Government of Western Australia
Department of Water

Water quality protection note 33
June 2010

Looking after all our water needs

Nutrient and irrigation management plans

Purpose

Nutrient and irrigation management plans (NIMPs) provide detailed guidelines for minimising water wastage and fertiliser losses when establishing or growing crops, gardens, trees or turf. NIMPs demonstrate that inputs such as water and fertiliser are well-matched to the plant growth cycle resulting in healthy plants and minimal contaminant leaching into the surrounding environment. Good planning and operational practice is vital for irrigated and fertilised plants so that water is used effectively and plants flourish with a maximum uptake of essential nutrients (principally nitrogen and phosphorus).

Well-prepared NIMPs offer potential economic benefits as they promote cost savings through the efficient use of water and agricultural chemicals, while offering protection to the quality of local water resources. Social benefits also arise if the community perceives that farmers and landscape managers operate with minimal environmental impact. For our water resources to retain their value (that is, quality suited to sustaining aquatic ecosystems, people and animals) they need protection so that negligible amounts of contaminants from chemicals applied to land leach through or across the soil into water resources.

Problems linked to historic irrigation and fertiliser application practices include:

- poor performance of crops, trees or turf
- soil erosion with resultant turbidity and excessive sediment in waterways and wetlands
- elevated concentration of leached salts (chlorides, sulphates and nitrates) entering the watertable (potentially harming the amenity and health of people and stock animals dependant on local groundwater supplies) and degrading the ecology of waterways
- eutrophication (excessive aquatic plant growth) in waterways and wetlands which impedes navigation and recreational use of waters, can displace or kill plants or animals due to toxicity, shading or oxygen starvation, and can generate foul odours when algae blooms decay.
- excessive concentrations of dissolved ammonia that is toxic to fish
- more competition (and cost) for access to limited fresh 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 reuse.

This note offers:

- our current views on managing water and nutrient application to vegetated land, while sustaining downstream water resource values
- guidance on acceptable practices used to protect the quality of the state's 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.

Scope

This note focuses on rural, commercial or recreational land exceeding 5000 square metres in area where:

- vegetation is irrigated and fertiliser/pesticides are applied; and/ or
- animals are held intensively in paddocks and their wastes containing nutrients are deposited onto the land.

NIMPs may be required for lesser areas where local water resources values are sensitive to nutrient contamination (see Appendix A). NIMPs are also suited to sites where industrial or municipal wastewater rich in the nutrients, nitrogen (N) and phosphorus (P), is applied to foster the growth and maintenance of healthy vegetation.

Activities likely to need a NIMP include:

a land irrigated with animal industry wastewater, such as from farm dairies, feedlots, piggeries and stables

b land receiving treated effluent from municipal wastewater treatment works

c intensive animal holding in paddocks (where feed is brought onto the site)

d fertiliser or stabilised animal manure application (including chicken litter) to irrigated land such as golf courses, pasture, recreation areas, sports grounds, turf farms and wood-lots

e food product processors disposing of treated wastewater onto the land such as - abattoirs, commercial dairies, canneries, rendering works, vegetable processors and wineries

f intensive agricultural or horticultural industries such as exotic flower growing, orchards, vineyards or market gardens.

The scale and intensity of a development where government agencies may request a NIMP will depend on the probability of discernible environmental impact, after consideration of relevant factors including:

a watering schedules and nutrient application rate and frequency

b site environmental factors such as soil types, climate and land slope

c proximity of the intensive land use area to surface or ground water

d potential travel pathways for any leached contaminants or eroded soils

e site history (animal usage, fertiliser applications and waste disposal to land)

f contaminant contributions from surrounding land areas

g value and importance of local water resources to the community

h present quality of local waters and their sensitivity to harm

i protection measures employed onsite such as contaminant barriers, buffers and drainage controls.

Advice and recommendations

The following information should assist in development of comprehensive and effective NIMPs, and assist regulatory agencies to assess their adequacy in meeting environmental objectives.

Summary of the land use proposal

1 For any project involving vegetation irrigation and application of nutrient rich matter (including manure), containing plant-available nitrogen (N), phosphorus (P) and/or other essential minerals, an overview of the project nature and the planned development time-line should be provided, including:

   a Proponent's name and contact details

   b Site location (lot number, street and locality name)

   c A brief description of nature and scale of the project

   d Anticipated start date and duration of the intensive land use.

Project setting

2 The following data should be collated and presented in the NIMP:

   a A site layout map showing the area irrigated/ fertilised relative to key local features such as adjoining properties, cropland, drains, remnant vegetation, residences, other structures, roads, and services.

   b Existing and historic site use description, including the location and extent, dominant vegetation species, extent of cleared land and current land condition (with supporting maps or sketches).

   c Compatibility with local planning scheme land zoning, local government development approval and State planning policy 2.7 *Public drinking water source policy* (where applicable).

