

# Water Quality Protection Note

## ROADS IN SENSITIVE ENVIRONMENTS

### Purpose

The Department of Environment is responsible for managing and protecting Western Australia's water resources. The Department is also a lead agency for water conservation and reuse. This note

- Provides our current considered views on road siting, construction and management
- Guides on acceptable practices used to protect the quality of the State's water resources
- Provides for future development of environmental guidelines or code of practice that seek to balance the views of industry, government and the community, while sustaining a healthy environment.

Roadway, drainage and bridge works are vital links in the social and economic life of the community. However they require good site selection, planning or construction, maintenance and incident management during their operational life to avoid harm to water resources. Issues include land clearing, preventing turbidity and petroleum derivatives in stormwater run-off, solvent loss from bitumen preparation, spread of vegetation dieback disease, chemical spills during transport accidents, waste losses during maintenance and clearing, and environmental damage caused by those who access a sensitive environment via the road. Use of effective pollution prevention and risk management measures during the design, construction, operation and maintenance of roadways can help minimise these problems.

This note provides a general guide on issues of environmental concern, and offers potential solutions based on professional judgement and precedent. Anyone may propose alternative, innovative yet practical environmental solutions suited to local conditions. The note's recommendations should not be used by regulators in place of a site-specific assessment of a project's environmental risks. Any conditions set should consider the values of the surrounding environment, the safeguards in place, and take a precautionary approach. This note may not be used as this agency's policy position on a specific matter, unless confirmed in writing by an authorised officer. The recommendations in the note do not constitute or override the requirements of any Acts, Regulations, By-laws or Government policy. The note may also be varied at our discretion, as standards change or new data becomes available.

### Scope

This note applies to all new or upgraded roadways (sealed or unsealed) and associated works such as bridges and drainage that could affect sensitive environments (see description overleaf). The note aims to cover all phases of the lifecycle of a roadway, from feasibility studies and planning, to construction, operation and maintenance, and possible closure and environmental restoration.

## **Sensitive environments (water resources) covered by this note include:**

- a. Those declared or assigned as Public Drinking Water Source Areas (i.e. Water Reserves, Catchment Areas or Underground Water Pollution Control Areas).
- b. Those used for private water supply sources (meeting human drinking or stock supply needs).
- c. Waters with specific quality requirements used to support commercial or industrial activities e.g. aquaculture, food processing or crop irrigation.
- d. Aquatic ecosystems- 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 features as defined via the *Environmental Protection Act 1986*;
  - Waterways managed under the *Waterways Conservation Act 1976*;
  - The Swan-Canning Estuary and adjoining lands managed via the *Swan River Trust Act 1988*;
  - Wetlands of regional, national and international ecological importance, including: Conservation Category Wetlands (CCWs) and Resource Enhancement Wetlands (REW) as defined by this agency, *Environmental Protection (Swan Coastal Plain Lakes) Policy*, 1992, Ramsar convention listed, and via *A Directory of Important Wetlands in Australia* (ANCA, 1996); and
  - Unconfined groundwater that sustains any ecological functions.
- e. Locations where surface water or water drawn from the ground-water table, may directly contact people and affect their health or well being; e.g. garden or recreation facility irrigation sources.
- f. Surface water bodies meeting significant and publicly recognised cultural or social needs, e.g. waters used for community swimming, fishing or valued for their visual appeal.

The note covers roadways used for vehicle movement only, not walk-ways, stock routes or bridle trails.

## **Recommended best management practices**

### **Siting of roads**

#### **Harmony with the local environment**

1. Roadways, any associated drains and bridges should (if practical) blend into the natural landscape and ecology of the site. The number of waterway crossings should be minimised. These crossings should create the least practical interference with the natural flow and aquatic habitat of the waterway. Environmental features need careful consideration when planning for roadways, e.g. topography, drainage patterns, soil types, climate, ecology and existing land use. Clearing of vegetation and recontouring should be minimised, natural vegetation and buffer areas preserved, sensitive land and water areas that provide water quality benefits protected (e.g. land-based plants dependant on sheet stormwater run-off, the ecology of wetlands and indigenous aquatic fauna). Areas susceptible to erosion and sedimentation should be avoided, unless in a disturbed part of an otherwise near-pristine area. Other aspects that need to be addressed include managing plant disease risk e.g. *Phytophthora cinnamomi*, and degradation of remnant native vegetation by weed invasion and human contact.

