KUNUNURRA WATER RESERVE
DRINKING WATER SOURCE PROTECTION PLAN

Kununurra town water supply

INTERIM REPORT

Department of
Environment

Government of **Western Australia**
Department of **Water**

Important information

The *Kununurra Water Reserve drinking water source protection plan* (2003, WRP no. 51) was reviewed in 2012.

Please ensure you read the *Kununurra Water Reserve drinking water source protection review* (2012, WRP no.137) alongside the 2003 plan to obtain all of the information about this drinking water source.

The 2012 review considers changes that have occurred in and around the Kununurra Water Reserve since the completion of the 2003 *Kununurra Water Reserve drinking water source protection plan.* Additional recommendations have been prepared to ensure the ongoing protection of this public drinking water source area:

- The reduced boundary should be amended under the *Country Areas Water Supply Act 1947* (WA)
- The Shire of Wyndham East Kimberley town and local planning schemes should incorporate this plan and reflect the identified Kununurra Water Reserve boundary, priority 1 area and wellhead protection zones (see Figure A3) in accordance with *Statement of planning policy 2.7: Public drinking water source policy. (Shire of Wyndham East Kimberley)*

You can find the 2012 *Kununurra Water Reserve drinking water source protection review* at www.water.wa.gov.au > publications > find a publication > drinking water source protection reviews or by contacting the Department of Water on +61 8 6364 7600 or drinkingwater@water.wa.gov.au.

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Interim Report

Resource Management Division
Department of Environment

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Foreword

Status of this Interim Report

This **Interim Report** has been prepared to address growing concerns about the:

- protection of the only existing drinking water source supplying consumers in Kununurra; and
- land planning pressures that exist in Kununurra because of a shortage of suitable land for development.

A third important issue is that Lake Kununurra is part of the Lakes Argyle and Kununurra wetlands system that is listed under the Ramsar Convention on Wetlands.

These three issues are interrelated **but the purpose of this Interim Report is foremost to protect the water quality of the only currently available drinking water source to Kununurra**. Protection of this source is important to ensure the provision of a safe, good quality drinking water to protect public health now and into the future at a reasonable cost to consumers.

Should an alternative drinking water source be identified; approved by Government; and put in place, this Interim Report will be reviewed with the objective of helping reduce the shortage of land for development of Kununurra. The listing of the wetland area under the Ramsar Convention will also need to be addressed in any decisions that are made in the future.

The publication of this Interim Report is consistent with the Cabinet agreed *Public Drinking Water Sources Policy* released by the Western Australian Planning Commission in February 2003. Its release will provide for the necessary level of protection of the existing drinking water source in Kununurra through proclamation of a revised, smaller, Kununurra Water Reserve area (see Figure 5). Deproclamation of the existing Water Reserve will also release land that could be considered to meet some of the current land development pressures in Kununurra.

Drinking Water Source Protection Plans

The Department of Environment is responsible for managing and protecting Western Australia's water resources. The Department has developed specific legislation and policies for public drinking water source areas (PDWSA) that allow for proclamation of these areas and identification of priority classification areas and special purpose protection zones to protect the quality of the water in these PDWSA (see Appendix 1 for details).

Drinking Water Source Protection Plans help protect the health of consumers by recommending how to improve or maintain the quality of water held in our surface or underground drinking water sources. The plans identify the significance of a drinking water source; areas of potential contamination of that source related to the land uses and activities in its catchment or recharge area; and set out programs for better management of the catchment or recharge area. The plans are developed in consultation with affected landowners, industry groups and relevant State and local government agencies.

The Department of Environment (DoE) works pro-actively with planning agencies to incorporate drinking water protection in the land planning process. This is because decisions on the type of landuse or activity that is approved in a public drinking water source area has a significant impact on the quality of the water we drink. The Department supports the amendment of Town Planning Schemes and Planning Strategies that reflect landuses/developments compatible with Drinking Water Source Protection Plans.

This Drinking Water Source Protection Plan provides a basis for establishing compatible landuses/development in Kununurra and is a mechanism for practical implementation of the Department's public drinking water protection strategies. Local government decision-makers, State planning authorities and operational staff can utilise this document as a basis for ensuring the protection of this important groundwater resource.

Contents

Maps

List maps in book pocket

Figures

Tables

Summary

Kununurra is located on the Ord River in the Kimberley Region of Western Australia It is the commercial and administrative centre for the Ord River Irrigation Area.

The Kununurra town water supply is obtained from bores in an unconfined aquifer on the northern bank of Lake Kununurra.

The bores are vulnerable to contaminants entering the aquifer via recharge from Lake Kununurra and, to a lesser extent, by infiltration of rainfall. Therefore, careful management of landuses above the aquifer is necessary to protect the resource. There are currently incompatible landuses in the aquifer's recharge area, for example, a caravan park with a boat launching area.

Agricultural and recreational activities in the Ord River catchment, upstream of Lake Kununurra and on the Lake itself, can also indirectly impact water quality in the aquifer.

The Kununurra Water Reserve was proclaimed in 1970 to protect water quality in the aquifer. This plan proposes to rationalise the Kununurra Water Reserve by reducing its area to the land bound by the M1 channel (to the east), low water mark of lake Kununurra (to the south), low water mark of the western boundary of Lily Creek Lagoon [excluding the existing caravan park in this area] (to the east) and along Victoria Highway until Ivanhoe Road where it will run across to the M1 channel about 300 - 400 m north of Victoria Highway road reserve (Figure 4).

All of the proposed new Kununurra Water Reserve area will be classified as Priority 1 (P1) source protection. This classification recognises existing approved landuses but limits any future development and expansion of existing landuses in the area consistent with the Department of Environment's: Land Use Compatibility Table published in the *Water Quality Protection Note, Land Use Compatibility in PDWSA* (Appendix 1). This Note also forms the basis of landuse development advice in the Western Australian Planning Commission's *Public Drinking Water Source Policy*.

The existing privately-owned Kona Lakeside Tourist Park (KLTP) is located in a key recharge area of the Water Reserve, as such it is also classified for P1 source protection.

Signs indicating the location and significance of the reserve should be erected. Any development proposals within the reserve should be assessed for impact on water quality and be consistent with the Departments *Land Use Compatibility in PDWSA* for P1 areas.

This plan recommends that monitoring of production wells should include scanning for pesticides, pathogens and nutrients as possible contaminants from Lake Kununurra, the wastewater treatment plant, KLTP, the stormwater drain and a suspected decommissioned landfill. **The plan also recommends that an assessment be undertaken of alternative water sources for Kununurra, and the results presented to Government.**

1 Introduction

Kununurra is located on the Ord River in the Kimberley Region of Western Australia (Figure 1). The town is in the Shire of Wyndham-East Kimberley and is the commercial and administrative centre for the Ord River Irrigation Area (ORIA). The ORIA consists of the irrigated areas of the Ivanhoe, Packsaddle and Weaber Plains. Lake Kununurra itself is part of the Lakes Argyle and Kununurra wetlands system that is listed under the Ramsar Convention on Wetlands.

Kununurra experiences a tropical climate with monsoonal rain falling during the period from December to March. Rainfall is variable with daily rainfall high during the monsoonal period. The average annual rainfall is 745 mm.

Kununurra's town water supply is obtained from a wellfield located on the northern bank of the Ord River Diversion Dam reservoir (Lake Kununurra). The wellfield is about 2.5 kilometres (km) south-west of the town and at the most southerly extension of the Ivanhoe Plain.

The current Kununurra Water Reserve (KWR) (proposed to be reduced in size consistent with this plan) was proclaimed under the *Country Areas Water Supply (CAWS) Act* (1947) in 1970 to protect water quality in the aquifer (Figure 2).

2 Hydrogeology

The hydrogeology of the Kununurra area has been described by Laws (1983, 1991), George (1983), McGowan (1983), O'Boy et al (2001) with additional modelling occurring in 2003 for this report. A summary of the hydrogeology follows.

An unconfined aquifer occurs within the surficial sediments of the Ivanhoe Plain. The coarser sand and gravel units are the main transmissive zones beneath the plains.

Near the wellfield, groundwater modelling by the Department shows that the groundwater flow direction is from Lake Kununurra northward to the Ord River, downstream of the Diversion Dam. Groundwater recharge for the wellfield is predominantly derived from Lake Kununurra with some potential minor influence from the M1 supply channel. The 2003 modelling also indicates that any new bores established to the east of the existing bores to meet future drinking water needs will also predominantly be recharged by water from Lake Kununurra around to the entrance of Lily Creek.

Monitoring studies indicate direct rainfall infiltration is unlikely to make a significant contribution to aquifer recharge because of the low permeability of the overlying clayey soils. However, even though the overlying clayey soils have a low permeability, the aquifer is still considered vulnerable to contamination from landuses due to the close proximity of the water table to the surface and the narrow surface clay layer.

