



WQPN 1, April 2006

Agriculture - dryland crops near sensitive water resources

Purpose

Dryland cropping involves growing grain, fodder and pasture seeds. It is a major contributor to the Western Australian economy. The State's main dryland cropping region extends from Geraldton in the mid-west to Esperance in the south, see map at Figure 1 at the end of this note.

Dryland crops are typically grown on a broad hectare scale and rely on seasonal rainfall rather than irrigation. Crops include cereals (such as wheat, barley and oats), maize, legumes (including field peas, faba bean, chickpea, lentils and lupins), oilseeds (such as sorghum, soybeans, and canola), and fodder (such as lucerne and clover). Many of the soils found in the dryland agricultural zone are nutrient poor, require the application of fertiliser and pesticides and are prone to salinity and erosion problems. Appropriate land and water management measures will ensure the risk of water resource contamination is minimised.

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:

- this Department's views on dryland cropping near sensitive water resources;
- guidance on acceptable practices used to protect the quality of Western Australian water resources; and
- 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 suited to local conditions may be considered. Regulatory agencies should not use this note's recommendations without a site-specific assessment of any project's environmental risks. Any regulatory conditions set should consider the values of the surrounding environment, the safeguards in place, and take a precautionary approach. This note shall not be used as this Department's policy position on a specific matter, unless confirmed in writing.

Scope

This note applies to dryland cropping located near sensitive water resources. Sensitive water resources are described in [Appendix D](#).

Grazing can be an important part of dryland agriculture because sheep or cattle are often held on paddocks after crop harvesting. Grazing in dryland cropping areas is not covered by this note, see this Department's Water Quality Protection Notes *Pastoral activities within rangelands* and *Stockyards in sensitive environments*.

This note also does not cover intensive agriculture (eg market gardens, irrigated horticulture or pasture, orchards and vineyards). For information on intensive agriculture see our Water Quality Protection Notes *Nurseries and garden centres; Orchards in sensitive environments* and *Floriculture activities in sensitive environments* (see [Appendix A, reference 9](#)).

Recommendations

Cropping locations

Within Public Drinking Water Source Areas

Public Drinking Water Source Areas (PDWSA) are catchments declared to manage and protect water sources used for public drinking water supplies. PDWSA include Underground Water Pollution Control Areas (UWPCA), Water Reserves and Catchment Areas proclaimed under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* or the *Country Areas Water Supply Act 1947*.

In 2005, twenty proclaimed groundwater reserves, three surface water catchments and six surface water reserves were located in dryland cropping regions. Drinking Water Source Protection Plans for each PDWSA are in production which show the catchment boundaries and recommend appropriate protection strategies. Completed plans are posted on this Department's internet site (see [Appendix A, reference 9](#)).

Land within PDWSA is assigned one of three priority classifications (P1, P2 or P3) which define the protection strategy used. The priority classification system considers the land use, existing or approved land zoning, form of ownership, the strategic importance and the vulnerability to contamination of the water source. In each priority area, various water quality protection measures are used including constraints on land use and requirements for best environmental practice. Limitations on chemical use and waste disposal may apply in zones closest to the sites where drinking water is harvested or stored. These zones are known as *Wellhead Protection Zones* or *Reservoir Protection Zones*

For detailed information on priority classifications, protection zones, or guidance on the acceptability of land uses within PDWSA, see this Department's Water Quality Protection Note *Land use compatibility in Public Drinking Water Source Areas*. Location details for these areas and zones are available from our regional offices.

- 1. In Priority 1 areas and Protection Zones:** Dryland cropping is incompatible with the management objectives for the water resource. This Department will oppose development or expansion of cropping within these zones. In strategic locations the Department may negotiate the purchase of cropland considered to pose a significant risk to water resource quality.
- 2. In Priority 2 areas:** Dryland cropping is a compatible activity with conditions. The conditions are likely to include buffer zones to water bodies, constraints on chemical and waste application to land, development and implementation of environmental management plans and occasionally environmental monitoring. The conditions should be site-specific, and consider the recommendations given in this note.
- 3. In Priority 3 areas:** Dryland cropping is acceptable provided best practice environmental management is adopted. This note provides guidance on appropriate environmental management practices

Near wetlands

Wetlands are areas of seasonally, intermittently, permanently waterlogged or flooded land. They include lakes, swamps, marshes, springs, damp-lands, tidal flats and estuaries.

The WA Environmental Protection Authority's Position Statement, *Environmental Protection of Wetlands*, recognises that wetlands have significant ecological, hydrological, social and economic values worthy of conservation, see [Appendix A, reference 7](#). Wetlands environments can be susceptible to impacts from agricultural practices that include vegetation loss, ecological disturbance, altered water level regimes, sedimentation and chemical contamination.

Mapping of the wetlands in dryland cropping regions is presently limited. Regional Natural Resource Management strategies (see internet site www.nrm.org.au) identify the need to undertake further wetland mapping. For guidance on the availability of wetland mapping and how to identify wetlands, see this Department's internet site ([Appendix A, reference 9](#)) or contact our local regional office.

Local, regional, national and international studies that identified significant wetlands in the cropping regions include:

- Wetlands of international importance (Ramsar sites) were defined under the *Convention on Wetlands 1971*. There are twelve Ramsar sites in Western Australia, three of which are found in dryland cropping regions, ie Lake Toolibin (near Narrogin) and Lakes Gore and Warden (near Esperance). Further information on the Ramsar Convention is provided on the Australian Department of the Environment and Heritage web page www.deh.gov.au/water/wetlands/database/directory/wa.html. The current list of Western Australian Ramsar sites is also provided at the Department of Conservation and Land Management (CALM) web page www.calm.wa.gov.au/national_parks/wetlands/wa_ramsar_sites.html.
- *Directory of Important Wetlands in Australia* (2001). Of the 120 wetlands listed in the *Directory of Important Wetlands*, 22 occur in WA dryland cropping regions. For more information, see the Australian Department of the Environment and Heritage internet site, [Appendix A, reference 15](#).
- *Geomorphic Wetlands Swan Coastal Plain* dataset covers that portion of the dryland cropping region located on the Swan Coastal Plain. The dataset identifies all wetlands on the plain (between Moore River, Bunbury and the Darling Scarp) and their management category. The Department of Environment has identified Conservation and Resource Enhancement management category wetlands as a priority for protection (see *Position Statement: Wetlands*, 2001). For more information on the dataset and Position Statement, see that Department's wetland web page, see [Appendix A, reference 10](#).
- Environmental Protection Policies (EPPs) are developed under the *Environmental Protection Act 1986* and published by the Environmental Protection Authority (EPA). For further information, see the internet site www.epa.wa.gov.au, select *Policy>Environmental Protection Policies*.
 - a. The *Environmental Protection (South-West Agriculture Zone Wetlands) Policy 1998*. This policy aims to prevent the further wetland degradation and to promote their rehabilitation in the State's south-west agricultural zone. Both Lake Monjigup near Esperance and Koojieda Swamp near Northam are located within the primary dryland agriculture region, and listed under the *South West Agricultural Zone EPP*.
 - b. The *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992*. The Swan Coastal Plain Lakes EPP protects the environmental values of lakes on the Swan Coastal Plain. Numerous lakes are listed under this EPP.
 - c. The *Draft Revised Environmental Protection (Swan Coastal Plain Wetlands) Policy 2004*. This policy updates protection of wetlands of high ecological value on the Swan Coastal Plain.

