Shoalhaven City Council

Environment - Growth - Community

LANDFILL ENVIRONMENTAL MANAGEMENT PLAN

West Nowra Recycling and Waste Facility

April 2008

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1. Introduction

The West Nowra Recycling and Waste Facility (Depot) is located at Flatrock Road, West Nowra. Refer to Figure 1.1 for a site location plan.

The principal site operations include:

- a current landfilling operation (Stage 3 – southern portion of the site),
- a public buyback centre / recycling area,
- a recycled / reprocessed materials stockpile area,
- a public transfer station,
- a leachate irrigation area, and
- sedimentation and leachate dams along the western boundary of the site.

Refer to Drawing Numbers 1.1 and 1.2 for the site layout plan (Stages 1, 2 & 3).

2. Purpose of the Landfill Environmental Management Plan (LEMP)

The purpose of the LEMP is to provide:

- an environmental management tool for the operation of the site,
- a means of identifying and concentrating on the key environmental, operational and rehabilitation issues,
- a basis for monitoring and reporting, and
- a guide for the interaction with relevant Government Authorities, including the Department of Environment and Climate Change (DECC), the Department of Planning and Infrastructure (DPI) and the Department of Water and Energy (DWE).

This LEMP has been prepared in accordance with the DECC's Environmental Guidelines: Solid Waste Landfills (1996)[1].

The LEMP is a working document, and the management strategies outlined are intended for review from time to time, and where necessary, changed as new strategies and technologies become available.

3. Site Overview

3.1 Property Description

The Depot is located on parcels of land owned by Shoalhaven City Council and includes Crown Land (currently being purchased by Council for future proposed development). Refer to Figure 3.1 for site plan. The Lot and DP numbers are summarised in Table 3.1.

Table 3.1 – Property details.

Property Owner	Lot Number	DP Number	Zone	Area (ha)
Shoalhaven City Council	437	808415	1(d)	4.315
Shoalhaven City Councill	436	808415	1(d)	8.289
Shoalhaven City	1	1018193	1(d)	13.040

Council				
Shoalhaven City Council	1	847203	5(a)	8.963
Shoalhaven City Council	1	870268	1(d)	20.330
Crown Land	1	1104402	1(d) & 7(d1)	14.500

There is a number of permanent infrastructure on the site, including the following:

- gate house and two weighbridges (entry and exit),
- staff amenities building,
- plant and equipment sheds,
- storage sheds,
- buy-back centre shed,
- recycling shed, and
- pump sheds.

3.2 Site History

The Depot commenced operation in 1979. It is a licenced solid waste landfill site (Environment Protection Licence (EPL) number 5877). It also accepts small quantities of hazardous waste in the form of asbestos. No liquid wastes are accepted.

Originally, the Depot had received domestic, industrial, commercial liquid and solid wastes. It had also received hazardous wastes, including asbestos and oil. The disposal of these wastes, with the exception of asbestos, has been prohibited at the Depot since 1996.

Previous landfilling practices involved the excavation and filling of a series of trenches. Operations have since progressed to comply with the DECC's Environmental Guidelines: Solid Waste Landfills, and have been divided into several stages, namely;

- Stage 1 – the "old" landfills, stockpile and irrigation areas,
- Stage 2 – the recently completed landfills, currently used for stockpiling and wet weather tipping areas,
- Stage 3 – the active landfill disposal area, and
- Stage 4 – acquired adjacent land for the future proposed development of a Resource Recovery Park and possible landfilling extension area.

3.3 Land Use Constraints

3.3.1 Zoning

The principle environmental planning instrument applying to properties in the Shoalhaven Local Government Area (LGA) is the Shoalhaven City Council "Shoalhaven Local Environmental Plan (SLEP) 1985[10], with amendments made as at 22 February 2008".

The Depot is divided into several zones. They are;

- Zone 1(d) – is zoned rural (general rural),
- Zone 5(a) – is zoned special uses (waste depot), and
- Zone 7(d1) – is zoned environment protection (scenic).

Council is in the process of re-categorising the zoning in accordance with the Citywide LEP review and its intention to apply the SP2 Infrastructure Zoning to any public assets, including waste facilities.

3.3.2 Archaeological Restrictions

According to an archaeological survey, there is little likelihood that there are significant Aboriginal sites located in the area of the landfill (Sinclair Knight Merz, 1990)[2].

3.3.3 Environmental Constraints

In the event of a water overflow, from the ponds on the site, it will eventually be released into Sandy Creek, which runs into the Shoalhaven River. Currently the closest residents to the landfilling operation are approximately 780 metres away, but in future, at its closest in 15 to 20 years time the landfill will be within approximately 325 metres. The proximity of surrounding residents to the landfilling operation also provides an environmental constraint.

In the future, the proposed development of Stage 4, may encounter additional environmental constraints such as; biodiversity surveys and assessments.

3.4 Surrounding Environmental Characteristics

3.4.1 Topography

The landfill is located on the western side of a ridge line. The landform falls gently to the west. The area is drained by Sandy Creek.

3.4.2 Geology

The site is underlain by Nowra Sandstone and Wandrawandian Siltstone of the Permian aged Shoalhaven Group. The Nowra Sandstone consists typically of quartz sandstone and the Wandrawandian Siltstone consists typically of siltstone and sandy siltstone. The soil profile (from top to bottom) of the site is typically (Maunsell, 1991)[3]:

- 50 mm to 100 mm of grey loam,
- 200 mm layer of yellow / white silty clay,
- 300 mm layer of yellow clay, and
- Deeper layer (> 1,600 mm red / yellow / white clay).

Drilling on site indicates the sandstone bedrock is variably and often deeply weathered over the site (Forbes Rigby, 1996)[4].

3.4.3 Hydrogeology

The Stage 1 area is underlain almost everywhere by a deep soil profile of weathered sandstone that is highly permeable in its deeper parts and can be water bearing if sufficient flow occurs (Forbes Rigby, 1996). The major source of groundwater to the Stage 1 area is derived from the east. It is believed that groundwater flows in a northeast to southwest direction from Stage 1, downslope towards Sandy Creek.

A water bearing zone, and in some cases two zones at different depths, were identified during a groundwater investigation (Forbes Rigby, 1996). The depth to both water bearing zones were found to be at an approximate depth of between 2 m to 3 m. The upper water bearing zone is a semi-confined aquifer running between the bedrock and the overlying soils.

3.4.4 Groundwater Monitoring Boreholes

Groundwater monitoring boreholes are strategically located around the site to monitor the groundwater flow and if there are any environmental impacts. Attached as Appendix 1 is the boreholes location plan.

3.4.5 Surface Water

There are no permanent watercourses over the site. The stormwater drainage system and sedimentation dam collect and progressively release stormwater on the site. This water is released into Sandy Creek. The leachate collection system and leachate dam collect both leachate and stormwater that may have come into contact with the waste.

3.4.6 Climate

Average meteorological data for the Nowra area is (Bureau of Meteorology, 2007)[5]*:*

- Average Annual Rainfall 1,318 mm
- Average Maximum Temperature 21.5^{o}C
- Average Minimum Temperature 13.1^{o}C

3.4.7 Flora and Fauna

A vegetation survey of the Depot identified three (3) distinct vegetation communities. These communities are:

- Woodland / open woodland,
- Woodland of Grey Gum, Blue-leaved Stringybark and Blackbutt variety, and
- Sedgeland / Heathland vegetation.

The Nowra Tea-tree was found in the north western and south western corners of the site. This is classified as a rare or threatened species as it is only found in the Nowra area. Fauna identified during site visits (Sinclair Knight Merz, 1990) include a range of bird species, wombats, wallabies and kangaroos, and herpetofauna including froglets and toadlets, lizards and goannas. There was also evidence of the presence of foxes and feral dogs.

3.4.8 Biodiversity Survey and Assessment

A comprehensive threatened biodiversity survey and assessment of Stage 4 land (to be purchased and developed) was carried out by Hyder Consulting, July 2007[6]. The investigation included a thorough literature review and field study to identify the range of threatened biodiversity present or potentially occurring at the site.

The literature review of State and Commonwealth conservation databases identified the potential for fifty three (53) listed threatened or migatory fauna and flora species. The field survey located three (3) threatened animals (powerful owl, glossy black cockatoo, yellow bellied glider), and one (1) threatened plant (Nowra heath myrtle).

The preferred recommendation for development of this site is to investigate the possibility of foregoing landfill expansion to avoid significant impact and utilise an identified 3.5 hectare plot for a proposed future Resource Recovery Park. Consideration should be given to retaining (habitat features), mitigate (ecological impact) and offset (habitat) for this future development.

4 Regulatory Control

The Depot is a licenced solid waste landfill facility under the Protection of the Environment Operations Act (POEO) Act 1997[7] (Environment Protection Licence (EPL) number 5877).

A copy of the current EPL is included as Appendix 2.

5. Structure and Operations Overview

5.1 Typical Operation of the Depot

5.1.1 General

There are a number of stages required in the recycling, resource recovery and landfilling operation. These are:

- Vegetation and topsoil stripping,
- Shallow and deep VENM excavation,
- Landfill barrier system construction (including synthetic lining of each landfill cell),
- Leachate collection system construction,
- Solid waste landfilling,
- Covering of waste,
- Environmental monitoring,
- Site capping, gas extraction and revegetation,
- Rehabilitation of the site, and
- Site closure.

