 9.4	Machine: Rockmaster

SUBSURFACE PROFILE / SAMPLING

Drilling Method	Water	Depth (m)	Graphic	USCS	Description	Moisture	Consistency	Recovery	Sampling	Well Construction Details	PID (ppm)
PT & AV		0 – 0.6		CI	**CLAY** Brown / dark brown, medium plasticity with some silt	<PL					
		0.6 – 1.2		CI	**CLAY** Brown, medium plasticity with some coarse grained sand	<PL					
		1.2 – 1.8		CI	**CLAY** Grey brown, medium plasticity with a trace of coarse grained sand	<PL					
		1.8 – 2.4			Light brown / brown						
		2.4 – 3.0		CI	**CLAY** Orange brown, medium plasticity with a trace of coarse grained sand and fine grained gravel	<PL					
		3.0 – 4.0		CI/CH	**CLAY** Brown / light brown, medium to high plasticity with a trace of fine grained gravel	<PL, >PL					
		4.0			Borehole terminated at 4 m						



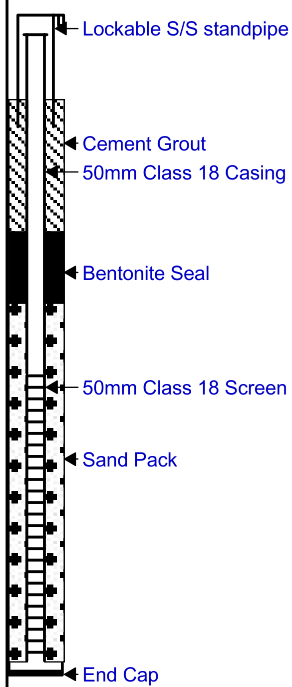
GROUNDWATER WELL REPORT

First Floor 207 The Parade
NORWOOD SA 5067

Client: Jeffries Gardens Soils		
Project: Organic Recycling Facility	Checked by: AKW	
Location: Buckland Park	Datum: Arbitrary	Logged by: ACS
Project No: SG031072	Easting: 794.64	Contractor: Drillmax
Date Comenced: 13/6/03	Northing: 819.45	Operator: John
Date Completed: 13/6/03	R.L. surface: 9.27	Machine: Rockmaster

SUBSURFACE PROFILE / **SAMPLING**

Drilling Method	Water	Depth (m)	Graphic	USCS	Description	Moisture	Consistency	Recovery	Sampling	Well Construction Details	PID (ppm)
PT & AV		0		CI	**CLAY** Brown / dark brown, medium plasticity with some silt	<PL					
		1		CI	**CLAY** Brown, medium plasticity with some coarse grained sand	<PL					
		2		CI	**CLAY** Grey brown, medium plasticity with a trace of coarse grained sand	<PL					
				CI	Light brown / brown	<PL					
		3		CI	**Sandy CLAY** Orange brown, medium plasticity, fine to medium grained sand	>PL					
		4		CI/ CH	Grey	>PL					
					Gravelly Sandy CLAY Brown / light brown, medium to high plasticity, fine to coarse grained sand, fine grained gravel						
					Borehole terminated at 4 m						
		5									
		6									
		7									



GROUNDWATER WELL REPORT

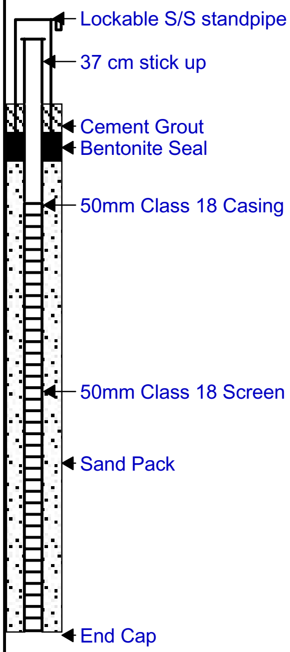
WELL NUMBER: BH03

First Floor 207 The Parade
NORWOOD SA 5067

Client: Jeffries Gardens Soils		
Project: Organic Recycling Facility	Checked by: AKW	
Location: Buckland Park	Datum: Arbitrary	Logged by: ACS
Project No: SG031072	Easting: 874.89	Contractor: Drillmax
Date Comenced: 13/6/03	Northing: 2445.89	Operator: John
Date Completed: 13/6/03	R.L. surface: 10.07	Machine: Rockmaster

SUBSURFACE PROFILE | **SAMPLING**

Drilling Method	Water	Depth (m)	Graphic	USCS	Description	Moisture	Consistency	Recovery	Sampling	Well Construction Details	PID (ppm)
PT & AV		0 – 0.5		CI	**Silty CLAY** Brown, medium plasticity clay	<PL					
		0.5 – 0.9		CH	**CLAY** Orange brown, high plasticity	<PL					
	▼	0.9 – 2.0		CL/ CI	**CLAY** Light brown, low to medium plasticity with some coarse grained sand and fine grained gravel	<PL =PL					
		2.0 – 4.0		SC	**Clayey SAND** Brown, fine to coarse grained, low to medium plasticity clay	W					
		4			Borehole terminated at 4 m						



GROUNDWATER WELL REPORT

WELL NUMBER: BH04

S&G
First Floor 207 The Parade
NORWOOD SA 5067

Client: Jeffries Gardens Soils		
Project: Organic Recycling Facility	Checked by: AKW	
Location: Buckland Park	Datum: Arbitrary	Logged by: ACS
Project No: SG031072	Easting: 945.01	Contractor: Drillmax
Date Comenced: 13/6/03	Northing: 1314.98	Operator: John
Date Completed: 13/6/03	R.L. surface: 11.10	Machine: Rockmaster

SUBSURFACE PROFILE

Drilling Method	Water	Depth (m)	Graphic	USCS	Description	Moisture	Consistency
PT & AV				SP	**SAND** Brown / dark brown, fine to coarse grained with some clay and silt. Clay content increasing with depth	D	
				CL/CI	**CLAY** Brown / dark brown, low to medium plasticity with some fine to coarse grained sand and some silt	<PL	
		1		CI/CH	**CLAY** Dark brown, medium to high plasticity with coarse grained sand and fine grained gravel inclusions	<PL	
				SC	**Clayey SAND** Brown, coarse grained, medium to high plasticity clay	D	
		2		CH	**CLAY** Brown, high plasticity	<PL	
		3		SC	**Clayey SAND** Brown, fine to medium grained, medium plastcity clay	D	
				CI/CH	**CLAY** Brown / light brown, medium to high plasticity	<PL	
		4, 5, 6, 7		CH	**CLAY** Orange brown, high plasticity	=PL	

Borehole terminated at 7.2 m

SAMPLING

Recovery	Sampling	Well Construction Details	PID (ppm)
		Lockable S/S standpipe	
		42 cm stick up	
		Cement Grout	
		Bentonite Seal	
		50mm Class 18 Casing	
		50mm Class 18 Screen	
		Sand Pack	
		End Cap	

GROUNDWATER WELL REPORT

WELL NUMBER: BH05

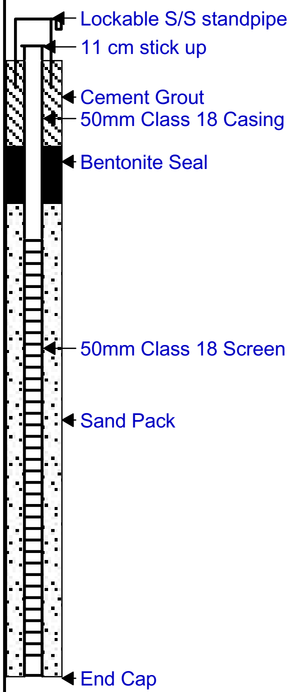
First Floor 207 The Parade
NORWOOD SA 5067

Client: Jeffries Gardens Soils		
Project: Organic Recycling Facility	Checked by: AKW	
Location: Buckland Park	Datum: Arbitrary	Logged by: NBP
Project No: SG031072	Easting: 1387.00	Contractor: Drillmax
Date Comenced: 13/6/03	Northing: 1114.11	Operator: Carlo
Date Completed: 13/6/03	R.L. surface: 10.11	Machine: Rockmaster

SUBSURFACE PROFILE | **SAMPLING**

Drilling Method	Water	Depth (m)	Graphic	USCS	Description	Moisture	Consistency	Recovery	Sampling	Well Construction Details	PID (ppm)
AV		0–0.4		SM	**Silty SAND** Brown, fine to medium grained, low plasticity fines	M					
		0.4–1.6		CI	**Sandy CLAY** Pale brown, medium plasticity, fine to coarse grained sand	<PL					
	▼ (approx. 2.1)	1.6–3.5		CI	**Sandy CLAY** Pale brown, medium plasticity, fine to coarse grained sand with a trace of fine grained gravel	>PL					
		3.5–4.35		CI	**Sandy CLAY** Red brown / pale brown, medium plasticity, fine to coarse grained sand with pockets of grey sand	>PL					
					Borehole terminated at 4.35 m						

Depth scale (m): 0, 1, 2, 3, 4, 5, 6, 7



GROUNDWATER WELL REPORT

WELL NUMBER: BH06

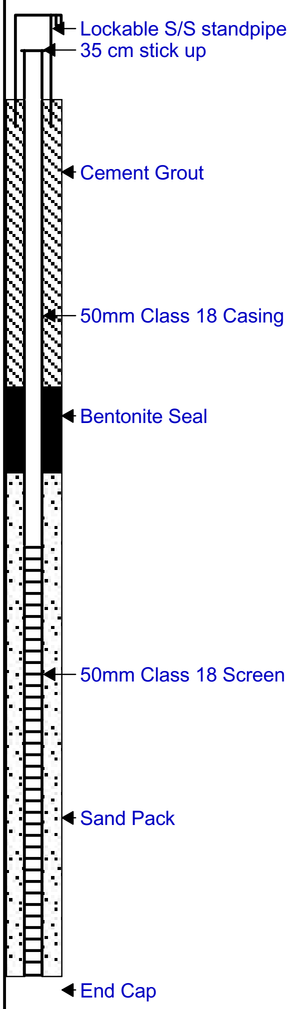
S&G
First Floor 207 The Parade
NORWOOD SA 5067

Client: Jeffries Gardens Soils		
Project: Organic Recycling Facility	Checked by: AKW	
Location: Buckland Park	Datum: Arbitrary	Logged by: NBP
Project No: SG031072	Easting: 1294.22	Contractor: Drillmax
Date Comenced: 13/6/03	Northing: 1906.94	Operator: Carlo
Date Completed: 13/6/03	R.L. surface: 12.95	Machine: Rockmaster

SUBSURFACE PROFILE | **SAMPLING**

Drilling Method	Water	Depth (m)	Graphic	USCS	Description	Moisture	Consistency	Recovery	Sampling	PID (ppm)
AV		0		SM	**Silty SAND** Brown, fine to medium grained, low liquid limit fines	D				
				SM	**Silty Clayey SAND** Red brown, fine to medium grained, low plasticity fines	D				
		1–2		SP	**Gravelly SAND** Pale brown, fine to coarse grained sand, fine to medium grained, calcareous gravel with some low plasticity fines	D				
		2–3		SP	**SAND** Brown, fine to medium grained with some low plasticity fines	M				
	▼ (approx. 4.8 m)	3–6		CI	**Sandy CLAY** Grey brown, medium plasticity, fine to coarse grained sand. High drilling resistance encountered between 3.5 m and 4.0 m	=PL, <PL, >PL				
		6.1			Borehole terminated at 6.1 m					

Well Construction Details



GROUNDWATER WELL REPORT

WELL NUMBER: BH07

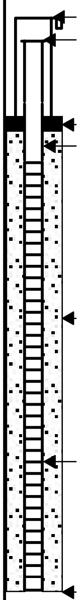
First Floor 207 The Parade
NORWOOD SA 5067

Client: Jeffries Gardens Soils		
Project: Organic Recycling Facility	Checked by: AKW	
Location: Buckland Park	Datum: Arbitrary	Logged by: NBP
Project No: SG031072	Easting: 175.22	Contractor: Drillmax
Date Comenced: 13/6/03	Northing: 2052.93	Operator: Carlo
Date Completed: 13/6/03	R.L. surface: 10.50	Machine: Rockmaster

SUBSURFACE PROFILE / **SAMPLING**

Drilling Method	Water	Depth (m)	USCS	Description	Moisture	Consistency	Recovery	Sampling	PID (ppm)
AV	▼ (approx. 1.6 m)	0	SM	**Silty SAND** Grey brown, fine to medium grained, low plasticity fines	D				
			SP	**SAND** Orange brown, fine to medium grained	M				
		1	SP	**SAND** Brown, fine to medium grained with some medium plasticity fines	M				
		2	SP	**SAND** Grey, fine to medium grained	W				
		3							
		4		Borehole terminated at 3.6 m					
		5							
		6							
		7							

Well Construction Details



Appendix B

Field Sampling Sheets

S & G

Appendix B – Summary of Field Measurements (24 June 2003)

Borehole ID	Date	Total Depth of Well	Standing Water Level	Stickup*	Volume Purged	DO	Temperature	Salinity	pH	Conductivity	Redox Potential	Turbidity	Comments
Units		m bTOC	m bTOC	m	L	mg/L	^{o}C	%	pH units	mS/cm	mV		
BH01	24-Jun-03	3.96	1.64	0.3	50	2.26	17.5	2.07	7.54	33.1	194	>999	
BH02	24-Jun-03	3.923	1.72	0.42	60	2.25	18	4	7.06	64.1	127	>999	
BH03	24-Jun-03	3.68	2.01	0.37	40	1.1	17.5	0.81	7.58	14.1	2.12	>999	
BH04	24-Jun-03	7.115	4.77	0.42	25	3.7	18	1.4	7.5	23	155	>999	Dry after 16 and 25 ltrs
BH05	24-Jun-03	4.35	2.30	0.11	15	4.76	17.5	1.38	7.48	22.9	116	>999	Dry after 9 and 15 ltrs
BH06	24-Jun-03	6.11	5.20	0.35	6	-	16.8	0.92	7.34	15.8	69	>999	Dry after 4 and 6 ltrs
BH07	24-Jun-03	3.11	2.10	0.44	40	0.73	17.6	1.13	7.45	19.1	-25	>999	

Abbreviations: bTOC - below top of casing, DO - dissolved oxygen

* Note: stickup refers to the height of the TOC above the immediate ground surface