Note: A large number of wetlands are listed under the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*. Clearing is restricted adjacent to these wetlands under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (see Note in the *Land Clearing* section).

Native vegetation buffers adjoining wetlands help maintain their ecological processes and functions, and protect the wetland from potential harm. Buffers can also help protect the community from potential nuisance insects, eg midges. To maintain wetland values, it is important to determine, implement, protect and manage adequate buffers. Buffers extend outward from the margin of wetland vegetation (or seasonally waterlogged soils in the absence of wetland vegetation).

The extent of the buffer around any wetland will depend on:

- the wetland values;
 - management objectives for the wetland and adjoining vegetation;
 - activities, land uses or development (existing and proposed) near the wetland;
 - environmental risks posed by the adjacent activities, land uses or development; and
 - management techniques applied to the activities, land uses or developments near the wetland.
4. Farmers should be aware of the location of wetlands on their property, and ensure that all activities are in accordance with relevant *Environmental Protection Act* policies and use best industry practice management. Dryland cropping should be managed to prevent harm or disturbance to wetlands. Appropriate buffers from disturbed land should be maintained.

For further information on wetland values and protection, see the Department of Environment's wetland web page <http://wetlands.environment.wa.gov.au> or contact the nearest regional office.

Near waterways

Waterways include creeks, brooks, rivers, or streams, and natural watercourses. Waterways also encompass floodplains and wetland systems that overflow into rivers, as well as any lakes or swamps that are mainly fed by streams rather than shallow groundwater.

The draft *Statewide Waterways Policy* provides the WA government's policy on the management of waterways in Western Australia. Information on the values of waterways can be found in *The Importance of Western Australia's Waterways 2004*. These documents recognise that waterways have cultural, social, ecological, economic and hydrological values. As with wetlands, waterways can be susceptible to impacts from agricultural practices.

To protect waterways and their adjoining riparian area, the Department of Environment's policy is that an acceptable foreshore area or waterway buffer is based on an assessment of the biological and physical features associated with the waterway and its values and pressures. The features to be used in the assessment are known as *biophysical criteria*. These criteria and their application are described in *Water Note 23 Determining Foreshore Reserves 2001*. This approach allows flexibility and location-based decision making by considering a range of criteria and negotiated outcomes rather than using a nominal 'setback' requirement. It is considered a sustainable approach to waterway ecosystem management, and does not restrict the social and economic opportunities of waterways, while adequately protecting their ecological values. The onus is on farmers to demonstrate and justify the outcome of a 'foreshore area' on a case specific basis.

5. Farmers should be aware of the location of sensitive waterways on their property, to ensure that cropping activities are in accordance with the *Waterways Conservation Act 1976*, the *Rights in Water and Irrigation Act 1914*, the *Environmental Protection Act 1986*, and to enable best practice management. Dryland cropping should be managed to prevent harm or disturbance to waterways. Buffers of an appropriate distance should also be maintained (see this Department's Water Quality Protection Note: *Vegetation buffers to sensitive water resources*).

Further information is available on the Department of Environment's Catchment Management Branch page at <http://waterways.environment.wa.gov.au>, or by contacting their regional offices.

Farm planning

Good farm planning can minimise environmental problems and often be more cost-effective than fixing problems once they have harmed water resources.

6. A comprehensive farm environmental plan should be used for the establishment and management of farms to limit impacts on natural resources. The plan should include:
 - a. a map of the farm and neighbouring areas;
 - b. location of any sensitive environments, including water resources;
 - c. the needs of the farm business, and the potential impacts on neighbours and surrounding areas;
 - d. analysis of soil characteristics and climatic factors;
 - e. detail the farm's establishment and operation including best industry practice management, market influences and finance plan; and
 - f. provide for effective management of ongoing risks and opportunities.

The characteristics of the property, its productive potential and the economic resources and the options available should be described. Areas of current or potential land degradation should be identified such as salt affected, eroded and waterlogged areas induced by past land practices.

7. Farmers should assess the possible on and off site environmental impacts of their farm management practices and take all reasonable and practical steps to minimise detrimental effects. Farmers can get advice on how to set up farm plans suited to their property by either contacting the Department of Agriculture (WA) or Landcare WA, see contact details given at [Appendix C](#).
8. Regional Natural Resource Management (NRM) strategies have been recently developed (see [Appendix A, reference 8](#)). Farm management strategies should engage with the local NRM objectives, strategies and targets for protection of local water resource values.

Soil and land management

Fertile soil, adequate rainfall and ecologically viable land are key elements for the long term productivity and sustainability of agricultural land. Soil and land management practices are needed that retain top-soil, minimise soil erosion and associated biochemical impacts on water quality (eg nutrient enrichment and oxygen starvation), and reduce silt deposits and turbidity in waterways and wetlands. Appropriate soil and land management strategies include the following components:

- erosion control;
 - maintenance of soil structure;
 - salinity prevention;
 - acidity controls; and
 - heavy metals accumulation safeguards.
9. Soil erosion should be controlled using the following measures.
 - a. Implementing a farm plan, including:
 - selection of appropriate locations for grain, chemical, fertiliser and fuel storage areas;
 - soils analysis;
 - all-weather on farm access roads;
 - engineered erosion control measures eg contour and grade banks and revegetated areas; and
 - appropriate seeding and cropping practice.