These conceptual development stages are shown in ***Drawing Number 5.1***.

Landfilling has been completed in Stages 1 and 2, and is continuing in Stage 3. Future development of Stage 4 as a potential Resource Recovery Park (***refer to Site Staging Plans – Drawings ??? to ???***), although this can be varied in the future to suit waste streams, waste quantities and available waste treatment technologies.

The landfilling of waste shall be opened in cell stages in order to minimise the generation of leachate. The landfill cell dimensions will vary and be dependant on the configuration of each stage. Approximate landfill cell dimensions are 100 metres long x 40 metres wide. They shall have a longitudinal fall of 1% and a cross fall of 3%.

Each landfill cell shall be filled to full design height and then an approved final capping system installed to minimise water infiltration.

5.1.2 Landfilling

Following installation of approved leachate barrier and collection systems, a layer of municipal waste, of minimum thickness of 1 metre across the whole landfill cell, is to be placed over these systems in order not to damage (puncture or tear) the synthetic landfill cell flexible membrane liner (FML). Other solid waste may be able to be placed over this layer and compacted with a landfill compactor. A compaction density of approximately 1 tonne per cubic metre (1 t/m^3) is anticipated using existing compacting equipment.

The waste layers shall be placed in lifts of no more than 2 metres in thickness. At the end of each working day, the waste disposal and compaction area is to be covered using VENM or other approved material to a minimum thickness of 150 millimetres. An intermediate cover is required if the area is to be left exposed for a period longer than 90 days.

When the final design waste levels have been reached a final capping system shall be designed, approved by the appropriate regulatory body and constructed according to the design specifications.

5.1.3 Drainage

Open catch / swale drains shall be designed and constructed to divert surface water around the site and to a sedimentation dam. This sedimentation dam shall have an overflow which then discharges into Sandy Creek on the western boundary of the site.

The landfill cell design incorporates "V" drains and table drains around the perimeter of the landfill cells, which drain to the south west corner of the site and into the sedimentation dam. An open channel surface drain is constructed from the east to the west of the landfill site which drains runoff from the eastern side of the site to the sedimentation dam.

The final capping material over the landfill shall be designed with a slope of 3% to 5% to ensure there is no surface water ponding and that it is free draining. The reduced level (RL) at the top of the final capped landfill cell shall be in accordance with the final design plan.

5.1.4 Landscaping

The Landscape Management Plan (Appendix 3) is a comprehensive plan for rehabilitating areas (or precincts) within and around the landfilling site.

The aim of the landscape plan is to provide a management plan for the site and a comprehensive list of endemic plant species and planting schemes which will be used for re-vegetation purposes. The plan and landscape plans shall identify precincts, and within each precinct nominated planting zones which address plant re-vegetation habitat creation for both flora and fauna, screening along boundary lines and landscaping for aesthetic purposes along the central route and entrance.

The species selected shall replicate, as closely as practicable, the native vegetation typical of the surrounding area.

5.2 Types and Quantities of Waste

The following waste types are accepted at the Depot for disposal:

- mixed municipal waste (kerbside collection, and small vehicles),
- mixed commercial waste,
- VENM (cleanfill and rock),
- builders / inert wastes (concrete, brick, tile, glass),
- separated green and wood wastes,
- tyres, and
- small quantities of asbestos.

With the introduction of the DECC's Environmental Guidelines in 1996, an assessment and review of the landfilling operations was carried out. Actions were

recommended to allow for the operation to perform in accordance with these Guidelines. The Depot is licenced, under the Protection of the Environment Operations (POEO) Act 1997, as a solid waste landfill. The Environment Protection Licence (EPL) number is 5877.

During 2006 / 2007 the West Nowra Recycling and Waste Facility accepted approximately 115,917 tonnes of waste. This total includes waste from the Nowra area, as well as waste transferred from the Kangaroo Valley, Berry, Callala, Bendalong, Lake Conjola, Kioloa, Huskisson (excludes inert wastes) and Sussex Inlet (excludes inert wastes) sites.

The type, quantities, fate and disposal of the incoming wastes for 2006 / 2007 is summarised in Table 5.1 below:

Table 5.1 - Summary of waste types, quantities, fate and disposal for 2006 / 2007.

Waste Type	Quantity (tonnes)	Fate	Disposal
Construction and Demolition	12,822	Landfill	On-site
Construction and Demolition	3,693	Recycled	Off-site
Commercial and Industrial	25,053	Landfill	On-site
Commercial and Industrial	181	Recycled	Off-site
Green Waste	0	Landfill	On-site
Green Waste	9,356	Recycled	Off-site
Domestic Kerbside	22,772	Landfill	On-site
Domestic Kerbside	10,615	Recycled	Off-site
Drop Off Domestic	3,997	Landfill	On-site
Other Landfill	20,490	Landfill	On-site
Other Recycling	6,938	Recycled	Off-site
TOTAL	**115,917**		

5.3 Landfill Life Expectancy

The estimated life expectancy of the landfilling operation is 25 years.

The following assumptions have been made in the calculation:

- annual landfill tonnage figures,
- minimum and maximum landfill waste compaction of between 0.9 t/m^3 to 1.1 t/m^3, and
- daily cover and final landfill cell capping incorporating approximately 20% of total volume.

There are a number of variables that will definitely affect the possible landfill life expectancy. These variables are:

- future growth rate of the Shoalhaven Local Government (LGA) area,
- rate of increase or decrease of waste generated (seasonal residents and tourists), and
- presentation rate of kerbside recycling bins.

For planning purposes, a conservative estimate of 20 years can be assumed.

6. ENVIRONMENTAL ACTIONS TO MEET ENVIRONMENTAL GOALS

6.1 Water Pollution Management

The environmental goals for Water Pollution Management are:

- preventing water pollution by leachate and sediments,
- detecting of water pollution, and
- remediating water pollution.

6.1.1 Preventing Pollution of Water by Leachate and Sediments

The following management methods are used to prevent pollution of water by leachate and sediment:

- leachate barrier system,
- leachate collection system,
- leachate collection dam,
- swale and table drains,
- surface water and sedimentation dam, and
- leachate, surface and groundwater monitoring.

6.1.2 Leachate Barrier System

The purpose of the leachate barrier system is to contain leachate over the period of time that the waste poses a potential environmental risk.

Tasks and Actions

The following methods shall be used:

- an impermeable base material of minimum co-efficient of permeability of 1 x 10^{-9} m/s, a 300 mm compacted clay liner, and
- a flexible membrane liner (FML) of minimum co-efficient of permeability of 1 x 10^{-14} m/s shall be overlain the compacted clay liner.

Performance Indicators

- The leachate barrier system shall be constructed in accordance with the DECC's Environmental Guidelines: Solid Waste Landfills, 1996.

Frequency / Timing

- The leachate barrier system shall be constructed for each landfill cell.
- Each subsequent new landfill cell shall be constructed and capable of accepting waste prior to the final capping process of the active landfill cell.
- Each landfill cell shall be synthetically lined with a FML prior to acceptance of any waste.

Responsible Person

- Environmental Engineer - for designing and planning of each landfill cell, and
- Site Supervisor – for the successful construction, including testing, of each landfill cell.

Monitoring

- Regular earthworks visual inspections and testing during construction to ensure quality assurance.

Auditing
- On the construction of a landfill cell by landfill cell basis.

Reporting
- Completion report.

Corrective Actions
- Non performance of leachate barrier system to performance indicators, suggests that repairs may be required.

6.1.3 Leachate Collection System

The purpose of the leachate collection system is to ensure all excess leachate is collected and contained, as well as maintaining the liquid leachate head level at a maximum of 300 mm.

Tasks and Actions
The following methods shall be used:

- An approved granular material drainage layer of minimum thickness of 300 mm, with a maximum co-efficient of permeability of 1×10^{-3} m/s,
- perforated leachate collector pipes, with a granular material filter sock (permeable geotextile),
- landfill cell and perforated leachate collector pipes with longitudinal fall of 1%,
- landfill cell and perforated leachate collector pipes (spaced at not more than 50 metres in a herringbone pattern) with cross fall of 3%,
- leachate shall be collected in a leachate sump and pumped to a leachate collection dam for storage, and
- stored leachate shall be irrigated over a licenced irrigation area, or re-injected back into the active landfill cell.

Performance Indicators
- The leachate collection system shall be constructed in accordance with the DECC's Environmental Guidelines: Solid Waste Landfills, 1996.

Frequency / Timing
- The leachate collection system shall be constructed for each landfill cell.
- Each landfill cell shall be synthetically lined with a FML prior to acceptance of any waste.

Responsible Person
- Environmental Engineer - for designing and planning of each landfill cell, and
- Site Supervisor – for the supervision of installation staff and contractor, and carrying out of appropriate tests.

Monitoring
- Regular visual inspections and testing during the construction to ensure quality assurance.

Auditing
- On the construction of a landfill cell by landfill cell basis.

Reporting

- Completion report.

