WQPN 111, January 2009

Landfills for disposal of putrescible materials

Purpose

Landfill sites remain vital for the disposal of putrescible waste material that cannot otherwise be recycled or reused. If not well sited, constructed and managed, they can contaminate water resources both during their operational life and long after the landfill has closed. Risks include contamination of groundwater aquifers via leachate seepage and surface water contamination from runoff and airborne emissions caused by dust during the operation process. The purpose of this note is to provide general guidance on statutory approvals from regulatory bodies and an overview of best management practice for the location, design, construction, operation and rehabilitation for putrescible landfill sites near sensitive water resources.

The Department of Water is responsible for managing and protecting the state's water resources. It is also a lead agency for water conservation and re-use. This note offers:

- our current views on the sustainable life cycle of putrescible landfills
- guidance on acceptable practices used to protect the quality of Western Australian water resources.
- a basis for the development of a multi-agency code or guideline designed to balance the views of industry, government and the community, while sustaining a healthy environment.

This note provides a general guide on issues of environmental concern, and offers potential solutions based on professional judgement and precedent. The recommendations made do not override any statutory obligation or government policy statement. Alternative practical environmental solutions to suit local conditions may be proposed.

Regulatory agencies should not use this note's recommendations without a site-specific assessment of any project's environmental risks. Any conditions set should consider the values of the surrounding environment, the safeguards in place, and take a precautionary approach. The note shall not be used as this department's policy position on a specific matter, unless confirmed in writing

Scope

This note applies to the siting, operation and rehabilitation of Class II or III landfill sites (Reference 2b - *Landfill waste classification and waste definitions*) existing or proposed near sensitive water resources.

This note does not apply to Class 1 (inert) landfills covered in our water quality protection note 24 *Landfilling with inert materials*, or secure (class IV) or intractable (class V) waste landfills, but may offer some useful guidance on potential risks to water resources and good practice.

Background

The primary State Government body for waste management in Western Australia is the *Waste Authority*, established under the *Waste Avoidance and Resource Recovery Act 2007*, which provides advice to the Minister for the Environment. The Authority provides advice on the strategic direction and the associated priorities for waste management, and is also the administrator of the *Waste Avoidance and Resource Recovery Account,* which receives moneys collected by the *Landfill Levy*.

In conjunction with the *Waste Authority*, the Department of Environment and Conservation is responsible for developing and implementing policy, regulatory processes and operational strategies for the management and disposal of waste in Western Australia. This process may include the need for *Environmental improvement plans* (EIP), financial assurance plans and an operational management framework developed by site operators which addresses potential and actual environmental risks inherent to class II and III landfills, contingency management and site closure plans.

For detailed advice on regulatory approvals and management of putrescible landfills contact the Department of Environment and Conservation.

Sensitive water resources

Where existing putrescible landfills are located within or near sensitive water resources (Appendix A), and have the ability to impact on those resources, proponents and or operators should undertake remediation of the landfill site by implementing best management practice during landfill operation and avoid further impacts.

Putrescible landfill sites that are located, operated and rehabilitated inadequately are considered a potentially contaminating activity. The risk of contamination is higher for those sites where leachate from landfills may enter surface water or groundwater resources. Where water resources are identified as being contaminated and as such present a risk to human health, the environment or any environmental value, the site may be registered as a contaminated site under the *Contaminated Sites Act 2003*.

In order to avoid a registered contaminated site occurring, proponents for new and established putrescible landfills, including those in remote areas, should consider if the landfill has been sited or currently exists near a sensitive water resource.

Clearing of native vegetation under the Environmental Protection Act 1986

Clearing permits for native vegetation are issued by the Department of Environment and Conservation under the provisions of the *Environmental protection (clearing of native vegetation) regulations 2004*.

These permits apply to private and public land throughout Western Australia, unless the clearing is for an exempt purpose. Application forms and guidelines for the lodgement of a permit and the EPA Position Statements 2 and 3 and Guidance Statements 51 and 56 are available online from < www.dec.wa.gov.au > select *Management and protection* > *plants* > *native vegetation*, phone the department's office on 6364 6500 or the national relay number for the hearing or speech impaired on 1800 555 660.

For *Bush Forever sites*, contact the Western Australian Planning Commission online at <www.wapc.wa.gov.au/publications> *bushforever* or phone 08 9264 7777.