- b. Using effective windbreaks to provide protection against wind-driven erosion. Vegetation wind-breaks are especially important in dry years when low crop yields result in reduced residual groundcover. For further details on planning and constructing wind breaks, see the Department of Agriculture's Farmnote 43/ 999 *Windbreaks for horticulture on the Swan Coastal Plain*.
 - c. Minimising bare ground by retaining crop stubble, see Farmnote 67/ 2002 *Amount of stubble needed to reduce wind erosion*.
 - d. Avoiding additional land clearing. See the following section on **Land clearing**.
 - e. Orienting crop rows to influence and minimise surface water run-off patterns, frost susceptibility, and erosion potential. Crop rows should be planted along contours rather than up and down slopes;
 - f. Using existing roads and tracks (if practical) to minimise erosion and to prevent changes to surface hydrology and drainage. Unpaved roads should be constructed parallel to the land contour, avoiding slopes exceeding one in ten to limit erosion and turbid water run-off. Waterway crossings should be minimised. For further information, see our Water Quality Protection Notes – *Roads in sensitive environments* and *Vegetated buffers to sensitive water resources*.
 - g. Rehabilitate areas of existing gully and landslip erosion.
 - h. The WA Department of Agriculture's *Preventing erosion and soil structure decline* (miscellaneous publication 23/97- printed copies only available), provides further information on techniques to minimise soil erosion.
10. Soil structure degradation should be minimised by:
- a. Best practice tillage techniques, see the Department of Agriculture's Farmnote 48/1996 *Enhancing soil processes*.
 - b. Retention of crop trash in situ after harvesting.
 - c. Cultivate soils at the appropriate moisture content and depth (hard pans and compaction layers will require extra attention). See the Resource Management Technical Report 99 *Minimal soil disturbance sowing in New South Wales* (2001) for further information on ways to reduce water erosion ([Appendix A, reference 6e](#)).
 - d. Farmnote 26/02 *Treatment of compacted soils in the eastern wheatbelt* 2002 provides information on methods to reduce degradation of soil structure.
11. The fertility of leached soils may be improved by the addition of treated sewage biosolids or approved industrial processing by-products. For information on these options, see the *WA Guidelines for direct land application of biosolids and biosolids products 2002*, and our Water Quality Protection Note *Soil amendment using industrial by-products to improve soil fertility*.
12. Soil salinity (including salt leaching into water bodies) should be managed by:
- a. Retention or replanting native trees and shrubs to stabilise soil and help to control salinity. Trees and saplings should be protected from grazing pressure by native animals and stock, fencing, netting or wire mesh to deter ringbarking and rubbing damage.
 - b. Implementation of *Catchment Management Programs* designed to assist in managing salinity problems within a region. For further information on causes of salinity and what individual farmers and catchment protection groups can do, see web page <http://salinity.environment.wa.gov.au>, select 'Publications'.

13. Soil acidity should be minimised by:
 - a. Regular soil testing to keep track of changes to acidity/alkalinity (pH).
 - b. Controlling the application of acidifying fertilisers. Soil pH is frequently altered by application of chemical fertilisers.
 - c. Use of information given in Farmnote 80/2000 *Management of soil acidity in agricultural land*.
14. The build-up of heavy metals in soil (which leach into waterways if soils are eroded) should be prevented by:
 - a. Using low cadmium fertiliser to minimise its accumulation in the soil, where considerable phosphorus fertiliser or phospho-gypsum applications are used.
 - b. Maintaining or increasing soil organic matter.
 - c. Application of alkalis eg agricultural lime to reduce soil acidity.

Land Clearing

Rainfall run-off rate and volume increases in areas of cleared land compared to uncleared areas. Greater run-off results in more erosion, including the removal of topsoil that is rich in organic matter, and has an increased capacity to transport contaminants. Increased runoff can also result in larger and more frequent floods and impacts on waterways, including erosion, decreased stability of beds and banks and sedimentation of pools.

Note *The Environment Protection Act 1986* (as amended) protects all native vegetation in Western Australia. Clearing of native vegetation is prohibited unless a clearing permit has been granted by the Department of Environment or the clearing is of a kind exempt under Schedule 6 of the Act or under the *Environmental Protection (Clearing of Native Vegetation) Regulations, 2004*.

Clearing of native vegetation regulated under the *Environmental Protection Act 1986* applies to “*indigenous aquatic or terrestrial vegetation*”. Clearing includes killing, destroying or removing, severing or ringbarking trunks or stems of, or doing any other substantial damage to some or all of the native vegetation in an area, and includes flooding, draining, grazing and burning.

15. Anyone intending to clear land for dryland agriculture must submit a clearing permit application to the Department of Environment’s Native Vegetation Protection Branch, unless the clearing is exempt.
16. The Native Vegetation Protection Branch’s assessment will consider ten clearing principles addressing biodiversity, water quality and land degradation, planning instruments and other relevant issues. For further information on exemptions and the application process, contact the Department of Environment.

Chemical management

Agricultural and veterinary chemicals are valuable management tools which, when used responsibly, contribute significantly to the production of safe, high quality food and fibre. However, the misuse and poor management of these chemicals can harm water resources, so care needs to be exercised in their storage, handling and application.

17. Landowners should ensure that farm chemical use follows supplier recommendations. All bulk chemicals should be stored in accordance with Australian Standard 2507 *The storage and handling of agricultural and veterinary chemicals*. This standard recommends that chemicals be stored in secure weather-proof containers with impermeable and bunded floors to limit pilferage, spillage into the environment, flooding or storm damage.

18. Reactive materials, eg acids and alkalis, or ammonium nitrate fertiliser and fuel oil should be stored separately. All storage facilities should also be inspected on a regular basis for the early detection of deterioration or leaks. See this Department's Water Quality Protection Note: *Toxic and hazardous substances – storage and use* for further information.
19. Chemical storage tanks should be located remote from drinking water tanks, dams, wetlands and waterways, and avoid Protection Zones in proclaimed drinking water source areas. For further information, see our Water Quality Protection Notes *Tanks for above ground storage*, *Tanks for underground chemical storage* and *Vegetation buffers to sensitive water resources*, and the Department of Consumer and Employment Protection 's guidance notes on dangerous goods.
20. The loading, mixing and use of chemicals within or near sensitive water resources should be avoided. Chemicals should be used and handled as described in the regulatory requirements of the Department of Health (pesticides), the Department of Consumer and Employment Protection (see [Appendices A and C](#)) and the manufacturer and supplier's recommendations.