Appendix C

DLWBC groundwater database information

Appendix D

Laboratory Certificates & Chain of Custody Documentation

CERTIFICATE OF ANALYSIS

ALS Environmental

CONTACT:	MR ANDREW NUNN	**Batch:**	EM17987
CLIENT:	SOIL & GROUNDWATER CONSULTING	**Sub Batch:**	0
ADDRESS:	P.O.BOX 552 GLENSIDE SA 5065	**LABORATORY:**	MELBOURNE
		DATE RECEIVED:	26/06/2003
		DATE COMPLETED:	08/07/2003
ORDER No.:	SG031072	**SAMPLE TYPE:**	WATER
PROJECT:	BUCKLAND PARK	**No. of SAMPLES:**	8

COMMENTS

EG-020 metals conducted by ALS Sydney, NATA Site No. 10911. Mercury LOR raised x 10 for all samples due to matrix interference. Ionic balances are within acceptable limits as detailed in the 20th edition APHA "Standard Methods for the Examination of Water and Wastewater". TDS by method EA-015 may bias high due to the presence of fine particulate matter which may pass through the prescribed GF/C paper.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: MELBOURNE

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Clayton VIC 3168

Phone: 61-3-9538 4444
Fax: 61-3-9538 4400
Email: trish.edwards@alsenviro.com

Signatory

Valda Chen
Senior Inorganic Chemist

Dr. Aaron Stott
Senior Organic Chemist

LABORATORIES

AUSTRALASIA

Brisbane
Melbourne
Sydney
Newcastle
Mumbai

Hong Kong
Singapore
Kuala Lumpar
Auckland
Bogor

AMERICAS

Vancouver
Santiago
Antofagasta
Lima

Australian Laboratory Services Pty Ltd (ABN 84 009 936 029)

NATA Accredited Laboratory Number 825
Site: MELBOURNE

Batch:	EM17987
Sub Batch:	0
Date of Issue:	25/07/2003
Client:	SOIL & GROUNDWATER CONSULTING
Client Reference:	BUCKLAND PARK

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	2	3	4	5	6	7	8		
		Date Sampled		24/06/2003	24/06/2003	24/06/2003	24/06/2003	24/06/2003	24/06/2003	24/06/2003	24/06/2003		
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	BH01	BH02	BH03	BH04	BH05	BH06	BH07	DUP1		
EA-015	Total Dissolved Solids (TDS)	mg/L	1	31000	58900	10900	18700	17700	12200	13300	13600		
ED-005F	Calcium - Filtered	mg/L	1	104	524	55	141	59	419	130	153		
ED-010F	Magnesium - Filtered	mg/L	1	108	1200	24	92	32	284	65	88		
ED-015F	Sodium - Filtered	mg/L	1	4650	12000	2580	4550	4290	2170	3340	3930		
ED-020F	Potassium - Filtered	mg/L	1	184	512	60	82	70	95	71	95		
ED-035	Bicarbonate as CaCO3	mg/L	1	506	450	767	576	878	423	788	800		
ED-037	Alkalinity as CaCO3	mg/L	1	506	450	767	576	878	423	788	800		
ED-040F	Sulphate - Filtered	mg/L	1	1000	3300	688	1660	1520	1000	965	1140		
ED-045F	Chloride - Filtered	mg/L	1	7500	23000	2900	6710	4500	3500	4820	5620		
EG-020F	Arsenic - Filtered	mg/L	0.001	<0.001	<0.010	<0.001	<0.001	<0.001	0.002	0.022	0.020		
EG-020F	Cadmium - Filtered	mg/L	0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001		
EG-020F	Chromium - Filtered	mg/L	0.001	0.003	<0.005	0.003	0.008	0.003	0.002	0.002	0.002		
EG-020F	Copper - Filtered	mg/L	0.001	0.008	<0.020	0.005	0.007	0.008	0.006	0.004	0.004		
EG-020F	Nickel - Filtered	mg/L	0.001	0.015	0.022	0.003	0.003	0.010	0.004	0.009	0.009		
EG-020F	Lead - Filtered	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
EG-020F	Zinc - Filtered	mg/L	0.005	0.015	<0.020	0.013	0.011	0.008	0.018	0.018	0.016		
EG-035F	Mercury - Filtered	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
EK-055	Ammonia as N	mg/L	0.01	0.05	1.98	<0.01	<0.01	<0.01	0.16	0.45	0.32		
EK-061	Total Kjeldahl Nitrogen as N	mg/L	0.1	0.8	2.9	0.2	<0.1	0.6	0.5	1.0	2.6		
EK-062	Total Nitrogen as N	mg/L	0.1	1.9	2.9	3.6	6.6	10.4	16.3	1.0	2.6		
EK-067	Phosphorus as P - Total	mg/L	0.01	1.63	2.36	1.13	0.42	0.34	0.96	0.88	1.03		
EP-026	Chemical Oxygen Demand	mg/L	1	2240	4840	929	1420	1590	590	1470	1830		
EP-030	Biochemical Oxygen Demand	mg/L	2	2	2	2	4	4	4	4	4		
EZ-005	Total Cations	me/L	0.01	221	660	118	215	194	141	159	188		
EZ-010	Total Anions	me/L	0.01	243	727	111	235	176	128	172	198		
EZ-015	Actual (Anion / Cation) Difference	me/L	0.01	21.4	66.6	6.81	20.8	18.1	13.3	12.8	9.75		
EZ-020	Allowed (Anion / Cation) Difference	me/L	0.01	3.87	11.4	1.83	3.75	2.84	2.09	2.77	3.18		

Batch:	EM17987
Sub Batch:	0
Date of Issue:	25/07/2003
Client:	SOIL & GROUNDWATER CONSULTING
Client Reference:	BUCKLAND PARK

QUALITY CONTROL REPORT

METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	SAMPLE IDENTIFICATION									
	Laboratory I.D.			1	8	200	201	202					
	Date Sampled			24/06/2003	24/06/2003	26/06/2003	24/06/2003	24/06/2003					
				BH01 MS	DUP1 CHK	METHOD BLANK	LCS	MS					
				CHECKS AND SPIKES									
EA-015	Total Dissolved Solids (TDS)	mg/L	1	----	13200	<1	101%	----					
ED-005F	Calcium - Filtered	mg/L	1	----	144	<1	108%	----					
ED-010F	Magnesium - Filtered	mg/L	1	----	83	<1	101%	----					
ED-015F	Sodium - Filtered	mg/L	1	----	3280	<1	98.0%	----					
ED-020F	Potassium - Filtered	mg/L	1	----	79	<1	105%	----					
ED-035	Bicarbonate as CaCO3	mg/L	1	----	795	----	----	----					
ED-037	Alkalinity as CaCO3	mg/L	1	----	795	<1	99.0%	----					
ED-040F	Sulphate - Filtered	mg/L	1	----	1110	<1	97.0%	----					
ED-045F	Chloride - Filtered	mg/L	1	----	----	<1	97.0%	96.0%					
EG-020F	Arsenic - Filtered	mg/L	0.001	106%	0.019	<0.001	92.0%	106%					
EG-020F	Cadmium - Filtered	mg/L	0.0001	92.0%	0.0001	<0.0001	93.0%	92.0%					
EG-020F	Chromium - Filtered	mg/L	0.001	93.0%	0.002	<0.001	96.0%	93.0%					
EG-020F	Copper - Filtered	mg/L	0.001	96.0%	0.004	<0.001	98.0%	96.0%					
EG-020F	Nickel - Filtered	mg/L	0.001	96.0%	0.009	<0.001	93.0%	96.0%					
EG-020F	Lead - Filtered	mg/L	0.001	93.0%	<0.001	<0.001	97.0%	93.0%					
EG-020F	Zinc - Filtered	mg/L	0.005	96.0%	0.016	<0.005	95.0%	96.0%					
EG-035F	Mercury - Filtered	mg/L	0.001	116%	----	<0.001	102%	----					
EK-055	Ammonia as N	mg/L	0.01	89.0%	0.32	<0.01	100%	----					
EK-061	Total Kjeldahl Nitrogen as N	mg/L	0.1	75.0%	----	<0.1	101%	----					
EK-062	Total Nitrogen as N	mg/L	0.1	----	----	----	----	----					
EK-067	Phosphorus as P - Total	mg/L	0.01	117%	----	<0.01	97.0%	----					
EP-026	Chemical Oxygen Demand	mg/L	1	----	----	<1	102%	----					
EP-030	Biochemical Oxygen Demand	mg/L	2	----	----	----	102%	----					
EZ-005	Total Cations	me/L	0.01	----	----	----	----	----					
EZ-010	Total Anions	me/L	0.01	----	----	----	----	----					
EZ-015	Actual (Anion / Cation) Difference	me/L	0.01	----	----	----	----	----					
EZ-020	Allowed (Anion / Cation) Difference	me/L	0.01	----	----	----	----	----					

CERTIFICATE OF ANALYSIS

ALS Environmental

CONTACT:	MR ANDREW NUNN	**Batch:**	EM17987
CLIENT:	SOIL & GROUNDWATER CONSULTING	**Sub Batch:**	1
ADDRESS:	P.O.BOX 552 GLENSIDE SA 5065	**LABORATORY:**	MELBOURNE
		DATE RECEIVED:	26/06/2003
		DATE COMPLETED:	08/07/2003
		SAMPLE TYPE:	WATER
ORDER No.:	SG031072	**No. of SAMPLES:**	8
PROJECT:	BUCKLAND PARK		

COMMENTS

Insufficient sample was provided for extended QC analysis. Surrogates not determined due to sample matrrix effects.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: MELBOURNE

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Signatory

Valda Chen
Senior Inorganic Chemist

A. Stott

Dr. Aaron Stott
Senior Organic Chemist

LABORATORIES

AUSTRALASIA

Brisbane
Melbourne
Sydney
Newcastle
Mumbai

Hong Kong
Singapore
Kuala Lumpar
Auckland
Bogor

AMERICAS

Vancouver
Santiago
Antofagasta
Lima

Australian Laboratory Services Pty Ltd (ABN 84 009 936 029)

NATA Accredited Laboratory Number 825
Site: MELBOURNE

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Batch: EM17987
Sub Batch: 1
Date of Issue: 25/07/2003
Client: SOIL & GROUNDWATER CONSULTING
Client Reference: BUCKLAND PARK

CERTIFICATE OF ANALYSIS

METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	SAMPLE IDENTIFICATION									
	Laboratory I.D.			1	2	3	4	5	6	7	8		
	Date Sampled			24/06/2003	24/06/2003	24/06/2003	24/06/2003	24/06/2003	24/06/2003	24/06/2003	24/06/2003		
				BH01	BH02	BH03	BH04	BH05	BH06	BH07	DUP1		
EP-075A-WS	**PHENOLS**												
EP-075A-WS	Phenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	<2		
EP-075A-WS	2-Chlorophenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	<2		
EP-075A-WS	2-Methylphenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	<2		
EP-075A-WS	3- & 4-Methylphenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	<2		
EP-075A-WS	2-Nitrophenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	<2		
EP-075A-WS	2.4-Dimethylphenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	<2		
EP-075A-WS	2.4-Dichlorophenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	<2		
EP-075A-WS	2.6-Dichlorophenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	<2		
EP-075A-WS	4-Chloro-3-methylphenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	<2		
EP-075A-WS	2.4.6-Trichlorophenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	<2		
EP-075A-WS	2.4.5-Trichlorophenol	ug/L	2	<2	<2	<2	<2	<2	<2	<2	<2		
EP-075A-WS	Pentachlorophenol	ug/L	4	<4	<4	<4	<4	<4	<4	<4	<4		
EP-075S-WS	**ACID EXTRACTABLE SURROGATES**												
EP-075S-WS	2-Fluorophenol	%	1	43	59	Not Det'd	15	Not Det'd	53	47	52		
EP-075S-WS	Phenol-D6	%	1	30	39	Not Det'd	15	Not Det'd	33	30	34		
EP-075S-WS	2-Chlorophenol-D4	%	1	85	76	33	53	18	89	73	77		
EP-075S-WS	2.4.6-Tribromophenol	%	1	67	72	30	32	Not Det'd	67	69	70		

Batch: EM17987
Sub Batch: 1
Date of Issue: 25/07/2003
Client: SOIL & GROUNDWATER CONSULTING
Client Reference: BUCKLAND PARK

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION										
		Laboratory I.D.		100	101	102								
		Date Sampled		24/06/2003	24/06/2003	24/06/2003								
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	METHOD BLANK	VSVOCW435 SCS	VSVOCW435 DCS								
				CHECKS AND SPIKES										
EP-075A-WS	**PHENOLS**													
EP-075A-WS	Phenol	ug/L	2	<2	36.3%	35.1%								
EP-075A-WS	2-Chlorophenol	ug/L	2	<2	71.1%	66.4%								
EP-075A-WS	2-Methylphenol	ug/L	2	<2	67.6%	60.3%								
EP-075A-WS	3- & 4-Methylphenol	ug/L	2	<2	66.6%	60.0%								
EP-075A-WS	2-Nitrophenol	ug/L	2	<2	81.1%	77.3%								
EP-075A-WS	2.4-Dimethylphenol	ug/L	2	<2	101%	58.5%								
EP-075A-WS	2.4-Dichlorophenol	ug/L	2	<2	80.6%	72.8%								
EP-075A-WS	2.6-Dichlorophenol	ug/L	2	<2	77.0%	69.5%								
EP-075A-WS	4-Chloro-3-methylphenol	ug/L	2	<2	77.0%	72.2%								
EP-075A-WS	2.4.6-Trichlorophenol	ug/L	2	<2	81.4%	73.3%								
EP-075A-WS	2.4.5-Trichlorophenol	ug/L	2	<2	81.5%	73.0%								
EP-075A-WS	Pentachlorophenol	ug/L	4	<4	55.5%	50.1%								
EP-075S-WS	**ACID EXTRACTABLE SURROGATES**													
EP-075S-WS	2-Fluorophenol	%	1	42	39	38								
EP-075S-WS	Phenol-D6	%	1	31	33	31								
EP-075S-WS	2-Chlorophenol-D4	%	1	80	76	72								
EP-075S-WS	2.4.6-Tribromophenol	%	1	79	96	84								

CERTIFICATE OF ANALYSIS

ALS Environmental

CONTACT:	MR ANDREW NUNN	**Batch:**	EM17987
CLIENT:	SOIL & GROUNDWATER CONSULTING	**Sub Batch:**	2
ADDRESS:	P.O.BOX 552 GLENSIDE SA 5065	**LABORATORY:**	MELBOURNE
		DATE RECEIVED:	26/06/2003
		DATE COMPLETED:	08/07/2003
		SAMPLE TYPE:	WATER
ORDER No.:	SG031072	**No. of SAMPLES:**	8
PROJECT:	BUCKLAND PARK		