Clearing of native vegetation under the Country Areas Water Supply Act 1947

Under Part 12c of the *Country Areas Water Supply Act* 1947 special clearing licences are required from this department within six gazetted public drinking water source areas (PDWSA) to protect the quality of the drinking water source, including salinity control. They are listed as follows:

- Warren River Water Reserve
- Kent River Water Reserve
- Mundaring Weir Catchment Area
- Wellington Dam Catchment Area
- Harris River Dam Catchment Area
- Denmark Catchment Area.

The proponent should complete and forward an application for a clearing permit (if required) to our local regional office for assessment and approval. The permit for clearing native vegetation must be received prior to commencing clearing.

Advice and recommendations

Location

1 Within designated areas described under part V, section 57 of the Environmental Protection Act 1986, comment may be referred to the Minister for Water regarding works approval and licence applications. Works approvals and licenses for prescribed premises may then be required to be submitted to the Department of Water for assessment and advice.

2 Within proclaimed public drinking water source areas, putrescible landfill sites (class II and III) are incompatible with this department's source protection policy. The establishment of putrescible landfills or expansion of existing landfills in these areas and zones will be opposed by this department.

3 Previously approved putrescible landfills in proclaimed public drinking water source areas should have a minimum 500 metre vegetated separation buffer to the full supply level of reservoirs, their primary feeder streams, and any water production bores or wells used as a source of drinking water.

4 A minimum vertical separation distance of two metres for loam soils and three metres for granular soils to the maximum (wet season) groundwater table is recommended. For soils information refer to the *Methods of testing soils for engineering purposes Soil classification tests* (Reference 12). In order to avoid leachate contamination, preference should be given to sites that reduce the risk of groundwater pollution by providing a natural attenuation layer beneath the liner (sub base) for contaminants that may leach through the liner.

5 Class II and III landfills should not be established on one-in-100 year average return interval flood plains, where they contact or require diversion of any natural watercourse or where filling seasonal swampy ground is necessary. They should also not be established on sites where they will occupy land which support damp-land vegetation. In addition class II and III landfills should not be located within 100 metres of any surface waters, ephemeral waterways and watercourses.

6 In remote areas such as mining camps and remote communities, landfill sites should be located with a buffer distance of at least 700 metres down gradient (down stream of groundwater flow) ((Draft Report 2007) Reference 8) and not be placed between production bores used for drinking water supply and the camp or community.

7 Summary information on statutory requirements and approvals for putrescible landfill sites is provided at Appendix B.

Landfill design

8 Landfills should be constructed and maintained to conform with works approval or licence conditions set by regulatory authorities. Typical characteristics of a cell designed to contain putrescible waste are provided at Appendix D.

9 Landfills should have the following design features:

- a The landfill should be constructed in a pit where the sides are graded at or less than the natural angle of repose for surrounding soils.
- b The base of the pit should not contain organic matter e.g. peat, root matter and similar waste material at a depth of at least two metres below the finished base.
- c The base of the pit should consist of either undisturbed soils or have soils compacted and conditioned where necessary to provide a base with a tested uniform bearing capacity.
- d The pit shall be fully contained with a low permeability liner (either engineered soil or synthetic). For guidance on suitable liners, see this department's water quality protection notes, (Reference 9b)
- e A leachate recovery system should be installed immediately above the base of the liner.

f Drainage diversion channels sufficient to prevent pit flooding during significant storm events.

g Security fencing to prevent unauthorised access when the facility is unattended.

Construction and operation of landfills

10 Waste minimisation is the preferred management option for landfill operation. The operator should ensure that recyclable materials entering the site are removed from the waste stream. For more information see *Guide to best practice at transfer stations* (Reference 3) and the Waste Authority (WA) website < www.zerowastewa.com.au >.

11 Where approved near sensitive water resources, all on-site above-ground fuelling facilities for vehicles and plant operations should be constructed and operated within low permeability (less than 10^{-9} metres/ second) bunded compounds designed to allow recovery of any spilt fuel. These compounds should be constructed to capture incident rainfall, jetting fuel, any over-fill of tanks, and resist misuse. Where mobile tanks are used, an impermeable underlay barrier such as a high density polythene liner at least 0.5 millimetres thick**,** with water tight joints may be suitable provided it is protected from operational damage. More detailed information is available in our water quality protection note 56 *Tanks for above ground chemical storage* and *58 Tanks for temporary above ground chemical storage* (Reference 9b) *.*

12 Where approved near sensitive water resources, mechanical servicing should comply with the recommendations given in our water quality protection note 28 *Mechanical servicing and workshops* (Reference 9b).

13 Waste from amenities such as toilets and “crib” rooms should be managed in accordance with the *Health Act 1911* and local government authority (council) requirements. For additional information, see our water quality protection note 70 *Wastewater treatment – onsite domestic systems* (Reference 9b).