The National Farmers' Federation and the Rural Training Council of Australia (RTCA) have introduced a voluntary, self-regulatory National Farm Chemical User Training Program called *ChemCert Australia*. For information on this scheme, see the internet site www.chemcert.org.au/.

21. When applying chemicals, landowners should ensure that weather conditions are suitable (ie sufficiently dry and not windy) to minimise chemical spray drift or wash-off into water resources. Landowners should seek professional advice on the type and quantity of chemicals that should be applied, and check labels for warnings on protecting aquatic species before applications near water or sensitive areas. Spray plans should also be kept up to date and identify locations of sensitive areas and crops. For further details, see the *Code of Practice For the Use of Agricultural and Veterinary Chemicals in Western Australia 2002*, and the Department of Environment's Water Note 22 *Herbicide Use in Wetlands 2001*.
22. Pesticide use in drinking water source catchments should be undertaken in accordance with this Department's Statewide Policy No. 2 *Pesticide Use in Public Drinking Water Source Areas*. The use of herbicides should be limited to those stated within the Department of Health's *PSC 88 Use of herbicides in water catchment areas*. For further advice, contact this Department or the Department of Health's Environmental Health Branch.
23. Chemical containers should be effectively rinsed and cleaned using the recommendations in our Water Quality Protection Note *Toxic and hazardous substances* and the *DrumMUSTER* guidelines, see Internet site www.drummuster.com.au/content.asp?id=14. *DrumMUSTER* is the national program for the collection and recycling of empty, cleaned, non-returnable crop production and on-farm pharmaceutical chemical containers.

Container rinsing after emptying should be carried out immediately at a location remote from water bodies, as residues are more difficult to remove when dry. Container washings should be stored for use to dilute the next batch of chemical prior to application. Landowners should organise the safe collection and recycling of waste chemicals and rinsed chemical containers. Alternatively contact your local government authority (council office) for information on local arrangements for storage, recycling or disposal of containers.

Fertiliser and animal waste nutrient management

Carefully planned and controlled fertiliser and manure application is crucial. These materials contribute to soil acidity, contamination and risk harm to sensitive water resources.

24. Landowners should apply the minimum quantity of nutrients necessary to sustain crop growth. Applying fertilisers at times of plant uptake, while avoiding periods of heavy rainfall, limits leaching of nutrients. Where practical, stabilised manures and slow release fertilisers should be used. Less water-soluble fertilisers that dissolve slowly or breakdown gradually can better meet plant nutrient demand and reduce losses through leaching.

Case-Study

A case study in the Parry Inlet Catchment (west of Denmark) has found not fertilising along minor creeks (including drains and pasture swales) is a useful strategy for reducing nutrient loads in waterways. During this study there was no report of any decline in productivity, but there was a significant saving in the amount of fertiliser used on the farm.

For further information, telephone the Department of Environment's South Coast Region in Albany Office on (08) 98425760

25. Phosphorus and nitrate fertiliser application should be carefully controlled according to soil type and drainage conditions. For generic details, see the *Guidelines for Management of Farmland adjacent to the Busselton Wetlands* (Agriculture WA 2002). Landowners should always seek professional advice on the type and quantity of fertilisers to be applied and check labels for warnings regarding aquatic species before applications near water or sensitive environments. Application Plans should also be kept up to date and identify locations of sensitive areas or crops. See the Department of Agriculture's *Code of practice for environmentally sustainable vegetable and potato production in Western Australia*, section 10: *Minimising Air Pollution* 2002 for advice on good practice; and the CSIRO's *maNage wheat* program: www.csiro.au/index.asp?type=mediaRelease&id=Prmanage.

Fuel storage and management

26. Fuel storage facilities and storage tanks should not be located near water resources, sensitive environments or with areas subject to flooding. Storage and handling facilities should be bunded to ensure any fuel spillage is contained and an appropriate buffer provided to any wetland, waterway or domestic water source. Where possible, these facilities should be located down gradient from stock and human water supply well sites to lessen the risk of water contamination due to leaks or spills.
27. Storage tanks should be installed properly to ensure minimal potential for leakage, and regularly inspected for signs of deterioration or leakage. For further information, see our Water Quality Protection Notes *Tanks for above ground chemical storage; Tanks for underground chemical storage* and the Department of Consumer and Employment Protection's Dangerous Goods Guidance Notes.
28. Re-fuelling areas for vehicles and aircraft should be bunded and located away from water resources and sensitive environments to prevent any accidental spillage contaminating soil or seeping into groundwater aquifers. All servicing area run-off should be directed towards a fully contained collection sump for recovery and appropriate disposal.

For further information on the construction and maintenance of collection sumps, see our Water Quality Protection Notes *Liners for containing pollutants using engineered soil* and *Liners for containing pollutants using synthetic membranes*.

29. For the storage of fuel volumes greater than 5000 litres, approval is currently required by Department of Consumer and Employment Protection. Fuel storage should be adequately bunded and located at a safe distance from waterways and wetlands. Storage facilities should be placed at least 100 metres from any drinking water source, conservation wetland or waterway, and avoid land subject to flooding.

Stormwater drainage

Good drainage systems can reduce the incidence of soil water logging and the creation of salt affected areas, benefiting crop or pasture production. Deep drains may be installed to reduce water logged areas or to locally lower the groundwater table, whilst shallow drainage is often installed to direct water run-off to certain areas such as dams for stock watering. Naturally waterlogged environments such as damp-lands and palusplains should not be drained. The construction of drains and the direction of collected water into waterways have potential to significantly harm the ecology of conservation-valued waterways and wetlands.

Regulations 5 and 6 of the *Soil and Land Conservation Regulations 1992* control the drainage of saline land in Western Australia. The Regulations require landholders intending to drain or pump water from under the land surface to notify the Commissioner of Soil and Land Conservation (at the Department of Agriculture) at least 90 days before work commences. The aim of the notification is to allow for an assessment of the proposed works to be carried out, and to ensure that neighbouring landholders and relevant public authorities are given the opportunity to comment on the proposal.