#### **Buffers to sensitive environments**

2. Perennial indigenous vegetation buffers should be retained or be re-established between any roadway and water supply wells, surface drainage channels, rivers, streams, and wetlands. These buffers will lower the immediate contamination risk to waters, act as contaminant filters and should allow time for effective remedial action in the event of a chemical spill incident. These buffers may need to be supported by other protective measures e.g. roadside depressions to capture chemical spills along designated industrial transport routes. These buffers should be wide enough to be self sustaining, and (where practical) fenced to exclude people, vehicles and stock intrusion.

## Protection of riparian and wetland vegetation

3. Where the footprint of roads and bridges will harm areas of waterway and wetland dependant vegetation they should be either relocated or if this is impractical, the impact minimised. These vegetated areas provide significant water quality benefits through their ability to sustain aquatic ecosystems and filter pollutants in stormwater run-off . Roadways should therefore be placed sufficiently high in the landscape to permit retention of waterway or wetland-dependant vegetation, and allow for the effective operation of filter zones and sediment control works.
4. **Public roads in sensitive environments** should only be located on land zoned as a road reserve by the Department for Planning and Infrastructure, the Department of Land Administration or the Local Government Authority (LGA).

## Consultation

5. This agency and the community should be consulted when any roadways are proposed through or near any potentially sensitive environments. This ensures that transport corridors are negotiated well in advance of road construction; so they are suitably located, constructed, operated and maintained with an appropriate balance of environmental as well as social and economic consideration. Any road-works proposed within **500 metres** of a sensitive environmental feature should be referred to this agency's regional office for assessment, with supporting information addressing the environmental risks.

## Public Drinking Water Source Areas (PDWSAs)

6. These are areas declared via the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* or the *Country Areas Water Supply Act 1947*. They provide for the management and protection of waters used for public drinking water supplies. PDWSAs include Underground Water Pollution Control Areas, Water Reserves and Catchment Areas.
  - a. Within Priority 1 PDWSAs, well-head and reservoir protection zones: This agency normally opposes new roads in these areas, as they are incompatible with our risk avoidance policy. Roads may occasionally be conditionally approved, where the proponent shows that the road is needed to either lower the risks posed by present local transport routes or is vital to the State's interests.
  - b. Within Priority 2 PDWSAs: Our policy is to give approval with conditions to roads in these areas, provided the proponent demonstrates the road will not cause an increased risk to water resource functions and values. The conditions of approval should minimise the water contamination risks. Road-works in these areas should be developed with provision for both maximum traffic safety and minimum risk of environmental impacts e.g. from chemical spillage due to transport accidents.
  - c. Within Priority 3 (P3) PDWSAs: Roads are compatible with these areas, provided best industry design and construction practice is followed. These notes propose best environmental practice options for roadways.
7. Road developers should use scientific investigation and contaminant movement modelling to define protective buffers to reservoirs, bores and wells. The model should take into account the properties of any water contaminant (including its initial concentration, solubility and degradation potential, its method of movement and probable duration between its release point and the water supply source, meteorological effects, vegetation and soil filtering, and bio-chemical attenuation processes along the travel pathway, any synergistic effects in the environment, the receiving water quality requirements for its present usage and a suitable factor of safety so that the model is conservative. Such modelling does not override any statutory controls or the policy position of this agency related to protection of public water supplies.

8. Under some circumstances it may be impractical to carry out the scientific studies recommended above e.g. for small-scale developments or where a potential buffer zone has been severely disturbed. The default separation distance from road-works (where conditional or compatible) should be at least **100 metres** to drinking water source bores, the full supply level of storage reservoirs and their feeder streams.

### **Conservation-category wetlands**

9. Roadways and associated facilities e.g. parking bays, should not be constructed through or within natural wetlands with publicly recognised conservation values or their fringing vegetation buffer, unless approved either by the Minister for the Environment on the advice of this State's Environmental Protection Authority, or this agency.

Any such road development proposals should undergo environmental impact assessment in accordance with Part IV of the *Environmental Protection Act 1986*. Where passage through a wet environmental feature is unavoidable, a target of no change in its function should be achieved through offsets e.g. enhanced protection of a nearby equivalent water body or a constructed extension to the affected wetland to provide the same values and wetted area. For additional information on wetland categories, boundaries and buffer definition, see [Appendix A- References 5a & 5b](#).