Land use and nutrient application details

3 Describe the planned land use, including details of the fertiliser use regime. Provide details and areas of proposed crops, gardens, plantations and turf where fertilizer or nutrient-rich material is or will be applied.

4 Animal species and numbers contributing waste onto the site (such as cattle, horses, pigs, sheep and other domesticated animals).

5 Numbers of people expected to be resident or employed on-site and how domestic wastewater will be managed.

Local rainfall and evaporation

6 Local rainfall and evaporation data (average monthly rates) should be determined and used to define the site water balance. Meteorological information is available online from the Bureau of Meteorology at < www.bom.gov.au/weather/wa/ >.

7 Rainfall runoff and infiltration factors anticipated should be presented guided by the Engineers Australia publication *Australian rainfall and runoff* (reference 7).

Soils and landform description

8 The following data should be determined and provided in the NIMP:

a Contour map showing landforms present on the site

b Map depicting surface soil types. Information on soils may be available from the Department of Agriculture and Food (WA)

c The soil strata defined to two metres (minimum) below the finished surface, including any drilling or excavated pit location details

d The *phosphorus retention index* (PRI) or *phosphorus buffer index* (PBI) for project soils should be determined with assistance from a soil testing laboratory. Multiple tests should be carried out covering the vegetation root zone (typically the top 30 centimetre section of the irrigated soil). Tests should be conducted for each soil type in the project area or, if soil types are variable, using a sampling grid

e An evaluation of any acid sulphate soil risk resulting from any change to the watertable in soils rich in organic matter such as swamps and peat beds

f Any proposed earthworks details, including map of the land profile affected

g Details of any imported soil amendment, either existing or planned for the site.

Water resources description and use

9 The following water resources data should be determined and provided in the NIMP:

a Natural sensitive water resources (waterways, wetlands or groundwater) on or near the site potentially affected by the intensive land use, including the location of water bodies valued for their recreational or environmental features by the community and any water supply bores or ponds (with dimensions). Sensitive water resources are described in Appendix A.

b Map and description of any land subject to seasonal or occasional flooding

c Groundwater description and depth (where a water table is present beneath the site). Information is also needed on any aquifer confining layers. If practical, describe the direction and rate of groundwater flow, and any seasonal variability

d Is the site located in a proclaimed public drinking water source area (PDWSA)? Land use constraints apply in PDWSA. For more information, see Appendix A

e Representative data on the quality of local water resources such as pH, salinity (measured as electrical conductivity), turbidity, concentrations of nutrients (N, P, K) and relevant dissolved trace contaminants such as metals and pesticides

f Usage presently made of local water resources onsite and on nearby land.

Site management

Irrigation

Efficient methods of irrigation should not only reduce water, energy and maintenance costs, but can also minimise fertiliser leaching. The use of modern well-maintained technology, with the practices recommended, can assist effective irrigation practice.

10 Taking of surface and ground water (excluding domestic consumption) is regulated over most of Western Australia. Water resource abstraction is managed under the *Rights in Water and Irrigation Act 1914*. Water availability and licensing information is available from any of this department's regional offices. Details of any present licensed use of water resources or proposals for the use of natural waters should be provided.

11 A description of any irrigation scheme in the NIMP should include:

- a Source of irrigated water (e.g. waterway, spring, runoff storage, wetland or groundwater). Information on any recycled water use should be included.
- b Details of any water storage tanks or ponds on site and their capacity.
- c Zones to be irrigated. The design of the irrigation system should suit the expected seasonal climatic, vegetation and soil-wetting needs when matched to the soil type, root depth and seasonal readily available water (RAW) uptake rate for both existing and intended plantings.
- d Sprinkler type, operating pressure and layout should be chosen to efficiently water the crop, achieve a high coefficient of uniformity in application and limit wind drift.
- e The water application rates (millimetres per hour), watering duration (minutes/ cycle) and watering frequency (applications per week for each growing season) should be matched to seasonal evapo-transpiration rates, soil moisture reserves and plant health needs. Watering cycles should be varied based on both weather conditions and the extent of the plant's feeder root growth.
- f Details on any seasonal variation or any planned expansion of irrigated vegetation.
- g How irrigation will be managed to avoid runoff, excessive watertable mounding and nutrient leaching. Seasonal watering schedules should incorporate regular monitoring of crop water usage and soil moisture status to match irrigation with crop requirements. Irrigation water runoff or passage below the plant root zone should be minimised. Lysimeters (accessible below ground water collectors used to determine soluble contaminant concentrations) should be used to assess leachate presence and quality. Soil moisture probes (such as soil pressure tensiometers, capacitance, gypsum block, TDR or neutron probes) should be used to initiate irrigation cycles.
- h Describe measures to turn off the irrigation system during and following wet weather.
- i Outline of how the soil structure will be maintained. Intensive cultivation or use of salty water may harm vegetation or soda-rich irrigation can lead to dispersive or poorly drained loam soils, increasing the risk of runoff, soil erosion and crop failure.
- j For fine textured soils (clays, loams and silts), the potential to recapture any runoff from rainfall and irrigated areas and recycle the water should be assessed.