Existing production bores are drilled to depths of about 30 m into continuous sand and shingle beds of the Ord River alluvial deposits which overlie Upper Devonian quartz sandstone. The sand and shingle beds are overlain by up to 4 m of surface clays grading down into about 8 m of sandy clays. The depth to the water table is about 6 m and the aquifer thickness is about 24 m.

Salinities measured in all bores have generally been below 300 mg/L and show no long-term trends.

High manganese concentrations in the bores have previously caused problems with plumbing fixtures, taste and laundry staining. The variation in manganese concentrations within the groundwater system is due mainly to pH-Eh conditions that vary over small distances rather than proximity to recharge areas, groundwater salinity or bore depth (Holmes 1995).

Although periodically high values of iron have been recorded, the concentrations have remained under 0.3 mg/L in all bores since 1987. This is the limit set by the National Health and Medical Research Council (NHMRC) for aesthetic considerations.

With the exception of the variable iron and elevated manganese concentrations, the aquifer is performing satisfactorily with no adverse water quality trends.

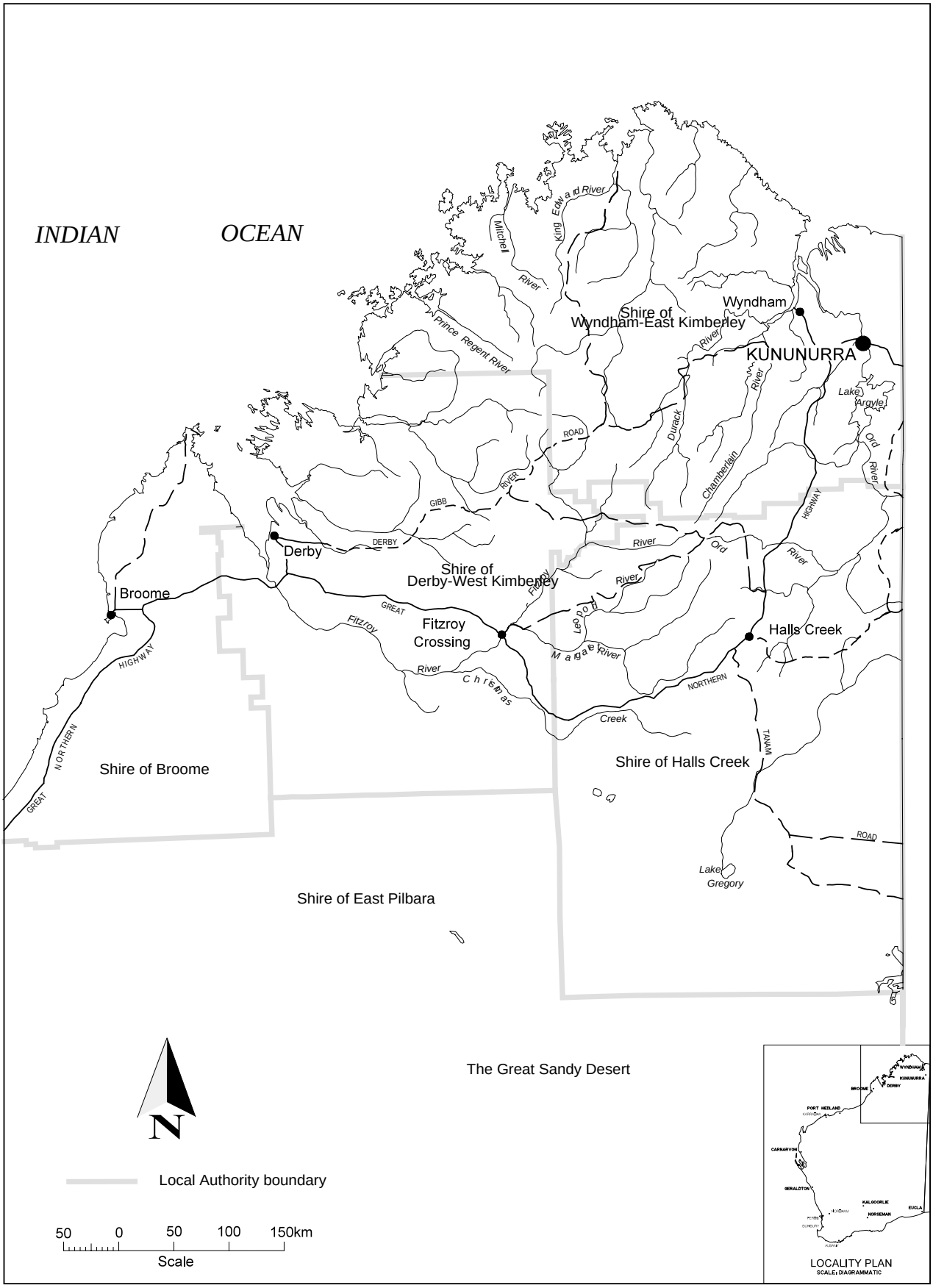

Figure 1. Kununurra locality map

3 Scheme description

The wellfield comprises 5 production and 4 monitoring bores (Figure 2). The equipped production bores are designated 2/69, 3/69, 1/70 (6), 1/89 and 1/95. Typical bore headworks are shown in Plate 1. The four monitoring bores are designated 2/65, 1/68, 1/69 and 3/82.

Current wellfield configuration is able to meet demand from the Kununurra Town Water Scheme and no adverse trends in aquifer storage or water quality are evident.

The untreated water is pumped to a collector tank and pump station where it is aerated and chlorinated to precipitate dissolved manganese. The treated groundwater is then settled and filtered prior to additional chlorination and reticulation to storage tanks.

Alternative sources for Kununurra's town water supply may include both surface and groundwater sources. However, until alternative sources are investigated and approved for their suitability and viability, protection of the currently used public drinking water source area is essential for provision of a safe, good quality drinking water supply. The demand for and cost of developing alternative supplies would be an important factor in any decision to reduce the protection measures proposed in this management plan.

These potential additional sources include extraction directly from Lake Kununurra, from bores on Ivanhoe Plains and/or Packsaddle Plains, from possible gravels on the eastern bank of the Ord River, upstream of the existing wellfield, from beneath the golf course west of the KWR, and from Lake Argyle. All of these sources pose issues that make them considerably less viable than the existing source (Table 1). However, it is recommended that possible alternative water sources should be assessed and advice provided to government on all environmental, social, and economic implications of sources.

Table 1 on page 8 summarises risks and consequences for implementing each of the suggested alternate sources.

Figure 2 on page 6 shows how the investigation of alternative sources will affect the Land Use Planning (LUP) and Drinking Water Source Protection Planning (WSPP) processes.

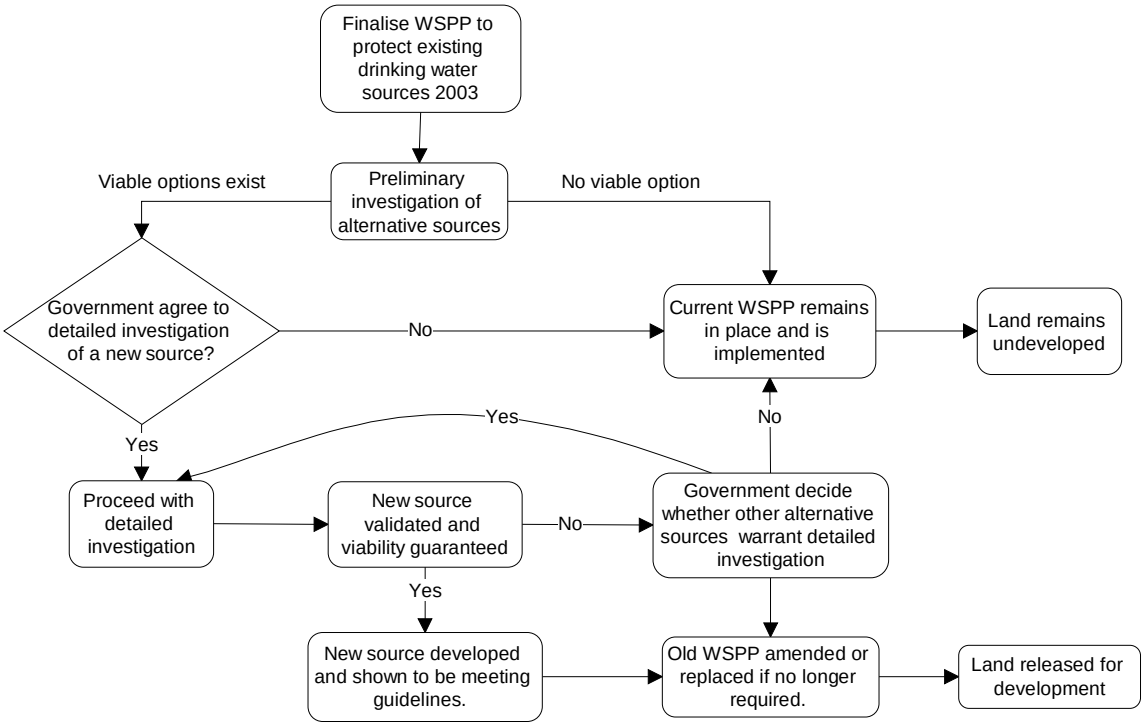

Figure 2. Flow chart for investigation of alternative town water sources for Kununurra