30. A catchment-wide approach should be considered when making alterations to improve a drainage system and advice should be sought on the capacity of drains with shallow profiles instead of narrow deep systems. A *Notice of Intent to Drain* (NOID) must be submitted to the Soil and Land Conservation Commission for approval prior to the commencement of any drainage proposal on a property. Drainage systems installed on dryland agricultural properties should ensure there are no detrimental effects to existing vegetation, waterways, wetlands or neighbouring properties.
31. Improving the upper part of drainage systems and not the lower areas, can result in flooding downstream if the drainage water is not intended to be stored on farm. Low gradients reduce potential for erosion and seasonally timed construction works and seeding of disturbed areas should be used to minimise erosion from newly constructed drains.

For professional advice on agricultural drainage design, contact the Department of Agriculture, see www.agric.wa.gov.au, select *Land, Water & Environment* > *Commissioner of Soil & Land Conservation*. For information on drainage design, see that Department's Resource Management Technical Report 185 *Common Conservation Works used in Western Australia* 1998.

32. The definition of clearing includes the draining and flooding of areas of native vegetation, as well as direct clearing for drains. These activities may require a clearing permit, see the recommendations given in the section *Biodiversity management* (see page 11).

Diversion of water courses and installation of dams

Although dryland crops are not irrigated, dams may be constructed for other purposes eg stock or fire-fighting within these areas.

33. Under the *Soil and Land Conservation Act 1945* landowners must consult with land use planning authorities and the Department of Agriculture when planning to construct any in-stream dam. The construction of any in-stream dam should ensure that a spillway and a low-flow bypass is incorporated.
34. If an area is proclaimed under the *Rights in Water and Irrigation Act 1914*, landowners require a licence to take water from watercourses. Contact our nearest Regional Office for advice. A surface water permit is also required if a landowner wishes to make alterations to the bank or bed of a watercourse. To locate our nearest regional office, see the internet site www.water.wa.gov.au and select *Contact us*.

Biodiversity management

The variety of life in all its forms (ie plants, animals and micro-organisms, their genes and ecosystems) is defined as biodiversity (State of Environment Advisory Council 1996). The greatest pressure on the maintenance of biodiversity is habitat modification and includes habitat changes resulting from agricultural practices. The management of biodiversity on properties should be undertaken through:

- retaining native vegetation;
- native animal management; and
- controlling feral animals and introduced plants.

Pockets of natural vegetation on a farm can provide benefits for the landowner by acting as a buffer between different land uses and as windbreaks, which can assist in the rehabilitation and reclamation of degraded areas. Native vegetation is generally deep-rooted, reducing salinity through evapo-transpiration and recycling nutrients within the ecosystem.

35. Landowners needing assistance in retaining and managing native vegetation for biodiversity conservation reasons, should consult the Government's publication *Biodiversity Incentive Programs in Western Australia*, available via the Department of Conservation and Land Management's web page www.calm.wa.gov.au/orc/pdf/biodiversity_incentives.pdf. The information covers financial assistance, labour programs, land sale/purchase options, legal protection, technical advice and training programs administered by Government and non-Government organisations.
36. Farmers wishing to control native animal numbers and impacts require specialised management and control instruments and where practical non-lethal management options should be used (eg netting or use of sound deterrents). A *Damage Mitigation Permit* (required under Section 112 of the *Nature Conservation Regulations 1994*) must be obtained from the Department of Conservation and Land Management to destroy or harm any protected wildlife.
37. Regular control of feral animals (ie foxes, cats, goats, pigs and rabbits) should be undertaken to prevent crop damage and erosion problems. Conventional control methods include fencing, trapping, poisoning and shooting (Farm Care, 1998). Landowners should:
 - a. Follow the Department of Conservation and Land Management's protocol when using 1080 fox bait (sodium mono-fluoro-acetate) and ensure baits are not placed within 100 metres of wetlands, watercourses and reservoirs.
 - b. Within proclaimed public drinking water source catchments, incinerate or bury carcasses more than 100 metres of any waterway or wetland, with the water table at least 1.5 metres below the surface and avoid areas subject to waterlogging. Adequate soil should cover buried carcasses to deter scavengers.
38. Weed invasion can disrupt the balance of natural ecosystems through competition for limited resources (water, light, and nutrients) and increase the wildfire risk. Aquatic weeds have the potential to damage irrigation channels, and to degrade and block waterways and wetlands. Farmers should help combat any introduced weeds. Environmental weeds that are declared under the *Agriculture and Related Resources Protection Act, 1976* should be controlled. For further information, see the Department of Environment's Water Notes: *Wetlands and Weeds and Herbicide Use in Wetlands*; and the internet site www.agric.wa.gov.au, search for *Weed control*.

Note: Clearing of native vegetation is prohibited (see [Land Clearing](#) section for details).

38. Landowners should also be aware that declared rare flora and fauna are also specifically protected under the *Wildlife Conservation Act 1950*. The Department of Conservation and Land Management administers this Act. Contact that Department for further information.

Accidents and emergency response

39. Adequate accident and emergency response plans should be prepared and implemented to address foreseeable emergency situations eg accidents, floods, fires, chemical spills and vandalism that could impact on land values and water resources. Landholders should ensure farm managers and farm hands are trained and assigned roles in conducting effective emergency response procedures. For further information, see this Department's Water Quality Protection Note *Contaminant spills – emergency response*.
40. Major chemical spills or contaminated water that threaten the environment should be immediately reported to the Department of Environment (phone 1300 784 782). The Water Corporation should also be advised immediately if the spill is within a proclaimed Public Drinking Water Source Area (phone: 1800 652 897). Reports should include the date and time of the incident, a description of the escaped chemicals, the quantity, loss location and action taken on discovery to remedy the problem.

Wildfire

Regular controlled burns of native vegetation reduce the risk of wildfire by preventing fuel build up. For information on fire management, contact the local government authority (council), Department of Conservation and Land Management or Fire and Emergency Services Authority of Western Australia (FESA).

Burning of native vegetation other than under the *Bush Fires Act 1954* is regulated under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. For further advice, contact the Department of Environment's Native Vegetation Protection Branch.