The design and operation of any runoff collection basins to hold waters for later use should be described. Details of leakage, odour and algae controls for these basins should be included.

k In hot, low rainfall conditions salts and toxins concentrated by solar evaporation may place operating constraints on water recycling and a portion of stored water may need seasonal disposal to waste.

l Any pre-treatment of irrigated water, such as chemical conditioning or filtration. Describe the management and disposal method for the separated solids.

Nutrient application

12 The total amount of nutrients applied from all sources should be matched to the seasonal vegetation growth needs, with allowance for excess nutrient retention in the topsoil. Nutrients should also be applied in a timely manner that minimises wash-off or leaching losses. Planning considerations should include:

a Fertiliser needs differ during the establishment, growth and maintenance phases of crops. The site manager should obtain technical advice on nutrient availability and crop needs. Any data on soil and plant tissue testing should be included. Data on nutrient needs for growing commercial crops is available from the Department of Agriculture and Food (reference 4). For soil testing, see *Analysts* in the yellow pages phone directory.

b Nutrient needs should be defined for:

- planned short-term crops at various points in their growth cycle such as at germination, during growth, crop setting and at plant maturity
- maintenance of long-term vegetation, such as trees or turf, based on seasonal uptake.

c The types and constituents of any fertiliser proposed for application should be described. Information on typical constituents of animal waste are provided at Appendix C. Consider the use of slow-release fertilisers or fertigation (i.e. measured quantities of soluble nutrients added to irrigated water) matched to vegetation growth needs. The background nutrient concentration in irrigation water sources should also copnsidered in the fertiliser management component of the NIMP.

d Identify and record which areas of the site will be fertilised, including data on the quantity, duration, frequency and method of fertiliser application.

Drainage and contaminant leaching controls

13 Drainage system design should be included in the NIMP, especially for high water consumption activities such as recreational turf, playing fields and golf courses.

a Outline the design and function of any artificial water controls that are proposed for construction or use such as purpose-built lakes, wastewater stabilisation ponds, wetland filters, drainage balance basins or soakage/evaporation sumps.

b Describe the planned management and monitoring of water bodies likely to be affected by irrigation seepage or runoff (including water balance and water quality assessment).

c Incorporate earth water diversion banks, land contouring and/ or vegetation filter systems into earthworks design where there is risk of runoff into sensitive waters.

d Describe existing surface or underground drainage systems including those managed by government agencies, paddock drains, and natural waterways both on and near the site. Include details of any proposed stormwater diversion pipe-work or channels.

e Describe surface water runoff rate design for both for frequent (annual wet season) rainfall events and extreme events (ten or more year's average return interval), including the volume and destination of calculated surface run-off.

f Describe how site drainage may be affected by the development proposal. Will any storm water runoff be diverted to storage? How will extreme storm events be managed? Use *Australian rainfall and runoff* (reference 7) to assist in calculating runoff rates. Land development should not generate runoff volumes and velocities that may cause erosion, sedimentation and flooding affecting downstream wetlands or waterways.

g Describe the planned management of potential problems such as sodicity (as excess sodium damages fine textured soil structure), soil compaction and salinity.

h Drainage design should incorporate the principles and objectives described in the *Stormwater management manual for Western Australia* (reference 6e).

Protection of natural water resources

14 Intensive irrigation and nutrient application to land should not occur without effective safeguards where:

a Soils have poor nutrient retention such as Bassendean sands near Perth.

b Water tables rise seasonally to within two metres of the irrigated site surface.

c Fertiliser could wash into drainage pathways or soaks as it both wastes resources and may lead to eutrophication in surface water bodies.

d Sites are upstream of *sensitive water resources* (Appendix A), as discernible water contamination may affect water resource values or foster algal blooms.

15 For irrigated sites of ten hectares or more, a science-based *contaminant fate and transport model* such as the Department of Primary Industries and Resources (South Australia) *WASTLOAD* for any nutrient losses should be used to predict the impact of applied agricultural chemical residues on downstream water resources. Such models assess the expected change in concentration of pollutants such as nutrients and metals as they move through soils from the application point to where they may affect water resource values. For more information, see our draft water quality protection note 107 *Nutrient fate and transport models* (reference 6d).

16 The model predictions should be compared against both data on local water resource quality (where available) and the *national water quality management strategy* guideline recommendations for water quality (reference 1a &1b) to determine whether the irrigated land may harm downstream water resource values.

17 Where harmful effects are predicted, the crop management system should be altered to provide an acceptable outcome, measures put into place to correct the contaminant loss to an acceptable level, or the site used for another purpose.