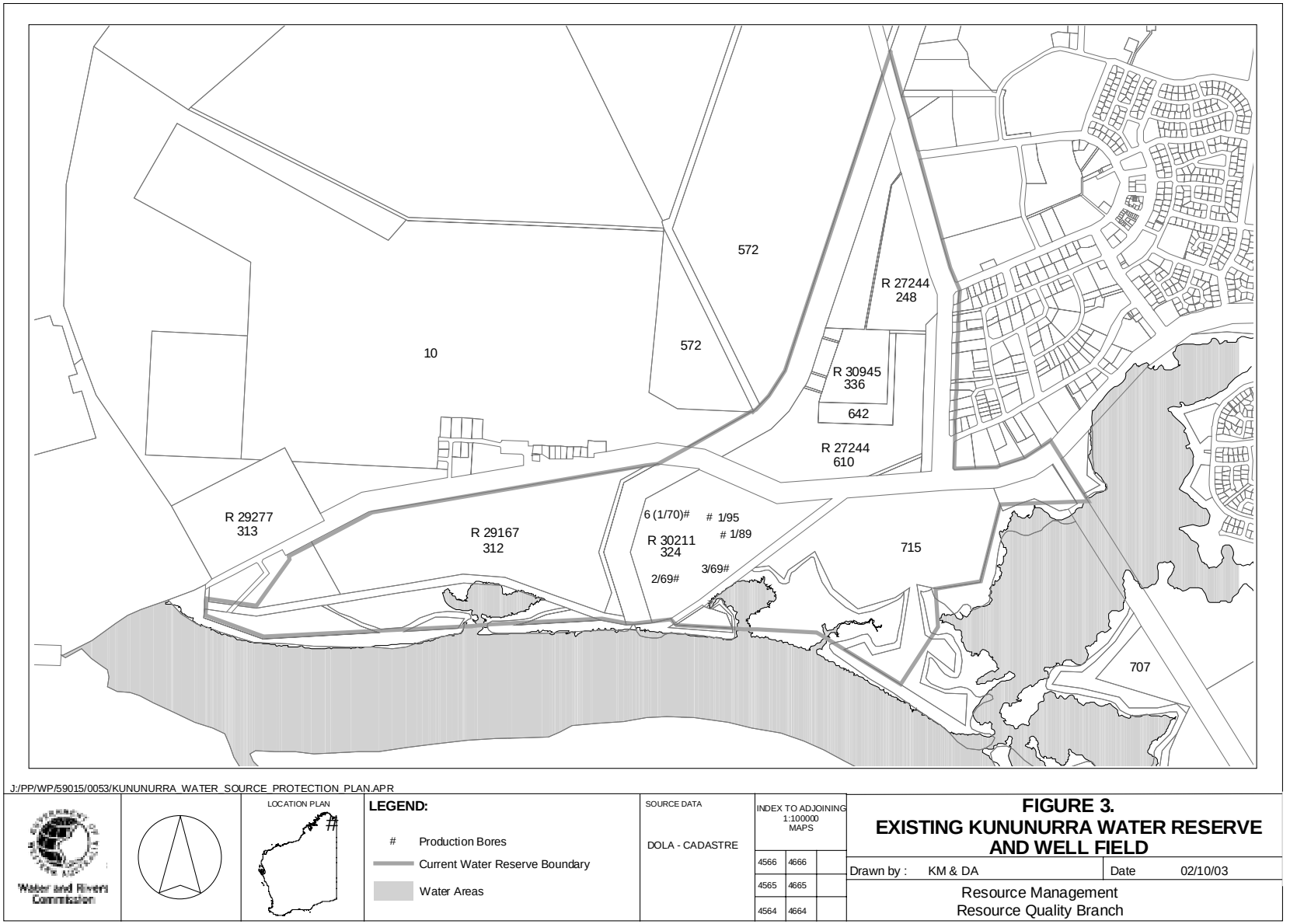

Figure 3. Existing Kununurra Water Reserve (Figure 5 reflects proposed new boundaries)

Table 1: Summary of risks and consequences for implementing each of the suggested alternate town water sources for Kununurra

Source description	Risks	Level of risk	Comments and consequences
Lake Kununurra	Pathogens from recreational contact such as swimming, canoeing, boating. Hydrocarbons from boating and aeroplane activities.	Extreme	To use Lake Kununurra as a source, a highly sophisticated and expensive treatment plant combined with the prohibition of all recreational activities on the Lake would be necessary. It is extremely unlikely that the Community would accept prohibition of all recreational activities on the Lake, but without these conditions the source would deliver a less reliably-safe drinking water to the community
Golf course	Hydrocarbons from additive used to stabilise sand greens. Nitrogen from fertilisers applied to fairways. Herbicides used to control weeds.	High	It is likely that the aquifer beneath the golf course is contaminated with hydrocarbons used as sand stabiliser for the greens, herbicides to control weeds and fertilisers to make the fairway grass grow. Moving the wellfield to this area would be subject to investigations proving that the aquifer extends beneath the golf course and that there is no contamination. A new wellfield, however, would require the same limitations on foreshore activities as the existing reserve, and would also require the closure of the golf course.
Ivanhoe Plains	Nitrogen from fertilisers applied to crops. Herbicides and pesticides used to control weeds and pests. Spilled hydrocarbons from handling and storing fuel. Rising salinity due to rising water levels from irrigation.	Extreme	Although there are extensive gravels beneath the Ivanhoe Plains, they lie beneath intensive irrigation areas and therefore are at risk from contamination from pesticides and from increasing salinity related to rising water levels from irrigation. Such sources would also be unlikely to meet the ADWG (2003). Irrigation practices within the catchment zones to each production bore would also have to cease.
Packsaddle Plains	Same as above	Extreme	Same as above
Northern shore of Bend on Ord River 6 km south-east of town near Maxwell Plains	Pathogens from recreational contact such as swimming, canoeing, boating. Hydrocarbons from boating activities.	Medium	Investigations carried out to locate water supplies for aboriginal reserves indicated that while limited resources were available, they could not compare in quantity and quality with the existing town supplies. Gravel aquifers are not extensive in this area.
Lake Argyle	Pathogens from recreational contact such as swimming, canoeing, boating. Hydrocarbons from boating and aeroplane activities. Nitrogen from food used to feed Barramundi involved with a large aquaculture project.	Medium	To use Lake Argyle as a source, a highly sophisticated and expensive treatment plant combined with the prohibition of all recreational activities on the Lake would be necessary. Additionally, while there is ample water in Lake Argyle the economics of constructing a 60 km-pipeline and ancillary works are likely to be prohibitive. It could also be necessary to relocate the aquaculture venture from the Lake. As this venture's targets for fish production have recently been upgraded from 500 to 2,000 tonnes per year there would be major economic costs involved.

4 Existing and proposed landuse of the proposed water reserve

The immediate area around the production bores in the proposed wellfield is a Land Act reserve vested with the Minister for Water Resources. The reserve comprises uncleared bushland. The main irrigation channel (M1) forms the western boundary of the wellfield.

The eastern portion of the Water Reserve is Unallocated Crown land with areas set aside for wildlife reserves. A privately-owned caravan park/tourist accommodation area, Kona Lakeside Tourist Park (KLTP), is located on land near the Kona Inlet, within the proposed Water Reserve). KLTP lease the foreshore reserve surrounding their property from joint vestee's, SWEK and DoE. The remaining foreshore reserve within the water reserve is also jointly vested with SWEK and DoE.

Another Caravan Park (Kimberlyland) is located outside the north-east border of the Water Reserve (Figure 3). Recreational activities such as boating and swimming are conducted from both caravan parks.

Several tourist operators including boat cruises and float plane tours. are located on the north shore of Lake Kununurra.

The Water Corporation's wastewater treatment ponds are located north of the proposed Water Reserve. The treatment ponds are surrounded by land vested with the Department of Conservation and Land Management (DCLM for public purposes (arboretum).

The Packsaddle Plains on the Ord River catchment, upstream of the Water Reserve, are used for agricultural purposes. An area immediately adjacent to the Lake, known as Packsaddle Swamps, is a proposed conservation reserve, vested in and to be managed by Department of Conservation and Land Management (DCLM). The Lakes Argyle and Kununurra wetlands system is also listed as a Ramsar wetland area.

Durack Tourist Park is proposed to cover the eastern portion of the proposed water reserve. Numerous incompatible and conditional activities (section 5 – Tourist/Caravan Parks) would be associated with such a development

5 Potential for contamination

The aquifer has various potential contamination pathways. It is vulnerable to contamination from Lake Kununurra and from pollutants infiltrating from the ground surface.

The following landuses have been identified as having potential to impact on drinking water quality. Figure 4 shows their general locations.