41. In the event of a wildfire, contact the local volunteer fire brigade or the Fire and Emergency Services Authority.

More Information

Your views on this note are welcome. Feedback provided on this topic is held on this Department's file **14342**. To comment on this note or for more information, please contact our Water Source Protection Branch at the Atrium in Perth. Phone: (08) 6364 7600 (8am to 5pm on workdays); fax: 6364 6525 or via e-mail, see *Contact us* at web page <http://drinkingwater.water.wa.gov.au>, citing the topic and version.

This note will be updated periodically as new information is received or industry/activity standards change. Updates are placed on our internet site select *Publications*> *Water Quality Protection Notes*.

In October 2005 the State Government announced the formation of the Department of Water. In January 2006 the Department of Water assumed primary responsibility for managing the State's water resources. Once the Department of Water is legally constituted, it will replace many of the functions of the Water and Rivers Commission and operate in parallel (with separate powers) to the Department of Environment. The custodian and recommendations made in this note will then change to match the assigned responsibilities within the departments of Environment or Water.

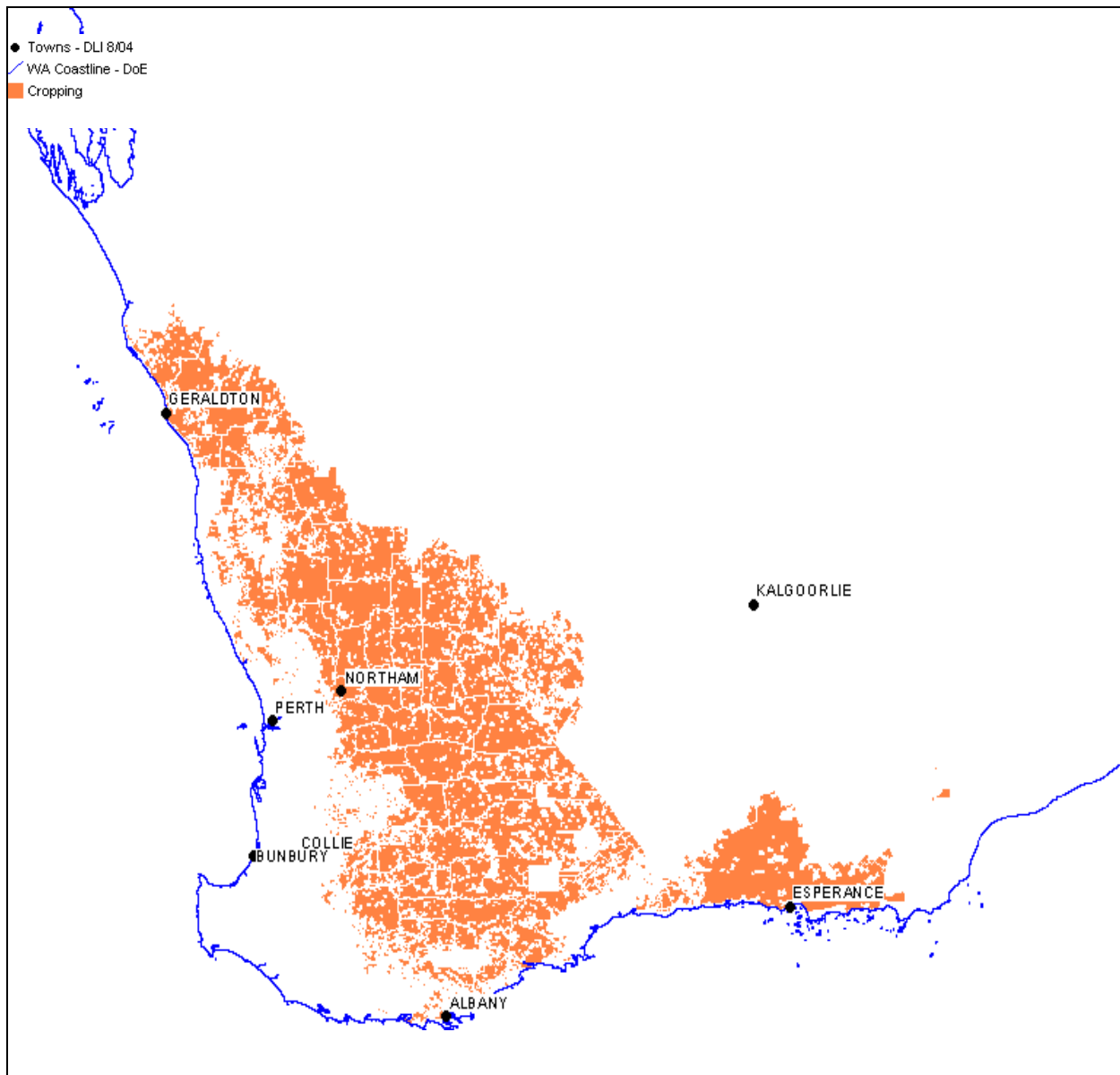


Figure 1. Distribution of dryland cropping in Western Australia



Department of Water
Government of Western Australia

www.water.wa.gov.au
Telephone: (08) 6364 7600
Facsimile: (08) 6364 7601
Floor 4, The Atrium
168 St Georges Terrace Perth
Western Australia 6000



Department of Environment
Government of Western Australia

www.environment.wa.gov.au
Telephone: (08) 6364 6500
Facsimile: (08) 6364 6525
Floor 4, The Atrium
168 St Georges Terrace Perth
Western Australia 6000

Appendices

Appendix A - References and further reading

1. National Water Quality Management Strategy
 - a. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, ANZECC, ARMCANZ 2000;
 - b. *Australian Guidelines for Water Quality Monitoring and Reporting*, ANZECC, ARMCANZ: 2000;
see internet site www.deh.gov.au/water/quality/nwqms/index.html.
 - c. ARMCANZ, *NRMRC: Australian Drinking Water Guidelines*, 2004;.
see internet site www.health.gov.au/nhmrc/publications/synopses/eh19syn.htm.
 - d. ANZECC, ARMCANZ: *Policies and Principles*, 1994;
 - e. ANZECC, ARMCANZ: *Implementation guidelines*, 1998;
 - f. ANZECC, ARMCANZ: *Rural land uses and water quality- a community resource*, 2000.
see internet site bookshop@awa.asn.au, or request from a library service.