COMMENTS

Insufficient sample was provided for extended QC analysis.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: MELBOURNE

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Signatory

Valda Chen
Senior Inorganic Chemist

Dr. Aaron Stott
Senior Organic Chemist

LABORATORIES

AUSTRALASIA
Brisbane, Melbourne, Sydney, Newcastle, Mumbai
Hong Kong, Singapore, Kuala Lumpar, Auckland, Bogor

AMERICAS
Vancouver, Santiago, Antofagasta, Lima

NATA Accredited Laboratory Number 825
Site: MELBOURNE

Australian Laboratory Services Pty Ltd (ABN 84 009 936 029)

Batch:	EM17987
Sub Batch:	2
Date of Issue:	25/07/2003
Client:	SOIL & GROUNDWATER CONSULTING
Client Reference:	BUCKLAND PARK

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	2	3	4	5	6	7	8		
		Date Sampled		24/06/2003	24/06/2003	24/06/2003	24/06/2003	24/06/2003	24/06/2003	24/06/2003	24/06/2003		
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	BH01	BH02	BH03	BH04	BH05	BH06	BH07	DUP1		
EP-068A-WS	**ORGANOCHLORINE PESTICIDES**												
EP-068A-WS	alpha-BHC	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068A-WS	HCB	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068A-WS	beta-BHC & gamma-BHC	ug/L	1	<1	<1	<1	<1	<1	<1	<1	<1		
EP-068A-WS	delta-BHC	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068A-WS	Heptachlor	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068A-WS	Aldrin	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068A-WS	Heptachlor epoxide	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068A-WS	Chlordane - trans	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068A-WS	Endosulfan 1	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068A-WS	Chlordane - cis	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068A-WS	Dieldrin	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068A-WS	DDE	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068A-WS	Endrin	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068A-WS	Endosulfan 2	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068A-WS	DDD	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068A-WS	Endrin aldehyde	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068A-WS	Endosulfan sulfate	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068A-WS	DDT	ug/L	2	<2	<2	<2	<2	<2	<2	<2	<2		
EP-068A-WS	Endrin ketone	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068A-WS	Methoxychlor	ug/L	2	<2	<2	<2	<2	<2	<2	<2	<2		
EP-068B-WS	**ORGANOPHOSPHORUS PESTICIDES**												
EP-068B-WS	Dichlorvos	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068B-WS	Demeton-S-methyl	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068B-WS	Monocroptophos	ug/L	2	<2	<2	<2	<2	<2	<2	<2	<2		
EP-068B-WS	Dimethoate	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068B-WS	Diazinon	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068B-WS	Chlorpyrifos-methyl	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068B-WS	Parathion-methyl	ug/L	2	<2	<2	<2	<2	<2	<2	<2	<2		
EP-068B-WS	Malathion	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068B-WS	Fenthion	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068B-WS	Chlorpyrifos	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068B-WS	Parathion	ug/L	2	<2	<2	<2	<2	<2	<2	<2	<2		
EP-068B-WS	Pirimiphos-ethyl	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		

Batch:	EM17987
Sub Batch:	2
Date of Issue:	25/07/2003
Client:	SOIL & GROUNDWATER CONSULTING
Client Reference:	BUCKLAND PARK

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	2	3	4	5	6	7	8		
		Date Sampled		24/06/2003	24/06/2003	24/06/2003	24/06/2003	24/06/2003	24/06/2003	24/06/2003	24/06/2003		
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	BH01	BH02	BH03	BH04	BH05	BH06	BH07	DUP1		
EP-068B-WS	Chlorfenvinphos E	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068B-WS	Chlorfenvinphos Z	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068B-WS	Bromophos-ethyl	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068B-WS	Fenamiphos	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068B-WS	Prothiofos	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068B-WS	Ethion	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068B-WS	Carbophenothion	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068B-WS	Azinphos-methyl	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		
EP-068S-WS	**ORGANOCHLORINE PESTICIDE SURROGATE**												
EP-068S-WS	Dibromo-DDE	%	1	111	78	97	100	107	112	106	100		
EP-068T-WS	**ORGANOPHOSPHORUS PESTICIDE SURROGATE**												
EP-068T-WS	DEF	%	1	110	74	80	92	81	102	103	94		

QUALITY CONTROL REPORT

METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	100	101	102							
				SAMPLE IDENTIFICATION									
		Laboratory I.D.		100	101	102							
		Date Sampled		26/06/2003	26/06/2003	26/06/2003							
				METHOD BLANK	VOCOPW115 SCS	VOCOPW115 DCS							
				CHECKS AND SPIKES									
EP-068A-WS	**ORGANOCHLORINE PESTICIDES**												
EP-068A-WS	alpha-BHC	ug/L	0.5	<0.5	110%	100%							
EP-068A-WS	HCB	ug/L	0.5	<0.5	108%	98.1%							
EP-068A-WS	beta-BHC & gamma-BHC	ug/L	1	<1	112%	104%							
EP-068A-WS	delta-BHC	ug/L	0.5	<0.5	106%	102%							
EP-068A-WS	Heptachlor	ug/L	0.5	<0.5	103%	97.0%							
EP-068A-WS	Aldrin	ug/L	0.5	<0.5	106%	101%							
EP-068A-WS	Heptachlor epoxide	ug/L	0.5	<0.5	105%	101%							
EP-068A-WS	Chlordane - trans	ug/L	0.5	<0.5	105%	99.5%							
EP-068A-WS	Endosulfan 1	ug/L	0.5	<0.5	106%	99.6%							
EP-068A-WS	Chlordane - cis	ug/L	0.5	<0.5	105%	100%							
EP-068A-WS	Dieldrin	ug/L	0.5	<0.5	103%	97.8%							
EP-068A-WS	DDE	ug/L	0.5	<0.5	109%	104%							
EP-068A-WS	Endrin	ug/L	0.5	<0.5	106%	100%							
EP-068A-WS	Endosulfan 2	ug/L	0.5	<0.5	105%	99.1%							
EP-068A-WS	DDD	ug/L	0.5	<0.5	106%	100%							
EP-068A-WS	Endrin aldehyde	ug/L	0.5	<0.5	104%	100%							
EP-068A-WS	Endosulfan sulfate	ug/L	0.5	<0.5	104%	99.4%							
EP-068A-WS	DDT	ug/L	2	<2	94.1%	89.8%							
EP-068A-WS	Endrin ketone	ug/L	0.5	<0.5	104%	97.4%							
EP-068A-WS	Methoxychlor	ug/L	2	<2	115%	111%							
EP-068B-WS	**ORGANOPHOSPHORUS PESTICIDES**												
EP-068B-WS	Dichlorvos	ug/L	0.5	<0.5	93.8%	84.1%							
EP-068B-WS	Demeton-S-methyl	ug/L	0.5	<0.5	111%	94.0%							
EP-068B-WS	Monocroptophos	ug/L	2	<2	62.4%	68.4%							
EP-068B-WS	Dimethoate	ug/L	0.5	<0.5	97.9%	92.5%							
EP-068B-WS	Diazinon	ug/L	0.5	<0.5	106%	101%							
EP-068B-WS	Chlorpyrifos-methyl	ug/L	0.5	<0.5	105%	101%							
EP-068B-WS	Parathion-methyl	ug/L	2	<2	104%	99.6%							
EP-068B-WS	Malathion	ug/L	0.5	<0.5	106%	101%							
EP-068B-WS	Fenthion	ug/L	0.5	<0.5	105%	99.5%							
EP-068B-WS	Chlorpyrifos	ug/L	0.5	<0.5	106%	101%							

Batch: EM17987
Sub Batch: 2
Date of Issue: 25/07/2003
Client: SOIL & GROUNDWATER CONSULTING
Client Reference: BUCKLAND PARK

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION										
		Laboratory I.D.		100	101	102								
		Date Sampled		26/06/2003	26/06/2003	26/06/2003								
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	METHOD BLANK	VOCOPW115 SCS	VOCOPW115 DCS								
				CHECKS AND SPIKES										
EP-068B-WS	Parathion	ug/L	2	<2	102%	95.9%								
EP-068B-WS	Pirimiphos-ethyl	ug/L	0.5	<0.5	104%	99.0%								
EP-068B-WS	Chlorfenvinphos E	ug/L	0.5	<0.5	----	----								
EP-068B-WS	Chlorfenvinphos Z	ug/L	0.5	<0.5	107%	102%								
EP-068B-WS	Bromophos-ethyl	ug/L	0.5	<0.5	104%	98.7%								
EP-068B-WS	Fenamiphos	ug/L	0.5	<0.5	106%	101%								
EP-068B-WS	Prothiofos	ug/L	0.5	<0.5	104%	98.3%								
EP-068B-WS	Ethion	ug/L	0.5	<0.5	103%	97.6%								
EP-068B-WS	Carbophenothion	ug/L	0.5	<0.5	102%	96.8%								
EP-068B-WS	Azinphos-methyl	ug/L	0.5	<0.5	113%	111%								
EP-068S-WS	**ORGANOCHLORINE PESTICIDE SURROGATE**													
EP-068S-WS	Dibromo-DDE	%	1	82	115	107								
EP-068T-WS	**ORGANOPHOSPHORUS PESTICIDE SURROGATE**													
EP-068T-WS	DEF	%	1	81	113	112								

Appendix J

Jeffries Quality Control Systems Registration Details

Quality System

Quality
Endorsed
Company

CERTIFICATE OF REGISTRATION

Jeffries Garden Soils

A trading name of L.F. Jeffries Nominees Pty Ltd

ACN 007 797 748

247 Cormack Road WINGFIELD SA 5013 AUSTRALIA

complies with the requirements of

AS/NZS ISO 9001:1994

Quality systems-Model for quality assurance in design development production installation and servicing

for the following capability

The registration covers the Quality Management System for the design and manufacture of premium and regular standard potting mix; wholesale and retail supply; bulk inter and intra state delivery also includes the hire of recycling equipment and expertise.

Registered by:

Quality Assurance Services Pty Limited (QAS) ACN 050 611 642 286 Sussex Street Sydney NSW 2000 Australia

Certificate No.: QEC5086
Issue Date: 14 June 2001

Certified Date: 21 March 1995
Expiry Date: 15 December 2003

Keith Ketheeswaran
Managing Director
For and on behalf of
The Board of Quality Assurance Services Pty Limited

Authorised Local Signatory, QAS

JAS-ANZ

QAS is Accredited by the Joint Accreditation System of Australia and New Zealand. Acc No. [illegible]

QAS

QUALITY ASSURANCE SERVICES

Certified Product

Australian Standard

STANDARDSMARK SCHEDULE

L. F. Jeffries Nominees Pty Ltd
Trading As Jeffries Garden Soils

ACN 007797748

SA

AS 4454:1999 - Composts, soil conditioners and mulches.

Model identification of the goods on which the STANDARDSMARK may be used:*

FORMULA/ PRODUCT NO.	BRAND	PRODUCT	CLASSIFICATION	PACKAGING
ORGCOM	Jeffries	Organic Compost	Composted Soil Conditioner	Bulk
SOILCON	Jeffries	Recover	Composted Soil Conditioner	Bulk
LFMULCH	Jeffries	Forest Mulch	Composted Mulch	Bulk

End of Record

Licence No.: 2017

Issue Date: 13 March 2002

Alex Ezrakhovich
General Manager Certification
For and on behalf of Quality Assurance Services Pty Limited

Authorised Local Signatory, QAS

JAS-ANZ

QAS is Accredited by the Joint Accreditation System of Australia and New Zealand. Acc. No. Z1440295AS

QAS QUALITY ASSURANCE SERVICES

*Items that do not display the STANDARDSMARK do not comply with the conditions of the licence.

MK898.01 CDAN 99/160

NASAA
certified organic
AQIS and IFOAM Accredited ®

Certificate of Registration

Licence Number

5125M

JEFFRIES GROUP
ABN: 38 498 297 669
247 Cormack Road
Wingfield SA 5013

The above licensee has been assessed and certified by The National Association for Sustainable Agriculture, Australia Limited (NASAA) as complying with the NASAA Standards for Organic Agricultural Production and/or the NASAA Processing and Preparation Standards for Certified Food and Fibre

CERTIFIED FOR:

The production of the products known as *Jeffries Organic Compost* and *Jeffries Forest Mulch* at the facilities of Jeffries Garden Soils at 247 Cormack Road, Wingfield in the State of South Australia

Common Seal
NATIONAL ASSOCIATION FOR SUSTAINABLE AGRICULTURE AUSTRALIA LTD
A.C.N. 003 260 348

Date of Issue: 29 April 2003
Date of Expiry: 30 June 2004

Chairperson

Manager

This certificate is limited to the above licensee, and its validity is subject to ongoing compliance with the Standards. It is not intended as a commercial or transaction document and remains the property of NASAA.

NATIONAL ASSOCIATION FOR SUSTAINABLE AGRICULTURE, AUSTRALIA LIMITED
Unit 7/3 Mount Barker Road, Stirling, South Australia 5152 ABN: 85 003 260 348

Appendix K

Parsons Brinckerhoff Risk Assessment Report

Buckland Park Organics Waste Treatment and Recycling Research Facility – Environmental/Social Risk Review

29 April 2003

Jeffries Garden Soils

PARSONS BRINCKERHOFF

Parsons Brinckerhoff Australia Pty Limited ACN 078 004 798 and Parsons Brinckerhoff International (Australia) Pty Limited ACN 006 475 056 trading as Parsons Brinckerhoff ABN 84 797 323 433

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Adelaide SA 5000
GPO Box 398
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Telephone *+61 8 8405 4300*
Facsimile *+61 8 8405 4301*
Email *adelaide@pb.com.au*

ABN 84 797 323 433
NCSI Certified Quality System ISO 9001

2002 ENGINEERING EXCELLENCE AWARD WINNER

2102426A
03-0246-02

Author:	V Farrington ....
Reviewer:	.... P Woods
Approved by:	V Farrington ....
Signed:	....
Date:	29 April 2003 ....
Distribution:	Jeffries Garden Soils, Finlaysons Lawyers................................

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Contents

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1. Introduction

Jeffries Garden Soils have released a Public Environmental Report (PER) for a proposed Organics Resource Treatment and Recycling Facility at Buckland Park, near Virginia, north of Adelaide. The proposed facility will accept predominantly green wastes from metropolitan Adelaide, for composting, and incorporates an irrigation pivot for horticulture.