Recreational activities

Recreational activities in and around Lake Kununurra such as swimming, boating, canoeing and fishing, bush walking, camping and exercising animals all increase the risk of contamination by increased access, pathogen transfer and spillage of chemicals such as fuel. The concentration of contaminants entering Lake Kununurra from these sources is significantly reduced before it is extracted from the existing bores by the Lake dilution and by filtration through the gravels and soils of the aquifer. However, a large contaminant load such as a houseboat accidentally discharging its sewage storage tanks or a hydrocarbon spillage, will significantly increase the risk of these contaminants reaching the existing drinking water bores.

Stormwater run-off

It is acknowledged that run-off from the town via a stormwater drain into the old borrow pits east of the existing wellfield could be seen as a potential source of contaminants. An inspection of the area shows that this run-off is channelled through the borrow pits and then into Lily Creek and Lake Kununurra. Dispersion and attenuation of runoff infiltrating the soil profile, followed by considerable dilution within the Lake, and filtration through gravels and soil significantly reduces any potential problems. Furthermore, even if a significant contaminant load were to be discharged into this drain, groundwater modelling indicates that under the present pumping regime, groundwater flow through the region of the receiving area of the drain (old borrow pits) does not reach the existing bores.

However, any future development of the wellfield to the east would need to consider possible impacts of contaminants coming from this source.

Reported decommissioned landfill site

It is reported that the old borrow pits, created to build the Kununurra Diversion Dam, were used as a landfill site before the water reserve was proclaimed in the mid sixties. It was apparently covered with dirt and never cleaned up. Reports are yet to be verified. However, there has been no evidence of contamination of groundwater from the town wellfield that can be attributed to the presence of an old refuse disposal site. The water source is monitored regularly to ensure it meets the ADWG. Observation bores should also be installed between the production bores and the reported decommissioned landfill and monitored regularly.

In addition, the groundwater modelling that has been undertaken to enable the Department to reduce the size of the KWR indicates that under the present pumping regime groundwater flow through the region of the alleged site does not reach the existing bores. However, if the wellfield were to be extended to the east within the KWR, the alleged waste disposal site may need to be rehabilitated.

Agricultural activities near Lake Kununurra (irrigation areas)

Agricultural practices on the irrigated land could pose a risk of contamination from nutrients and pesticides. Pesticide residues have been reported in the Lake by various studies conducted by the Geological Survey of Western Australia and the Chemistry Centre of Western Australia. However, concentrations are below recommended drinking water guidelines.

Tour operators

The boat cruise and float plane operators use refuelling facilities located over water (Plate 2). The boat cruise operator has an above ground storage tank located on the old irrigation pump house structure. The tanks are bunded, however it is likely the tanks are filled from a bowser with fuel lines. The float plane operator refuels the aircraft from the floating pontoon. Spillage of fuel from either of these sources is possible.

The Shire of Wyndham-East Kimberly (SWEK) is currently considering applications from other tourist operators wanting to operate incompatible activities within the proposed Water Reserve. An independent consultant employed to recommend suitable alternative locations has identified that these operators would be best placed west of the M1 channel which is outside the proposed Water Reserve.

Wastewater Treatment Pond

The wastewater treatment ponds are located in the northern section of the current Water Reserve (Plate 3). The treated effluent is discharged to the main irrigation channel. Groundwater modelling carried out by the Water and Rivers Commission in 1999 indicates this discharge is down-gradient of the wellfield and will not be drawn into production bores at the current rate of abstraction.

If expansion eastwards of the existing wellfield is required, further groundwater modelling should be undertaken to determine if there is potential to draw groundwater into the wellfield from beneath the treatment ponds. If this is a possibility, it is recommended that appropriate monitoring be undertaken for leakage from the ponds and/or consideration be given to relocating the treatment works and ponds.

Caravan Parks/Tourist accommodation

KLTP is connected to a sewer that discharges into the town wastewater treatment ponds. No septic systems exist within this part of the Water Reserve. All the foreshore land surrounding KLTP's pocket of private land is Crown, owned and jointly vested in the Department of Environment and SWEK. Future lease conditions will ensure risk of contamination is minimised. Observation bores should be installed between the production bores and KLTP and monitored regularly.

According to the Commission's Water Quality Protection Note *Land Use Compatibility in Public Drinking Water Source Areas*, incompatible activities conducted within the KLTP include shops, reception centre, office, park home park, motor vehicle washing, fast food outlet, convenience outlet, car parking and recreational activities such as boating and swimming. Conditional activities conducted within the KLTP include the provision of toilet blocks and change rooms, and a caretaker's dwelling.

Boat launching facilities on Lake Kununurra

Boat launching facilities on Lake Kununurra are of an informal nature using cleared tracks through to the edge of the lake. There is a risk of contamination from fuel spilling onto the ground or into the water while refuelling the boats, or from oil leaking from the cars and trucks entering the area.

Litter may also pose a risk of contamination (Plate 4). The bins provided along the foreshore should be regularly inspected and emptied. Other refuse discarded elsewhere in the Water Reserve should be removed as required.

Victoria Highway

West of the M1 channel, the highway is down-gradient of the wellfield, and any pollution incidents will not impact water quality in the reserve.

East of the M1 irrigation channel, the highway transects the northern part of the proposed Water Reserve. While this portion of the highway is within the water reserve it is down gradient of the wellfield. As a result, any pollution incidents occurring on this section would only have minor impact on the wellfield. It is expected however that the emergency spill protocols and procedures would ensure any contamination would be contained before reaching the aquifer.

Proposed Durack Tourist Area

Development of the Durack Tourist Area will introduce numerous contamination threats to the key recharge area for the drinking water aquifer. More treatment would be necessary to reduce contamination of the reticulated drinking water supply. Over reliance on treatment strategies is costly and does not always remove all contaminants. That is, treatment will not necessarily guarantee safe drinking water quality. The risk of contamination occurring in treated water is intensified if non-compatible landuses are permitted in the Water Reserve because there is an automatic increase in contamination sources. This reinforces the Department's position that reliance on treatment to counteract the impacts of incompatible development is not acceptable.

Any activities that are proposed for the immediate foreshores would require a lease from the joint vestees ie, SWEK and DoE. It is unlikely that DoE would support any lease for an activity within the foreshore or reserve that could threaten the quality of the water source.

5.1 Emergencies

Escape of chemicals during unforeseen incidents and use of chemicals during emergency response can cause groundwater contamination. The Shire of Wyndham-East Kimberley Local Emergency Management Advisory Committee through the Broome Emergency Management District should be familiar with the location and purpose of the Kununurra Water Reserve. A locality plan should be provided to the Fire and Rescue Services headquarters for the HAZMAT Emergency Advisory Team. The Regional Manager Water and Rivers Commission should have an advisory role to any HAZMAT incident in the Kununurra Water Reserve.

Personnel who deal with WESTPLAN - HAZMAT incidents within the area should be given ready access to a locality map of the Kununurra Water Reserve. These personnel should receive training to ensure an understanding of the potential impacts of spills on the groundwater resource.