Acronyms

ANZECC : Australian and New Zealand Environment and Conservation Council,
ARMCANZ: Agriculture and Resource Management Council of Australia and New Zealand
NRMCC : Natural Resource Management Ministerial Council
NHMRC : National Health and Medical Research Council

2. Australian Bureau of Statistics
Agriculture –Glossary of Terms, Canberra.2004, See Internet site www.abs.gov.au, select *Industry> Agriculture*.
3. Institution of Engineers Australia
Australian Rainfall and Runoff;
see internet site www.engaust.com.au/bookshop/ebookspub.html.
4. Wetland information
 - a. For RAMSAR wetlands, see internet site www.ramsar.org.
 - b. Department of the Environment and Heritage (Australia)
A Directory of important wetlands in Australia, see web page www.deh.gov.au/water/wetlands/databases.html, or the Department of Conservation and Land Management (WA) web page www.naturebase.net/national_parks/wetlands/wa_wetlands.html.
 - c. *Geomorphic wetlands of the Swan Coastal Plain* dataset which displays wetland locations, boundaries, geomorphic classification (wetland type) and management categories. The dataset and maps are available from the following sources:
 - WA Land Information System at internet site www.walis.wa.gov.au. This site should be used in conjunction with “a guide to viewing the WALIS dataset” available at <http://wetlands.environment.wa.gov.au>, select *Data>Wetland mapping*.
 - *Perth Groundwater Atlas*, see internet site www.water.wa.gov.au select *Tools, System & Data*. For additional information contact the Water Information section.
 - Publication *Wetlands of the Swan Coastal Plain*, volume 2B *Wetland mapping, classification and evaluation - wetlands atlas* (Hill, Semeniuk, Del Marco 1996). Reference copies are available from the Department of Environment library in Perth.

- d. *Geomorphic wetlands Augusta to Walpole* available from the following sources:
- Publication *Mapping and Classification of Wetlands from Augusta to Walpole in the South West of Western Australia* (V & C Semeniuk Research Group for the Water and Rivers Commission 1997). Reference copies are available from the Department of Environment's library in Perth.
 - Dataset is available from the *Information Services Branch – GIS support analyst* at the Department of the Environment (WA), phone 6364 6500.
- e. *South Coast Significant Wetlands* dataset which supports the South Coast Natural Resource Management Strategy. This is available from the *Information Services Branch – GIS support analyst* at the Department of the Environment (WA) phone 6364 6500.
5. Government of Western Australia
State Salinity Strategy in Western Australia, Perth 1996
 See internet site agspsrv34.agric.wa.gov.au/environment/salinity/links.
6. Department of Agriculture (WA), see internet site www.agric.wa.gov.au
- a. Farmnotes (use *Search for*: Farmnote series)
- *Farmnote 26/02 Treatment of compacted soils in the eastern wheat-belt;*
 - *Farmnote 67/ 02 Amount of stubble needed to reduce wind erosion;*
 - *Farmnote 80/00 Management of soil acidity in agricultural land;.*
 - *Farmnote 43/99 Windbreaks for horticulture on the Swan Coastal Plain; and*
 - *Farmnote 48/ 96 Enhancing soil processes.*
- b. Bulletins (search for: *Bulletin 4581*)
Bulletin 4581 West Australia's Agriculture, Food & Fisheries Industries 2002-2003;
- c. Miscellaneous publications (search for: *Miscellaneous publication No 23/97*)
Miscellaneous publication 23/97 Preventing erosion and soil structure decline.
- d. Codes of practice and guidelines (search for: *Code* or *Guidelines* + *title words*)
- *Code of Practice for the use of Agricultural and Veterinary Chemicals in Western Australia; and*
 - *Code of practice for environmentally sustainable vegetable and potato production in Western Australia*
 - *Guidelines for Management of Farmland adjacent to the Busselton Wetlands 2002.*
- e. Resource Management Technical Reports (search for: *Resource Management Technical Reports series*):
- *Resource Management Technical Report 185 Common Conservation Works used in Western Australia.*
 - *Resource management technical report 1999 Minimal soil disturbance sowing in New South Wales, and its relevance to reducing water erosion in Western Australia.*
- f. Rapid Catchment Appraisal (Search for: *Rapid catchment appraisal*).
7. Environmental Protection Authority (WA)
- a. *Environmental Protection (South West Agriculture Zone Wetlands) Policy 1998;*
- b. *Environment Protection (Swan Coastal Plain Lakes) Policy 1992;and*
- c. *Position Statement No. 4, Environmental Protection of Wetlands 2004.*
 see web page www.epa.wa.gov.au/index.asp, select *Policies*> *Environmental Protection Policies* or *Position Statements*.

8. Natural Resource Management in Western Australia
See internet site www.nrm.org.au.
9. Department of Water (WA)
- a. Environmental Guidelines:
Western Australian Guidelines for direct land application of biosolids and biosolid products, 2002
- b. Water Quality Protection Notes:
- *Floriculture activities in sensitive environments;*
 - *Land use compatibility in Public Drinking Water Source Areas;*
 - *Nurseries and garden centres;*
 - *Orchards in sensitive environments;*
 - *Pastoral activities within rangelands;*
 - *Rural land use and water quality;*
 - *Soil amendment using industrial by-products to improve soil fertility;*
 - *Stockyards in sensitive environments;*
 - *Tanks - above ground storage tanks;*
 - *Tanks - underground chemical storage tanks;*
 - *Toxic and hazardous substances – storage and use; and*
 - *Vegetated buffers to sensitive water resources;*
- see web page www.drinkingwater.water.wa.gov.au > select *publications* > *guidelines* or *water quality protection notes*.
- c. Drinking Water Source Protection Policies and Plans;
see web page www.drinkingwater.water.wa.gov.au , select *Publications*> *Policies* or *Guidelines*>*Water Source Protection Plans*.
10. Department of Environment (WA)
- a. Waterways
- *Foreshore Policy 1 – Identification of the foreshore area;*
 - *Statewide Policy No 4 – Waterways WA (draft);*
 - *The Importance of Western Australia’s Waterways;*
 - *Water Facts 16: Living Wetlands: An Introduction to Wetlands;*
 - *Water Note22: Herbicide use in wetlands; and*
 - *Water Note 23: Determining Foreshore Reserves;*
- see web page <http://waterways.environment.wa.gov.au> select *publications*>*policies* or *manuals*.
- b. Wetlands
Position Statement: Wetlands
see web page <http://wetlands.environment.wa.gov.au>, select *publications*.
11. Department of Consumer and Employment Protection (WA)
Dangerous goods storage guidelines;
see web page
www.docep.wa.gov.au/ResourcesSafety/Sections/Dangerous_Goods/Guidance_Material/overview.html