The project is to be assessed as a Major Development under the provisions of Section 46 of the *Development Act 1993*. Guidelines for the PER were released by the Major Developments Panel in November 2002, and the PER was released in January 2003.

Following the release of the PER, Parsons Brinckerhoff were engaged by Jeffries Garden Soils to undertake an environmental and social risk assessment of the proposed project. In developing this assessment, Parsons Brinckerhoff have considered the following:

- The description of the project as presented in the PER
- A review of the concerns raised in the responses to the PER
- Identifying the key environmental and social aspects
- Undertaking an environmental and social risk assessment of the key aspects.

Following the review of the PER and the responses, the following key aspect topics were identified:

- Site suitability/compatibility with other uses
- Odour and odour modelling
- Dust emissions
- Traffic/traffic noise
- Groundwater
- Plant pests, pathogens and weeds
- Human health/allergy reactions
- Birdstrike
- Miscellaneous aspects.

Note these aspect topics are not listed in any particular order, including of importance.

The environmental and social risks associated with these key aspects topics are discussed in the following sections. The format is some discussion of the topic and a tabular presentation of the individual aspects associated with each topic, the identified risk for each aspect, the mitigation (either proposed in the PER or suggested), and comments if appropriate.

The main focus of this review is on the composting operations component of the proposal. The irrigation pivot, which would be used for demonstration and research purposes, is existing and is similar to other activities in the area. No particular aspects were identified for the pivot, and few comments were made on it in the public responses.

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2. Site Suitability/Compatibility With Other Uses

The PER (Section 5.9) describes the consistency of the proposal with the Playford City Development Plan and the Planning Strategy for Metropolitan Adelaide, and the appropriateness of the proposal within the zoning of the site – Extractive Industry Zone (southern section) and Horticulture Zone (northern section).

The Planning Assessment (Appendix 17 of the PER) concludes that the proposed development accords with the Development Plan and is not seriously at variance with either the Extractive Industry or Horticulture Zone provisions. A contrary view was expressed in one of the submissions (Jamie Botten and Associates) on the PER, however the Planning SA Assessments Branch response supports the conclusions of Appendix 17.

The Planning SA response stated 'the proposed development satisfactorily accords with the relevant provisions of the Development Plan and Planning Strategy and is not seriously at variance with either the Extractive Industry Zone, Horticulture Zone or Council Wide provisions of the City of Playford Development Plan'.

From the discussion in the PER and the assessment by Planning SA, it is concluded that the site is suitable for the intended purpose of the site (namely composting and horticulture) in terms of conformance with planning policy.

As part of this review a comparison is made with the SA Environment Protection Authority (EPA) consultation draft *Guidelines for Separation Distances* (August 2000), which provides guidance on recommended separation distances for a wide range of industrial and other activities. These distances are from the activity boundary to the nearest sensitive land use or zone. The nearest residence to the proposed windrow composting activities is approximately 1,000 m.

The following conclusions were made in this comparison:

1. The Buckland Park site meets the separation distance criterion for Compost activities for 'green' waste (500 m).

2. The site meets the bird hazard criteria for landfill sites and airports (3 km, compared with actual of about 8 km to the nearest runway, at the RAAF Edinburgh airbase). It is also noted that the potential attraction of birds to the proposed facility is considerably less than for a landfill. Birdstrike is discussed further in Section 9.

3. The draft guideline does not provide a separation distance for in-vessel composting. However, "treated organic waste not sewage", and "incineration for chemical/ biomedical/organic waste", have recommended separation distances of 500 m. Animal processing and rendering works, which would be expected to have a higher potential for odour (depending on the nature of the input material), have a recommended separation distance of 1 km. Based on these comparisons an appropriate separation distance for in-vessel composting may be considered to be 500 m, and at most 1 km.

It is considered that the site meets the EPA draft separation distance guidelines.

The key aspects and risks in regard to development encroachment are discussed in the Table 2.1. The key risk identified is potential future encroachment of development.

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Table 2.1 Risks – Development

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Aspect	Identified Risk	Mitigation	Comment
Compatibility of proposed activities with existing development - horticulture research and demonstration - composting.	Potential land use conflicts if existing uses are incompatible with the proposed facility.	Development is in conformance with Development Plan and Planning Strategy.	The larger part of the proposed site (the existing pivot) would be a commercial horticultural research and demonstration area.
Conformance with buffer zone guidelines.	Buffer zone distances are determined to minimise the impacts caused by noise, odour or polluting air emissions.	The proposal conforms with the EPA draft *Guidelines for Separation Distances* (August 2000).	The EPA guidelines are intended to be applied in the assessment of new developments.
Future development encroachment, after the project has been established.	Should development encroachment occur and bring new residences close to the project (say within 1 km), complaints of odour, dust, allergy effects and truck noise could arise from these new residents.	Amend the site layout so that the areas of main site activity, such as the receival and preliminary processing area, are located as far away from the eastern boundary as reasonably practicable. Monitor proposals for any new development within 1,000 m of the site. Monitor proposals for any zoning change that would encourage development within 1,000 m.	Development encroachment could arise as a result of future zoning change, or without zoning change but with gradual infill by development approvals of hobby-type rural allotments. The irrigation pivot would provide a 1–1.5 km separation distance from the composting facility to the north, along Thompson Road.

It is noted that the EPA has raised development encroachment as a potential issue, stating that they are aware of a proposal to divide a large area in the vicinity into rural allotments. It is understood that the proposed subdivision referred to by the EPA is some 3 km from the proposed Jeffries Garden Soils facility. At this distance the proposed subdivision would be unaffected.

It is noted also that Planning SA has referred to a Buckland Park Plan Amendment Report, which is in preparation. However, no information is currently available on the content or status of the report.

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3. Odours and Odour Modelling

The potential for odours from the facility was an issue raised by a number of respondents. The PER included an odour assessment, and some comment was made on the odour modelling undertaken for the project.

The Ausplume model was used for the odour assessment in the PER. This is the standard regulatory model used by the EPA for the assessment of dispersion of air emissions, although other models may be more suitable for situations involving complex terrain or complex meteorological conditions including sea breezes. It is considered that Ausplume is suitable for regulatory assessment in this instance.

The Ausplume model is periodically upgraded, as reflected in the reports in Appendix 6 to the PER. The SA EPA also re-issued its odour assessment guideline (Technical Bulletin 25 (TB 25)) in March 2003. TB 25 provides criteria levels of 10 odour units (3 minute, 99.9%) for a single residence (less than 12 people) and 8 odour units for receiver groupings of 12 to 59 people.

The PER modelling used input meteorological data taken from the RAAF Edinburgh air base, 8 km away. These input data are considered to be quite suitable, although the coastal conditions experienced at the site may be somewhat more gustier than inland. These coastal effects would likely result in better dispersion for odours but could give rise to greater potential for fugitive dust emissions from the site.

The odour measurements used to determine the odour flux inputs for the model were taken using the Victorian B2 measurement standard. TB 25 recommends the use of odour determinations in accordance with the draft Australian standard. Recent comparative work (Dr Barry Severne pers. comm.) has shown that a factor of 1.26 is appropriate, in the case of composting operations, to convert odour measurements from the Victorian B2 measurement standard to the draft Australian standard. This factor has now been included in the re-run of the model by Dr Severne.

One other matter raised in the responses to the PER is whether all odour sources were accounted for. In particular it was considered that the odour flux inputs from the receival shed and the in-vessel composting operation were not included in the model. However Dr Severne has confirmed that the overall odour flux used as input to the model in the PER included the receival area.

In-vessel composting was included in the PER as an inclusion in Stage 3 of the project, which is projected to be 5 years time and beyond. The potential odours from in-vessel composting are not included in the present odour assessment. The choice of equipment including odour control technology would be made closer to the appropriate time, and it is expected that a licence variation application with updated modelling would be submitted to the EPA at that time.

The updated odour modelling indicates that the criteria in the latest SA EPA odour assessment guideline (re-issued March 2003) are met. This provides criteria levels of 10 odour units (3 minute, 99.9%) for single residences and 8 odour units for receiver groupings of 12 to 59 people.

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The key aspects and risks identified in regard to odours and the odour modelling assessment are discussed in Table 3.1.

Table 3.1 Risks – Odours and Odour Modelling

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Aspect	Identified Risk	Mitigation	Comment
Under some weather conditions morning sea breezes may carry odours further east than indicated from the modelling.	Odour levels may be under-estimated for sea breeze conditions.	Operate facility to minimise odour emissions.	The modelling undertaken is in conformance with EPA TB 25. Establish liaison with EPA. Implement community program.
The modelling results are 3-minute averages and transient odours over shorter time periods may be detected by receivers.	Individuals vary according to their odour detection thresholds; also some individuals may be prepared to accept an odour where others may not.	Operate facility to minimise odour emissions.	The modelling undertaken is in conformance with EPA TB 25. Establish liaison with EPA. Implement community program.
It is not clear whether the receival area is included.	Odour levels may be under-estimated. The EPA has stated that all sources need to be included to comply with TB 25.	The receival area was included in the original overall odour flux estimate.	
Lack of input odour source data for in-vessel composting. (It is noted that this equipment would not be installed for some years, and thus equipment selection including odour control technology will not be made for some years).	Odour levels may be under-estimated. The EPA has stated that all sources need to be included to comply with TB 25.	Re-run model with odour flux estimate for the in vessel composting area. However, would need to assume a typical odour flux, as equipment has not been selected.	The alternative may be to seek an EPA licence for the first stage of the project without in-vessel composting, and submit a licence variation application with updated modelling at the appropriate time.
The odour flux inputs are based on the Victorian standard.	Odour levels are under-estimated. The SA EPA has noted that this does not comply with TB 25.	Re-run model or re-present the results with the 1.26 conversion factor to comply with the Australian standard.	Re-run model or re-present results with conversion factor to Australian standard.

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4. Dust Emissions

Dust emissions were raised as an issue in some of the submissions. These concerns related to dust nuisance and also to the risk of hayfever and allergies, which is discussed separately in Section 8.

One of the dust control measures proposed in the PER was to curtail operations such as windrow turning and screening in winds greater than 15 km/h from the northern quadrants. This has brought some adverse comments in the public submissions, as nuisance could also arise with wind from other quarters.

It is also recognised that the potential for dust nuisance depends on a number of other factors apart from wind strength, including maintaining the moisture content of windrows, recent wet weather, relative humidity, the length of time of recent hot dry weather, and the effectiveness of wind breaks and other control measures undertaken on site including watering.

Thus the specification of an actual threshold wind speed for curtailing site activities is not considered necessary. A practical approach is to establish wind breaks, maintain moisture levels in the windrows, water internal roads and other working areas as necessary in dry windy conditions, and curtail site activities if watering proves ineffective in extreme dry windy weather conditions.

It is noted that a meteorological station is proposed to be installed on site. Over time this station would provide a history of information on weather conditions associated with dust emissions on site. In conjunction with weather forecasts the proposed activities on site during the coming day, including control measures such as watering and curtailing the turning of windrows, could be planned to minimise the potential for dust nuisance.

The proposed dust control measures in the PER have been reviewed. In summary the recommended key dust control provisions are:

- Use of covered trucks for incoming material.
- Receival and primary processing to be undertaken in an enclosed building.
- Curtail windrow turning, grinding and tromelling operations in extreme dry windy weather conditions if watering proves ineffective.
- Maintain windrows at their optimum moisture content (approximately 40-50%).
- Water other operational areas using sprinkler systems in dry windy conditions.
- Use a water truck in trafficked areas during dry windy conditions.
- Restrict vehicle speed within the site to 10 km/hr.
- Undertake meteorological monitoring on site, to be used to assist in dust control management (as described above).
- Undertake dust monitoring to track the dust control performance of the facility over time.

It is considered that these measures would minimise the potential effect of any dust nuisance arising from the proposed facility off site.

The key aspects and risks identified in regard to dust emissions are discussed in Table 4.1.

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Table 4.1 Risks – Dust Emissions

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Aspect	Identified Risk	Mitigation	Comment
Dust emissions during construction.	Complaints of dust nuisance or health/allergy effects.	A water truck is proposed to apply water to maintain soil moisture levels. Restrict vehicle speed within the site to 10 km/hr. Implement environmental code of practice as part of construction contract, with periodic auditing.	The PER gives a commitment to use a water truck in dry windy weather during construction.
Dust emissions receival and primary processing.	Complaints of dust nuisance or health/allergy effects.	Receival and primary processing to be undertaken in an enclosed building.	The PER gives this commitment.
Dust emissions from incoming and outgoing trucks.	Complaints of dust nuisance or health/allergy effects.	Use covered trucks for incoming material. Seal access road and truck delivery area. Use wheel wash for trucks exiting the site.	The PER gives these commitments. The use of covered trucks for incoming material is also essential to ensure that weed seeds are not spread in the area.
Fugitive dust emissions from site generally, including static windrow area.	Complaints of dust nuisance or health/allergy effects.	Maintain windrows at their optimum moisture content (approximately 40-50%). Water other operational areas using sprinkler systems in dry windy conditions.	A meteorological monitoring station is proposed to be installed on site, and dust monitoring will be undertaken. Both of these will assist in dust control management. The specification of a wind speed threshold for curtailing site activities is not considered essential – the potential for dust nuisance depends on a number of other factors apart from wind strength, including recent wet weather, relative humidity, the length of time of recent hot dry weather, and the effectiveness of wind breaks and other control measures including watering.
Dust emissions arising from site mobile plant.	Complaints of dust nuisance or health/allergy effects.	Use a water truck in trafficked areas during dry windy conditions. Restrict vehicle speed within the site to 10 km/hr.	
Dust emissions during windrow turning, grinding, tromelling etc.	Complaints of dust nuisance or health/allergy effects.	Curtail windrow turning, grinding and tromelling operations during extreme dry windy weather conditions, if watering proves ineffective.	

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5. Traffic/Traffic Noise

Some respondents expressed concern about noise from truck movements, in particular during late evening to early morning hours.

Jeffries Garden Soils have confirmed that the standard operating hours for the facility are the hours 6 am to 6 pm, Monday to Friday. Trucks collecting green waste start operation typically at 6 am, and would need to undertake their first round before driving to the facility. The first trucks are likely to arrive at the facility about 8 am, and most should be leaving after their last drop off by 4 pm. Thus in a practical sense the out-of-hours truck movements would be minimised.