Surface water protection

18 Native vegetation buffers between irrigated or nutrient-enriched land and watercourse banks or wetland vegetation margins, should be developed and maintained as described in this department's water quality protection note 06 *Vegetated buffers to sensitive water resources.* For information on establishing protective buffers, see references 5, 6a, 6c and 6d.

19 Damage to native vegetation buffers should be prevented by use of stock-proof fencing or similar control barriers (reference 6c).

20 Intensive crop-growing or grazing of land subject to seasonal flooding should not occur without an effective management system to control erosion and contaminant leaching.

21 Steep land slopes (more than one in ten) and rocky terrain should not be cultivated, due to the risk of excessive runoff or erosion.

Groundwater protection

22 Trace contaminants and nutrients leached below the root zone may harm groundwater quality. To limit harmful levels of pollutants harming groundwater, options include:

- a Amending sandy soils with organic carbon rich matter (humus including plant compost) and iron-rich material (loam) to increase the moisture holding capacity and minimise loss of nutrients, metals and pesticides. Any soil amendment program should be evaluated including the type of amendment (e.g. compost, loam, or bauxite residue), application rate, incorporation method and depth. Design details of the amendment program, expected performance and effective life should be defined.
- b Avoiding waterlogged areas, where the water table depth is less than two metres deep.
- c Placing irrigation water supply bores down gradient of the intensive land use to intercept any leached contaminants and recycle them.

Vegetation management

23 Appropriate vegetation management can help minimise nutrient losses. The NIMP should describe:

- a How the crops, pasture, trees or turf will be monitored and maintained.
- b Erosion protection measures for soils and water resources, especially when any ground cover is removed during harvest.
- c How water and nutrients are applied to match to the growth cycle plant's needs, targeting the feeder root zone.
- d Protection of any remnant or other vegetation buffers along waterways, property boundaries and on unused land.

e Vegetation species (if practical) selected that have a low water and nutrient-demand near sensitive water resources.

f Vegetation species are well matched to the seasonal nutrient and trace element loads from any fertigation, applied industrial, agricultural products or wastewater.

g Perennial native vegetation shelter-belts should be used to reduce the amount of irrigation water needed and to stabilize soils, particularly for horticultural activities.

Pesticide storage and use

Pesticides are frequently used in conjunction with irrigated land to control weeds, fungi and insects. Some pesticides and their carrier solvents do not easily degrade, and may be leached into water resources in the same way as nutrients.

24 Where practical, physical barriers and biological controls should be used instead of chemical pesticides. Where unavoidable, pesticide application near rivers and wetlands should be carried out in accordance with the supplier's instructions, relevant guidelines from the departments of Agriculture and Food, Environment and Conservation, Health and/or Water and be target-specific. Details of broad-scale pesticides use and management should be included in the NIMP as follows:

a Description of type and constituents of pesticides, including their frequency and rates of application.

b Method of application and safeguards proposed against spray drift, runoff or leaching.

c Potential for residue leaching and impact on non-target species should be investigated and reported. The CSIRO's *Pesticide impact rating index* (PIRI) model, detailed online at < www.csiro.au/resources/pf6c.html > is recommended.

d Secure weather-proof chemical storage and mixing facilities provided.

e Information on the qualifications, training and experience of those applying pesticides.

25 Pesticide use in any proclaimed drinking water source catchments should follow the recommendations in this department's state-wide policy 2 *Pesticide use in public drinking water source areas* (reference 6a).and our water quality protection note *37 Pesticides - storage and use* (reference 6d).

26 For additional information on the safe handling, transport and storage of agricultural chemicals and pesticides, see the *Code of practice for the use of agricultural and veterinary chemicals* 2002 (reference 2).

Site monitoring and reporting

27 A site environmental monitoring program should be incorporated in the NIMP, including:

a *Pre-development nutrient and irrigation management program*

- Description of the program of soil, plant tissue, groundwater and irrigation water testing.
- Soil phosphorus retention index (PRI) or buffer index (PBI) and for water and soils, pH, salinity, phosphorus and nitrogen concentrations over the site.

- Definition of the methods used to analyse and report on the above parameters.
- Where groundwater resources are present, establish monitoring facilities such as monitoring bores, piesometers or lysimeters (instrument that captures water soluble matter in soil), for water quality assessment across the site.
- Determine the site water balance, including what water enters and leaves the site seasonally (including allowance for seepage and evaporation losses).

b *Post-development nutrient and irrigation management program*

- Description of the environmental monitoring system to be implemented, including metering and recording of site data.
- The residual PRI/ PBI of any amended soils at five year intervals.
- Specific tests used to demonstrate the effectiveness of any storage or nutrient stripping ponds.
- Vegetation tissue analysis conducted to determine any nutrient or trace element deficiencies
- Details of any consultants and analytical laboratories used in implementing the monitoring program.
- Procedures for recording the use and rates of application of various fertilisers.
- Fertiliser rates requiring periodic alteration on the basis of results from soils monitoring.