Corrective Actions

- Non performance of leachate collection system to performance indicators, suggests that it may require flushing or repairs to be made.

6.1.4 Surface Water and Sedimentation Dam

The objectives of surface water controls are to:

- Prevent unacceptable sediment loads in receiving waters,
- Prevent surface water contact with waste,
- Prevent erosion of cover material and waste, and
- Avoid the generation of excessive leachate.

Tasks and Actions

Sediment control measures at the site include stormwater diversion drains and sedimentation dams. Erosion control measures are required for all construction works where there is a possibility for soil erosion and are used to control and minimise erosion and sedimentation.

Erosion control measures shall incorporate the following:

- Diversion of up slope waters away from the landfilling operations, and final capped landfill cells,
- Limiting the movement of vehicles around the site,
- Turfing / revegetation of soil areas,
- Dust suppression, using water cart or irrigators, on exposed soil areas,
- Construction of silt traps and other control structures, where required,
- Construction of sedimentation dam,
- Installation of sediment fences and hay bales, where required, and
- Construction of catch / swale drains around the site perimeter to capture waters before leaving the site.

Performance Indicators

- Quantity of sediment in sediment control structures, and
- Level of maintenance to sediment control structures.

Frequency / Timing

- Installation of sediment control structures before and during construction, and
- Maintenance of sediment control structures.

Responsible Person

- Site Supervisor – for the installation and maintenance of sediment control structures.

Monitoring

- Inspection of the sediment control structures after major rainfall events and environmental monitoring after periods of sedimentation dam overflow.

Auditing

- On the levels of dust generated during the day.

Reporting

- Annual report.

Corrective Actions

- Regular and ongoing maintenance and repair of the sediment control structures.

6.1.5 Leachate Monitoring Program

The objectives of a leachate monitoring program are to:

- Determine the quality of the leachate, and
- Assess the effect leachate could have when irrigated onto an open irrigation area.

Tasks and Actions

- Collection of sample from the leachate dam.

Performance Indicators

- Previous leachate monitoring results, and
- Australian and New Zealand Environment Conservation Council (ANZECC) Guidelines[8] for Fresh and Marine Quality Water, 2000.

Frequency / Timing

- Leachate monitoring shall be carried out in accordance with the EPL requirements at the time.

Responsible Person

- Environmental Engineer and Monitoring Consultant.

Monitoring

- Monitoring shall be carried out in accordance with the EPL requirements at the time.

Auditing

- Annual.

Reporting

- Annual report and annual DECC return.

Corrective Actions

- If the leachate quality exceeds acceptable limits do not irrigate over licenced irrigation area.

6.2 Detecting Water Pollution

The following methods shall be applied for early detection of surface water and groundwater pollution:

- Groundwater monitoring network,
- Groundwater monitoring program,
- Groundwater assessment program, and
- Surface water monitoring program.

6.2.1 Groundwater Monitoring Network

The objectives of the groundwater monitoring network are to:

- Ensure that the design, number and location of groundwater boreholes be able to demonstrate that the groundwater is not contaminated, and
- Ensure early detection of any contamination by means of regular monitoring.

There are fifteen (15) monitoring groundwater bores across the Depot. The borehole network shall be designed to ensure early detection of movement of groundwater contamination.

Refer to Appendix 1 for borehole locations plan.

6.2.2 Groundwater Monitoring Network

The objectives of the groundwater monitoring program are to:

- Ensure there is an effective monitoring and reporting character on groundwater, and
- Provide early detection and reporting of possible pollution of groundwater.

Tasks and Actions

- Samples shall be collected and sampled from the groundwater monitoring boreholes. Sampling QA/QC procedures shall be in accordance with the relevant monitoring guidelines.

Performance Indicators

- Previous groundwater monitoring results, and
- Australian and New Zealand Environment Conservation Council (ANZECC) Guidelines for Fresh and Marine Quality Water, 2000.

Frequency / Timing

- Groundwater sampling shall be carried out in accordance with the EPL requirements at the time.

Responsible Person

- Environmental Engineer and Monitoring Consultant.

Monitoring

- Monitoring shall be carried out in accordance with the EPL requirements at the time.

Auditing

- Annual.

Reporting

- Annual report and annual DECC return.

Corrective Actions

- If the groundwater monitoring program detects possible failure of the leachate barrier system, a Groundwater Assessment Program shall be established to determine the extent of the failure.

6.2.3 Groundwater Assessment Program

The objective of the groundwater assessment program is to set procedures in place in the possible event of a failure of the leachate barrier system.

Groundwater shall be monitored and background concentrations shall be established for all analytes. Significant changes in concentration levels for any of the indicator parameters over two consecutive reporting periods is detected, then the affected groundwater monitoring boreholes shall be re-sampled as soon as possible. Anomalies, after re-sampling, shall be notified to the DECC.

6.2.4 Surface Water Monitoring Program

The objectives of the surface water monitoring program are to:

- Effectively monitor and report on surface water character, and
- Demonstrate that surface water is not contaminated by the landfilling operation.

Tasks and Actions

Surface water sampling shall be carried out at the following location:

- Sedimentation dam.

Performance Indicators

- Previous surface water monitoring results, and
- Australian and New Zealand Environment Conservation Council (ANZECC) Guidelines for Fresh and Marine Quality Water, 2000.

Frequency / Timing

- Surface water sampling shall be carried out in accordance with the EPL requirements at the time.

Responsible Person

- Environmental Engineer and Monitoring Consultant.

Monitoring

- Monitoring shall be carried out in accordance with the EPL requirements at the time.

Auditing

- Annual.

Reporting

- Annual report and annual DECC return.

Corrective Actions

- If surface water monitoring contamination is detected the DECC's Pollution Line shall be conducted within 24 hours of the incident. A written report, to the DECC, detailing the nature and source of the contamination, and any actions taken, and future actions that will be carried out to prevent recurrence.

6.3 Groundwater Contamination Remediation Plan

The purpose of the Groundwater Contamination Remediation Plan is to set in place procedures to be employed if groundwater or subsoil contamination is confirmed by the Groundwater Assessment Plan. The Groundwater Contamination Remediation Plan will describe the process to protect the groundwater resource from further contamination and nominate a means to return the groundwater to the original quality down hydraulic gradient from the landfilling operation.

7. AIR POLLUTION MANAGEMENT

The Environmental Goals for Air Pollution Management are:
Preventing Landfill Gas Emissions

- Detecting landfill gas emissions, and
- Remediating landfill gas emissions.

7.1 Preventing Landfill Gas Emissions

The Management Techniques used to control landfill gas emissions are:

- Landfill gas containment system,
- Extraction and disposal of landfill gas,
- Fire prevention, and
- Controlled burning of waste, and
- Site closure.

7.1.1 Landfill Gas Containment System

The final capping system for a landfill cell shall be designed to minimise the emissions of landfill gas and surface water infiltration. This shall be achieved by the construction of a 300 mm thick gas drainage layer under a 500 mm minimum thickness clay sealing layer having a permeability of less than 1×10^{-8} m/s. The accumulated gas shall effectively be contained between the gas drainage layer and the sealing layer, due to the clay capping, and over time the gas should move laterally through this layer.

7.1.2 Extraction and Disposal of Landfill Gas

The objectives of extraction and disposal of landfill gas are to:

- Reduce the risk of explosion and fire,
- Reduce the contribution to greenhouse gases, and
- Lower the level of toxic organic compounds emitted from the landfill.

The opportunities for utilisation of landfill gas is directly dependent on the degree to which the gas is cleaned. There are several options for use of landfill gas at the Depot, but the following option already exists on the site:

- Power generation. Small scale gas turbines are used to generate green power for use in the electricity grid.

The other possible options could be:

- Well venting. Passive gas venting wells or gas extraction wells may be installed to allow escape of the landfill gas to the atmosphere. The pressure of the landfill gas beneath the final capping layer forces the gas to move to the more porous gas collection layer and vent well. The gas moves to this low pressure, low concentration area created by the vent well and from there dissipates into the atmosphere.
- Gas flaring. It is used as a control measure to limit the gas migration and to mitigate landfill gas odours.
- Heating. Landfill gas may be combusted to generate heating for light industry.

As quantities of landfill gas change, other options or combination of options may be used. Ongoing monitoring of landfill gas volumes and disposal methods may be necessary if there is a large buildup of gas.

Tasks and Actions

- Gas wells are currently installed to collect and extract the gas in a controlled manner to the power the small gas turbines used to generate green power.
- The gas wells consist of HDPE / MDPE riser pipes connected to approximately 2 metres above the leachate collection system. The length of pipe below the final capping layer is perforated.
- The gaps between the riser pipe and the top of the final capping layer are to be made air tight so that no gas escapes the collection and extraction system.

Performance Indicators

- Level of maintenance of the riser and extraction pipes, and small gas turbines.

Frequency / Timing

- Gas wells, collector and extraction pipes shall be installed after each landfill cell has been final capped.
- The gas extraction and extraction process shall be ongoing.

Responsible Person

- Environmental Engineer and Monitoring Consultant.

Monitoring

- Monitoring for gas detection of final capped landfill cells surface and surrounding buildings.

Auditing

- Annual.

Reporting

- Annual report and annual DECC return.