10. Buffers are designed to protect wetlands from potential impacts while helping safeguard and maintain ecological processes and functions within the wetlands, and wherever practical, within the buffer. Wetland buffers are measured from the outside extent of the wetland boundary, which encompasses both waterlogged and inundated areas and the surrounding wetland-dependant vegetation. For current information on wetland boundaries and appropriate processes for defining buffers, contact our local regional office for the latest Wetlands Position Statement.

### **Environmental Protection Policy lakes**

11. The *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* prohibits the unauthorised filling, mining, drainage change, and effluent discharge into lakes, in accord with Part III of the *Environmental Protection Act 1986*. Roadways must not be constructed through, or otherwise harm such wetlands, unless approved either by the Minister for the Environment on the advice of the EPA or this agency.

### **Waterways**

Five Waterways Management Areas have been declared under the *Waterways and Conservation Act 1976* to provide special protection to estuaries and their associated waterways considered especially vulnerable to degradation. These areas are the Albany Waterways, Avon River, Leschenault Inlet, Peel–Harvey, and Wilson Inlet Management Areas.

12. If a development is located within a Waterways Management Area, written approval from this agency is needed.
13. To protect a waterway and its associated riparian area, a foreshore area or waterway buffer should be determined based on an assessment of the biological and physical features associated with the waterway, its values and pressures, as outlined in this agency's *Foreshore Policy 1-Identifying the Foreshore Area* (2002). The features to be used in the assessment are known as *bio-physical criteria*.

This approach to buffer setting allows flexibility and site-specific decision-making by considering a range of criteria and negotiated outcomes, rather than using a standard buffer distance that may not match the local conditions. We consider this is a sustainable approach to waterway management, that does not restrict the social and economic opportunities for waterways, while adequately protecting their ecological values.

14. Details of how to use biophysical criteria to determine the size or width of a foreshore area or waterway buffer, including the underlying rationale, can be found in our Water Note 23 *Determining Foreshore Reserves* (2001) see Appendix A, Reference 5b. The onus is on the development proponent to demonstrate and justify the process and outcome of defining a 'foreshore area' on a case-specific basis.

### **Swan River Trust management area**

15. The Swan-Canning estuary and abutting reserves are managed by the Swan River Trust using the *Swan River Trust Act (1988)*. Written approval from the Trust is needed for any land or water based development that may have an effect on the estuary.

### **Other siting constraints**

16. A minimum vertical separation distance of 2 metres to the high (wet-season) water table should be retained for free-draining soils, to avoid waterlogging and allow for soil filtration of potential contaminants/ aerobic microbial action.
17. Other buffers may be needed to manage noise, light spill, or community safety.

### **Approval of road development or upgrades**

18. For summary details of approvals; relevant statutes, and managing agencies, see [Appendix B](#).

### **Road design**

19. Road-works crossing waterways should:
  - a. Not change flow regimes or cause storm event flooding of upstream land. For rivers and semi-perennial streams, bridges are preferred to fords, pipe-work or box culverts due to less interference with the water flow regime and aquatic habitat. The crossing should replicate the natural cross-sectional area and shape of the waterway so that flows are not concentrated or flooding risk increased. Summary information on the road crossing hydraulic calculations and backwater impacts should be provided to this agency with any development submission.
  - b. Avoid creating barriers or impediments to migration of aquatic fauna. The number, sizing, shape and location of any culverts should be selected to minimise the impacts on fish habitats. Techniques, such as ensuring sufficient light in crossings and fitting rock baffles or other flow velocity controls along the base of culverts, can be used to make fish passage easier. Fish-ways or fish ladders can also be installed to allow migrating fish to overcome these barriers in their path. Several types of fish-ways can be built to provide passage along the length of the river. For more information see our Water Note 26 *Simple fish-ways* (2002)-see Appendix A Reference 5b, or contact our nearest regional office.
  - c. Avoid (where practical) alteration to natural waterway beds and banks.
  - d. Incorporate measures to prevent significant erosion of stream banks.
  - e. Avoid crossings at channel bends or at angles much less than 90 degrees to the flow channel; and
  - f. Avoid meandering or dynamic waterways where the channel change process is active and is likely to continue in the future. Crossings interfere with this natural process of meander progression and structural damage to bridges may occur, as well as increased channel erosion.

A diagram is provided at [Appendix C](#), illustrating environmental protection measures at waterway crossings.