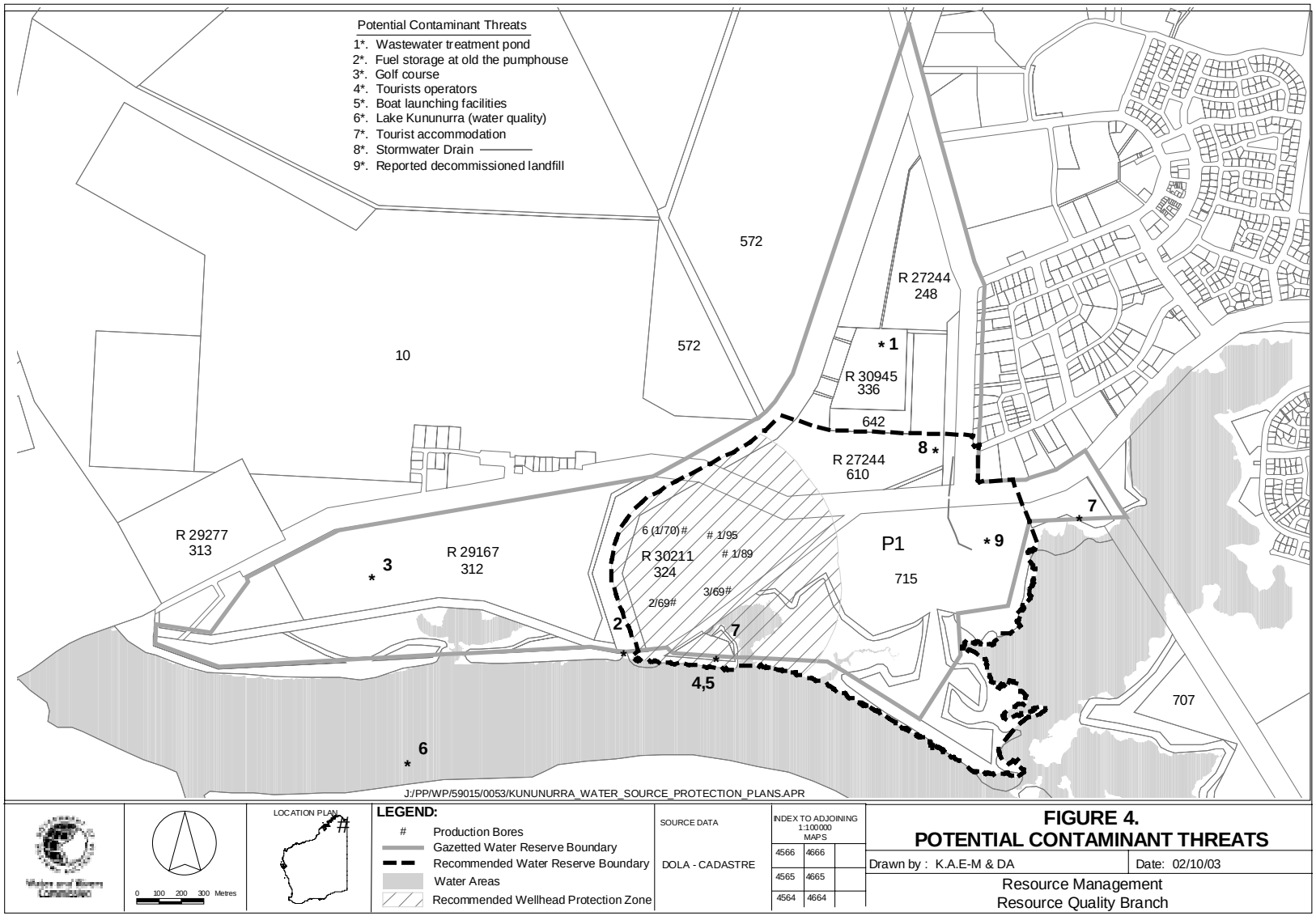

Figure 4. Potential contamination threats.

6 Proposed proclaimed areas

A Water Reserve covering the town water supply wellfield at Kununurra was originally gazetted under the CAWS Act on 6 March 1970. The boundary of that Water Reserve is shown in Figure 2. It is now proposed to modify the reserve by truncating the northern boundary (300-400 m above the Victoria Highway road reserve) and western boundary (along the M1 channel), and extending the southern boundary to the low water mark of Lake Kununurra and to the western side of Lily Creek Lagoon up to a point where it will exclude the existing caravan/tourist park in this area and meet Victoria Highway (Figure 4).

The proposed revision will effectively cover the wellfield's direct recharge areas, while allowing for extension of the wellfiled to meet future needs in an easterly direction.

It is proposed to classify all of the proposed Kununurra Water Reserve for Priority 1 (P1) source protection. The Crown land within this area is uncleared and vested with several government agencies and is compatible with the proposed P1 classification.

P1 source protection areas are declared to ensure that there is no degradation of the water source. P1 areas are declared over land where the provision of the highest quality public drinking water is the prime beneficial landuse.

The KLTP is located in the south-west corner of the proposed Water Reserve and should also be classified for Priority 1 (P1) source protection. There is a high potential for abstraction bores to be contaminated by any pollutants from the KLTP as the drinking water aquifer is considered vulnerable to contamination. That is, contaminants can be rapidly transported from the KLTP to the abstraction bores and into the towns drinking water supply. Hence, in the absence of a confirmed and viable alternative drinking water source, a Priority 1 classification for this land area is considered appropriate.

However, as the KLTP is an existing operating activity it is proposed that it be allowed to continue as a non-conforming landuse activity within the P1 area. It is recognised that the owners of KLTP have adopted a strong environmental ethos and have worked assiduously to ensure that KLTP does not contribute any pollutants to the reserve.

In the interests of protecting the drinking water source, private land in P1 areas may be considered for purchase by the Department, if the owner is agreeable. However, the DoE cannot force the owner to sell the land, nor does it resume land.

Circular wellhead protection zones, extending for a radius of 500 m, should be established around each production bore in the P1 area.

Logically, Lake Kununurra should also receive a priority classification particularly as it is the primary source for recharge to the wellfield. However enforcement of a priority classification for the Lake is regarded as unviable. Never-the-less any further activities, planned or proposed, for Lake Kununurra should be referred to the DoE for comment to avoid the approval of uses/activities on or near the Lake that may have an adverse impact on Kununurra's drinking water quality and public health.

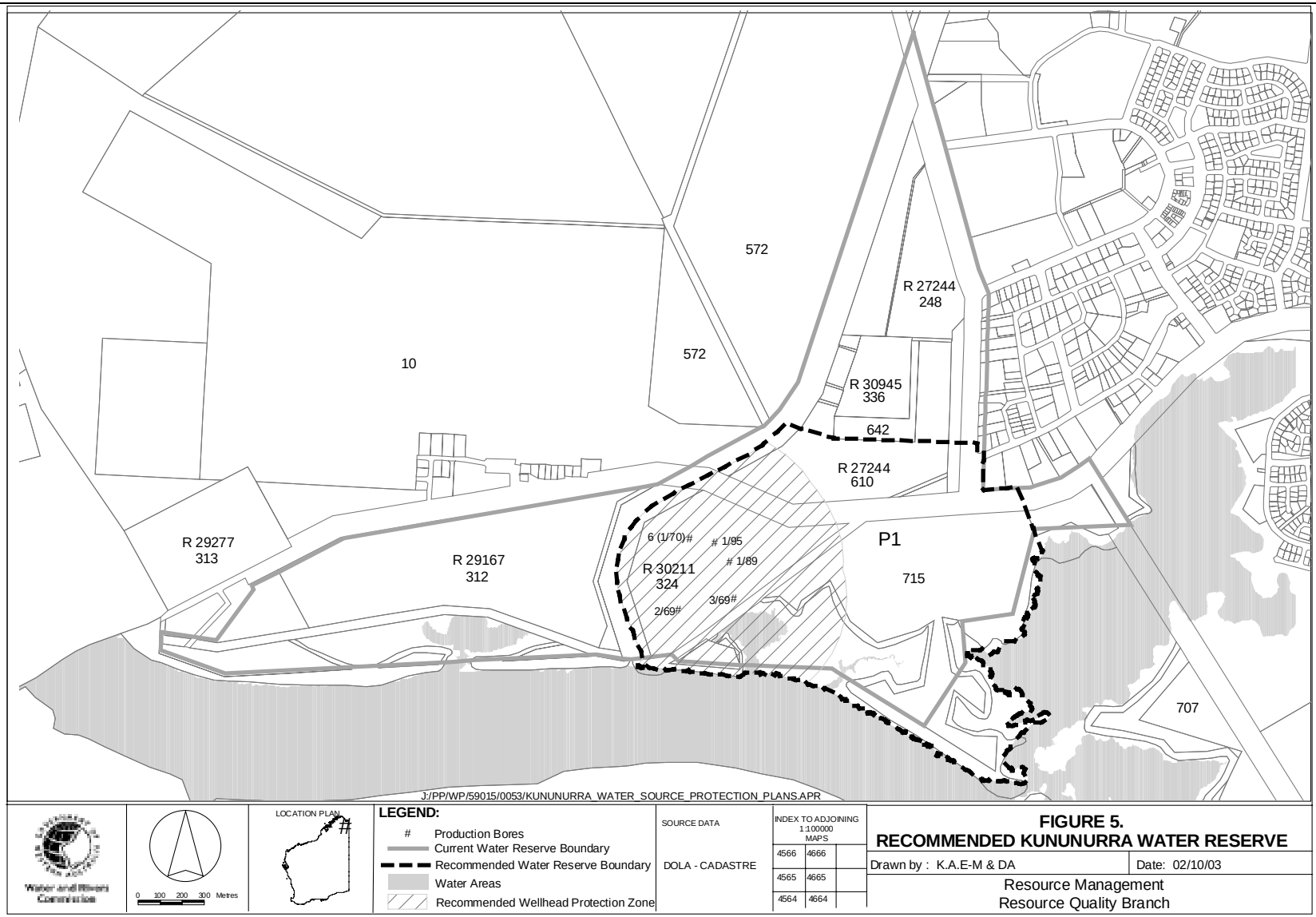

Figure 5. Recommended Kununurra Water Reserve (Priority 1 protection area)

7 Recommendations

1. The Kununurra Water Reserve boundary should be amended as shown in Figures 4 and 5.

2. The Town Planning Scheme should recognise the Kununurra Drinking Water Source Protection Plan and only support landuses compatible with the assigned priority classification. Planning strategies within the proposed new Water Reserve should incorporate the management principles outlined in the Water and Rivers Commission's *Land Use Compatibility in Public Drinking Water Source Areas* (Appendix 1) and reflect the Priority 1 classification given to the Water Reserve. This recommendation is consistent with the proposed Western Australian Planning Commission's *Public Drinking Water Source Policy*.

3. All development proposals in the Water Reserve that are likely to impact water quality and are not consistent with the Department's published Policy, Guidelines, Water Quality Protection Notes or other documents should be referred to the Department of Environment.