12. Department of Health (WA)
Using pesticides safely;
see web page www.population.health.wa.gov.au/Environmental/index.cfm, select *Resources>Toxicology*.
13. Department of Natural Resources (Queensland)
Minimum construction requirements for water bores in Australia, 2003
see web page www.iah.asn.au/pdfs/mcrwba.pdf.
14. Rural Industries Research and Development Corporation
RIRDC Annual Operational Plan.
see web page www.rirdc.gov.au/aop04-05/contents.htm.
15. Australian Department of Environment and Heritage
 - a. *Inventory on natural resource monitoring techniques, monitoring and evaluating of vegetation projects*;
 - b. *The Directory of Important Wetlands in Australia*, Canberra 2001;
see web page www.deh.gov.au/water/publications/index.html#wetlands.
 - c. *State of Environment Report*, Canberra 1996;
see web page www.deh.gov.au/soe/soe96/ex-summary/biodiversity.html.
16. Government of Alberta, Canada,
An Introduction to Wind Erosion Control, 2003, Alberta Canada; see internet site [www1.agric.gov.ab.ca/\\$Department/deptdocs.nsf/all/agdex3524?opendocument](http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/agdex3524?opendocument).

Appendix B - Statutory requirements and approvals include:

What's regulated	Relevant Acts and Policy	Regulatory Agency
Storage of fuels, solvents, explosive and dangerous goods	<i>Explosive and Dangerous Goods Act 1961</i>	Department of Consumer and Employment Protection
Control of declared animals and plants	<i>Agriculture and Related Resources Protection Act 1976</i>	Department of Agriculture
Permit to clear land, effects of erosion, salinity, land drainage and flooding	<i>Soil and Land Conservation Act 1945</i> and associated <i>Regulations</i>	Commissioner for Soil and Lands (c/- Department of Agriculture)
	<i>Environmental Protection (Clearing of Native Vegetation) Regulations 2004</i>	Department of Environment
Impact on the values and ecology of land or natural waters	<i>Environmental Protection Act, 1986</i> , Part IV- Environmental Impact Assessment	Minister for the Environment, advised by Environmental Protection Authority
Development in Public Drinking Water Source Areas	<i>Metropolitan Water Supply, Sewerage and Drainage Act 1909</i>	Department of Water
	<i>Country Areas Water Supply Act 1947</i>	
Use, storage, handling and disposal of pesticides	<i>Health (Pesticide) Regulations 1956</i>	Department of Health-Environmental Health Division

Appendix C - Useful contacts for technical support

Topic	Section	Organisation	Phone
Farm planning	<i>Heavenly Hectares</i> program	Department of Agriculture	08 9368 3333
Farm planning	Landcare education	Landcare WA	08 9622 0200
Drainage design & Salinity Control	Salinity Branch	Department of Environment	08 6364 6500
Public water protection	Water Source Protection Branch	Department of Water	08 6364 7600
Storage and transport of dangerous goods	Resources safety division	Department of Consumer and Employment Protection	08 9282 0777
Use and handling of chemicals and pesticides	Environmental Health Division	Department of Health	08 9388 4999

APPENDIX D - Sensitive water resources

Clean water resources, used for drinking water, sustaining aquatic and terrestrial ecology, industry and aesthetic values, along with breathable air, rank as the most fundamental and important needs for viable communities. These water resources should remain within specific quality limits, and therefore require stringent and conservative protection measures. Guidance on water quality parameters necessary to maintain water values are published in the *National Water Quality Management Strategy Guidelines* (see internet site www.deh.gov.au/water/quality/nwqms/index.html).

The Department of Water strives to improve community awareness of catchment protection measures for surface water and groundwater aquifers as essential elements in a multi-barrier protection approach to maintain the quality of water resources and their values.

To be considered sensitive, water resources must support one or more of the environmental values described below. Any activity or a land use will pose a risk to water quality if contaminants are able to be washed or leached into sensitive water resources in discernible quantities. These water resources may be shallow groundwater accessed by water supply wells, surface waterways, estuaries, or wetlands. Community support for these values, setting of management objectives for water resources and implementation of a practical attainment strategy are seen as key elements in protecting and restoring the values of these water resources.

Sensitive water resources include:

- a. Those proclaimed or assigned as Public Drinking Water Source Areas (ie Water Reserves, Catchment Areas or Underground Water Pollution Control Areas) via the *Metropolitan Water Supply, Sewerage and Drainage Act 1909*, the *Country Areas Water supply Act 1947* or the *Health Act 1911*.
- b. Those used as private drinking water supply sources (ie for human or stock consumption).
- c. Waters with specific quality necessary to support commercial or industrial activities eg aquaculture, food processing or crop irrigation.
- d. Wetlands and waterways- pristine or conservation-valued, (not highly disturbed, unless subject to active management to restore historic environmental values), and detailed as follows:
 - Policy areas covering water resources defined via Part III of the *Environmental Protection Act 1986* eg *Environmental Protection (Swan Coastal Plain Lakes) Policy, 1992*;
 - Waterways managed under the *Waterways Conservation Act 1976*, ie the Avon, Peel-Harvey, Leschenault, Wilson Inlet and Albany Waterways Management Areas;
 - The Swan-Canning Estuary and adjoining lands administered via the *Swan River Trust Act 1988*;
 - Wetlands of regional, national and international importance, including but not limited to: Conservation category wetlands (CCW) and Resource Enhancement category wetlands (REW), *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992*, and wetlands listed within *A Directory of Important Wetlands in Australia* (see the Australian Department of Environment and Heritage internet site which also provides information on Ramsar convention sites): www.deh.gov.au/water/wetlands/database/directory; and
 - Groundwater aquifers that sustain important ecological functions.
- e. Locations where surface water or water drawn from the ground water table may be consumed or inhaled affecting people's health or well-being, eg garden, recreation facility or irrigation sources.
- f. Surface water bodies and wetlands meeting recognised cultural or social needs, eg water resources used for community swimming, fishing or valued for their visual appeal.

Where a conflict arises between this Department's recommendations 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 if the Department's recommended protection measures were used.