20. The following measures should be used (where reasonable and practical) in sensitive environments to limit the risks and effects of transport accidents, especially where traffic densities may be high:

- a. Sight distances (horizontal and vertical) should be suited to the intended road use, seasonal weather patterns and designated vehicle speed limits;
- b. Slow vehicle passing lanes installed on major transport routes;
- c. Advisory and hazard warning signs maintained, but deter erection of distracting advertising signs;
- d. Broad road shoulders installed to allow for vehicles to safely pull off the roadway in an emergency;
- e. Suitable carriage-way buffers provided to trees and service poles, especially on bends;
- f. Intersections minimised, and use of turnout lanes, median strips and roundabouts;
- g. Reflective road markers and vibration strips used to define lanes and indicate deviations on tourist and transport routes;
- h. Where gradients are steep, guard railings installed and brake fail arrester beds for heavy transport.

### Unpaved roadways

- 21. These should be avoided (if practical) as they may lead to more traffic accidents and turbid stormwater run-off. Where a paved surface is uneconomical, roads should run parallel to the land contour, avoiding slopes exceeding 10 per cent to minimise erosion. Where roads in steep terrain are unavoidable, erosion prevention measures and drainage structures should be employed to limit environmental harm.

### Road drainage

- 22. Drainage systems should incorporate the principles of water-sensitive design. These techniques include kerb-less roads in flat terrain, vegetated roadside soakage swales, contaminant bio-filters and local stormwater disposal in built-up areas. Drains direct to natural waterways and wetlands with recognised social and ecological values should be avoided, unless effective measures are in place to control litter and chemical discharge as a result of transport accidents.

### Parking bays, stopping places and picnic areas

- 23. Where practical, these should not be placed in or immediately upstream of sensitive environments. Where unavoidable, they should be provided with managed toilet and litter disposal facilities. In public drinking water source catchments, such proposals should be referred this agency for assessment and response prior to their implementation.

### Road construction

- 24. **Erosion and sediment control:** Road designers or contractors should develop a site-specific erosion and sediment control plan to minimise environmental impacts of stormwater run-off during construction activities. The following sediment control measures should be included in the plan:
  - a. Clearing and exposed soil working surfaces kept to a minimum, and protected from stormwater erosion;
  - b. Silt fences and sediment traps optimally placed to prevent soil export to surface water bodies;
  - c. Vehicle wash-down facilities employed to remove excess soil when leaving construction sites. Wash-down facilities for mechanical plant or vehicles should be constructed and operated as recommended in our Water Quality Protection Note: *Wash-down of mechanical equipment*; and
  - d. Temporary entry or exit roads to construction sites should be provided with a coarse rock surface to prevent the transfer of soil off-site, where it may affect nearby drainage channels or spread plant dieback disease.

## Construction depots

25. These should be located as far as practical from sensitive environments. They should be located on gently-sloping, well-drained land.
26. Depot environmental protection measures include:
  - a. Raw material storage should be located where it will not be flooded or eroded. Where stormwater run-off may occur, settling ponds should intercept flows and provide sufficient detention or other effective means to effectively control turbidity; and
  - b. Fuelling facilities for vehicles and construction plant should follow the recommendations given in our Water Quality Protection Note: *Tanks- above ground chemical storage in sensitive environments*.

## Water supply

26. The availability of scheme or local water supply facilities should be taken into account when planning road-works. Waters taken from surface or groundwater sources may require a licence under the *Rights in Water and Irrigation Act 1914*. Information on regulated waters and licensing requirements may be obtained from our regional offices.

## Waste disposal

27. All wastes from portable sewage units, employee amenities (e.g. toilets, showers and crib rooms) should be either discharged to sewer or managed in accordance with the *Health Act 1911*, and the requirements of the Local Government Authority (LGA). Buffers of at least **50 metres** from on-site wastewater management and disposal facilities to surface waters should be used.
28. Any solid putrescible, hazardous or intractable waste generated on the site should be disposed of at a site acceptable to the LGA on advice from the Department of Health and our Environmental Regulation Division. See [Appendix A, Reference 5d- Guidelines for acceptance of solid waste to landfill](#).

## Chemical use and management

29. Waste or spilt construction site chemicals (e.g. fertilisers, fuel, herbicides, insecticides, oils, degreasers, anti-freeze, solvents for asphalt products, sealers, and paints), and wash-water associated with these materials should be stored, handled and contained to minimise their soakage or run-off to the environment. An option is to provide temporary containment compounds where these products are frequently used, such as fuelling areas and equipment washing areas. Secondary containment can prevent harmful chemicals from entering ground or surface water resources. For more information, see our Water Quality Protection Note: *Toxic and hazardous substances- storage and use*.