Corrective Actions

- Ongoing inspection, maintenance, testing and monitoring of whole gas collection and extraction system.

7.1.3 Fire Prevention

The objectives of fire prevention are to:

- Minimise emissions to the atmosphere, and
- Increase the level of safety at the Depot.

Tasks and Actions

The following minimum control measures shall be addressed to prevent fires:

- Signs shall be erected and displayed at the entrance to the Depot advising the customer that liquid and hazardous wastes are not permitted to be disposed at the site. The weighbridge operator shall also advise the customer and carry out visual inspections of the load.

- Stockpiles of approved combustible wastes (tyres and green wastes) shall be in piles and windrows no higher than 3 metres and away from working and public areas.
- Landfill cell construction, compaction and covering of waste shall use materials not conducive to a landfill fire.
- All empty drums accepted at the Depot shall be washed clean and punctured in order to not contain any residual chemical fuels.
- All fuels and flammable solvents used for operational purposes shall be stored in suitably ventilated and secure stores.
- Waste oil shall be stored within a bund of 110% capacity of the volume of those flammable liquids so that any release of raw or burning fuel will not cause a fire in landfilling areas or impact on stormwater.

Performance Indicators
- Number of fires occurring at the site.

Frequency / Timing
- The prevention of fire shall be ongoing.

Responsible Person
- Site Supervisor.

Monitoring
- Stockpiles of combustibles, fuels and flammable solvents shall be inspected on a daily (combustible wastes), weekly (fuels) and quarterly (flammable solvents) bases for fire risk.
- Any fire occurring at the site shall be investigated and the causes, damage and impact shall be fully documented.

Auditing
- Annual.

Reporting
- Annual report and annual DECC return.

Corrective Actions
- The cause of any site fires shall be determined and appropriate work procedures shall be put in place to minimise re-occurrence.

7.1.4 Controlled Burning of Waste
There shall be no controlled burning of waste at the Depot.

7.1.5 Site Closure
The landfill site shall be closed in a manner that minimises the emission of landfill gases, and minimises the production of leachate. The design and construction of the final capping and revegetation layers are intended to decrease the potential for gas emissions and leachate production.

7.2 Detecting Landfill Gas Emissions
The Management Techniques used to detect landfill gas emissions are:

- Surface gas emissions monitoring, and
- Gas accumulation monitoring.

7.2.1 Surface Gas Emissions Monitoring

The objective of surface gas emissions monitoring is to demonstrate the effectiveness of the final capping design and construction.

Tasks and Actions

- In areas where intermediate cover or final capping has been placed, the air shall be tested above the surface, as per testing requirement.
- Within surrounding buildings, plant and equipment.

Performance Indicators

- Detection of methane over final capped landfill cells.

Frequency / Timing

- Surface gas emissions monitoring shall be carried out in accordance with the EPL requirements at the time.

Responsible Person

- Environmental Engineer and Monitoring Consultant.

Monitoring

- Monitoring shall be conducted with appropriate and calibrated gas detection equipment.

Auditing

- Annual.

Reporting

- Annual report and annual DECC return. The monitoring shall continue until the Certificate of Completeness is issued or when the detection of gas is no longer in concentrations that pose an environmental risk.

Corrective Actions

If the concentrations of gas exceed the allowable limits of methane at any point on the landfill cell surface, corrective action is necessary. This action shall include, but not be limited to:

- Repairing or replacing the final capping material and layer, and
- Adjusting or installing gas collection and extraction equipment.

7.2.2 Gas Accumulation Monitoring

The objective of gas accumulation monitoring is to monitor gas build-up which may have the potential to be detrimental.

Tasks and Actions

- All building within 250 metres of the active and final capped landfilling areas shall be monitored in accordance with the EPL requirements at the time.
- Future surface structures or buildings to be constructed within the 250 metres of landfilling areas shall be designed so as not to accumulate landfill gas.

Performance Indicators

- Buildings are not to have gas concentrations exceeding 1.25% methane (v/v).

Frequency / Timing

- Gas accumulation monitoring shall be carried out in accordance with the EPL requirements at the time.

Responsible Person
- Environmental Engineer and Monitoring Consultant.

Monitoring
- Monitoring shall be conducted with the appropriate and calibrated gas detection equipment.

Auditing
- Annual.

Reporting
- Annual report and annual DECC return.

Corrective Actions
- If methane gas concentrations exceed 1.25% (v/v) within the buildings, daily testing shall be undertaken until ventilation or other measures control the methane gas build-up.

7.3 Remediating Landfill Gas Emissions

If the concentration of methane is detected at greater than 1.25% (v/v) during the surface or building monitoring, the DECC shall be notified within 24 hours. A written assessment of the emissions and management controls implemented, or proposed to be implemented to prevent further emissions, shall be provided to the DECC within 14 days of the incident.

8. LAND MANAGEMENT AND CONSERVATION

The Environmental Goals for Land Management and Conservation are:

- Assuring Quality of Design, Construction and Operation,
- Assuring Quality of Incoming Waste,
- Recording of Wastes Received,
- Minimising of Landfill Space Used,
- Maximising Recycling, and
- Remediating Landfill After Closure.

8.1 Quality Assurance

The purpose of Quality Assurance is to ensure all design, construction and operation of the Facility are covered by (or working towards) a documented quality assurance system.

Tasks and Actions

- A Quality Assurance System Framework shall be developed for the Facility.
- The materials and processes used in the construction of the landfill shall have a Construction Quality Assurance System. Standard specifications for clay liner, leachate barrier and collection systems and flexible liner membrane (FML) shall be in accordance with the DECC's Environmental Guidelines: Solid Waste Landfills.

Performance Indicators

- Compliance with relevant Australian Standards for Quality System.

Frequency / Timing

- Annual review.

Responsible Person

- Environmental Engineer.

Monitoring

- Internal Quality System audits shall be conducted by the Environmental Engineer, with external audits undertaken as required.

Auditing

- Annual by Environmental Engineer.

Reporting

- Results of audits shall be reported by the Environmental Engineer.

Corrective Actions

- All non-conformances in the Quality System identified by an internal or external audit shall be rectified as soon as possible. Any non-conformances of the Quality System in the construction or operation of the Facility shall require repairs to the construction or changes in the operation.

8.2 Assuring Quality of Incoming Waste

8.2.1 Screening of Waste Received

The purpose of inspecting and screening the wastes received is to ensure that the Facility receives only those wastes that it is licenced to receive. The Environmental Protection Licence (EPL) for the Depot is 5877.

Tasks and Actions

- Inspection and screening of all incoming and outgoing loads of waste at the weighbridge,
- Inspection and screening of waste at active landfill area, and stockpiling areas, and
- Erection of signage at the entrance to the Facility clearly indicating the types of wastes accepted and charge list, as well as those wastes not accepted.

The Depot's Procedures Manual for standard procedures for the screening of incoming and outgoing wastes, forms and records, and procedures for dealing with hazardous and unacceptable wastes.

Performance Indicators

- Quantities of unacceptable waste types,
- Number of detection reports of rejected waste types, and
- Monitoring data indicating consistent occurrences of unacceptable waste being detected.

Frequency / Timing

- Inspecting and screening of all incoming and outgoing vehicle loads, and
- Inspecting and screening of vehicles at the active landfill area, and stockpiling aeas.

Responsible Person

- Weighbridge Operator and Facility Supervisor.

Monitoring

- The inspecting and screening of incoming and outgoing loads of waste shall attempt to detect and identify the quantities of non-licenced wastes.

Auditing

- Daily on a load by load basis.

Reporting

- Monthly Section 88 returns to the DECC.
- Annual report and annual DECC return.

Corrective Actions

- If unacceptable loads of waste are detected and identified at the weighbridge, the Weighbridge Operator must notify the driver of the vehicle of the non-licenced waste and direct them to leave the site and dispose of waste appropriately.
- If unacceptable loads of waste are detected and identified at the active landfilling area, the active landfill cell operator(s) must notify the driver of the vehicle to cease tipping of the non-licenced waste and notify the Weighbridge Operator or Facility Supervisor immediately.
- The Waste Facility Supervisor must attend the area immediately and isolate it to other landfill users and landfill operators. The waste must be identified and disposed in the correct manner, at the waste owner's cost. Council's Rangers must also be contacted and informed of the incident.

8.3 Recording of Wastes Received

The Management Techniques for recording the wastes received is:

- Quantifying of wastes received, and
- Recording the quantities, types and sources of waste received.

8.3.1 Quantifying of Wastes Received

The purpose of quantifying the wastes received at the Depot is to accurately obtain data on the waste quantities, types and sources for reporting and planning purposes.

Tasks and Actions

- All vehicles must enter via the weighbridge. The Weighbridge Operator must ask the vehicle driver of the waste type, and inspect and screen the waste for non-licenced wastes.
- The gross vehicle weight is recorded upon entry to the Depot, and tare weights are recorded upon departure where the driver will be charged accordingly.
- Smaller vehicles, charged at the fixed rate for cars, utes and trailers with mixed municipal and green wastes will be charged upon entry.

Performance Indicators

- The number of times the weighbridges and waste tracking system are not operational.

Frequency / Timing

- Every incoming and outgoing vehicle.