The PER presents predicted noise levels along McEvoy Road, which show a predicted 6-7 dB increase in L_{Aeq} during the day versus at night, e.g. at a distance of 20 m, predicted noise levels are 51 dB L_{Aeq} at night (10 pm to 7 am) and 58 dB L_{Aeq} during the day (7 am to 10 pm) . Appendix 10 of the PER includes a discussion of desirable noise ranges.

Comments were also received on truck movements in surrounding roads, and on the adequacy of the exit and entry lanes to McEvoy Road along Port Wakefield Road.

Particular comments on commitments made in relation to traffic and traffic noise are provided in the following table.

Table 5.1 Risks – Traffic/Traffic Noise

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Aspect	Identified Risk	Mitigation	Comment
Concern about noise from truck movements, in particular during early morning hours.	Noise nuisance if heavy trucks access the site out of the hours 7 am to 10 pm.	The noise predictions in the PER indicate that noise levels will be within acceptable criteria.	The main truck movements to and from the site are expected in the hours from 8 am to 4 pm.
Concern about dust from truck movements.	Nuisance from dust emissions arising from truck movements.	McEvoy Road to be sealed. Use wheel wash for trucks exiting the site to minimise carryout of dust from the site.	There is a background dust level in the area, associated with horticultural and other rural activities, and unsealed roads.
Concern about the adequacy of the entry/exit lanes at the Port Wakefield Road/McEvoy Road intersection.	The existing entry/exit lanes from Port Wakefield Road to McEvoy Road may not be adequate for large vehicles.	Ensure entry/exit lanes from Port Wakefield Road to McEvoy Road are of adequate design.	Transport SA have recommended that the entry /exit lanes from Port Wakefield Road to McEvoy Road should be upgraded.
Concern about the number of truck movements in the local area.	Noise and dust from passing trucks, and traffic congestion and safety.	Appropriate traffic management in the area.	Traffic management responsibilities are Transport SA for Port Wakefield Road, and the City of Playford for minor roads.

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6. Groundwater

The PER includes discussion of groundwater issues, and has a supporting report by Delta Consultants. The PER proposes that seven wells would be installed. This number is considered to be sufficient to characterise the hydrogeology of the processing part of the site and for on going monitoring of the potential effects of the composting operations. However, a further three wells would be required to also include the pivot area.

Background monitoring and interpretation of results should be undertaken early in the construction phase to allow the findings to be taken into account for any modifications to the design and layout, if required. This work would comprise installing the wells and undertaking hydraulic testing on selected wells to establish local hydrogeological conditions. It is suggested that water level data loggers be placed in two selected wells for a minimum period of one year to examine local seasonal water level variations.

The table of leachate composition (page 56 of the PER) probably gives a good idea of potential contaminants of concern (see also Appendix 8), although the initial background monitoring should include a longer analytical list.

Following the initial 'background' monitoring program and its interpretation, it is suggested that a quarterly groundwater monitoring program be instituted for the first year of operation, reducing thereafter to six-monthly (early spring and early autumn). The monitoring and reporting schedule would then be reviewed on an annual basis.

The objective of the groundwater monitoring program would be to allow early detection of the development of possible off-site impacts, with the aim of early modification of water management practices to minimise or avoid such impacts.

The key aspects and risks identified in the groundwater assessment are discussed in the following table.

Table 6.1 Risk Assessment – Groundwater

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Aspect	Identified Risk	Mitigation	Comment
Leaching of nutrient-rich water into the salt ponds.	Low risk, subject to confirmation that the salt ponds are above the local water table.	This issue could be fixed by construction of an interception trench, although the disposal of collected salty water could be problematic.	Expect initial groundwater monitoring to confirm that the site is hydraulically lower than the salt pans. Alternatively to providing an interception trench, sufficient monitoring is needed to show that the management practices are working.
Potential leaching of nutrient-rich water into drains (stormwater or via groundwater) with possible algal blooms.	Risk is real, but likelihood low if good management practices are implemented and maintained.	Implement management practices – clay-lined floor area to windrows, 2% cross-fall, enclosed receival area, drainage swales in windrow area, which, in turn, discharge to the site stormwater retention pond.	Need sufficient monitoring to show that the management practices are working, and modify them if necessary.

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Aspect	Identified Risk	Mitigation	Comment
Possible increase of groundwater levels leading to salinisation of the soil surface.	Risk is real, but the likelihood is considered to be low if good stormwater drainage is implemented and excessive watering of windrows is avoided.	Implement stormwater drainage system. Use moisture monitoring to avoid excessive watering of windrows.	Need sufficient monitoring to show that the management practices are working, and modify them if necessary.
Insufficient site-specific groundwater information to estimate flow velocities and where the groundwater ends up.	Risk is that when groundwater wells are put in, they may be insufficient in number in the first instance to allow water flow directions to be discerned.	Provide adequate groundwater monitoring wells to allow water flow directions to be discerned and problems to be anticipated and avoided/mitigated.	Groundwater movement can be inferred to a limited extent from topography and location of drains. Need sufficient monitoring to show that the management practices are working, and modify them if necessary.
Insufficient site-specific groundwater information to properly design monitoring network.	Risk is that when groundwater wells are put in, they may be insufficient in number, or insufficient analytes, for monitoring design and for problems to be anticipated and avoided/mitigated.	Provide adequate groundwater monitoring wells to allow water flow directions to be discerned and problems to be anticipated and avoided/mitigated.	Need sufficient monitoring wells and sufficient analytes to be measured to provide baseline information.
Lack of sufficient local background groundwater composition information - shallow groundwater in the area may already contain some nutrient levels that pre-date the proposed development.	Without background data, there is a risk pre-existing nutrient levels may be blamed on the proposed development.	Even if no monitoring wells are put in until the project is approved, it will be very important to undertake and interpret the first monitoring round (preferably more than one round) before operations commence.	The previous agricultural/ dairying land use means that nutrient levels in the shallow groundwater may already be raised above ‘natural’ background. Need sufficient background monitoring to establish the pre-existing nutrient levels on the site.

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7. Plant Pests, Pathogens and Weeds

A number of responses to the PER expressed concern about the potential for the proposed facility to introduce plant pests, pathogens and weeds into the Northern Adelaide Plains (NAP) region.

Davidson Viticultural Consultants (DVC) has undertaken an assessment of this issue. The DVC report reviews the current horticultural industry in the NAP in both physical and economic terms, and discusses the infesting pests and diseases known to be present in the region.

The major pests and diseases currently of concern to producers are Western Flower Thrip, Mediterranean Fruit Fly and Queensland Fruit Fly. The DVC report details the management practices and quarantine protocols that are required for the management of these existing pests.

The DVC report further addresses other pests and diseases which are considered to be a risk by some producers on the NAP, as detailed in the Submissions to the PER. These additional pests and diseases are Phylloxera, Pierces Disease (vector, Glassy Winged Sharp Shooter) and Potato Cyst Nematode.

The DVC report also details the protocols for control of these diseases – in the case of Phylloxera and Potato Cyst Nematode, the Australian protocols and management plans are discussed. Pierces Disease is currently not present in Australia, and Australian Quarantine Information Service guidelines relating to importation of Californian tablegrapes are the relevant regulations.

The key conclusions of the DVC study are as follows:

- Pests and diseases exist in the NAP horticultural region, and there is a risk of an outbreak of other diseases. However, this risk is minimal if growers continue to comply with existing protocols.
- The increased movement of vehicles carrying green waste to the proposed facility should not increase the risk of Phylloxera to the NAP region because similar risks currently exist with increased visitation to the growing wine region and expansion of the immediate urban areas.
- In the case of Phylloxera and Potato Cyst Nematode, Australian protocols and management plans are in place. These have been developed in consultation with the relevant industry sectors over some years. Pierces Disease is currently not present in Australia, and Australian Quarantine Information Service guidelines relating to importation of Californian tablegrapes are the relevant regulations.
- Assuming that the relevant Australian Quarantine and Inspection Service (AQIS) quarantine protocols are followed, there will be no change to the current risk of the introduction of the Glassy Winged Sharp Shooter or Pierces Disease into the NAP region following the development of the proposed composting facility. The risk of these entering Australia is a current threat to the entire Australian Wine Industry.
- The Western Flower Thrip is already entrenched in the NAP region and is being managed by a range of practices.

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- No record was found of any Fruit Fly infestation in South Australia of commercially grown crops of tomato, cucumber, grapes nor olives, nor city backyard vegetable gardens for the 10-year period from 1991. All infestations recorded during that period were in fruit trees, none of which appear to be grown commercially in the NAP area but all of which may be present in household backyards. Nevertheless, discovery of Fruit Fly in the region would result in a quarantine of all potential host crops, regardless of whether the infestation was in a commercial or domestic situation.

- The economic risk assessment estimates that the cost of a worst-case scenario of the simultaneous development of Phylloxera, Fruit Fly, Glassy Winged Sharp Shooter/Pierces Disease and Potato Cyst Nematode, is currently $106.03 million.

The report concludes that the composting facility is unlikely to increase the risk of a pest or disease outbreak on the NAP. Further it concludes that should the facility be established on the NAP, the level of economic risk to the horticultural industry would be unchanged from the present situation. The key aspects and risks identified are discussed in Table 7.1.

Table 7.1 Risks – Plant Pests, Pathogens and Weeds

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Aspect	Identified Risk	Mitigation	Comment
Spread of pests and diseases by trucks passing through the area.	Spread of pests and weed seeds along access roads.	Use covered trucks for transporting material to site.	The covering of trucks should be effective in preventing spread of pests and weed seeds along access roads. Note there is an existing level of risk by other activity in the area.
Spread of pests and diseases from the receival and primary processing area.	Pests and diseases from the receival area.	Use an enclosed building to receive and primary process incoming materials. Process incoming material as soon as possible after being received.	The PER commits to an enclosed building to receive and primary process incoming materials, and to process incoming material within 60 hours of being received.
Potential spread of *Phytophthora*, a soil organism that affects native species.	Spread of *Phytophthora* presents a significant threat to native vegetation.	Commit to wheel wash design in accordance with Transport SA guidelines *Phytophthora (dieback) control* (2000).	The PER commits to a wheelwash. The Transport SA guidelines include an indicative design for a washdown facility.
Potential spread of Phylloxera (an aphid that lives on grapevines).	Spread of Phylloxera presents a significant threat to grapevines.	Maintain windrows at their optimum operating temperatures, which are lethal to Phylloxera.	DVC note SA is presently Phylloxera free, and that spread is most likely by movement of grapevine rootings and equipment. The presence of the JGS composting facility should not increase the risk of Phylloxera to the region.

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Aspect	Identified Risk	Mitigation	Comment
Potential for the composting facility to introduce fruit fly into the area. The PER concludes that the operation will not add to the risk of fruit fly.	PIRSA has stated that the potential exists for small numbers of adult flies to emerge if a homeowner were to dispose of heavily infested fruit into a green waste bin prior to recognition of a fruit fly infestation in a collection area. This could trigger suspension of export of produce e.g. future export of tomatoes to the USA.	Receive all incoming material in a receival shed with a concrete floor, so that any fruit fly maggots or pupae in incoming waste cannot complete their life cycle. Maintain windrows at their optimum operating temperatures, which are lethal to fruit fly maggots and pupae. PIRSA maintain fruit fly trapping stations at 3,800 locations around the state. If outbreaks occur rigorous procedures are implemented by PIRSA.	DVC considers that the presence of the JGS composting facility should not increase the risk of introduction of fruit fly into the region.

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8. Human Health/Allergy Reactions

Effects on human health were raised as a potential issue in a number of the responses to the PER. The potential human health effects of the project include allergy effects, airborne fungal spores and bacteria. These issues were identified in the PER guidelines and were addressed in the PER (Sections 5.2.9, 5.2.10) and Appendix 14.

The Health Assessment Report, by Dr R Bentham of the Department of Environmental Health, School of Medicine, at Finders University, concludes that human health risks to the resident population are minimal although uncontained dust and odour emissions may present a nuisance.

Overall the Health Assessment Report concluded that the microbial health risks are most probably confined to those working on site, and also there was a small site risk of contraction of disease by inhalation of fungal spores. It was suggested that employees should take appropriate occupational precautions to minimise the potential health effects of working on the site.

It is noted that the proposed actions to minimise dust emissions (refer Section 4) will also minimise the potential for carryover of pollens, airborne bacteria or fungal spores from the site.

Comment on human health aspects has also been provided by the Director of the Environment Health Service of the Department of Human Services (DHS). The DHS note that the published evidence indicates that respiratory irritations and allergies are the most likely adverse health affects associated with composting. It is also noted that the evidence of respiratory effects is restricted to workers and is primarily an occupational health, safety and welfare issue that can be dealt with by on-site controls.

Importantly the DHS state that "The buffer zones to the nearest sensitive receptors are considered to be more than adequate to minimise public exposure to organic and microbial dusts and hence to provide sufficient protection from adverse respiratory impacts in the general community……..As stated in the report the indicated buffer zones also provide more than adequate protection against transmission of infectious micro-organisms."

It is also noted that the United States Environmental Protection Agency (USEPA) (1994) does not identify community health risks as an issue associated with composting activities. The USEPA does however recommend that individuals with asthma, diabetes, or suppressed immune systems should be advised to not work at a composting facility because of their greater risk of infection.

The key aspects and risks identified in regard to potential health risks are discussed in Table 8.1.

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Table 8.1 Risk Assessment – Health Risk

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Aspect	Identified Risk	Mitigation	Comment
Increased incidence of hayfever, asthma and allergy effects in the nearby community.	Hayfever, asthma and allergy effects to nearby residents, particularly those with a history of respiratory conditions.	Minimise dust emissions, as follows – (refer also to Section 4 and Table 4.1): Use covered trucks for incoming material. Receival and primary processing to be undertaken in an enclosed building. Maintain windrows at their optimum moisture content (approximately 40-50%). Water other operational areas using sprinkler systems in dry windy conditions. Use a water truck in trafficked areas during dry windy conditions. Restrict vehicle speed within the site to 10 km/hr. Curtail windrow turning, grinding and tromelling operations during extreme dry windy weather conditions, if watering proves ineffective.	The proposed actions to minimise dust emissions (refer Section 4) will also minimise the potential for carryover of pollens, airborne bacteria or fungal spores from the site. The USEPA (1994) does not identify community health risks as an issue associated with composting facilities.
Nuisance from dust and odour.	Complaints of dust and odour nuisance.	Refer box above.	Refer also Sections 3 and 4.
Risk of infection from airborne bacteria or fungal spores.	The Health Risk Assessment concludes that health risks associated with the composted materials are most probably confined to employees or contractors working on the site who have immediate contact. The Health Risk Assessment concludes that health risks to the resident population are minimal.	Action to minimise dust emissions (refer box above) will also minimise the potential for carryover of airborne bacteria or fungal spores from the site. The Health Risk Assessment recommends that employees should take appropriate occupational protective action to minimise heath risks. The USEPA (1994) recommends that individuals with asthma, diabetes, or suppressed immune systems should be advised not to work at a composting facility because of their greater risk of infection.	The Health Assessment Report concludes that there is very little likelihood of viable microorganisms being transmitted in sufficient quantities to impact health greater than 1,000 metres, and therefore the risk to residential areas is very low. Cool, humid, and cloudy (low sunlight) conditions are the most conducive for the transfer of microorganisms.