28 Environmental monitoring reports should be supplied as required under the conditions of any development approval, licence or permit.

29 Where there is no requirement for reporting, records of data acquired in managing a NIMP area should be maintained for up to five years, to permit audits as necessary.

Contingency plans

30 The NIMP should indicate what will be done to minimise loss of chemicals to water resources via:

a Runoff after wildfire or major storm events.

b Accidental spillage and leakage of chemicals.

c Overflow or seepage from ponds used to store or treat contaminated water.

Submission and assessment of development proposals

31 Proposals should initially be submitted to the local government authority (council) responsible for land use planning and development approval of the project.

32 The council should forward all significant proposals to relevant state government departments for comment. If inadequate data is provided for an effective assessment, more information may be sought before approvals are considered. Regulatory authorities likely to assess NIMPs include local government and the Environmental Protection Authority, and departments of Agriculture and Food, Environment and Conservation and Water (Appendix B).

33 This department will assess the NIMP (using the advice in this note) and determine whether it provides for an acceptable level of risk management for water resources.

Appendix A - Key supporting information

Sensitive water resources

Water resources are used for drinking and sustaining ecological systems, industry and aesthetic values. Along with breathable air, uncontaminated water is essential for viable communities. Natural water resources must remain within specific quality limits to retain their ecological, social and economic values. Therefore they require stringent and conservative protection measures to minimise contamination.

Information on water quality parameters and processes to maintain water values are published in the Australian Government's National water quality management strategy papers. These papers are available online at < www.environment.gov.au > select *water* > *water policy and programs* > *water quality*.

The Department of Water strives to improve community awareness of catchment protection measures (for both surface water and groundwater), as part of a multi-barrier protection approach to sustain acceptable water resource quality. Human activity and many land uses pose a risk to water quality if contaminants are washed or leached into sensitive water resources in significant quantities. Sensitive waters include estuaries, natural waterways, wetlands and unconfined groundwater. Sensitive waters support one or more of the environmental values described below.

1 Public drinking water sources

Public drinking water source area (PDWSA) is the collective name given to any area proclaimed to manage and protect a water source used for community drinking water supplies. PDWSA include *underground water pollution control areas, water reserves* and *catchment areas* administered under the provisions of the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* (WA) or the *Country Areas Water Supply Act 1947* (WA). For online information on the location of PDWSA, see < www.water.wa.gov.au > select *tools and data* > *maps and atlases* > *geographic data atlas,* then open *environment* > *public drinking water source areas*.

For land planning, rezoning and development purposes, three priority areas (P1, P2 and P3) have been defined for use within PDWSA. Priority areas are assigned based on the current land planning scheme zoning, land tenure and the water resource's strategic value and vulnerability to harm. Each priority area is managed using a specific risk–based strategy to provide for effective water resource protection. P1, P2 and P3 areas are assigned in *drinking water source protection plans* or *land use and water management strategies.* These documents are prepared by this department in consultation with other government agencies, landowners, industry and the community.

P1 areas are defined to ensure that there is *no degradation* of the water source. These areas are declared over land where the provision of the high quality drinking water for public use is the prime beneficial land value. P1 areas typically cover land under state

agency control. P1 areas are managed in accordance with the principle of *risk avoidance* and so most land development and activity is normally opposed.

P2 areas are defined to ensure that there is *no increased risk of pollution* to the water source once a source protection plan has been published. These areas are declared over land where low intensity development (such as rural use) already exists. Protection of public water supply sources is a high priority in these areas. P2 areas are managed in accordance with the principle of *risk minimisation***,** and so restricted intensity development (with management conditions) and activities with a low contamination risk are accepted.

P3 areas are defined to *manage the risk of pollution* to the water source. These areas are declared over land where public water supply sources must coexist with other land uses such as residential, commercial and light industrial development. Protection of P3 areas is achieved through management measures defined via environmental guidelines (such as these notes) or via site-specific conditions that limit the contamination risk to water resources from the land use or activity. If, however, the water source becomes significantly contaminated, then water supplied from P3 sources may need to be treated or an alternative water source found.

Protection zones are also defined close to the point where drinking water is harvested or stored. These zones are known as *wellhead protection zones* (WHPZ) and *reservoir protection zones (RPZ)*. Additional constraints apply to activities in these zones to safeguard the area immediately surrounding these vulnerable water sources.

WHPZ are assigned within the immediate surrounds of water production wells and special land use restrictions apply. In these zones, groundwater moves rapidly towards wells due to aquifer depressurisation from pumping. Any contamination leaching from the ground surface could rapidly migrate into scheme water supplies (before effective remedial action can occur). In sedimentary basins, WHPZ are usually circular, with a radius of 500 metres in P1 areas and 300 metres in P2 and P3 areas. These zones do not extend outside PDWSA boundaries.