Responsible Person

- Weighbridge Operator and Facility Supervisor.

Monitoring

- The weighbridges and waste tracking system shall be operational, as far as practicable, at all times the Depot is open.

Auditing

- The weighbridges shall be calibrated and have a valid Calibration Certificate from the Department of Fair Trading displayed at the weighbridge office. The weighbridge calibrations shall be carried out as per Department of Fair Trading requirements.

Reporting

- Monthly Section 88 returns to the DECC.
- Annual report and annual DECC return.

Corrective Actions

- If any of the weighbridges are inoperable, the tare weight, in tonnes, of all vehicles shall be calculated using the "Waste Factors by Vehicle and Waste Type" sheet.

8.3.2 Recording of Quantities, Types and Sources of Wastes Received

The objectives of recording the quantities, types and sources of wastes received at the Depot are to:

- Enable the effective monitoring of incoming waste, and
- To aid in reporting requirements.

Tasks and Actions

- Each month, Council shall submit Section 88 monthly returns to the DECC, on the quantities, types and sources of waste received at the Depot.
- A suitable waste tracking system shall be employed to monitor the incoming and outgoing wastes.
- Volumetric surveys shall be carried out in June and December every year by a registered surveyor to confirm the volume of landfill space consumed, and stockpile quantities on a six monthly basis.

Performance Indicators

- The accurate recording of the quantities, types and sources of waste received at the Depot.
- The accurate and timely submission of DECC Section 88 returns.

Frequency / Timing

- Monthly submission of Section 88 returns to the DECC.
- Volumetric surveys of the Depot every June and December.

Responsible Person

- Weighbridge Operator and Facility Supervisor.
- Environmental Engineer and Registered Surveyor.

Monitoring

- Of accurate data from the waste tracking system.

Auditing

- Auditing of landfill volumetric survey to confirm landfill space consumed and remaining in the previous 6 months.

Reporting

- Monthly Section 88 returns to the DECC.
- Annual report and annual DECC return.
- Volumetric surveys of the Depot in June and December each year.

8.4 Minimising Landfill Space Used

The Management Techniques used to minimise the landfill space used are:

- Compaction of waste, and
- Filling and contour plans.

8.4.1 Compaction of Waste

The purposes of compacting the waste are:

- Minimise the amount of land required to dispose waste,
- Improve the stability of the landfill, and
- Minimise voids that would normally encourage vermin, fires and excess generation of leachate.

Compaction shall be undertaken using a suitable landfill compactor, with capability of compacting between 0.9 t/m^3 and 1.1 t/m^3.

Tasks and Actions

- Establishment of a landfilling area at a grade which enables plant to compact to manufacturer's specifications.
- Waste shall be spread in layers of maximum thickness of 500 mm and then compacted.
- The compacted waste must be covered on a daily basis using an approved cover material.

Performance Indicators

- The compaction aim is 1.00 t/m^3.

Frequency / Timing

- Continual throughout the day.
- At end of each day's operations.

Responsible Person

- Compactor Operator and Facility Supervisor.

Monitoring

- Daily, by visual inspections.
- Six monthly monitoring of compaction data from reconciliation of waste quantities landfilled and stockpiled, with the volumetric surveys carried out every 6 months.

Auditing

- Six monthly.

Reporting

- The achieved compaction rate (excluding cover material) shall be calculated and submitted in the Annual report to the DECC.

Corrective Actions

- If compaction data falls below performance indicator, compaction operating procedures shall be reviewed. This may require spreading and compacting thinner layers or the specifying of additional compactor passes.

8.4.2 Filling and Contour Plans

The objectives of producing filling and contour plans are to:

- Demonstrate that site operations are being controlled in a planned manner, and
- To estimate the volume of waste landfilled.

Tasks and Actions

The landfilling plans shall:

- Be updated when each landfill cell is commenced and completed.
- Identify the type of waste in each landfill cell and the location of any special burials, such as asbestos.

Performance Indicators

- The preparation of filling and contour plans.

Frequency / Timing

- Filling and contour plans shall be completed after each landfill cell.

Responsible Person

- Environmental Engineer.

Monitoring

- Surveys assist in the estimation of landfilled waste and calculation of remaining landfill capacity. The survey shall be carried out by a registered surveyor.

Auditing

- Annually.

Reporting

- Annual report to the DECC.

8.5 Maximisation of Recycling

8.5.1 Recycling

A Resource Recovery and Buy-Back Center is located before the weighbridge and entry to the landfilling operation. The Center accepts and receives post consumer recyclables, and sells secondhand recovered goods.

A Waste Transfer Station has been constructed to enable the greater recovery of household waste materials and re-usable and recyclables goods. These are separated from the waste stream, stockpiled and resold to the public at the Resource Recovery and Buy-Back Center. The Transfer Station improves safety at the Facility by separating small vehicles from heavy vehicles. A bunded tank is installed at the

Buy-Back Center for the safe disposal of small quantities of sump oil. The bunded tank is to contain any spillages or leaks.

Green waste is separated and stockpiled away from the general waste stream. The loads of incoming green waste disposed at the Depot are delivered in small and heavy vehicles. Only clean loads of green waste are sent to the stockpiling area, in order to keep feedstock free of contamination. All other loads are sent either to the Transfer Station or the active landfilling area. There are currently no kerbside collections of green waste in the LGA.

Inert waste, such as; concrete, brick and tiles, are separated and stockpiled away from the general waste stream. The loads of incoming inert waste disposed at the Depot are delivered in small and heavy vehicles. Only clean loads of inert waste are sent to the stockpiling area, in order to keep feedstock free of contamination. All other loads are sent either to the Transfer Station or the active landfilling area.

Steel is separated and stockpiled away from the general waste stream. Loads of incoming steel disposed at the Depot is delivered in either small and heavy vehicles. Only clean loads of steel waste are sent to the stockpiling area, in order to keep feedstock free of contamination. All other loads are sent either to the Transfer Station or the active landfilling area.

Incoming loads of VENM cleanfill and rock are also separated and stockpiled away from the general waste stream.

Tasks and Actions
The waste stream at the Transfer Station is separated into:

- Mixed municipal waste.
- Green waste.
- Inert waste (concrete, brick, tile).
- Steel.
- Asbestos (asbestos bin – only accepted if presented in accordance with procedure for disposal of asbestos).

The following materials shall be recycled at the Buy-Back Center:

- Glass bottles and jars,
- Aluminium and steel cans,
- Selected clean metals,
- Paper and carboard,
- PET, PVC, HDPE, and “R” plastic bottles,
- Batteries, and
- Sump oil.

Performance Indicators
- Quantity and quality of recyclable materials recovered.

Frequency / Timing
- Continual throughout the day.

Responsible Person
- Facility Supervisor.

Monitoring

- Monthly records of recyclable material types and quantities recovered.

Auditing

- Annual.

Reporting

- Annual report to the DECC.

Corrective Actions

- If the quantity of recyclable materials recovered declines over a period, the recycling strategy and resource recovery practices shall be reviewed.

8.6 Remediating Landfill Site After Closure

The Management Techniques used for remediating the landfill site after closure are:

- Financial assurance,
- Site final capping and revegetation, and
- Landfill closure and post-closure monitoring and maintenance.

8.6.1 Financial Assurance

The purposes of maintaining financial assurance are to:

- Ensure that Council adequately plans for emergency closure,
- Site remediation, and
- Post closure care.

Financial assurance shall be covered by the available funds in Council's Consolidated account.

8.6.2 Final Site Capping and Revegetation

The objectives of final site capping and revegetation are:

- To ensure that the finished final surface provides an impermeable barrier to the migration of waters into the waste,
- Control emissions to the atmosphere, and
- Reduce the risk of hazards.

Tasks and Actions

- The final capping system shall be designed to minimise surface water infiltration into the completed landfill cell and to prevent the emission of landfill gases (methane) into the atmosphere.
- The final capping system shall be designed and constructed in accordance with the DECC's Environmental Guidelines: Solid Waste Landfills, 1996. Innovative alternatives to the design and construction of the final capping system shall be submitted to the DECC for prior approval.

The final capping shall have a minimum 5% gradient to ensure adequate run-off. Until the construction of the final capping, perimeter drains and bund walls shall be used to re-divert and to minimise the entry of surface water from around the landfill site.

Performance Indicators

- The clay or equivalent final capping and drainage layers shall be constructed in accordance with the DECC's Environmental Guidelines: Solid Waste Landfills, 1996,
- Quantity and quality of generated leachate,
- Quantity of surface and sub-surface gas generated, and
- Quality of surface water and groundwater.

Frequency / Timing

- Final capping shall be undertaken as soon as possible after each landfill cell has been completely filled with solid waste.
- Revegetation shall commence as soon as possible after successful construction of the final capping system.

Responsible Person

- Environmental Engineer and Facility Supervisor.

Monitoring

- Regular earthworks monitoring and testing during construction to ensure quality of clay material and work.
- Groundwater, surface water, leachate, surface gas and sub-surface gas monitoring programs (as per EPL Environmental Monitoring requirements).

Auditing

- Annual.

Reporting

- Annual report to the DECC.