4. All new proposed activities for Lake Kununurra should be referred to the Department of Environment for comment.

5. Signs should be erected along the boundaries of the Water Reserve to define the reserve and promote public awareness of the need to protect water quality for drinking water purposes.

6. Incidents covered by WESTPLAN – HAZMAT in the Kununurra Water Reserve should be addressed through the following measures:

   - The Kununurra Local Emergency Management Advisory Committee (through the Broome Emergency Management District) being familiar with the location and purpose of the Kununurra Water Reserve.
   - The locality plan for the Kununurra Water Reserve being provided to the Fire and Rescue Services headquarters for the HAZMAT Emergency Advisory Team.
   - The Department advising the HAZMAT Emergency Advisory Team during incidents in the Kununurra Water Reserve.
   - Personnel dealing with WESTPLAN - HAZMAT incidents in the area given ready access to a locality map of the Water Reserve and training to understand the potential impacts of spills on the groundwater resource.

7. Surveillance should be undertaken on a periodic basis to identify any incompatible landuses or potential contaminant threats within the Water Reserve. Inspect existing landuses in the Water Reserve, such as the caravan park, to investigate and confirm action for groundwater protection.

8. If the wellfield needs to be extended to the east in the future, further detailed groundwater modelling should be undertaken. Irrespective of this modelling, a monitoring program should be established to determine the extent of any contaminant movement that might threaten the water quality of the wellfield. Monitoring of production wells should include scanning for pesticides, pathogens and nutrients as possible contaminants from Lake Kununurra, the wastewater treatment plant, KLTP, the stormwater drain and the alleged decommissioned landfill. Observation bores should also be installed between the production bores, KLTP and the reported decommissioned landfill and monitored regularly.

9. Government should consider possible alternative drinking water sources and provide advice on the environmental, social, and economic implications of developing those sources which could then allow land adjacent to Lake Kununurra to be further developed.

10. The reported decommissioned landfill should be verified and cleaned up if it exists so that the water quality of future bores in that area is not threatened. Possible impacts from the decommissioned landfill and the stormwater drain should be taken into consideration during development of a future wellfield in the eastern part of the reserve.

11. Existing boat launching facilities on Lake Kununurra within the Water reserve should be reviewed (to look at opportunities to minimise potential impacts and expansion, or for relocation outside the Water Reserve) and vehicle access rationalised to restrict uncontrolled access to the Water Reserve area. This could include closure of unnecessary tracks. Development of any new boating facility on or adjacent to the proposed Kununurra Water Reserve is not supported due to the risk of contamination of Kununurra's drinking water. The litter issue on the foreshore and inland within the Water Reserve should be addressed.

12. A full review of this protection plan should be undertaken after five years, or sooner if an alternative public drinking water source area is established.

8 Implementation strategy

No	Description	Implemented by	Timing
1.	Gazettal of proposed new Water Reserve (replacing old gazetted boundaries).	Program Manager, Protection Planning (WRC).	2003/2004
2.	Incorporate the WSPP findings into planning schemes and strategies for Kununurra.	Shire of Wyndham-East Kimberley, Department of Planning and Infrastructure	Ongoing
3.	Refer development proposals: (i) DoE to liaise with Shire of Wyndham-East Kimberley in development of guidelines for referral of development proposals within Water Reserve and Lake Kununurra. (ii) Referral of development proposals within Water Reserve.	(i) Manager, Kununurra Office, North West Region (DoE) and Shire of Wyndham-East Kimberley. (ii) Shire of Wyndham-East Kimberley, Ministry for Planning and Department of Environmental Protection.	(i) 2003/2004 (ii) Ongoing
4.	Signs: (i) development of appropriate signage. (ii) determine number and location of signs required. (iii) erect signs.	(i) Program Manager, Protection Planning (DoE). (ii) Regional Manager, North West Region (DoE), Regional Business Manager, North West (WC). (iii) Regional Manager, North West Region (DoE), Regional Business Manager, North West (WC).	(i) 2003/2004 (ii) 2003/2004 (iii) To be determined

(contd)

5.	Incidents covered by WESTPLAN – HAZMAT in the Kununurra Water Reserve should be addressed through the following measures: (i) The Kununurra Local Emergency Management Advisory Committee (through the Broome Emergency Management District) being familiar with the location and purpose of the Kununurra Water Reserve. (ii) The locality plan for the Kununurra Water Reserve being provided to the Fire and Rescue Services headquarters for the HAZMAT Emergency Advisory Team. (iii) The Department of Environment advising the HAZMAT Emergency Advisory Team during incidents in the Kununurra Water Reserve. (iv) Personnel dealing with WESTPLAN – HAZMAT incidents in the area given ready access to a locality map of the Water Reserve and training to understand the potential impacts of spills on the groundwater resource.	(i) Kununurra Local Emergency Management Advisory Committee (through DoE North West region). (ii) DoE (North West region). (iii) Department of Environment. (iv) Kununurra Local Emergency Management Advisory Committee.	(i) 2003/2004 (ii) 2003/2004 (iii) Ongoing (iv) Ongoing
6.	Surveillance program: (i) Undertake surveillance of land uses in the Water Reserve to ensure incompatible uses do not become established and that existing approved facilities are operating with due regard to the significance of the Water Reserve (ie, implementing or adopting best practice operations) .	(i) Regional Manager, North West Region (DoE), Regional Business Manager, North West (WC).	(i) Ongoing

7.	Additional investigations. (i) Install and regularly monitor observation bores between the current production bores, KLTP and the reported decommissioned landfill. (ii) Include extra sampling parameters for current production and observation bores to account for potential contaminated leachate from Lake Kununurra , the wastewater treatment plant, KLTP, the stormwater drain and the alleged decommissioned landfill, ie, monitor production and observation bores for pesticides, pathogens and nutrients. (iii) Desktop assessment of alternative water sources.	(i) Water Corporation. (ii) Water Corporation (iii) Water Corporation	(i) Ongoing (ii) To be determined (iii) 2003
8.	Potential decommissioned landfill: (i) Investigate allegations and remove contamination threat if required. (ii) Consider impacts from the reported landfill and stormwater drain during development of any future wellfield in the eastern part of the reserve	(i) To be determined. (ii) Water Corporation	(i) To be determined (ii) To be determined

9.	Foreshore issues (i) Review existing small boat launching facilities. (ii) Recommend against or oppose new developments on foreshore or Lake Kununurra adjacent to the Water Reserve that may contaminate the drinking water (refer DoE Land Use Compatability Table). (iii) Clean up litter on foreshore and within the Water Reserve.	(i) DoE, WC. (ii) DoE and WC (iii) Shire of Wyndham–East Kimberley, DoE, WC.	(i) 2003/04 (ii) Ongoing (iii) Ongoing
10.	Review: (i) Drinking Water Source Protection Plan 2003 (Interim Report).	Resource Quality Branch (DoE).	(i) After 5 years or sooner if Government locates and approves an alternative source

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Appendix 1: Landuse compatibility in public drinking water source areas

(This version is the most current version. However, it will be updated from time to time as feedback is received or land-use activity standards change. The Department of Environment's website contains any updated versions).
www.wrc.wa.gov.au

Land Use Compatibility in Public Drinking Water Source Areas

Purpose

This water quality protection note provides our position on land use practices and activities within areas gazetted as public drinking water sources, for protection and maintenance of the quality of the State's drinking water resources.

This note forms an integral part of the Western Australian Planning Commission's draft Statement of Planning Policy - *Public Drinking Water Source Policy* prepared by the Department for Planning and Infrastructure under Section 5AA of the *Town Planning and Development Act 1928*. The note will be reviewed in March and September each year and updated to reflect our present policy position, advances in technology or land use activity standards and decisions made concerning drinking water quality protection.

The note should be used when developing formal guidelines on land use activities in public drinking water source areas in consultation with key stakeholders, such as the Department for Planning and Infrastructure, local government and the Department of Agriculture.

Scope

The note provides our position on a range of land uses assessed against our water quality protection strategies and management objectives within Public Drinking Water Source Areas (PDWSAs). Where a specific land use has not been covered in the accompanying tables, it should be referred to our Resource Quality Branch for assessment and a written response.

PDWSAs are Underground Water Pollution Control Areas, Water Reserves or Catchment Areas declared under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* or *Country Areas Water Supply Act 1947*.

The note is intended to complement the statutory role and policy of other State and local government authorities. The note does not override the need for proponents to fulfil their legal responsibilities, including land use planning, environmental, health and building approvals.

PDWSA Protection Framework

This agency is responsible for managing and protecting the State's water resources. Our policy for the protection of public drinking water source areas includes three risk management-based priority zones for land within PDWSAs. Priority classifications are determined through specific Drinking Water Source Protection Plans, that are prepared in consultation with State government agencies, landowners, local government, and key industry and community stakeholders.