RPZ are defined over and around public water supply reservoirs or pipe-heads. Special access and land use restrictions apply. The aim is to restrict the likelihood of contaminants being deposited or washing into water sources following rainfall. RPZ within state controlled land cover an area of up to two kilometres measured from the reservoir top water level and include the wetted area when the reservoir is full.

For additional explanatory information on PDWSA, see this department's water quality protection note 25 *Land use compatibility in public drinking water source areas* and note 36 *Protecting of public drinking water source areas.*

Buffers to water supply sources

Vegetation buffers should separate compatible land use operation areas from the full supply level of reservoirs, their primary feeder streams and production bores used as a source of drinking water. Advice is provided on buffer form and dimensions in our water quality protection note 6 *Vegetated buffers to sensitive water resources*.

Clearing control catchments

Special controls on vegetation clearing for salinity management purposes are provided under part IIA of the *Country Areas Water Supply Act 1947* (WA). These controls apply in the Wellington Dam, Harris River Dam, Mundaring Weir and Denmark River catchment areas and the Kent River and Warren River water reserves.

Details on clearing controls may be obtained from our local regional office, see < www.water.wa.gov.au >, select *Contact us*.

Established activities in PDWSA

Many land use activities were approved and established before publication of a source protection plan or strategy. We encourage the operators of all land use activities to progressively improve their environmental management facilities and practices so the risk to water resources is minimised (factoring in practical and economic constraints).

New or expanded activities in PDWSA

Any proposed new or expanded activities that could affect drinking water sources should be referred to this department's regional office for assessment and written response. The development proposal may be approved (with or without conditions); additional relevant information sought prior to making a decision; or rejected due to a policy conflict or inadequate protective measures to safeguard the water source. To facilitate environmental approval, operators should demonstrate that under all operating conditions the materials and processes used on-site do not pose a significant contamination risk to the local waters.

2 Private water supply sources

These water sources include:

a human or stock (animal) drinking water sources

b commercial or industrial water sources (requiring specific qualities that support activities such as aquaculture, cooling, food or mineral processing or crop irrigation)

c urban or municipal irrigation sources (where water quality may affect vegetation performance or people's health or wellbeing).

3 Underground ecological functions

Important underground ecological functions that may be at risk include stygofauna and microorganisms in aquifers (within sand, gravel and karst soils).

4 Waterway ecological and social values

a Maintenance of waterways of high conservation significance described in the WA Environmental Protection Authority's guidance statement 33 *Environmental guidance for planning and development* (section B5.2.2). This statement is available online at < www.epa.wa.gov.au > select *EIA* > *guidance statements.*

b Waterways managed by the Department of Water under the *Waterways Conservation Act 1976* (WA). These including the Avon River, Peel-Harvey Inlet, Leschenault Inlet, Wilson Inlet and Albany waterways.

c Waterways managed under Section 9 of the *Water Agencies (Powers) Act 1984* (WA). For online advice, see < www.water.wa.gov.au > select *waterways health* > *looking after our waterways*.

d Waterways managed by the Swan River Trust under the *Swan and Canning Rivers Management Act 2006 (WA)*. For online advice, refer to < www.swanrivertrust.wa.gov.au >.

e Social values in natural waterways include their aesthetic appeal, use of watercraft, fishing, tourism, swimming and other aquatic activities.

Engineered drains and constructed water features are normally not assigned ecological values because their function and operational factors override these water values.

5 Wetland ecology

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

b Wetlands defined by the Australian government in the *Directory of important wetlands in Australia,* available online at < www.environment.gov.au > select *water* > *water topics* > *wetlands.*

c Wetlands of high conservation significance described in the Environmental Protection Authority (WA) guidance statement 33 *Environmental guidance for planning and development (section B4.2.2).* This is available online at < www.epa.wa.gov.au > select *Environmental impact assessment* > *guidance statements.*

d Wetlands identified for conservation value or for resource enhancement via:

- *Geomorphic wetlands of the Swan coastal plain* dataset
- *South coast significant wetlands* dataset
- *Geomorphic wetlands Augusta to Walpole* dataset.

The *Geomorphic wetlands Augusta to Walpole* dataset awaits detailed evaluation.

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

Wetlands that are highly disturbed by rural land use, or have been landscaped to provide a social amenity or drainage control function in urban settings, may not have ecological conservation values unless they are being actively managed to restore these values.

Many aquifers, waterways and wetlands in Western Australia require detailed scientific evaluation and their values remain unclassified. Unless proven otherwise, any natural waters that are slightly disturbed by human activity are considered to have sensitive values.