Corrective Actions

- If monitoring indicates a failure of the final capping system, site investigations shall be conducted to determine the extent of the failure. Remedial measures may need to be considered.

8.6.3 Landfill Closure and Post Closure Monitoring and Maintenance

The objectives of the Landfill Closure Plan and Post Closure Monitoring and Maintenance are:

- To ensure that the landfill continues to be non-polluting, and
- Does not create an environmental hazard after site closure.

A site Closure Plan shall be submitted to the DECC for approval within three (3) months of the completion of the site's waste receipt operations. The Closure Plan shall include putting into place a post closure monitoring and maintenance program which ensures the long term integrity of the site. The following section describes the proposed components of the Closure Plan:

- *Leachate, Gas and Stormwater Monitoring*
  All leachate collection, gas collection and stormwater sediment controls, monitoring and reporting practices shall be described.

- *Groundwater Monitoring*
  Groundwater monitoring shall be described and shall map the movement of any leachate plume in the groundwater over time. Monitoring shall continue

until the quality of the groundwater reaches environmentally acceptable levels.

- *Maintenance*
  A description of how the following items shall be maintained, at a standard equivalent to that during the operational life of the landfill site, for the period until the landfill does not pose a threat to the environment:

  - sediment retention dams,
  - vegetation,
  - rehabilitated land, and
  - vermin and pest control.

- *Complaints*
  Records of complaints shall be kept in the same manner as during operation of the landfill site.

- *Waste Receival*
  Description of the means to ensure waste materials will not be received for disposal by the Depot after landfill operations cease. Waste material intended for use in the rehabilitation and remediation shall be documented and reported in the same way as for an operating Depot.

- *Certified Statement of Completion*
  When sufficient evidence is provided that the former landfilling operation is stable and non-polluting, Council shall seek to complete all obligations and settle any financial assurance by submitting a Certified Statement of Completion which states that the site remediation work has been completed and further environmental management of the site is not required. The statement shall show that:

  - Gas concentration levels in all perimeter gas wells have fallen to less than 1% methane (v/v) and less than 1.5% carbon dioxide for a period of 24 months,
  - Waste stabilisation has been completed. This would be documented by the composition of the leachate changing to a low level of contamination, and posing no hazard to the environment,
  - Groundwater monitoring has indicated no failure of the landfill synthetic liner (where it has been used) that would pose a threat to the groundwater quality,
  - The landfill capping has been assessed over some years and found to be stable with acceptable surface water drainage,
  - Documentation to demonstrate that all functions in the closure planning segment of the LEMP and the written confirmation of procedures have been completed, and
  - The site has been placed on the Contaminated Land Register.

Upon receipt of the approved Certified Statement of Completion , by the DECC, Council may cease the maintenance and monitoring of the site, and any of the financial assurance requirements will lapse.

9. HAZARDS AND LOSS OF AMENITY

The Environmental Goals of avoidance of hazards and loss of amenity are:

- Preventing unauthorized entry,
- Preventing degradation of local amenity,
- Preventing noise pollution,
- Adequate fire fighting capacity, and
- Adequate staffing and training.

9.1 Preventing Unauthorised Entry

9.1.1 Security of Site

Tasks and Actions

- The landfill site shall be bounded by a 2.1 metre high security chainwire perimeter fence. The front entrance gate shall be locked outside of normal business hours.

Performance Indicators

- Number of intruders identified.
- Illegally disposed waste at the gate or nearby the Depot.
- Number of complaints with regard to access to the Depot.

Frequency / Timing

- Daily inspections of the gate and surrounding fence areas.
- Weekly inspections of the boundary fenceline.

Responsible Person

- Facility Supervisor.

Monitoring

- The perimeter fencing shall be visually inspected.

Auditing

- Annual.

Reporting

- Annual report to the DECC.

Corrective Actions

- Carry out necessary repairs to the fencing immediately after being identified to ensure security of site.

9.2 Preventing Degradation of Local Amenity

The Management Techniques used for the prevention of degradation the local amenity are:

- Litter control,
- Cleaning of vehicles,
- Covering of waste,
- Dust controls,
- Pest, vermin and noxious weeds controls, and

- Odour controls.

9.2.1 Litter Control

The purpose of litter control is to minimise windblown litter.

The generation of litter is primarily through wind movement of litter which has not been covered. To minimise the incidence of windblown litter, the active landfilling area shall be covered daily.

A fixed chainwire fence already exists around the perimeter of the Depot. Regular litter patrols are carried out of the perimeter fencing to collect any windblown litter.

Tasks and Actions

- Vegetative litter screens shall be installed around strategic locations within the Depot.
- Permanent and temporary litter fencing shall be erected at strategic locations around the site, in particular, permanent perimeter fencing and temporary landfill cell fencing.
- Entry and exit signage shall be erected to advise customers that littering is an offence and fines will apply from the improper transportation of waste.
- Regular litter patrols shall be carried out by staff / contractors.

Performance Indicators

- Number of complaints received regarding offsite litter.
- Quantity of litter found in nearby land and waterways.

Frequency / Timing

- Offsite windblown litter shall be retrieved on a daily or as needs basis.

Responsible Person

- Facility Supervisor.

Monitoring

- Permanent and temporary fences shall be inspected and cleared of litter on a daily or as needs basis, depending on the quantity of litter found.

Auditing

- Annual.

Reporting

- Annual report to the DECC.

Corrective Actions

The following procedures shall assist in the control of litter:

- Open loads of waste shall be covered.
- Waste shall be compacted and covered more frequently during the day.
- Confine the disposal of waste to a smaller working area.

9.2.2 Cleaning of Vehicles

The objectives of cleaning vehicles are to:

- Minimise the effect on both local amenity, and
- Quality of stormwater run-off.

Tasks and Actions

- Internal access roads are sealed to ensure mud is not tracked along local streets.
- A wheel wash bay shall be located within the site, as close as possible to the exit gate, for use by customers before leaving the site, if roads are unsealed.
- As far as practicable, heavy vehicles leaving the site shall use the wheel wash bay after leaving the active landfilling area.
- The wheel wash bay shall be available to customers for a nominal fee.

Performance Indicators

- Number of complaints received from the surrounding community regarding the tracking of mud and litter from the site.
- Mud and litter found on surrounding roads and land.

Frequency / Timing

- Random audits of vehicles leaving the site.

Responsible Person

- Facility Supervisor.

Monitoring

- Visual inspection.

Auditing

- Annual.

Reporting

- Annual report to the DECC.

Corrective Actions

- Vehicles found not to be utilising the wheel wash bay shall be directed to do so before leaving the site.

9.2.3 Covering of Waste

The objectives of cover material are to:

- Limit the run-on and reduce the infiltration of surface water and stormwater.
- Control and minimise the risk of fire.
- Minimise the emission of landfill gas.
- Suppress odours.
- Reduce pest and vermin.
- Decrease litter generation.

Currently, Virgin Excavated Natural Material (VENM) is being used as the daily and intermediate cover material. Application for the use of other suitable daily cover materials shall be made to the DECC from time to time.

Tasks and Actions

Cover material is classified as daily, intermediate or final:

- Daily Cover – shall be placed over active landfilling area prior to the end of each working day, or more frequently to minimise the generation of dust and contain the waste from the surrounding environment. The thickness of daily

cover material (VENM) shall be a minimum 150 mm. Any surface water run-off coming in contact with the daily cover material shall be treated as leachate.

- Intermediate Cover – only if active landfilling area is left exposed for more than 90 days which does not generally occur within the method of operation of the site. This form of cover shall be placed to a depth of 300 mm when active landfilling areas are exposed for prolonged periods of time. Any surface water run-off coming in contact with the daily cover material shall be treated as leachate.
- Final Cover – shall be placed on final surfaces of a landfill cell. The final cover or capping shall be designed to minimise the rain water infiltration to the landfill. Surface water run-off from the final capped landfill cell shall be treated as clean water. The final cover (capping) shall be carried out in accordance with the DECC's Environmental Guidelines: Solid Waste Landfills.
- A two (2) week cover material stockpile shall be kept within the site, adjacent to the active landfilling area.

Performance Indicators

- Quantity of daily, intermediate and final cover material used.
- Effective covering of the waste from the environment.

Frequency / Timing

- Daily.
- At the completion of each landfill cell.

Responsible Person

- Facility Supervisor.
- Plant Operators.

Monitoring

- Visual daily inspections.

Auditing

- Annual.

Reporting

- Annual report to the DECC.

Corrective Actions

- Uncovered waste shall be covered as soon as practicable, in accordance with the tasks / actions from Clause 9.2.3.

9.2.4 Dust Controls

The objectives of dust control are to:

- Minimise pollutants leaving the site as airborne dust.
- Reduce stormwater sediment load.
- Protect local amenity.

Emissions causing a reduction in air quality can originate from:

- Landfilling operations. This includes the construction of landfill cells, landfill liner preparation, waste disposal and compaction, capping, vehicle traffic, and plant and equipment used in the landfilling operation.

Dust emissions are more likely to occur in the warmer and drier months, in particular during windy days. The magnitude of the impact will depend upon the type and size of the landfilling operation, prevailing wind speed and direction, adjacent land use and the occurrence of natural and / or constructed wind breaks, wind abatement measures or buffers.