Priority 1 (P1) source protection areas are defined and managed to ensure that there is **no degradation** of the water source in these areas. This is the highest level of protection for the water sources and normally will apply to land owned or managed by State agencies. P1 areas are characterised by low-intensity and low-risk land uses, such as forestry and extractive industries. Protection of the public drinking water source outweighs virtually all other land uses. P1 areas are managed using the principle of **risk avoidance**. Most land uses are **incompatible** with P1 management objectives.

Priority 2 (P2) source protection areas are defined to ensure that there is **no increased risk of pollution** to the water source. P2 areas are declared over land where low risk development (such as low intensity rural activity) already exists. Protection of PDWSAs is a high priority in these areas. P2 areas are managed in accordance with the principle of **risk minimisation.** Some development defined as *Conditional* is allowed in P2 areas.

Priority 3 (P3) source protection areas are defined to **manage the risk of pollution** to the water source. P3 areas are declared over land where water supply sources co-exist with other land uses such as residential, commercial and light industrial developments. There is restriction on land uses considered to have significant pollution potential. Protection of P3 areas is mainly achieved through **environmental management guidelines** for land use activities. If the water source becomes contaminated, then public water supplies may need additional treatment or an alternative source located and commissioned.

In addition to the priority classifications, **wellhead protection zones** and **reservoir protection zones** are defined to protect the drinking water source from contamination in the immediate vicinity of production wells and reservoirs. Statutes provide for defined land uses and activities within these zones that are prohibited, restricted or subject to imposed agency conditions so that contamination of the water source is prevented. Special conditions, for example, restrictions on storage and use of chemicals, may be applied within these zones.

Wellhead protection zones are usually circular, with a radius of 500 metres in P1 areas and 300 metres in P2 and P3 areas. Wellhead protection zones do not extend outside PDWSA boundaries.

Reservoir protection zones consist of a 2 kilometre buffer area around the top water level of storage reservoirs and include the reservoir itself. A reduced buffer area may be applied where the reservoir is designed only for short-term storage of collected water (e.g. pipehead or pumpback dams) before transfer to a storage reservoir. Reservoir protection zones are normally only designated over Crown land and generally prohibit public access to prevent contamination (physical, chemical and biological) of the source. Reservoir protection zones do not extend outside PDWSA boundaries.

Compatibility of land uses within PDWSAs

The tables in this note define land uses as Compatible, *Conditional* (i.e. can be managed to be compatible), or **Incompatible** with the sustainable use of the drinking water source and the retention of environmental values associated with the water source. These tables have been prepared for use by local governments and other authorities as a basis for regulating land use within the PDWSAs, consistent with the Western Australian Planning Commission's draft *Statement of Planning Policy - Public Drinking Water Source Policy*.

This Water Quality Protection Note acknowledges there may be special circumstances, such as Government supported community needs or site specific circumstances, which may allow an 'incompatible' land use to be conditionally approved. In these instances, project proponents must demonstrate that there is an overriding community benefit achieved by the land use at the particular location and that the proposed land use will not increase the risk of contamination of the water resource.

More detailed information on water quality protection issues is available in the form of guidelines or water quality protection notes for some of the land uses listed in the tables. These, along with the most recent version of this note, can be found on our Internet site (**http://*www.wrc.wa.gov.au/protect/policy/***). Alternatively, information on land use and development regulation within PDWSAs can be obtained from our Regional Offices. The Resource Quality Branch, located in East Perth, is custodian of this water quality protection note and will provide strategic advice on its application and coordinate any suggested amendments.

Existing activities

We recognise that many activities covered in this note were legally established prior to gazettal of specific statutory measures to protect PDWSAs. Accordingly, we may negotiate with the operators of existing non-conforming, conditional or compatible activities to implement management practices that minimise the impact of those land uses or activities on water sources.

Proposed activities

Following consideration of this protection note, please consult our nearest Regional Office for advice on the location of Public Drinking Water Source Areas, Priority areas and protected zones, and aspects of the land use proposal that may affect water resources. All statutory State and local government planning policies, scheme provisions, and the normal planning approval processes apply and are not over-ridden by this note.

Definition of terms used in the following tables

"Compatible" means the land use is compatible with the management objectives of the priority classification.

"***Conditional***" means the land use can be compatible with the management objectives of the priority classification, provided appropriate site management practices are used. Conditional developments or activities should be referred to this agency for assessment and a written response.

"Incompatible" means the land use is incompatible with the management objectives of the priority classification. We will normally oppose their approval by regulators. Any contentious development proposals received may be referred for formal Environmental Impact Assessment via the *Environmental Protection Act 1986*.

"Extensive" means limited additional inputs are required to support the desired land use, e.g. supplementary animal feed only during seasonal dry periods or during the final preparation of stock for the market.

"Intensive" means regular additional inputs are required to support the desired land use, e.g. irrigation, fertilisers, or non-forage animal feed dominates.

Interpretation of land use recommendations into planning schemes and decisions

When translating the recommendations of the land use compatibility table into planning schemes and decisions, the following relationships should be used:

a) Where the table identifies a land use as "Compatible", this use is permitted within that priority source protection area. It should be identified as a "**P**" (permitted) use in a scheme, providing the use complies with the relevant development standards and the requirements of the scheme.

b) Where the table identifies a use as "*Conditional"*, this land use is considered to be a discretionary use within the priority source protection area and should be identified as either a "**D**" or "**A**" (after special notice) use in the scheme. Proposals for *Conditional* uses should be referred to this agency for assessment and response, unless prior agreement has been made between a specific local government authority and this agency on regulatory measures. Specific guidelines, codes of practice or notes covering a land-use type, or memoranda of understanding may be used to define an agreed position on the land-use type or activity.

c) Where the table identifies a use as "**Incompatible"**, this use should not be permitted within that priority source protection area, and should be identified as an "**X**" (not acceptable) use in the scheme.

d) Where the table does not include a proposed land use, that use should be considered to be "**Incompatible**" until the project proponent can demonstrate that it meets the drinking water quality protection objective for the Priority area within the PDWSA.

If the land use planning approval process supports a proposal that is inconsistent with our drinking water quality protection advice for the priority source protection area, then we should be advised of this situation and the reasons for that decision. This advice will trigger an assessment of the significance of that decision to the drinking water source and will be considered in the periodic review of this water quality protection note.

Tables defining land-use compatibility with PDWSA protection objectives

Land use descriptions (**in Model Scheme Text** #)	P1	P2	P3
Agriculture			
- extensive (see pastoral leases below)	**Incompatible**	CONDITIONAL (see notes 11&12)	Compatible
- intensive aquaculture, hydroponics	**Incompatible**	*Conditional*	*Conditional*
- intensive orchards; nurseries– potted plants; viticulture– wine and table grapes	**Incompatible**	*Conditional*	Compatible
- intensive floriculture; market gardens; turf farms	**Incompatible**	**Incompatible**	*Conditional*
- intensive livestock grazing	**Incompatible**	**Incompatible**	*Conditional*
- intensive garden centres	**Incompatible**	CONDITIONAL (see note 2)	Compatible
- pastoral leases	*Conditional*	Compatible	Compatible
Agro-forestry	**Incompatible**	*Conditional*	Compatible
Amusement parlour	**Incompatible**	**Incompatible**	Compatible (see note 1)
Animal establishment			
- animal saleyards and stockyards (see note 13)	**Incompatible**	CONDITIONAL (see note 2)	CONDITIONAL (see note 2)
- apiaries	*Conditional*	Compatible	Compatible
- catteries	**Incompatible**	Compatible	Compatible
- dairy sheds	**Incompatible**	CONDITIONAL (see notes 2, 3,& 12)	CONDITIONAL (see note 3)
- dog kennels	**Incompatible**	*Conditional*	*Conditional*
- equestrian centres (see note 17)	**Incompatible**	**Incompatible**	Compatible
- feedlots	**Incompatible**	**Incompatible**	CONDITIONAL
- stables (see note 18)	**Incompatible**	CONDITIONAL	Compatible
Animal husbandry, intensive			
- piggeries	**Incompatible**	**Incompatible**	**Incompatible**
- poultry farming - housed	**Incompatible**	*Conditional*	*Conditional*
Bed and breakfast (bed and breakfast, farm stay accommodation, rural chalets)	*Conditional* (see notes 6 & 16)	*CONDITIONAL* (see note 4)	Compatible
Betting agency	**Incompatible**	*CONDITIONAL* (see note 2)	Compatible (see note 1)
Caravan park	**Incompatible**	**Incompatible**	*CONDITIONAL* (see note 1)
Caretakers dwelling	Conditional (see note 2)	*Conditional*	Compatible
Car park	**Incompatible**	*CONDITIONAL* (see note 2)	Compatible
Cemeteries	**Incompatible**	**Incompatible**	*Conditional*
Child care premises	**Incompatible**	*CONDITIONAL* (see note 2)	Compatible (see note 1)