## Mechanical servicing

30. Routine plant and vehicle servicing involving liquids such as coolants, hydraulic oils, brake fluid, or lubricants should occur within weather-proof structures designed to contain fluid spills. The operator should install effective systems for the capture and export of waste liquids for recycle or approved disposal. All facilities and operations should be compatible with our Water Quality Protection Notes: *Mechanical servicing and workshops* and *Mobile mechanical servicing and cleaning*. This activity requires this agency's written approval within public drinking water source areas that are designated as *Underground Water Pollution Control Areas*.

## Workforce environmental awareness

31. Awareness programs for contractors and construction crews should be prepared and implemented, covering environmental protection (including water resource issues).

## Best management practices

32. Best management practices (BMPs) should be utilised to protect the environment and conserve water resources. Typical examples of BMPs can be found in our document: *A Manual for managing urban stormwater quality in Western Australia* (current version). BMPs may cover construction sites, operation and maintenance of roadways, drainage management and site restoration.
33. BMPs are used for temporary control of waste, chemical spills, erosion and polluted run-off. Examples for disturbed erosive soils include brush cover, straw bale barriers, silt fences and sedimentation basins. They may provide for inspection and maintenance of drainage, erosion and sediment control facilities after construction has been completed. Aspects include programmed inspections, temporary cereal crop cover and follow-up permanent vegetation seeding. Land stabilisation practices help to intercept polluted run-off from the operation of roadways or from erosion and sedimentation generated at small construction sites.
34. BMPs may also be used for permanent or long-term control. They may be both structural and non-structural. Some examples include erosion and sediment management using grassed swales, filter strips and stormwater infiltration areas. Post and mesh fencing/ protective barriers along road reserves will help in separating road users from sensitive areas and lessen fauna access to the road lowering the risk of accidents.

## Roadway operation and maintenance

35. Road, highway, and bridge operation and maintenance programs involve inspection, routine and season-specific maintenance, and repairs of not only highways and bridges, but also the rights-of-way where drainage control facilities are located. An infrastructure safety program should also be developed in conjunction with general inspection and maintenance programs.
36. Roadway operators should develop and implement a routine inspection and maintenance schedule, incorporating the practical measures to minimise contamination of nearby waters. Options include:
  - a. Mechanically sweep or vacuum-clean urban streets and associated parking bays;
  - b. Collect and remove dead animals and road litter; and
  - c. Ensure litter control e.g. via way-stop litter bins, verge clean-up campaigns and drainage litter traps.
37. The roadway owner or operator should as part of a regular program, undertake the following roadway measures to minimise transport accidents and contaminated run-off:
  - a. Inspect barriers, fences, erosion and sediment control devices;
  - b. Maintain retaining walls and pavements to minimise cracks and water damage;
  - c. Repair pot-holes to minimise risk of vehicle accidents;
  - d. Maintain stormwater energy dissipaters and velocity controls on open drains to minimise run-off velocity and soil erosion;
  - e. Dispose of accumulated sediment collected from detention ponds, drainage systems, and pollution control structures, and any wastes generated during maintenance operations in accordance with appropriate local and State controls;
  - f. Use techniques during bridge maintenance such as suspended tarpaulins, vacuum collection or booms to prevent paint spills, solvents and scrapings from becoming pollutants;

- g. When blading unpaved roads, take care to maintain a structurally sound surface while providing an adequate crown and drainage so that erosion or scattering of base materials is avoided; and
- h. Keep drainage ditches and turnouts free from accumulated debris.