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9. Birdstrike

The key aspect in relation to birdstrike is whether the compost facility would be attractive to birds in sufficient numbers to increase birdstrike risk to the Edinburgh RAAF airbase, which is 8 km distant. Birds of key interest in relation to the composting facility are larger water birds, gulls (which may occur in high numbers) and soaring birds such as birds of prey.

Birdstrike was raised as a potential issue by the Department of Defence (Defence), in relation to the Edinburgh RAAF airbase. Defence note the cost to repair aircraft involved in birdstrike incidents. They also note the distance of Buckland Park from the Edinburgh airbase (8 km) and that the proposed development is on the edge of the RAAF controlled airspace, and is thus relevant to operations of the airbase. Edinburgh is the operational base for the Orion coastal surveillance aircraft, however F1-11 and FA-18 fighter-bombers also operate from the airbase.

Birdstrike has been investigated as an issue for a number of environmental studies, in particular for airports such as Sydney Third Runway and also RAAF Airbase Tindal near Katherine in the Northern Territory. Bird species vary in terms of their likelihood of being involved with collisions with aircraft. The risks vary according to available habitat, the locations of potential food sources, typical flying height, flocking characteristics, size and agility of the various species, and the flying patterns of the birds from roosting areas to food sources.

Large soaring birds such as certain birds of prey are of particular concern; also for airports near water bodies or the ocean large water birds may be a concern. Gulls, although smaller, may also be present in large numbers, particularly around landfill sites.

The particular bird species noted by Defence are silver gulls, ibis and egret. The area around the Buckland Park site has some attraction to water birds. In particular the salt evaporation pans, mangrove and coastal margin areas, and Bolivar treatment plant all provide habitat attractive to water birds. The Conservation Council and also the Department of Environment and Heritage (DEH) have made reference to water birds in their submissions. In regard to birds of prey, DEH also note observations of the Nankeen Kestrel, Black-shouldered kite and Wedge-tailed eagle in a field visit in January this year.

The proposed facility would not have any wetland areas, however there is an existing water dam on site, which would be retained, and also a stormwater retention basin would be provided on site. The water dam is about 2 m deep and has an area of approximately 6,000 m^2, and the stormwater retention basin would be about 1 m deep and an area of approximately 3,500 m^2. The margins of the stormwater pond may be of some attraction to water birds; however in the context of the waterbird habitat in the surrounding area, this is likely to be of minor significance.

In regard to silver gulls, a good understanding of the attraction of gulls to the potential development may be gained by observation of bird activity at the existing Jeffries Garden Soils facility at Wingfield. Observation indicates that the existing facility is of little attraction to gulls. Although gulls are present in large numbers in the vicinity of the existing Wingfield facility, being attracted to the surrounding landfills, there is an absence of birds at the existing composting facility.

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Birds of prey are a particular issue where human activity may lead to increased rodents, such as may occur with poorly operated landfills. Some birds of prey such as kites may be particularly attracted to landfills, and their soaring behaviour may present a birdstrike risk.

Observation at the existing composting facility at Wingfield indicates that the facility is not particularly attractive to rodents, and the regular turning of windows does not present good habitat for building nests. It is concluded from this observation that composting involving regular turning of windrows of green waste is not conducive to rodents.

It is noted that the high level of horticultural activity in the Virginia area may in itself be attractive to some species of birds, and this in itself would present an existing level of risk of birdstrike to the Edinburgh airbase.

It is considered that the proposed compost facility would not present any significant added attraction to birds in the area. This, and the distance of the proposed site to the airbase of 8 km, would indicate that the additional birdstrike risk to Edinburgh airbase associated with the operation of the proposed development is minimal.

It is noted that Defence have advised Planning SA that they no longer wish to have their submission addressed in the PER process.

The key aspects and risks identified in regard to birdstrike are discussed in Table 9.1.

Table 9.1 Risk Assessment – Birdstrike

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Aspect	Identified Risk	Mitigation	Comment
The facility may attract gulls (to windrows) or water birds (to water storage pond or stormwater retention basin).	Birdstrike to RAAF Edinburgh airbase or to aerial crop sprayers.	Operate the facility to minimise attraction to gulls and water birds. Observation indicates that the existing JGS facility at Wingfield is of little attraction to gulls.	The additional birdstrike risk to Edinburgh airbase associated with the operation of the proposed development is considered to be minimal in the context of the Buckland Park area.
The facility may cause an increase in rodents in the area and attract birds of prey.	Birdstrike to RAAF Edinburgh airbase or to aerial crop sprayers.	Operate the facility to minimise attraction to rodents. Undertake rodent control should it become necessary. Observation indicates that the existing JGS facility at Wingfield is of little attraction to rodents.	The additional birdstrike risk to Edinburgh airbase associated with the operation of the proposed development is considered to be minimal in the context of the Buckland Park area.

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10. Miscellaneous aspects

The following miscellaneous aspects were identified:

- The PER states that Jeffries Garden Soils would seek ISO 14001 certification for the facility. It is noted that certification means having a good environmental management system in place, but this in itself would not necessarily lead to improved environmental performance unless targets are set and progress against these are reported on.

- Site noise – the PER provides an estimate of noise levels from the site, however, potential propagation of noise under meteorological conditions such as inversions, which may occur at certain times of the year in the early morning hours, has not been addressed. However, site operating hours are 6 am to 6 pm, and trucks are not expected to arrive on site till approximately 8 am. In addition, the 5 m high woodlot mound and proposed relocation of the main site activity area to the south-western corner of the site, should ensure that noise nuisance from the site is not an issue.

- Buffer planting and landscaping – the PER provides a planting and landscaping plan with the aim of providing a windbreak and to screen the operations. Appropriate salt tolerant species were suggested. The Department of Environment and Heritage (DEH) have suggested changes to some of the species listed in the plan. The species list in the plan would be amended to take on board DEH's suggestions. DEH also suggested that alternative habitat be provided for the White-winged fairy wren if boxthorn is removed.

The key miscellaneous aspects and risks are discussed in Table 10.1.

Table 10.1 Risks – Miscellaneous Aspects

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Aspect	Identified Risk	Mitigation	Comment
ISO 14001 certification means having a good environmental management system in place, but may not in itself lead to environmental improvement.	ISO 14001 alone may not lead to improved environmental performance unless targets are set and progress against these reported on.	Consider giving a commitment to determine appropriate performance targets in relation to matters such as environmental and pest/weed control, and reporting on progress e.g. via the Internet or an annual report, or both.	Reporting progress on targets would demonstrate a commitment to ongoing environmental improvement.
Noise from site activities, particularly during some meteorological conditions such as early morning inversions.	Potential for noise nuisance from site activities.	A 5 m woodlot embankment is proposed. Relocate the main site activities to the south-western corner of the site. The main site activities will be 6 am to 6 pm, and truck are not expected to arrive on site till approximately 8 am.	With the relocation of the main site activities, the nearest sensitive receivers will be about 1.5 km from this area.

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Aspect	Identified Risk	Mitigation	Comment
Buffer planting and landscaping – the PER provides a plan to act as a windbreak and to screen the operations - appropriate salt tolerant species were suggested.	The Department of Environment and Heritage (DEH) suggest some species in the plan are potentially invasive or aggressive. DEH also suggest alternative habitat be provided for the White-winged fairy wren if boxthorn is removed.	Modify buffer planting and landscaping plan as suggested by DEH.	From the DEH comments it appears that the overall plan is acceptable subject to some minor changes.

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Appendix L

Daily Report Proforma
And
Weekly Inspection Proforma

DAILY REPORT

Date……../……/……..

Weather Conditions

Rainfall (mm)……………..

Wind strength (Km/hr) and direction on day that windrows attended to:

Time	calm 0 – 15	gentle breeze 15 – 30	moderate breeze 30 – 45	strong breeze 45 – 60	windy >60	Wind Direction
10.00am 3.00pm						

Materials Details

Volume of material stored on site:…………………..m^3

Green organics delivered to site: ……………m^3

Other organic material delivered to site: Type………………………………/………….m^3

Type………………………/……. ……..m^3; Type………………………/………..m^3

Total volume of material on site: Unprocessed……………………….m^3;

Processed…………………………………m^3; Screened………………………….m^3

Processing Details
Number of windrows turned: ………………………….

Milled volume: ………………m^3; Screened volume……………………m^3

Comments: Moisture content; dry / moist (40%) / wet;

Environmental Details
Odour; earthy / sharp / strong;
Fly numbers: same as background / greater than background
Evidence of vermin: yes / no
Litter: none / <100 / >100

Dust level: dust blown more than 25 m from windrow area; yes / no

Infrastructure Details
Condition of internal access roads: good / fair / bad
Condition of drainage swails: good / fair / bad
Condition of landscaping: good / fair / bad

Complaint Details…………………………………………………………………………

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Corrective Action Details:…………………………………………………………………..

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Inspection undertaken by:

……………………………………………………………………………..
(Name and signature)

……/………/……

Jeffries Garden Soils
Buckland Park Recycled Organics Facility
Inspection Sheet

Inspection Date: ………………………….

Date of Previous Inspection: ………………………………..

Inspection Undertaken By: …………………………………………………….

Weather Conditions:
……………………………………………………………………………………………….

Item	Yes	No	Comments
1. Incoming Materials • All incoming material complies with information provided in EMP • All incoming material windrowed within 2 weeks of receival • Fruit fly quarantine areas identified and recorded • Material from fruit fly quarantine areas diverted to landfill			
2. Windrow Formation Details • Average height, 3 m • Average base width, 7 m • Spacing between windrows, 3m • Width of track around perimeter of windrow area, 3 m			

3. Windrow Turning Details

Windrow No.	Date Formed	Date Last Turned	Total No. Of Turns	Comments

<table>
<tr><th>Item</th><th>Yes</th><th>No</th><th>Comments</th></tr>
<tr><td>4. Machinery Operational
• Grinder
• Scat
• Screen</td><td></td><td></td><td></td></tr>
<tr><td>5. Temperature
• Temperature records inspected
• Temperature maintained within the range 55-65^{0}C
• Corrective action taken</td><td></td><td></td><td></td></tr>
<tr><td>6. Dust
• Screening stopped due to wind

• Dust complaints received</td><td></td><td></td><td><table><tr><th>Date</th><th>Time</th><th>Wind Dir.</th></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>7. Odour
• Odour levels below acceptable limit
• Odour complaints received</td><td></td><td></td><td></td></tr>
<tr><td>8. Drainage
• Water ponding within site</td><td></td><td></td><td></td></tr>
<tr><td>9. Litter
• Contamination level, incoming material:
  • High
  • Medium
  • Low
• Litter collected daily
• Litter within site:
  • High
  • Medium
  • Low
• Complaints received</td><td></td><td></td><td></td></tr>
<tr><td>10. Vermin
• Vermin sited within the facility
• Evidence of nesting
• Complaints received</td><td></td><td></td><td></td></tr>
<tr><td>11. Flies
• Evidence of fly breeding in windrows
• Complaints received</td><td></td><td></td><td></td></tr>
</table>

12. Fire • 3 m gap between windrows • 3 m perimeter roadway available • Fire occurrence			
13. Groundwater • Monitoring program in place • Evidence of pollution from composting activities			
14. Noise • Complaints received			
15. Independent Audit • Date of previous audit			

Corrective Actions (including completion date) **and Other Comments**

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Signature: ……………………………………………; **Checked by:** ……………………………….**Date:** ……./……/…….

Appendix M

Complaint Resolution Proformas

COMPLAINTS FORM

Completed form to be faxed to the EPA immediately a complaint is received.

EPA Facsimile No: 8204 2025
Attention: Sharon Jamieson

JEFFRIES GARDEN SOILS
BUCKLAND PARK ORGANICS RESOURCE CENTRE

COMPLAINT DETAILS

Date:..…/……/…… and **Time:**……………………

Name and Address of Person Lodging Complaint:…………………………………………………

Tel. No:…………………

Complaint Details:…………………………………………………………………………

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Complaint Received by:……………………………………………………………………

Signature:…..……………………

Completed Complaints Form Received by Site Supervisor:……………………………
(Name)

Date:..…/……/…… and **Time:**……………………

Signature:…..……………………

COMPLAINTS ACTION FORM

Completed form to be faxed to the EPA within seven days of a complaint being received.

EPA Facsimile No: 8204 2025
Attention: Sharon Jamieson

Date:..…/……/……

Name and Position of Person Investigating Complaint:…………………………………

Date Complaint Received:……/……/……

Brief Details of Complaint:…………………………………………………………

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Issues/Items to be Investigated……………………..……………………………………

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Results of Investigation……………………..……………………………………..

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Details of Corrective Action Being Taken:…………..……………………………………

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Complainant Advised of Corrective Action being Taken: Yes / No

Site Supervisor:……………………………**; Date:**…../……./…….

CORRECTIVE ACTION IMPLEMENTATION DETAILS

Details of Corrective Action to be Taken (including date implementation to be completed):……………………………………………………………………………..…

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Amendments Required to Management Plan: Yes / No

Details of Amendments Required:……………………………………………………..

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Date Amendments Forwarded to EPA:……/……/……

Name of EPA Officer Receiving Amendments:.……………………………………………..

Site Supervisor:……………………………; **Date:**…../……./…….