14 Where natural surface or ground water is to be harvested for water supply or dust suppression, a water allocation licence may be required from this department in accordance with the *Rights in Water and Irrigation Act 1914*. Contact our nearest regional office for information on allocation licences to take water.

15 The installation and operation of monitoring facilities, such as groundwater monitoring bores, may be required by regulatory authorities where there is reason to suspect that hazardous, putrescible or contaminating materials may have entered the landfill, escaped from the site into local soils or a landfill is located near a sensitive water resource.

16 Groundwater monitoring objectives and bore operation should include the following:

a identification of the groundwater quality, water table (seasonal) levels, flow direction and rate

b indicate any change in water quality due to leachate contamination prior to migration offsite

c measure compliance with allocation conditions under the *Rights In Water and Irrigation Act 1914,* pertinent to the allocation licence holder. Groundwater quality both upstream and down gradient of the site should be monitored. For further information, see our water quality protection note 30; *Groundwater monitoring bores* (Reference 9b**)**..

Site rehabilitation

17 A rehabilitation plan should be developed during the planning and design stage and be refined during the construction and operation of the landfill site. Considerations within the plan should include the needs of the community, surrounding land use (including the degree of sensitivity) and the type of restoration required to meet these objectives.

18 In conjunction with the rehabilitation plan, an after-care management plan should be developed to incorporate the following:

a maintenance of the landfill cap to prevent and control erosion, including monitoring protocols for depressions and cracks caused by settlement and rehabilitation of vegetation

b efficient operation of the leachate collection and treatment system during the after care period

c efficient operation of the landfill gas-extraction system during the after care period

d efficient operation of environmental monitoring systems that include surface and groundwater resources, landfill gas, leachate, vegetation regrowth monitoring and settlement during the after care period.

The typical period of after-care for class II and III landfills is approximately 30 years from the operation end date.

More information

We welcome your views on this note. All feedback is retained on our file **WT 3639**.

To comment on this note or for more information, please contact our water source protection branch as shown below, citing the note topic and version.

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This note will be updated periodically as new information is received or industry/activity standards change. Updated versions are placed online at < www.water.wa.gov.au > select *water quality > publications > water quality protection notes.*

References and further reading

1 Australian government - Department of Environment, Water, Heritage and the Arts

National water quality management strategy papers available online at < www.environment.gov.au > select *water* > *water quality*

a *Australian and New Zealand guidelines for fresh and marine water quality 4,* 2000

b *Australian drinking water guidelines 6,* 2004

c *Australian guidelines for water quality monitoring and reporting 7,* 2000

d *Policies and principles 2,*1994

e *Implementation guidelines 3,* 1998

f *Rural land uses and water quality - a community resource 9,* 2000

To obtain copies of paper 9, see internet site < www.awa.asn.au >, request by email at < bookshop@awa.asn.au > or from a library service.

2 Department of Environment and Conservation (WA)

a Wetlands policy and guidelines available at < www.dec.wa.gov.au > select *Management and protection* > *wetlands* > *publications* > *wetlands position statement*

Position statement - wetlands, WRC 2001.

b Waste management papers available online at < www.dec.wa.gov.au > select *pollution prevention* > *waste management* > *publications* > *guidelines*

- *Guidelines for acceptance of solid waste to landfill* 2001
- *Landfill waste classification and waste definitions* as amended
- *Western Australian waste reduction and recycling policy* 1997.

c Contaminated sites - guidance series available online at < www.dec.wa.gov.au > select *Pollution prevention* > *contaminated sites*.

3 EcoRecycle Victoria (2004) publications available online at < www.sustainability.vic.gov.au >, select *get informed* > *publications G-H*
Guide to best practice at resource recovery and waste transfer station facilities.

4 Engineers Australia publication for purchase at < www.engineersmedia.com.au > search > *EA books Australian rainfall and runoff* (current edition)

5 Environmental Protection Authority (WA) publications available online at < www.epa.wa.gov.au > select *guidance statements*

- Guidance statement 3 *Industrial-residential buffer guidelines*
- Guidance statement 33 *Environmental guidance for planning and development.*

6 Department of Health (WA) publication available online at < www.health.wa.gov.au > select *public health* >*water,* then search *household chemicals*

Safe use of household chemicals

7 Department of Mines and Petroleum - dangerous goods codes, guidelines and licenses. For online publications see < www.dmp.wa.gov.au > select *resources safety* > *dangerous goods* > *storage and handling*

8 Department of Planning and Infrastructure – *Land Use Buffers for Aboriginal Communities* , Draft Report 2007.

9 Department of Water (WA)

a Water resource management policies, available online at < www.water.wa.gov.au > select *policies*