### **Maintenance of verges**

38. The following preventative measures should be used to minimise verge erosion and minimise contamination of nearby waters:
- a. Use local native plants in roadside revegetation projects. Avoid planting deciduous or exotic plants, as their leaf litter contributes significant nutrient loads to water bodies and exotics may spread via seed movement along waterways, disrupting the natural ecology.
  - b. Mulch, seed and sparingly fertilise, or apply topsoil and perennial plants to damaged vegetated areas and slopes.
  - c. Establish environmentally safe programs for pesticide and herbicide use and nutrient management. For guidance on herbicide use restrictions near waterways and wetlands, see [Appendix A, Reference 5a](#).
  - d. Restrict herbicide and pesticide application in highway rights-of-way to certified operators, to ensure safe and effective application.
  - e. Follow supplier's recommendations on optimum application rates for chemicals such as soil stabilisers; dust palliatives, herbicides, pesticides and plant growth inhibitors. Try to avoid frequent use and consequent intrusion of such chemicals into surface stormwater run-off. Within PDWSAs, use of pesticides is limited by requirements of the Department of Health and our policy- *Pesticide use in PDWSAs*.
  - f. Regularly inspect, clean, reshape, and manage debris and vegetation in drains, ditches and swales to ensure they perform as effective drainage and contaminant filter systems. Keep ditch slopes covered with vegetation or other durable, non erosive material.
  - g. Maintain road shoulders, slopes and swales to assure their effective function and operation in protecting the road asset and the local environment.

### **Maintenance of bridges**

39. Where practical, pest control of timber structures should include the following measures:
- a. A pest-specific pesticide should be used so as to minimise the impact on other terrestrial or aquatic invertebrates.
  - b. Apply necessary pesticides using methods other than spraying.
  - c. Conform to the chemical registration conditions (normally shown as label directions).
  - d. Avoid treatment with soluble or mobile chemicals when rain is predicted within 48 hours.
  - e. Spillage control and capture measures should be in place prior to application to prevent pesticide entry into the waterway.
  - f. Pesticide operators should be qualified and experienced, and have received instruction on managing the local environmental risks.
  - g. All waste materials should be removed from the area for safe disposal at an approved site.

## Nutrient use and control

40. We recommend replanting disturbed land with native plant species endemic to the area, as these plants will reduce the need to apply fertilisers, need only initial watering and enhance habitat for native fauna. Fertilisers, where use is necessary to promote the growth of vegetation on disturbed earth, could contribute excessive nitrates and phosphates to surface waters.
41. Personnel qualified and experienced in soil testing and nutrient application should be involved to determine the least amount of fertiliser to apply in a given situation. Slow release fertiliser applications should be used and properly timed to maximise their delivery to growing plants and minimise their leaching and entry into run-off. For limitations on fertiliser application rates in sensitive environments, see our Water Quality Protection Note: *Irrigating vegetated land with nutrient-rich wastewater*.

## Performance audit

42. The road should be periodically inspected by government officers to audit the site operator's compliance with environmental and planning approval requirements.

## Accidents and emergency response

The risk of contamination to sensitive water resources increases with human access and the type of traffic using the road. Higher risks apply where roads provide for goods haulage and access to tourist destinations.

43. The risks and consequences in these areas should be defined at the road planning stage. Assessment should involve consultation with government agencies who manage the natural resources that could be affected by the roadway and its users.
44. A road may require location-specific BMPs to cope with accidental fuel or other chemical spillage. When a road is located within a sensitive environment in a remote location, response to a chemical spillage may take a long time due to the large travel distances from works depots. In this case, design of the road should include measures for interim spillage control and containment. These measures ensure the spill is contained while the response personnel are being mobilised. The road's proximity to emergency response facilities and risk of accidents should be considered during planning and design phase (consider associated costs for extra BMPs if located in remote locations).
45. Absorbent matter such as sand or inert litter should be readily available to assist clean-up of any waste spill. Any materials used for clean-up should be disposed of at an approved facility .

## Road closure and environmental restoration

46. Where a roadway is no longer required, its reserve should be de-proclaimed, the road closed and the roadway restored to a condition compatible with the adjoining land usage. This should include removal of the paved surface and redundant drainage structures, deep ripping of compacted road base, replanting of native vegetation and restoration of natural water-courses. Soil stabilisation, import of topsoil, limited fertiliser addition and establishment watering may be needed to ensure the replanted vegetation thrives.

## More Information

We welcome your views on this note. Feedback provided on this topic is held our file no. **12144**. The note will be updated periodically as new information is received or industry/activity standards change. Updates are posted on our Internet site: [www.environment.wa.gov.au](http://www.environment.wa.gov.au), click *water > drinking water > guidelines*.

If you wish to comment on this note or require more information, please contact the Water Source Protection Branch at our Hyatt offices in East Perth. Phone: (08) 9278 0300 (business hours); fax: (08) 9278 0585; or use *E-mail drinking water* at our Internet site: <http://drinkingwater.environment.wa.gov.au>, citing topic and version.