APPENDIX 3

Letters from key Government Agencies

EPA
South Australia

Environment Protection Authority

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Part of the Environment and Conservation portfolio

EPA 05/9161

Manager, Assessment Branch
Planning SA
Level 5, 136 North Terrace
ADELAIDE SA 5000

Dear Sir

RE: JEFFRIES ORGANICS RESOURCE PROCESSING AND RESEARCH FACILITY, BUCKLAND PARK

A proposal by Jeffries to establish an organics resource processing and research facility at Buckland Park has been declared a major development by the Minister for Urban Development and Planning. The company has subsequently prepared a Public Environment Report (PER) in accordance with the Development Act and Regulations. As the proposal includes an activity of environmental significance, namely composting, as prescribed in Schedule 1 of the Environment Protection Act 1993, the PER has been referred to the Environment Protection Authority (EPA) for assessment.

Assessment Criteria

Where an application for development authorisation is referred to the EPA under the Development Act 1993, the Authority is bound by the relevant parts of Section 57 of the Environment Protection Act 1993 ("the Act"). In essence, the Authority must, in determining its response:

- have regard to and seek to further the objects of the Act (Section 10);
- have regard to the general environmental duty (Section 25 of the Act), and
- have regard to any relevant environment protection policies.

The following assessment is based on the following documents prepared and submitted by Jeffries Gardens Soils:

- Public Environment Report (Jan 03)
- Response Document (May 03)
- Environment Management Plan (6 August 03 Revision 1)
- Development Application (25 September 2003)

In support of its application Jeffries has submitted a Draft Environment Management Plan (EMP) to the EPA for assessment. It is understood that the EMP will be the basis of any application for a licence under the Environment Protection Act which may be submitted by Jeffries.

This assessment is based on the Jeffries' Environment Management Plan (EMP) dated 6 August 2003 Revision 1 that discusses Stage 1 with a processing capacity of 75,000 tonnes pa. This was received at the EPA on Wednesday 24 September 2003. I note that only Appendix H was included in this EMP. On the 25 September 2003, Jeffries advised the EPA and Planning SA that they seek approval to process up to 150,000 tonnes pa, not 305,000 tonnes pa as originally proposed.

The Site

The subject site is described as Sections 138, 139(part), 142, 156 and 157, Hundred of Port Adelaide. The property's total area is 123 Ha with the recyclable organics recycling (composting) operation covering approximately 15 Ha.

The Proposal

The proposal for the site includes:

- An organic materials sorting, composting and landscape and garden manufacturing area of approximately 35 hectares;
- Operation of a commercial horticulture business and demonstration area utilising an existing centre pivot irrigation system;
- Construction of buildings including a mechanical workshop, security compound, production, administrative and corporate head office centre;
- A woodlot and beautification belt of approximately 30 Ha on the perimeter of the property;
- Information, education and training facility in partnership with Local Government, the horticultural industry, general industry, universities etc;
- Re-location of Jeffries' landscape and garden products manufacturing from its current Cormack Road, Wingfield site.
- Constructing commercial greenhouses and demonstration areas.

The documentation provided by Jeffries indicates that waste will be received in a fully enclosed receival shed, processed within 24 hours and trucked out to the windrowing area for composting.

The composting cycle takes approximately 8-12 weeks and the quantity being processed at any one stage will be a maximum of 19,000 tonnes. Green organics, timber and wet organics will be processed. Water for this process will be from the 511ML water allocation of treated effluent water from the Bolivar Wastewater Treatment Plant.

Jeffries has been in the composting business for many years and operates a compost depot at the Adelaide City Council landfill site at Wingfield. The company maintains the site in a well organised manner and the composting process is well understood by Jeffries. The majority of their products are quality tested to Australian Standards.

The Buckland Park site will have the windrows in a different formation to the Wingfield operation by having the windrows toe to toe and not a 3 metre divide between each row. This will maximise the absorption of rainfall and intensively utilise more of the engineered windrowing area.

Groundwater

An assessment of the suitability of the proposed composting operations for the site has been undertaken based on the following information:

1. Rainfall and evaporation information used in the management plan was obtained from the Edinburgh RAAF weather station but does not provide sufficient detail for an assessment. Whilst the data provided is for a particular year, consideration should have been given to the net water balance to be calculated for the wettest 6 months of the year (April-September/ May-October) for the years on weather record. Based on EPA calculations, the Edinburgh RAAF station has a net positive water balance at a frequency of 1 in 7 years in the wet 6 months of the year.

   However, the Stormwater Management Report (Appendix H) is more precise in analysing climate conditions which were subsequently used for water run-off calculations for the site. Furthermore, the report is based on a site capacity of $80,000m^3$ (of organic material) and on geometric calculations and is an acceptable method of determining the capacity for the purpose of water run-off calculations.

2. The windrow area will have a clay liner comprising of two layers each having a minimum compacted thickness of 150mm with a hydraulic conductivity of $1 \times 10^{-9}m/s$ and a smooth final surface that is graded at a minimum of 2% towards drainage lines and 1% along drainage lines. The clay will be covered with a 200mm thick layer of compacted rubble and the final surface will be graded to a minimum of 2% towards drainage lines and 1% along drainage lines.

3. A minimum one metre separation distance will be maintained between the highest standing groundwater level and the underside of the clay liner in every constructed area.

4. Full design and construction details, including material specification reports will be provided to the EPA for approval prior to material delivery to the site and commencement of construction on site.
5. An EPA licence condition will be included regarding the monitoring of the separation distance between groundwater and underside of the clay liner. Measures will be required to be put in place to ensure corrective actions being activated prior to the separation distance being at or less than 1.00m. It is proposed to set a trigger level at 1.10m (separation distance) for more frequent level monitoring (minimum daily) and a second one at 1.05m (separation distance) to activate corrective actions. An EPA licence condition will require water levels be measured weekly and assessed and reported monthly to the EPA for the first year of operation.
6. The most recent reading for groundwater levels in borehole BH3 was at 3.15 m AHD, however, as the bore is located approximately 900m upstream from the proposed composting activity, this does not represent an area for concern. Any proposal to expand the composting activity outside of the areas designated as "windrowing area" and "future windrowing area" in the current application and towards this area should be supported by an assessment of any risks to groundwater which may result.
7. There will be EPA licence conditions relating to the maintenance of all drains and ponds.
8. An EPA licence condition will address litter management such that no litter escapes from the boundary of the premises and that a nominated responsible person collect such litter as soon as practicable. An EPA condition will also require that all litter within the premises is collected and disposed of as often as necessary to maintain the grounds within the premises and the boundary fence free of litter.

Air Quality

The Development Application is for a total throughput of 150,000 tonnes per year. The Environment Management Plan is based on the processing of 75,000 tonnes per year, in the first instance.

The Development Application indicates that the windrow areas, for the initial stage of operations, will be located to the west of the site originally identified in the Public Environment Report. The composting operations will therefore be further from the houses in closest proximity to the area, than originally proposed. The proposed location of the windrows should have the effect of lowering the potential odour impact at the nearest residential houses. The Development Application confirms that wet organics are to be composted at the site. This would increase the potential odour impacts. The Jeffries documentation has over time not been totally clear on what was actually measured and modelled to arrive at an odour profile for the site and surrounding area. It is understood that Jeffries' current composting operation includes wet organics and did so when the odour measurements were undertaken from those sites as the basis for odour modelling for the subject site.

The proposed development is located such that there are no houses to the west of the site. The nearest house not associated with the development is approximately 1000 metres east of the windrow/receival area. All houses in the vicinity of the subject site are located in a rural/horticultural area either in small groups or well separated from each other. Due to the nature of the area, it is expected that, from time to time there would be some local dust from ploughing and local odours from the spreading of fertilisers on properties in the area.

As indicated earlier, the first stage is to process 75,000 tonnes of organic material per year. The Environment Management Plan indicates that this would be undertaken on an area of 364 x 125 metres, which is 45,500 square metres. The actual windrow area would be smaller as this includes some turning area and spaces between every 4 windrows. The final odour modelling output was supplied in a Report 03-0933 dated 24 September 2003. Odour emissions were from a windrow area of 70,560 m^2. It is estimated that an area this size could have a throughput of between 120,000 to 190,000 tonnes depending on the material being composted.

The odours were assumed to come from static windrows and from a considerably smaller area of recently turned windrows. The turning of the windrows would lead to higher odour emissions and was assumed to only occur 7 am to 4 pm Monday to Thursday and 6 am to 12 midnight on Friday.

The EPA has published odour modelling criteria in "Guidelines for Odour Assessment Using Odour Source Modelling"(SA EPA 373/03 September 03). The modelling methodology used complies with the EPA guideline. The odour criteria listed in the guideline are population dependent. For locality under consideration, the appropriate criteria would be 10 odour units (OU) (99.9 percentile, 3 minute average) for isolated houses, 8 OU where there is a group of houses in a small area and 6 OU where there is a group of houses with more than 60 people. For most of the area 8 or 10 OU would be the applicable criteria.

The modelling indicates that the predicted odour impact (99.9 percentile, 3 minute mean) is 2 OU or less at any house not associated with the development. The 8 OU contour is predicted to be completely west of Brooks Road. If there was some windrow turning conducted outside of the hours modelled, there may be an increase in the predicted odour levels at the neighbouring houses. As the predicted odour impacts are considerably below the EPA criteria, it is considered that any extra odour emission would not cause the odour criteria to be exceeded. While the odour impact is predicted to be acceptable, odours may still be detected at surrounding houses at times.

The predicted odour impacts were also produced for 98 percentile and 1 hour average. This modelling shows the area of impact for repeated low level exposure and to account for the effects of extremes or outliers in the meteorological data. Normally, when the predicted level is below 0.5 OU (98 %, 1 hour average) the odour impact would be deemed acceptable. This modelling tends to show that the higher odour impacts would tend to be to the south-west and to the north-north-west. The predicted odour level is 0.25 OU or less at all houses not associated with the development. This is acceptable

It is noted that there is a derelict house/shed east south east of the site on the east side of Brooks Road. While the predicted odour level is 6 OU and is below the EPA odour criteria, there may be potential problems with odours if a house was developed at this site in the future.

To minimise the chance of odour nuisance occurring in the future, careful consideration should be given to any residential development within approximately 1000 metres of the proposed site.

The Development Application indicates that an automatic weather station is to be installed. This would be useful for operational requirements, complaint resolution and to provide for suitable local meteorological data for any further air pollution modelling.

If there is good management, it is considered that there should not be a dust nuisance at the surrounding houses from the composting operations.

Summary – Air Quality

The modelling undertaken indicates that the proposed development, with a throughput of 150,000 tonnes per year, will not cause an unacceptable odour impact at neighbouring houses not associated with the development. It is concluded therefore that there is minimal risk of environmental harm or nuisance resulting from odour or dust from the subject site.

To minimise the chance of odour nuisance occurring in the future careful consideration should be given to any residential development within approximately 1000 metres of the proposed site.

Noise

The Environment Protection (Industrial Noise) Policy 1994 recommends the following maximum permissible noise levels (MPNL's) for an area which may be described as "predominantly rural":

7am to 10pm any day	47dB(A)
10pm to 7am any day	40dB(A)

Due to the modified layout of the site, a new windrow turner is currently being evaluated (pers. comm. Lachlan Jeffries) and therefore no information is available regarding its potential for noise. It is assumed with reasonable confidence that this new equipment will not be significantly different in terms of noise generated to those already in use. Notwithstanding that, in the event of noise complaints arising from the composting operation, Jeffries may be required to provide evidence, in the form of a report by a suitably qualified acoustic consultant, that the relevant maximum levels prescribed in the Environment Protection (Industrial Noise) Policy

1994 are not being exceeded. (Licence conditions may be modified eg. to limit hours of usage of equipment if there was exceedence.)

Given the separation of 1000 metres between the subject site and any residential premises not associated with the development, however, it is unlikely that the recommended MPNL's will be exceeded.

It is recommended that a condition of development authorisation be included which requires compliance with the MPNL's cited above.

The distance to the nearest sensitive receptor is measured at approximately 1.0km. It is imperative that the buffer distance to sensitive receptors is maintained. This is unable to be managed by Jeffries - it must ultimately be managed by the planning authority to ensure no encroachment occurs.

The proposed Service Centre must have grey and black wastewater treated to Department of Human Services standards, not EPA standards as stated on page 14.

Conclusion and Recommendations

Following an assessment of the documentation forwarded to the Environment Protection Authority by Planning SA and Jeffries, it is concluded that, subject to the adoption of the conditions of development authorisation recommended below, approval of the development application will not result in an unacceptable risk of environmental harm or nuisance, providing the level of site preparation, management and maintenance detailed in the EMP is maintained at all times.

If the development is approved, it is recommended that the following conditions be attached to the approval,

1. The total quantity of feedstock to be received or processed at the site must not exceed 150,000 tonnes per annum.
2. The composting operation must be located at all times at least 1000 metres from the nearest existing residential dwelling not associated with the development.
3. The construction of the processing areas (windrowing and final product), wheel wash bay area and surface wastewater storage area must be to the specifications listed in the 'Environment Management Plan for a Recycled Organics Resource Centre at Buckland Park' authored by RDA and dated 6 August 2003 Revision 1.
4. Construction of all stages for the windrowing areas and wastewater areas must be to Level 1 Supervision as set out in Australian Standard 3798-1996. Daily logs and the final supervision report must be forwarded to the EPA.
5. A minimum one (1) metre separation distance must be maintained between the groundwater level and the underside of all liners on the site.
6. Design specifications must be forwarded to the EPA for approval prior to construction of the receival shed. The receival shed must be fully enclosed and have a concrete floor.

7. All incoming feedstock material must be unloaded, stored and processed (screened, shredded etc) in the receival shed within 24 hours.
8. A meteorological station must be installed and be operational before operations at the site commence. It should be to such a standard that it produces data suitable for air pollution modelling and complaint resolution. Parameters that should be recorded for air pollution /odour modelling are wind speed and direction at 10 metres, standard deviation of wind direction, temperature at both 2 and 10 metres and solar radiation. Rainfall also to be recorded (The document "Meteorological Monitoring Guidance for Regulatory Modelling Applications" by US EPA, February 2000 would provide suitable specifications. A copy can be viewed at http://www.epa.gov/scram001/guidance/met/mmgrma.pdf.).

It is proposed that any licence granted by the EPA will include conditions of authorisation which will require, at least, compliance with the standards of site preparation, management and maintenance detailed in the EMP.

In particular, it is proposed that any authorisation granted under the Environment Protection Act 1993 will include, but may not be limited to, conditions which address:

- the monitoring of the separation distance between groundwater and underside of the clay liner. Measures will be required to be put in place to ensure corrective actions being activated prior to the separation distance being at or less than 1.00m. It is proposed to set a trigger level at 1.10m (separation distance) for more frequent level monitoring (minimum daily) and a second one at 1.05m (separation distance) to activate corrective actions. The EPA licence condition will require water levels be measured weekly and assessed and reported monthly to the EPA for the first year of operation.
- the maintenance of all drains and ponds.
- the specific nature and quantities of wastes to be composted on the site (including composting trials).