- Foreshore policy 1 – *Identifying the foreshore area, WRC* 2002
- State-wide policy 2 – *Pesticide use in public drinking water source areas,* WRC 2000

b Water quality protection notes available online at < www.water.wa.gov.au > select *water quality* > *publications* > *water quality protection notes*

- WQPN 06 *Vegetation buffers to sensitive waters*
- WQPN 24 *Landfilling with inert material*
- WQPN 25 *Land use compatibility in Public drinking water source areas*
- WQPN 26 *Liners for containing pollutants, using synthetic membranes*
- WQPN 27 *Liners for containing pollutants, using engineered soils*
- WQPN 28 *Mechanical servicing and workshops*
- WQPN 30 *Groundwater monitoring bores*
- WQPN 33 *Nutrient and irrigation management plans*
- WQPN 56 *Tanks for elevated chemical storage*
- WQPN 58 *Tanks for temporary elevated chemical storage*
- WQPN 65 *Toxic and hazardous substances - storage and use*
- WQPN 70 *Wastewater treatment - onsite domestic systems*

c Waterways water notes available online at < www.water.wa.gov.au > select *water quality* > *publications* > *water notes*

- WN 10 *Protecting riparian vegetation*
- WN 11 *Identifying the riparian zone*
- WN 23 *Determining foreshore reserves.*

d Stormwater publication available online at < www.water.wa.gov.au > select *water management* > *publications* > *stormwater management* > *stormwater management manual.*

Stormwater management manual for Western Australia.

10 Institution of Engineers Australia publication available for purchase at < www.engaust.com.au/bookshop/eabookspub.html >

Australian rainfall and runoff

11 Natural Resource Management Ministerial Council (Australia) publication available online at < www.iah.org.au > search *publications*

Minimum construction requirements for water bores in Australia, September 2003

12 Standards Australia publications available for purchase at < www.saiglobal.com > select *publications*

a AS 5667 *Water quality – sampling*

b AS 1289.3.1.1-1995/Amdt 1-1998 *Methods of testing soils for engineering purposes Soil classification tests - Determination of the liquid limit of a soil - Four point Casagrande method*

13 Western Australian Planning Commission policy available online at < www.wapc.wa.gov.au > select *publications*

State industrial buffer policy, draft 2004

Appendices

Appendix A - Sensitive water resources

Clean water resources used for drinking, sustaining aquatic and terrestrial ecology, industry, and aesthetic values, along with breathable air, rank as the most fundamental and important needs for viable communities. Water resources should remain within specific quality limits to retain their values, and therefore require stringent and conservative protection measures. Guidance on water quality parameters necessary to maintain water values are published in the Australian government's *national water quality management strategy* document set. For online information see < www.environment.gov.au > search *water > water quality > national water quality management strategy*.

This department strives to improve community awareness of catchment protection measures for both surface water and groundwater as part of a multi-barrier protection approach to water resource quality. Human activity and land uses pose a risk to water quality if contaminants can be washed or leached into sensitive water resources in discernible quantities. These waters include shallow groundwater accessed by supply wells, waterways, wetlands and estuaries. To be considered 'sensitive', water resources must support one or more of the environmental values described below. Community support for these values, setting of practical management objectives, sustainable protection strategies and effective implementation are key elements in protecting or restoring water values.

Sensitive water resource values include:

1 Public drinking water sources (i.e. *water reserves, catchment areas* or *underground water pollution control areas*) proclaimed or assigned under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909*, the *Country Areas Water Supply Act 1947* or the *Health Act 1911.*

2 Private sources, used for the following water supplies:
   a human or stock drinking water
   b commercial or industrial water supplies (with specific qualities that support the activities e.g. aquaculture, cooling, food or mineral processing or crop irrigation)
   c urban irrigation (that can affect people's health or wellbeing).

3 Recognised ecological functions in groundwater aquifers e.g. cave ecology.

4 Ecological functions and social values in natural waterways e.g. aesthetic appeal, boating, fishing, tourism and swimming, including:
   a high conservation significance waterways described in the Environmental Protection Authority's guidance statement 33 *Environmental guidance for planning and development* (section B5.2.2), available online at < www.epa.wa.gov.au > select *EIA > guidance statements.*
   b waterways management areas declared via the *Waterways Conservation Act 1976*, i.e. Avon, Peel-Harvey, Leschenault, Wilson Inlet and Albany waterways.
   c waterways managed via the *Swan and Canning Rivers Management Act 2006*.