Tasks and Actions

- Unsealed trafficable areas, roads and stockpiles shall be wetted down on a regular basis.
- Consideration may be given to relocating the active landfilling areas if dust is impacting upon nearby residents.
- Internal perimeter and access roads shall be properly formed, drained, surface treated and maintained.
- Limit site stripped areas to the minimum necessary for operational requirements.
- Revegetation of final capped landfill areas, as soon as practicable.
- Stockpiles shall be limited in height, wetted down, and be turned over regularly.
- Reduce vehicle speeds on the site to reduce dust generation.
- Control density of vegetation buffer to trap dust emissions.
- Mechanical plant and equipment shall be maintained and serviced on a regular basis, for efficient operation.
- Plant and equipment shall be fitted with the appropriate pollution control devices.

Dust shall be monitored visually to ensure immediate response with mitigation.

Performance Indicators

- Number of complaints received from the surrounding community regarding dust emissions from the site.
- Dust found on surrounding roads and land.

Frequency / Timing

- Wet down surfaces, roads and stockpiles as required.

Responsible Person

- Facility Supervisor.

Monitoring

- Visual daily inspections.
- Dust gauge box as required by the EPL.

Auditing

- Annual.

Reporting

- Any incidents of dust problems, and control measures taken, shall be reported in the Annual report to the DECC.
- The results of all dust monitoring conducted over the previous 12 months shall be included in the Annual Report and Annual Return.

Corrective Actions

- If dust monitoring detects concentrations above the performance indicator, control measures shall be undertaken to reduce / mitigate dust generation as a routine precaution and work practice. A review of the work practices shall take place and corrective actions shall be proposed.

9.2.5 Pest, Vermin and Noxious Weed Controls

The objectives of pest controls are to:

- Minimise the impact of vermin and noxious plants on the surrounding environment.

Tasks and Actions

- Rodent bait stations at various locations shall be conducted. A pest control contractor shall service the bait stations on a regular basis, and the results of this service shall be recorded in a log book which shall be kept at the site office.
- Insecticides and pesticides shall be used when necessary.
- Weed control measures, identified by the Noxious Weeds Officer, shall be conducted as per weeding program.
- Ensure the active landfilling area is kept to a minimum and covered regularly to limit food sources and breeding areas.
- Surface shall be free draining to prevent the ponding of surface water.

Performance Indicators

- Number of complaints from local nearby residents about pests / vermin moving off the site and to neighbouring properties.
- Number of pests / vermin found by the pest control contractor.
- Amount of infestation of noxious weeds.

Frequency / Timing

- Regular inspection and baiting for rodents by contractor.
- Annual and regular inspections and weeding by Noxious Weeds Officer.
- Trapping programs as required.

Responsible Person

- Facility Supervisor.
- Pest control contractor.
- Noxious Weeds Officer.

Monitoring

- Visual monitoring by Facility Supervisor.
- Records from pest control contractor.
- Records from Noxious Weeds Officer.

Auditing

- Annual.

Reporting

- Annual report to the DECC.
- Noxious Weeds Officer's Annual Report.

Corrective Actions

- Increase number of baiting stations and trapping if vermin numbers rise.
- Increase frequency of weed eradication if inspections and monitoring indicates a spread of weeds.

9.2.6 Odour Controls

Tasks and Actions

Council shall take the appropriate steps to prevent the production of odours. The use of daily cover attention to odorous waste loads shall minimise the transmission of odours.

Performance Indicators

- Number of complaints on odour escape off site.
- Detection of excessive odour.

Frequency / Timing

- Ongoing.

Responsible Person

- Facility Supervisor.

Monitoring

- Odorous smell.

Auditing

- Annual.

Reporting

- Council shall maintain records of all complaints received regarding odours over the previous 12 months and include this in the Annual report to the DECC.

Corrective Actions

- A comprehensive review of operations and practices if excessive number of complaints about odour.

9.3 Preventing Noise Pollution

9.3.1 Noise Control

Tasks and Actions

- Plant and equipment shall be regularly maintained.
- Noise barriers such as vegetation screens and earthen bunds (levees) shall be constructed.
- All contractors on the site shall make commitments to minimise the levels of noise from the carrying out of their activities.

Performance Indicators

Noise emanating from the site shall not exceed the limits set out in the NSW Industrial Noise Policy, 2000[9], for daytime and night time noise measured at any point within one (1) metre of any residential boundary.

Noise emanating from the site shall not exceed the limits set out in the NSW Industrial Noise Policy, 2000, when measured at any point within one (1) metre of any boundary of the premises.

Daytime -	7:00 am to 10:00 pm	Monday to Saturday
	8:00 am to 10:00 pm	Sunday and Public Holidays
Night Time -	10:00 pm to 7:00 am	Monday to Saturday
	10:00 pm to 8:00 am	Sunday and Public Holidays

Frequency / Timing

- Ongoing.

Responsible Person

- Facility Supervisor.

Monitoring

- Monitoring of maximum and background noise as required due to changed operating conditions.

Auditing

- Annual.

Reporting

- All noise complaints shall be recorded over the 12 month period and shall be included in the Annual report to the DECC.

Corrective Actions

- A comprehensive review of operations and practices shall be carried out if excessive numbers of noise complaints are received in excess of performance indicators.

9.4 Adequate Fire Fighting Capacity

9.4.1 Fire Fighting Capacity

In the event of a fire incident, the appropriate local fire fighting service shall be contacted.

Tasks and Actions

- In the event of a fire, the Facility Supervisor and employees shall ensure the safety of personnel on site. The Facility Supervisor shall immediately take all actions necessary to prevent the fire from spreading to the waste and sources of fuel within the site. Landfill staff shall be trained in fire fighting techniques and a site specific fire management plan / procedure shall have been devised.
- The Facility Supervisor shall immediately contact the emergency services and local fire brigade and advise them of the fire.
- All fire fighting equipment and facilities shall be regularly checked for damage / condition on a weekly basis and tested as required. Fire equipment signposting to Australian Standards and accessibility shall also be checked as required.
- Depot internal access roads shall act as suitable fire breaks and provide adequate protection / access if any fire outbreak occurs in stockpiles, buildings or landfilled areas.

Performance Indicators

- Number of fire fighting vehicles and appliances available.
- The length of time required to extinguish the fire.

Frequency / Timing

- Fire fighting capacity shall be maintained at all times.

Responsible Person

- Facility Supervisor.

Monitoring

- The capacity of the fire fighting shall be reviewed and monitored every 12 months.

Auditing

- Annual.

Reporting

- In the event of a fire incident, a report, including evaluation of the performance of the emergency systems shall be prepared and included in the Annual report to the DECC with system remedial measures, if necessary.

Corrective Actions

- If the performance indicators detect a failing, then measures shall be put in place to increase the fire fighting capacity.

9.5 Adequate Staffing and Training

9.5.1 Staffing and Training Requirements

The current staffing levels at the site consists of six (6) fulltime employees and three (3) fixed term employees. The breakdown is as follows:

- Facility Supervisor,
- Compactor operator,
- Dozer operator,
- Front end loader operator,
- Water cart operator, and
- Truck driver.

Tasks and Actions

- Additional staff will be required to assist with the additional work associated with the increasing resource recovery area.
- Staff shall be trained in safety and operating procedures and the correct identification of hazardous waste.

Staff shall be adequately trained to ensure that:

- All plant and equipment operators are skilled enough and appropriately ticketed at undertaking tasks required of them.
- Staff inspecting loads of incoming wastes are capable of accurate data recording, and skilled at identifying waste types that are unacceptable.

Performance Indicators

- The level of skill and performance of the staff.

- The outcome of staff performance and assessment reviews.
- The number of errors in data recording and reporting.
- Level of operational and administrative efficiency.

Frequency / Timing
- Regular or as required training for each individual staff member shall be arranged by the Facility Supervisor.

Responsible Person
- Facility Supervisor.

Monitoring
- Staffing and training shall be monitored annually.

Auditing
- Annual.

Reporting
- Annual report to the DECC.

Corrective Actions
- If the performance indicators detect a failing, then measures shall be put in place to increase the staffing levels and / or training requirements.

10. Summary of Monitoring Requirements

Table 10.1 summarises the monitoring parameters, location of monitoring points and the frequency of monitoring required by the DECC's Environment Protection Licence (EPL).

Table 10.1 – Summary of monitoring requirements.