Community support for water values, the setting of practical management objectives, providing sustainable protection strategies and effective implementation are vital to protecting or restoring our water resources for current needs and those of future generations.

Note interpretation

This note provides a general guide on issues of environmental concern, and offers solutions based on professional judgement and precedent. Recommendations made in this note do not override any statutory obligation or government policy statement. Alternative practical environmental solutions suited to local conditions may be considered.

This note shall not be used as this department's policy position on a specific matter, unless confirmed in writing. The note may be amended as needed, when new data is available. Regulatory agencies should not use recommendations made in this note in place of site-specific conditions based on a project's environmental risks. Any regulatory conditions should consider the values of the surrounding environment, the safeguards in place and take a precautionary approach.

Where a conflict arises between recommendations made in this note and any proposed activity that may affect a sensitive water resource, this note may be used to assist negotiations with stakeholders. The negotiated outcome should not result in a greater risk to water quality than would apply if our recommended protection measures were used.

This note will be updated as new information is received or industry/activity standards change. The currently approved version is available online at < www.water.wa.gov.au > select *publications* > *find a publication* > *series browse* > *water quality protection notes*.

Disclaimer

Appendix B - Statutory approvals covering this activity include:

What's regulated?	Statute	Regulatory agency
Land zoning and development approval	*Planning and Development Act 2005 (WA)* State planning policy 2.7 - *Public drinking water source policy 2003*	Department of Planning www.planning.wa.gov.au Local government
Significant impact on the values and ecology of land or natural waters	*Environmental Protection Act 1986 (WA),* Part IV – Environmental Impact Assessment	Minister for the Environment, advised by the Environmental Protection Authority www.epa.wa.gov.au
Regulation of prescribed premises	*Environmental Protection Act 1986 (WA),* Part V – Environmental Regulation	Department of Environment and Conservation www.dec.wa.gov.au
Licence to take surface water and groundwater	*Rights in Water and Irrigation Act 1914 (WA)*	Department of Water – regional office www.water.wa.gov.au
Agricultural sites within proclaimed public drinking water source areas	*Metropolitan Water Supply, Sewerage and Drainage Act 1909 (WA);* or *Country Areas Water Supply Act 1947(WA)*	
Discharge into managed waterways	*Waterways Conservation Act 1976 (WA)*	
Discharge of waters affecting the Swan –Canning estuary.	*Swan and Canning Rivers Management Act 2006 (WA)*	Swan River Trust www.swanrivertrust.wa.gov.au
Storage of fuels, solvent, explosive, dangerous goods	*Dangerous Goods Safety Act 2004 (WA);* and Regulations 2007	Department of Mines and Petroleum www.dmp.wa.gov.au

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

Appendix C - Typical organic waste characteristics[1,2]

Type /description	Mean weight of each (kg)	Waste output each animal (kg/d)[3,4]		VS each (g/d) [5]	N (kg/year) in waste		P (kg/year) in	
		Faeces	Urine		Faeces	urine	faeces	urine
Sewage (adults) 180 L/p/day	70	0.23	1	115	4.4		1	
Grey water 120 L/p/day	70				0.5		0.35	
Beef Cattle > 2 yrs old	450	20	9	2,950	62		15	
Heifers 1-2 yrs old	400	18	8	2600	55		18	
Steers > 1 yr old	300	13	6	2000	41		13	
Feeder calves	200	9	3	1300	28		9	
Dairy Cattle Cows > 2 yrs	600	48	16	3,600	85		20	
Heifers 1-2 yrs old	450	38	12	2,700	62		15	
Heifer calves	300	25	8	1,800	42		10	
Deer Fallow	50						1.6	
Slaughter at 1-2 years	70						1.8	
Red	100						2.6	
Dogs **-** small	<10	0.3			1.1		0.2	
- medium	10-30	0.6			2.3		0.5	
- large	30	1			3.4		0.7	
Emu – 2 adults + 19 chicks	30	25 (2 adults + 19 chicks)			100		40	
Goats - dairy	100	4	1.5		16		4	
- meat	40	1.6	0.6		7		1.6	
Horses Horse	450	18	4.5	4500	41	49	4.4	1.1
Pony	300	10	10	3000	9	33	2.9	0.7
Ostrich - 2 adults+ 20 chicks	120	80 (2 adults + 20 chicks)			280		126	
Pigs Piglets < 10kg	10	0.8	0.4	85	1.9		0.7	
Growers	50	4.7	2	425	7.3		3.2	
Porkers	70	6	2.7	600	13		4.6	
Gilts, sows, boars	100	8.5	3.9	850	19		6.6	
Poultry Turkeys - heavy	7	0.3		64	1.6		0.6	
Turkey- light	4	0.2		36	0.9		0.3	
Ducks	2	0.2		38	1.1		0.4	
Hens, barn laying	2	0.19		30	0.61		0.22	
Pullets, laying	1.5	0.14		18	0.46		0.16	
Broilers	1	0.15		17	0.4		0.11	
Pullets, non laying	0.6	0.06		10	0.24		0.07	
Rabbits - Does with young	6	0.2		85	1.1		2.2	
Resting adult	5	0.16		71	0.4		0.5	
Fattening young	2-3	0.1		40	0.3		0.4	
Sheep Rams	100	4	1.5	920	15		3.2	
Ewes >1 yr old	80	3.2	1.2	740	12		2.5	
Wethers	50	2	0.8	460	7.5		1.6	
Lambs	40	1.6	0.6	368	6		1.3	