Engineered drains or constructed water features are excluded as functional and operational factors may outweigh their water quality values.

5 Conservation values in wetlands (recognised or probable, generally excluding those highly disturbed unless actively managed to restore specified environmental values), including:

   a Ramsar wetlands, advice available online at < www.ramsar.org >.

   b High conservation significance wetlands as described in the Environmental Protection Authority's guidance statement 33 *Environmental Guidance for Planning and Development* (section B4.2.2), available online at < www.epa.wa.gov.au > select *Environmental impact assessment > guidance statements.*

   c Wetlands described by the Australian Department of the Environment, Water, Heritage and the Arts in *A directory of important wetlands in Australia,* available online at < www.environment.gov.au > select *water > water for the environment > wetlands > books, reports directories*. Alternately view the Department of Environment and Conservation site < www.dec.wa.gov.au > select *Management and protection > wetlands > publications.*

   d Conservation valued and resource enhancement category wetlands identified in the *Geomorphic wetlands of the Swan coastal plain* dataset, all wetlands identified in the *South coast significant wetlands* dataset and high value wetlands identified in the *Geomorphic wetlands Augusta to Walpole* dataset. The Augusta to Walpole wetland dataset awaits a detailed evaluation process.

Many waterways and wetlands in the state still need a detailed scientific evaluation and their value classified. Any natural waters that are largely undisturbed by human activity, should be assigned a high conservation value, unless proven otherwise.

The Department of Environment and Conservation is the custodian of the state wetland datasets and is responsible for maintaining and updating the information. The datasets are available online at < www.dec.wa.gov.au > search *wetland maps* or select *management and protection > wetlands > wetlands data.* Guidance on viewing the wetlands is provided on the same website at *water > wetlands > data* or by phoning the *nature conservation division* for assistance on 08 9334 0333.

Appendix B - Statutory requirements and approvals relevant to this note include

What's regulated	Statute	Regulatory office
Land zoning and development approval	*Planning and Development Act 2005*	Western Australian Planning Commission
		Department for Planning and Infrastructure
		Local Government (Council)
Impact of significant development proposals on the values and ecology of land or natural waters	*Environmental Protection Act 1986,* Part IV: Environmental Impact Assessment	Minister for the Environment advised by the Environmental Protection Authority
Regulation of prescribed premises that could pollute; Works approval and licence of landfills Licensed transport and disposal of controlled waste Prohibited discharge of specified contaminants	Part V of the *Environmental Protection Act 1986*- Environmental Regulation Environmental Protection Regulations 1987, Schedule 1 Category No 65, 66 & 89 Environmental Protection (Controlled Waste) Regulations 2004; Environmental Protection (Rural landfill) Regulations 2002 Environmental Protection (Unauthorised Discharges) Regulations 2004	Department of Environment and Conservation – regional office
Landfill Levy	*Waste Avoidance and Resource Recovery Act 2007* and Regulations 2008	
Licence to take surface water and groundwater	*Rights in Water and Irrigation Act 1914*	Department of Water – regional office
Landfill sites in proclaimed public drinking water source areas	*Metropolitan Water Supply, Sewerage and Drainage Act 1909* *Country Areas Water Supply Act 1947*	
Landfill sites near or within a waterways management area.	*Waterways Conservation Act 1976*	
Storage of fuels, solvent, explosive and dangerous goods	*Dangerous Goods Safety Act 2004 and* Regulations 2007	Department of Commerce

What's regulated	Statute	Regulatory office
Management of human wastes, Community health issues	*Health Act 1911* *Health (Treatment of sewage and disposal of effluent and liquid waste) Regulations 1974*	Local Government
		Department of Health
Emergency response planning	*Fire and Emergency Services Authority of WA Act 1998*	Fire and Emergency Services Authority

Relevant statutes are available from the *state law publisher* at < www.slp.wa.gov.au >.

Appendix C - Key information needed to assess development proposals

Where facilities are to be constructed or upgraded near sensitive waters, proponents should supply a notice of intent to this department, including the following details:

1 Site owner or operating tenant's contact name and address details.

2 A site plan showing the location of the project relative to surrounding lots, roads and water features.

3 Description of the activities that will be carried out on the project site.

4 Description of all materials/ chemicals stored or handled in commercial quantities on site.

5 Description of the types and quantities of waste that will be generated at the facility.

6 Proposals for chemical containment, waste management and disposal (with design sketches).

7 Details of any contingency measures to minimise the impacts of chemical spills, and disposal of contaminated waters from fire, flood or other emergency.

Appendix D -Typical cell design for putrescibles waste containment