## Appendices

### Appendix A - References and further reading

1. Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ):
  - a. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* 2000; and
  - b. *Australian Guidelines for Water Quality Monitoring and Reporting*, 2000.
2. National Health and Medical Research Council (NHMRC); Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) Canberra: *Australian Drinking Water Guidelines*, 1996.
3. Environment Australia 1998: *Conservation guidelines for the management of wild river values*. See also the Internet site: [www.heritage.gov.au/anlr/code/arc.html](http://www.heritage.gov.au/anlr/code/arc.html) and contact our Catchment Management Branch for information on the location and management provisions for near pristine rivers in WA.
4. Environmental Protection Authority (WA) documents  
*Environmental Protection (Swan Coastal Plain Lakes) Policy* 1992

Refer to Internet site: [www.epa.wa.gov.au](http://www.epa.wa.gov.au) ;click *policies*.

5. Department of Environment documents:

a. **Policies and position statements-**

- *Foreshore Policy 1-Identifying the Foreshore Area*, WRC November 2002
- *Pesticide use in Public Drinking Water Source Areas*, WRC 2000
- *Position statement: Wetlands*, WRC 2001

These documents can be accessed on our Internet site: [www.environment.wa.gov.au](http://www.environment.wa.gov.au) , click water > policy.

b. **Guidance on waterways and wetlands -**

- *Encouraging Wise Use of Perth's Wetlands*, (broadsheet) 1995
- *Water Note 22- Herbicide use in wetlands*, WRC 2001
- *Water Note 23- Determining Foreshore reserve*, WRC October 2001
- *Water Note 26-Simple fish-ways*, WRC January 2002
- *Wetlands of the Swan Coastal Plain*, WRC & DEP 1996

These documents can be accessed on our Internet site: [www.environment.wa.gov.au](http://www.environment.wa.gov.au) ,click *Water> Wetlands* or *Waterways*

c. **Water Quality Protection Notes-**

- *Above ground chemical storage tanks in sensitive environments*
- *De-watering of soil*
- *Extractive industries*
- *Lining systems (non-rigid) to contain polluting matter*
- *Soil liners to contain low hazard waste*
- *Mechanical servicing and workshop facilities*
- *Mobile mechanical servicing and cleaning*

- *Soil filling in public drinking water source areas.*
- *Stormwater Run-off from Industrial Sites,*
- *Toxic and hazardous material storage; and*
- *Wash-down of mechanical equipment.*

These documents can be accessed on our Internet site: <http://drinkingwater.environment.wa.gov.au>, select *Guidelines* and scroll to *Water Quality Protection Notes*..

**d. Guidance general-**

- *Guidelines for acceptance of solid waste to landfill, DEP January 2001*
- *A Manual for Managing Urban Stormwater Quality in Western Australia ,WRC (current draft)*