Notes:

1 Data has been adapted from the DOW Nitrogen load spreadsheet (MS –XL) Table 2 used for calculating land use nutrient loadings for the Gnangara and Jandakot UWPCA. It is not scientifically rigorous and may be used for estimation in the absence of project specific data.

2 Data sources: Kinhill Engineers Ltd (1995) - *Nitrogen application limits for various land uses* prepared for the Water Authority (WA), and Bott J *A guide to water quality monitoring and the establishment of water quality objectives*; augmented by literature search only (see ASAE, reference 1).

3 Animal waste load figures are for pasture fed, not demand fed. Missing data to be added when available.

4 Some waste **data** was extrapolated based on animal size and then rounded off.

5 Wet manure load (includes significant moisture content)

6 VS = Volatile solids (degradable portion of wastes) used in design of waste stabilisation systems.

References and further reading

1 Australian government - national water quality management strategy papers, available online at < www.environment.gov.au > select *water* > *water policy and programs* > *water quality*

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

   b Paper 6 *Australian drinking water guidelines, 2004*

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

2 *Australian Pesticides and Veterinary Medicines Authority,* for online information see < www.apvma.gov.au > select *publications*

   Code of practice for the use of agricultural and veterinary chemicals, 2002.

3 American Society of Agricultural Engineers –ASAE D384.1 *Manure production and characteristics*, Feb 2003

4 Department of Agriculture and Food (WA) papers available online at < www.agric.wa.gov.au > search for < *topic*>

   a Bulletin 4560 *Code of practice for the use of agricultural and veterinary chemicals,* 2002

   b Farm note 30/1992 *Design guidelines for fixed sprinklers and micro-irrigation systems*

   c Farm note 2/95 *Nitrates in groundwater beneath horticultural properties*

   d *Irrigation and drainage management plan (IDMP) guidelines.*

5 Department of Environment and Conservation (WA) publications available online at < www.dec.wa.gov.au >, select *management and protection* > *wetlands* > *policy and legislation*

   Position statement *Wetlands*, June 2001.

6 Department of Water (WA)

   a Policy available online at <www.water.wa.gov.au> select *water quality* > *publications* > *policy*

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

   b Environmental guidelines, available online at < www.water.wa.gov.au > select *publications* > *find a publication* > *series browse* > *guidelines*

      WA guidelines for direct land application of biosolids and biosolids products, 2002.

   c Water facts and water notes, available online at < www.water.wa.gov.au > select *publications* > *find a publication* > *series browse*

      - WF 03 *River and estuary pollution*
      - WF 06 *Algal blooms*
      - WF 10 *Groundwater pollution*

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

d Water quality protection notes, available online at < www.water.wa.gov.au > select *publications > find a publication > series browse > water quality protection notes*

- WQPN 06 *Vegetated buffers to sensitive water resources*
- WQPN 22 *Irrigation with nutrient-rich wastewater*
- WQPN 25 *Land use compatibility in public drinking water source areas*
- WQPN 36 *Protecting public drinking water source areas*
- WQPN 37 *Pesticides –storage and use (draft)*
- WQPN 50 *Soil amendment to improve its fertility using industrial by-products*
- WQPN 107 *Nutrient fate and transport models* (draft)

e Stormwater manual, see web page < www.water.wa.gov.au > select *water quality > stormwater > management manual*

- *Stormwater management manual for Western Australia.*

7 Engineers Australia publication available for purchase at < www.engineersmedia.com.au > search *EA books*

Australian rainfall and runoff (current edition).

8 Irrigation Australia Limited (formerly the Irrigation Association of Australia Limited) Certified irrigation designers list for WA is provided on web page < www.irrigation.org.au >, see *member profiles*.

9 Kingdon B.K. *Guidelines for fertiliser use on the Swan Coastal plain of WA,* 2000.

10 National program for sustainable irrigation publication see < www.npsi.gov.au > *Irrigation essentials*, December 2009.

11 Standards Australia publication, see web page < http://www.saiglobal.com/shop/Script/search.asp >

AS 4360 *Risk management*

AS 5667 *Water quality – sampling.*

12 Vegetables WA publications see < www.vegetableswa.com.au > select *good practice*. *Good practice guide* 2007.

More information

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