In addition, Jeffries has confirmed, through the Company's solicitors, Finalysons Lawyers, (see Attachment 1) that it will seek an initial licence under the Environment Protection Act 1993 for the composting of 75,000 tonnes of organic material per annum, as outlined in the EMP. Any subsequent application to amend the EPA licence to increase the volume of organics to be processed up to the maximum approved in any development authorisation that may be granted to the company for the site will be assessed by the EPA. However, a standard of site preparation and management at least equal to that detailed in the current EMP will be required by the EPA prior to the granting of a licence amendment to permit an increase in the volume of organic material to be composted on the site or to allow any other amendments to the initial licence conditions.

Please contact the undersigned in the first instance if you wish to discuss any of the matters raised in this response.

Yours sincerely,

Peter Torr

MAJOR PROJECTS COORDINATOR
ENVIRONMENT AND CONSERVATION PORTFOLIO

MANAGER, PLANNING AND LOCAL GOVT. SUPPORT
POLLUTION AVOIDANCE DIVISION
ENVIRONMENT PROTECTION AUTHORITY

Date: 29/09/03

PRIMARY INDUSTRIES AND RESOURCES SA

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- Energy

Ref No: 02/2335

Your Ref: PLN 02/0122

3 September 2003

Mr Neil Savery / Neil Spr 4/9 → Elmer Evans
Received 4/9 kff.
Executive Director
Planning SA
136 North Terrace
ADELAIDE SA 5000

Dear Mr Savery

PUBLIC ENVIRONMENTAL REPORT - ORGANICS WASTE TREATMENT AND RECYCLING RESEARCH FACILITY, BUCKLAND PARK

I am writing further to my previous letter dated 15 July 2003.

Since I wrote PIRSA has been supplied with additional information about proposed risk mitigation measures designed to minimise the risks associated with plant pests and diseases. These are listed in an attachment to this letter.

Based on the information in the Public Environmental Report and the Response Document the facility represents a possible additional risk of pests and disease threats to the Northern Adelaide Plains.

PIRSA notes that the risk mitigation measures for the proposed facility exceed those applying at other organics waste facilities in this state. PIRSA is aware that horticulture on the Northern Adelaide Plains is at risk from pests and diseases from current activities and practices. These include:

- The uncontrolled and indiscriminate dumping of plant material on roadsides and properties;
- The movement along Port Wakefield Road, of waste from metropolitan Adelaide to land fill sites to the north;
- The re-use, at the Adelaide Produce Market, of cartons and pallets brought in from interstate; and
- The import of potatoes to processing plants on the Northern Adelaide Plains.

PIRSA is of the view that provided the proposed risk mitigation measures listed in the attachment to this letter, are adopted; the proposed facility is no more likely than current activities and practices, to result in the introduction of plant pests and diseases to the Northern Adelaide Plains.

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Government of South Australia

Should additional information on this response be required, please do not hesitate to contact Keith Harris, Manager, Development Planning and Policy, telephone 8204 1421 or by email harris.keith@saugov.sa.gov.au.

Yours sincerely

Jim Hallion
CHIEF EXECUTIVE
PRIMARY INDUSTRIES AND RESOURCES SA

Attachment

ORGANICS WASTE TREATMENT AND RECYCLING RESEARCH FACILITY, BUCKLAND PARK

RISK MITIGATION MEASURES

Attachment to letter to Planning SA

Design of the facility

1. Deletion of the NAWMA recyclables organics transfer facility.
2. Location of the incoming materials receival area adjacent to the western boundary of the site distant from the final product packaging area.
3. Compost material from the Adelaide Produce Markets only within an in-vessel facility.
4. Receive incoming material in a fully enclosed building, constructed on a concrete slab and with all vehicle access points sealed using air curtains and all other openings covered by insect proof screens.
5. Construct a hardstand rubble base to windrow areas.
6. Do not plant host plants for Mediterranean or Queensland fruit fly on the property.

Operation of the facility

1. Process incoming material within 24 hours of receival.
2. Ensure internal windrow temperatures reach >50 C within 24 hours of the windrow being formed.
3. Require all vehicles transporting material to the site to securely cover their loads.
4. Restrict access to the site to vehicles with a carrying capacity of 5 tonnes or more.
5. Undertake the housekeeping practices as detailed in Section 7.9 Housekeeping of the Environment Management Plan 6 August 2003.
6. Screen and shred Incoming material to be before it is taken from the receival building.
7. Wash down all mobile plant before it enters or leaves the receival building.
8. Require all vehicles to pass through a wheel wash facility when entering and leaving the site.
9. Wash down the receival building weekly.
10. Undertake the measures detailed in Section 7.7 Plant Pests and Diseases of the Environment Management Plan 6 August 2003.
11. Implement a site specific contingency plan for outbreak of quarantinable pests or diseases (?).
12. Divert material from fruit fly quarantine areas to land fill.
13. Dedicate plant and machinery to specific activity areas eg the receival building, the windrowing area or the final product area.
14. Clean plant and machinery prior to movement from one activity area to another.

15. Recover wash down water and solids and run-off water and apply to compost windrows.
16. Implement a trace back system to sources of all material received.
17. Undertake weed management strategies to manage WFT on the property.

Monitoring

1. Establish and maintain yellow stick traps within the receival building (and surrounds if necessary) with an appropriate monitoring program and take action if the traps indicate that the site is contributing significant WFT populations to the surrounding area.
2.
3. Establish additional monitoring sites in order to extend the local PIRSA fruit fly monitoring grid to include the area around the facility.

Consultation arrangements

1. Establish a Community Consultative Committee with representatives of local government, Jeffries and the grower community to oversee the bio-security aspects of the facility.

Compliance assurance

1. Undertake audits of relevant processes and incorporate into QA processes and assure this by the licensing regime.
2. Adhere to and meet, the relevant Australian Standards.
3. Enter into formal arrangements with PIRSA to monitor plant pest and disease risk minimisation and monitoring measures.

SA Govt ③

Received 19/2/03

human services

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Environmental Health Service

PEHS 003/02/0105
PEHS 00303/0135

Attention: Mr Elmer Evans - Manager
Assessment Branch
Department for Transport and Urban Planning
GPO Box 1815
ADELAIDE SA 5001

Dear Mr Evans

Re: Jeffries Garden Soils Organics Waste Treatment and Recycling Research Facility, Buckland Park Public Environmental Report

Thank you for the opportunity to comment on the above Report which has been reviewed for public and environmental health impacts. The comments below are made in the context of the following definition of health:

Health is the state of complete physical, mental and social well-being and not merely the absence of disease and infirmity (World Health Organisation, 1948).

In principle, the process of large scale composting of organic waste is supported provided it is conducted in accordance with sound industry practices developed to minimise the risks to health and safety of the workers and the neighbouring community. The compost produced has the potential to greatly add to soil fertility, and hence increase food and other primary production. Alternatively, the disposal of organic waste in landfill results in the loss of nutrients from the soil, in addition to increasing the generation of a mixture of explosive and noxious gases by anaerobic decomposition and the potential for contamination of groundwater.

With the closure of the Adelaide City Council's Wingfield landfill site in December 2004, Jeffries Garden Soils requires a new site for its organics waste recycling (composting) facility. The proposed site at Buckland Park is close to both the source of the organic wastes and its potential markets. It has been examined for its potential benefits to health as well as adverse health effects, and subject to the issues below being addressed, the proposal is supported.

Government of South Australia

Comment 1 Additional health benefitsThe following are health benefits of the proposal in addition to those outlined above:

- Jeffries' Buckland Park proposal has the potential to employ an additional 26 people within 5 years whilst the number of those who would be indirectly employed is expected to be very much higher. As employment is a key determinant of health, this is a major benefit in a region of high unemployment.
- The diversion of the organic waste from landfill, for example, at Dublin, reduces the risk of motor vehicle accidents significantly.

Comment 2 Microbiological health impacts The human health risk assessment included in the Public Environmental Report focuses almost entirely on transport of viable organisms and the potential for infectious disease.

There is no discussion of potential allergies and irritations of the respiratory tract, for example, hypersensitivity pneumonitis and inhalation fever, caused by exposure to organic dusts including viable and non-viable fungi, gram negative bacteria and endotoxins. Exacerbation of pre-existing respiratory conditions is also not discussed. Published evidence indicates that respiratory irritations and allergies are the most likely adverse health effects associated with composting.

Notwithstanding this comment, the evidence of adverse respiratory effects is restricted to workers and is primarily an occupational health, safety and welfare issue that can be dealt with by on-site controls. The implementation of appropriate risk management procedures (for the workforce) will need to be considered in light of the processes employed.

The buffer zones to the nearest sensitive receptors are considered to be more than adequate to minimise public exposure to organic and microbial dusts and hence to provide sufficient protection from adverse respiratory impacts in the general community.

As stated in the Report the indicated buffer zones also provide more than adequate protection against transmission of infectious micro-organisms.

However, operating conditions should be continually monitored to ensure that best industry practice is achieved and that there is no migration beyond the boundary of the property of bioaerosols which could constitute a risk to health. One indicator of this is the minimisation of dust and odour within the property.

Comment 3 Dust and Odour The Public Environmental Report indicates that uncontained dust and odour emissions may present a public nuisance. However, it is considered that providing the plant is operated within accepted norms (as described in the Report) the indicated buffer zone to sensitive receptors should also minimise the likelihood of such nuisance. Therefore, it is restated that operating conditions should be continually monitored to ensure that dust and odour are minimised to ensure no environmental nuisance or risk to health beyond the boundaries.

Comment 4 Wind BuffersThe measures outlined to develop mounds and vegetative wind buffers are strongly endorsed as they are integral to the control of dust (including bioaerosols) and odours.

Comment 5 In Vessel Composting It is noted in the Report that in vessel composting of high nutrient materials (including various food by-products from shopping centres, industry and the community) is proposed for Stage 3 in 2006/2007. To ensure that this does not create a nuisance (for example, through odours) or risks to health, these materials should be delivered in fully enclosed vessels and the gases from the composting process should be passed through an odour scrubber before being vented to atmosphere (as outlined in Section 5 of the Report).

Comment 6 Wastewater of a Domestic Nature It is noted that there is no sewerage system in the area. To ensure the adequate control of risks to public health, all (domestic) wastewater collection, treatment and disposal systems require the approval of the local council or the Department of Human Services (under the Public and Environmental Health Act, 1987). It is suggested that applications for domestic wastewater systems be made to the relevant authorities as soon as possible.

Comment 7 Traffic Noise It is noted that the extra traffic arising from the proposal (282 trips per day after 10 years) is expected to use McEvoy Road with the predicted noise levels 20 metres from the road (the distance of the nearest residences) being: LAeq Day = 58 dB and LAeq Night = 51 dB, for a speed limit of 80 km/hr.

The WHO Guidelines for Community Noise, suggest that the following maximum noise levels for dwellings to prevent the health effect(s) listed below:

Specific environment of dwellings	Critical health effect(s)	LAeq (dB)	Time base (hours)	LA max fast (dB)
Outdoors living area, balconies & terraces	Serious annoyance, daytime & evening	55	16	
	Moderate annoyance, daytime & evening	50	16	
Indoors	Speech intelligibility & moderate annoyance, daytime & evening	35	16	
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open (façade or outdoor values	45	8	60

(It should be noted that these levels may **not** protect sensitive groups, eg, for sleep disturbances these include elderly persons, shift workers and persons with physical and mental disorders. The WHO reports that most countries in Europe have adopted 40 dB LAeq as the maximum allowable level for outdoor living areas including balconies and terraces, for new dwellings.)

As the proposed hours of operation by Jeffries at Buckland Park are 6.00 am to 6.00 pm Monday to Friday and 6.00 am to 2.00 pm Saturday, the existing traffic of 200 vehicles per day will also have a significant impact. Furthermore, Jeffries proposed operation would not be expected to have a significant impact on night road traffic noise levels along McEvoy Road. However, the predicted traffic noise levels indicate that there is the potential for some of the adverse health effects listed in the table above. Therefore, it is recommended that traffic management be reviewed to identify the feasibility of ways of reducing the traffic noise levels, for example, by reducing the speed limit on McEvoy Road and avoiding out of hours delivery and collection movements (up to 8 such vehicle movements per day are suggested in Appendix 11).

Should you have any queries regarding these comments, please do not hesitate to contact Frank Callaghan (telephone 8226 7145 or e-mail: frank.callaghan@dhs.sa.gov.au).

Yours sincerely

Kevin Buckett

19/2/03

Dr Kevin Buckett
Director
ENVIRONMENTAL HEALTH SERVICE

APPENDIX 4

Letters of Agreement from Jeffries for Road Works

22nd October 2003

The Honourable Jay Weatherill, MP
Minister for Urban Development and Planning
178 North Terrace
ADELAIDE SA 5000
c/- Mr. Elmer Evans
Planning SA

RE: ORGANICS WASTE TREATMENT AND RECYCLING RESEARCH FACILITY, BUCKLAND PARK

Dear Minister,

I refer to Playford Council requirement for the sealing of McEvoy Road as part of Jeffries application for Buckland Park.

Should approval be granted for this project, Jeffries undertakes to seal the road to meet Playford Council's requirements of construction and to meet the costs of this work.

Yours sincerely,

Lachlan Jeffries
Managing Director
Jeffries Group

Quality System
Quality Endorsed Company
ISO 9001 Lic 5086
Standards Australia

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Jeffries™

22nd October 2003

The Honourable Jay Weatherill, MP
Minister for Urban Development and Planning
178 North Terrace
ADELAIDE SA 5000
c/- Mr. Elmer Evans
Planning SA

RE: ORGANICS WASTE TREATMENT AND RECYCLING RESEARCH FACILITY, BUCKLAND PARK

Dear Minister,

I refer to Transport South Australia (TSA) requirement for the upgrading of the slip lane on Port Wakefield Road at the junction of McEvoy Road as part of Jeffries application for Buckland Park.

Should approval be granted for this project, Jeffries undertakes to upgrade the slip lane to meet Transport South Australia's requirements of construction and to meet the costs of this work.

Yours sincerely,

Lachlan Jeffries
Managing Director
Jeffries Group

Quality System
Quality Endorsed Company
ISO 9001 Lic 5086
Standards Australia

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