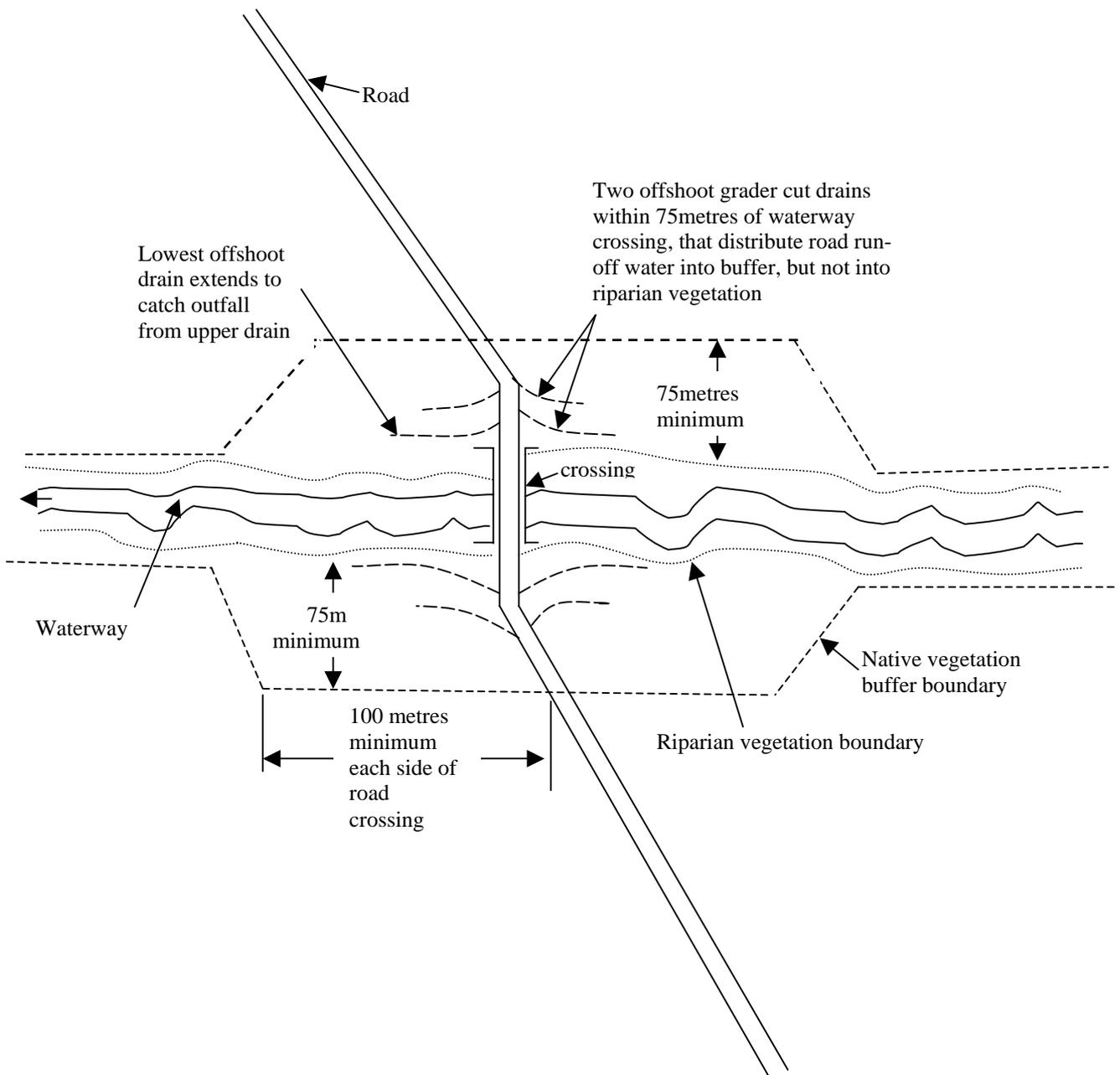
These documents can be accessed on our Internet site: [www.environment.wa.gov.au](http://www.environment.wa.gov.au)T, use- *search*.

**Appendix B - Statutory requirements include:**

<b>What's regulated</b>	<b>Regulatory agency</b>	<b>Statute</b>
Subdivision of land	<ul style="list-style-type: none"> <li>• WA Planning Commission/</li> <li>• Dept of Planning and Infrastructure (DPI)</li> </ul>	<i>Town Planning and Development Act, 1928</i>
Land zoning and development approval	<ul style="list-style-type: none"> <li>• Local Government (Council)</li> <li>• DPI</li> </ul>	<i>Town Planning and Development Act, 1928</i>
Impact on the values and ecology of land or natural waters	<ul style="list-style-type: none"> <li>• EPA (EP Act only)</li> <li>• Department of Environment – regional office</li> </ul>	<i>Environmental Protection Act, 1986</i>
Licence to take surface water and groundwater		<i>Rights in Water and Irrigation Act, 1914</i>
Industrial sites in existing public drinking water source areas		<i>Metropolitan Water Supply, Sewerage and Drainage (MWSS &amp; D) Act, 1909 or Country Areas Water Supply (CAWS) Act 1947</i>
Licence to discharge waters into managed waterways.		<i>Waterways Conservation Act 1976</i>
Approval for developments that may affect the Swan–Canning estuary	Swan River Trust	<i>Swan River Trust Act, 1988</i>
Storage of fuels, solvent, explosive and dangerous goods	Department of Industry and Resources	<i>Explosive and Dangerous Goods Act, 1961</i>
Discharge to sewer requires an industrial waste permit	Water Corporation/ other relevant sewer service provider	<i>MWS,S &amp; D Act, 1909 or Country Towns Sewerage Act, 1947</i>

**Note:** The former State Government agencies the *Department of Environmental Protection* and *Water and Rivers Commission* are presently being combined to form the *Department of Environment*. This process will not be complete until enabling legislation has been passed by Parliament and proclaimed. This note aims to present a generic ‘combined agency’ position on a specific topic.

## Appendix C – Waterway buffers- road crossing diagram



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