Environmental Goals	Management Technique	Location	Monitoring Parameter	Frequency
Prevention of water pollution by leachate	Landfill barrier systems	Synthetically lined solid waste landfill cells	Earthworks / flexible membrane liner	During construction of landfill cell
	Leachate collection system	Synthetically lined solid waste landfill cells	Earthworks / drainage	During construction of landfill cell
	Surface water controls	Whole site	Sediment accumulation	As per EPL
	Leachate monitoring program	Leachate collection pond / dam	Leachate quality	As per EPL
Detection of water pollution	Groundwater monitoring program	Monitoring bores	Groundwater quality	As per EPL
	Surface water monitoring program	Sedimentation dam	Surface water quality	As per EPL

Preventing Landfill Gas Emissions	Extraction and disposal of landfill gas	Final capped landfill cells	Riser pipe condition monitoring	As per EPL
Detecting Landfill Gas Emissions	Surface gas emission gas monitoring	Final capped landfill cell surface	Methane concentration levels	As per EPL
	Gas accumulation monitoring	Site offices and sheds within 200 metres	Methane concentration levels	As per EPL
Land Management and Conservation	Assurance of quality	Site activities	Conformance with QA	Annual review
Collection and Reporting of Waste Data	Collation of waste types and quantities	Weighbridge office	Waste tracking system	All incoming loads
Maximisation of Resource Recovery	Resource recovery / recycling	Transfer station / buy back center	Resources and recyclables recovered	Ongoing
Minimisation of Landfill Space Utilised	Effective waste compaction / waste filling plans	Active landfilling area	Waste	Every six (6) months
Landfill Remediation	Landfill cell final capping	Completed landfill cell	Earthworks	During construction of final capping
	Post closure monitoring	Closed landfill	Leachate, gas, groundwater	Ongoing after closure
Prevention of Unauthorised Entry	Site security	Perimeter security fencing	Condition of perimeter fencing / intruders	Weekly
Preventing Degradation of Local Amenity	Control of windblown litter	Erection of permanent and temporary litter fencing	Windblown litter	Daily
	Cleaning of vehicles	Vehicle wheel wash bay	Vehicles tracking mud / waste	Visual inspections of every load
	Covering of active landfill cell	Active landfilling area	Cover material (VENM or other approved alternative)	Daily
	Dust controls	Dust gauge	Generation of dust	Continuous monitoring
	Pest, vermin and noxious weed control	Whole site	Pest, vermin, noxious weeds	Regular inspections of bait stations
	Odour controls	Whole site	Odorous smells	Ongoing
Prevention of Noise Pollution	Noise controls	Noise monitoring	Noise generation	Number of complaints received

11. Performance Reporting Requirements

11.1 Introduction

Performance reporting is required to produce systematic, comprehensive and informative reports on the environmental monitoring, operational activities of the landfill and Regulatory reporting. Performance assessments are based on these reports and shall provide the basis of regulatory required information to the DECC for review of the LEMP. The necessary reports are described in the following sections.

11.2 Monthly Section 88 Returns

Within 60 days of the end of each month, Council shall submit a completed Section 88 Return, for the site, to the DECC on the types, sources, fate and total tonnages of waste received for that particular month. The Section 88 return must be submitted in the format requested by the DECC. At present, the Return is submitted electronically.

11.3 Environmental Monitoring and Reporting

Environmental monitoring and reporting shall be carried out as required under the site's EPL for the following:

- Groundwater.
- Surface water.
- Leachate.
- Gas.

The report shall contain raw environmental monitoring data, and analysis of this data for Council records which shall be used for preparation of the Annual Report. The analysis must include whether the site operations are having any off site environmental impacts.

11.4 Environmental Harm Reporting

The DECC shall be notified of any environmental harm, as soon as possible after becoming aware of the incident, that represents an environmental threat and which may lead to a breach of EPL conditions. Initial contact shall be made via the DECC's 24 hour Pollution Line on 131 555, and a written notice shall follow within seven (7) days after first being notified of the incident.

The environmental harm report shall include, but not be limited to, the following:

- Identifying incorrectly presented quantities of hazardous substances among the waste.
- Fires at the landfill, either surface or sub-surface.
- Mixing of leachate and stormwater, or waste and stormwater.
- Identification of any failure of an environmental protection system.
- Identification of significant difference in groundwater indicator parameters.
- Detection of landfill gas in surface or building monitoring at higher than recommended concentrations.
- Any other incident that could potentially pose an immediate environmental hazard outside normal operating conditions.
- Any proposed change in the landfill's ownership or occupier, (DECC approval required prior to transfer of EPL ownership or occupier).

11.5 Annual Report

The Annual report shall be submitted to the DECC each year in support of the Annual Licence Renewal application, within 60 days of the EPL Renewal date, and shall include the following:

- ***Summary Report –*** this shall include the total non-hazardous waste received during the previous 12 months (including cover material, its composition, and its eventual fate.
- ***Landfill Volume Report –*** this shall include the completion of a Landfill Volumetric Identification (LFIC) and Volumetric Survey Certificate (VSC) by a registered surveyor on the volume of landfill space used, and the volume of landfill space remaining (based on final landfill cell design).
- ***Hydrogeological Report*** – this shall assess the changes detected in the groundwater monitoring results over the period of operation. Changes in hydraulic gradient or statistically significant variations in contaminant concentrations shall be highlighted and explained.
- ***Leachate Collection Report*** – this shall identify the quantity and composition of leachate generated over the previous 12 months. Trends shall be highlighted and explained in terms of the biological activity within the landfill. The trends shall be related to monthly rainfall and quarterly sampling results.
- ***Surface Water Report*** – this shall summarise the surface water monitoring results over the period of operation for the previous 12 months. Changes in water levels and statistically significant variations in contaminants shall be highlighted and explained.
- ***Landfill Gas Emission Report*** – this shall demonstrate achievement of the appropriate environmental objectives in the previous 12 months for capped landfill surface and building accumulation gas monitoring.
- ***Dust Report*** – this shall summarise all dust monitoring results collected over the previous 12 months, with statistically significant variations explained.
- ***Environmental Harm Report*** – this shall summarise any incident report for the previous 12 months.
- ***Complaints Report*** – this report shall record, odour, litter, noise and other complaints received by the facility in the previous 12 months, icluding comments on their correlation with prevailing weather conditions or waste reception circumstances.
- ***Rehabilitation Report*** – describing rehabilitation works carried out over the previous 12 months, and proposed for the next 12 months.

11.6 Summary of Reporting Requirements

Table 11.1 summarises the reporting parameters, frequency of reporting, and items to be included in the reports which are required to be submitted to the DECC.

Table 11.1 – Summary of reporting requirements.

Type of Report	Frequency	What to Include in the Report
Incidents	As soon as possible after becoming aware of the incident	Incident that represents a threat to the environment and which may lead to a breach of the EPL
Monthly Section 88	Within 60 days of the end of reporting period	• Total tonnages of wastes received • Tonnages of specific

		source separated wastes • Fate of wastes
Annual and 6 monthly	6 monthly landfill volumetric survey and Annual report within 60 days of the reporting period	• Landfill volumetric survey • Tonnage summary • Hydrogeology • Leachate collection • Surface water • Landfill gas emissions • Dust • Incidents • Complaints • Construction • Rehabilitation

REFERENCES

1. **DECC NSW; Environmental Guidelines: 'Solid Waste Landfills', (1996)**

2. **Sinclair Knight Merz, (1990) "Proposed Extensions to West Nowra Waste Depot Statement of Environmental Effects – Shoalhaven City Council" Ref:nt125100.rp (unpub)**

3. **Maunsell Pty Ltd, (1991) "Shoalhaven City Council Landfills Leachate Study Fianl Report" Ref:97623127.E (unpub)**

4. **Forbes Rigby, (1996) "Report on Groundwater Hydrology and Water Quality West Nowra Waste Disposal Depot" Ref:91150=3 report 002 (unpub)**

5. **Bureau of Meteorology, (2007); www.bom.gov.au**

6. **Hyder Consulting, (July 2007) "Threatened Biodiversity Survey and Assessment – West Nowra", (unpub)**

7. **Protection of the Environment Operations Act (POEO), (1997)**
   - **Section 88**

8. **Australian and New Zealand Environment Conservation Council (ANZECC) Guidelines for Fresh and Marine Water, (2000) – National Water Quality Management Strategy**

9. **DECC NSW: Environment Protection Authority's (EPA) "Industrial Noise Policy, (2000)"**

10. **Shoalhaven City Council "Shoalhaven Local Environmental Plan (SLEP) (1985), with amendments (22 February 2008)**

APPENDICES

APPENDIX 1

Boreholes Location Plan

APPENDIX 2

Environment Protection Licence

APPENDIX 3

Landscape Management Plan

APPENDIX 4

Waste Factors By Vehicle and Waste Type

APPENDIX 4

WASTE FACTORS BY VEHICLE AND WASTE TYPE

Small Vehicle		All Mixed Waste
A	Car / station wagon	0.06 tonnes
B	Van / ute / trailer	0.30 tonnes

Heavy Open Vehicle		Municipal, C&I	C&D	VENM
C	Single rear axle with two rear wheels or four small rear wheels	0.62 tonnes	0.98 tonnes	2.47 tonnes
D	Single rear axle with four normal size wheels	1.16 tonnes	2.76 tonnes	5.58 tonnes
E	Tandem rear axle (bogie drive)	3.74 tonnes	7.14 tonnes	10.97 tonnes
F	Twin steer with twin rear axles	5.57 tonnes	7.61 tonnes	10.97 tonnes
G	Tipping semi trailer	5.79 tonnes	15.00 tonnes	15.00 tonnes

Enclosed Truck and Compactor		All Mixed Waste
H	Single steer with single rear axle	2.72 tonnes
I	Single steer with tandem rear axle	6.38 tonnes
J	Twin steer with tandem rear axle	7.96 tonnes
K	Waste transfer truck	19.89 tonnes