Cinema/ theatre	**Incompatible**	**Incompatible**	Compatible (see note 1)
Civic use	**Incompatible**	*CONDITIONAL* (see note 2)	Compatible (see note 1)
Club premises			
- sporting or recreation clubs	**Incompatible**	*Conditional*	Compatible (see note 1)
- health centres	**Incompatible**	**Incompatible**	Compatible (see note 1)
Community purpose			
- community halls	**Incompatible**	*CONDITIONAL* (see note 2)	Compatible
- irrigated golf courses or recreational parks	**Incompatible**	**Incompatible**	*CONDITIONAL* (see note 11)
- motor-sports (permanent racing facilities)	**Incompatible**	**Incompatible**	*Conditional*
- public swimming pools/ aquatic centres	**Incompatible**	**Incompatible**	*Conditional*
- rifle ranges	**Incompatible**	*Conditional*	Compatible

Land use descriptions (**in Model Scheme Text** #)	P1	P2	P3
Consulting rooms	**Incompatible**	*CONDITIONAL* (see note 2)	Compatible (see note 1)
Convenience store	**Incompatible**	*CONDITIONAL* (see note 2)	Compatible (see note 1)
Corrective institution	**Incompatible**	**Incompatible**	*CONDITIONAL* (see note 1)
Educational establishment - community education centres, scientific research institution - primary / secondary schools, tertiary education facilities	*CONDITIONAL* (see note 2) **Incompatible**	*CONDITIONAL* (see note 2) **Incompatible**	Compatible (see note 1) Compatible (see note 1)
Exhibition centre	**Incompatible**	**Incompatible**	Compatible (see note 1)
Family day care	**Incompatible**	Compatible (see note 19)	Compatible (see note 1)
Fast food outlet	**Incompatible**	**Incompatible**	Compatible (see note 1)
Forestry (native forest/ silviculture/ tree farming)	*CONDITIONAL* (see note 11)	*CONDITIONAL* (see note 11)	Compatible
Fuel depot	**Incompatible**	**Incompatible**	*Conditional*
Funeral parlour	**Incompatible**	**Incompatible**	Compatible (see note 1)
Home business	**Incompatible**	*CONDITIONAL* (see note 20)	Compatible (see note 1)
Home occupation	*CONDITIONAL* (see note 15)	Compatible (see note 21)	Compatible (see note 1)
Home office	*CONDITIONAL* (see note 15)	Compatible	Compatible
Home store	**Incompatible**	*Conditional*	Compatible (see note 1)
Hospital	**Incompatible**	**Incompatible**	*CONDITIONAL* (see note 1)
Hotel (hotels, hostels, resorts)	**Incompatible**	**Incompatible**	Compatible (see note 1)

Industry			
- abattoirs	**Incompatible**	**Incompatible**	**Incompatible**
- cottage	*Conditional*	*Conditional*	Compatible
- drinking water treatment plant	*Conditional*	*Conditional*	*Conditional*
- extractive, includes construction/ mining camps: (see note 10)	*Conditional*	*Conditional*	*Conditional*
- food processing, dairy product factories, breweries	**Incompatible**	**Incompatible**	*CONDITIONAL* (see note 1)
- general (chemical manufacture/ formulation, dry cleaning premises, dye works, laboratories– analytical, photographic)	**Incompatible**	**Incompatible**	*CONDITIONAL* (see note 1)
- general (metal production / finishing, pesticide operator depots, heavy industry, power stations/gas works, petroleum refineries)	**Incompatible**	**Incompatible**	**Incompatible**
- general (concrete batching, cement products, fertiliser manufacture/ bulk storage, wrecking)	**Incompatible**	**Incompatible**	*Conditional*
- general (mineral processing)	**Incompatible**	**Incompatible**	*CONDITIONAL* (see note 9)
- light industry	**Incompatible**	**Incompatible**	*CONDITIONAL* (see note 1)
- milk transfer depots	**Incompatible**	**Incompatible**	*Conditional*
- mining (includes mineral and energy exploration, oil or gas extraction / decontamination for transport)	*CONDITIONAL* (see note 9)	*CONDITIONAL* (see note 9)	*CONDITIONAL* (see note 9)
- mining (tailings dams)	**Incompatible**	**Incompatible**	*CONDITIONAL* (see note 9)
- mining (includes construction / mining camps) (see note 10)	*Conditional*	*Conditional*	*Conditional*
Industry (continued)			
- rural (animal product rendering works, tanneries, wool scourers)	**INCOMPATIBLE**	**Incompatible**	**Incompatible**
- rural (farm supply centres, manure stockpiling / processing facilities)	**Incompatible**	*CONDITIONAL* (see note 2)	*Conditional*
- rural (forestry products processing– chip mills, pulp/ paper, timber preservation, wood/ fibre works, composting/ soil blending - commercial)	**Incompatible**	**INCOMPATIBLE**	*Conditional*
- service industry	**Incompatible**	**Incompatible**	*Conditional*
Landfill (solid waste disposal)			
- class I (refer also to 'Storage - used tyres' land use advice)	**INCOMPATIBLE**	**INCOMPATIBLE**	*Conditional*
- class II or III	**Incompatible**	**INCOMPATIBLE**	**INCOMPATIBLE**
- class IV or V	**INCOMPATIBLE**	**Incompatible**	**Incompatible**

Lunch bar	**Incompatible**	*CONDITIONAL* (see note 2)	Compatible (see note 1)
Major transport infrastructure (roads, railways)	**Incompatible**	*CONDITIONAL* (see note 14)	Compatible
Marina	NA	NA	NA
Marine filling station (fuelling)	NA	NA	NA
Market (food; general produce; second–hand goods)	**Incompatible**	**Incompatible**	Compatible (see note 1)
Medical centre	**Incompatible**	**Incompatible**	Compatible (see note 1)
Motel	**Incompatible**	**Incompatible**	Compatible (see note 1)
Motor vehicle, boat or caravan sales (sales yards)	**Incompatible**	**Incompatible**	Compatible (see note 1)
Motor vehicle repair	**Incompatible**	**Incompatible**	*Conditional*
Motor vehicle wash	**Incompatible**	**Incompatible**	*Conditional*
National and regional parks and nature reserves	Compatible	Compatible	Compatible
Night club	**Incompatible**	**Incompatible**	Compatible (see note 1)
Office	**Incompatible**	*Conditional*	Compatible (see note 1)
Park home park	**Incompatible**	**Incompatible**	Conditional (see note 1)
Place of worship	**Incompatible**	**Incompatible**	Compatible (see note 1)
Plantation	*CONDITIONAL* (see note 11)	*CONDITIONAL* (see note 11)	Compatible
Reception centre	**Incompatible**	**Incompatible**	Compatible (see note 1)
Recreation– private (i.e. not generally open to public without charge)	**Incompatible**	**Incompatible**	Compatible (see note 1)
Residential building - house - group dwellings (aged and dependent persons)	*CONDITIONAL* (see note 16) **Incompatible**	Compatible (see note 4) **Incompatible**	Compatible (see note 1) Compatible (see note 1)
Restaurant	**Incompatible**	**Incompatible**	Compatible (see note 1)
Restricted premises (adult interests)	**Incompatible**	**Incompatible**	Compatible (see note 1)
Rural pursuit	See Agriculture, Animal establishment or husbandry		
Service station (includes aircraft, automotive repairs, boats, mechanical plant, service stations at transport and municipal works depots)	**Incompatible**	**Incompatible**	*CONDITIONAL* (refer to note 1)
Shop	**Incompatible**	*CONDITIONAL* (see note 2)	Compatible (see note 1)

Showroom	**Incompatible**	**Incompatible**	Compatible (see note 1)
Storage			
- used tyres (see note 22)	**Incompatible**	**Incompatible**	**Incompatible**
- chemical storage in under ground tanks	**Incompatible**	**Incompatible**	*Conditional*
- chemical storage in above ground tanks	**Incompatible**	*Conditional*	*Conditional*
Tavern	**Incompatible**	**Incompatible**	Compatible (see note 1)
Telecommunications infrastructure	*Conditional*	*Conditional*	*Conditional*
Toilet blocks and change rooms	*CONDITIONAL* (see note 2)	*Conditional*	Compatible
Trade display	**Incompatible**	**Incompatible**	Compatible (see note 1)
Veterinary centre	**Incompatible**	*CONDITIONAL* (see note 2)	*CONDITIONAL* (see note 1)
Warehouse	**Incompatible**	*CONDITIONAL* (see note 2)	*CONDITIONAL* (see note 1)
Waste transfer station (includes recycling depots)	**Incompatible**	**Incompatible**	*Conditional*
Wastewater infrastructure			
- sewerage – gravity sewers	**Incompatible**	**Incompatible**	Compatible
- sewerage – pressure mains	**Incompatible**	*Conditional*	Compatible
- sewer pump stations	**Incompatible**	*Conditional*	*Conditional*
- treatment plants, wastewater disposal to land	**Incompatible**	**Incompatible**	*Conditional*
- wastewater injection into the ground	**Incompatible**	**Incompatible**	**Incompatible**
Water treatment plants (drinking)	See **Industry**		
Winery (includes wine tasting facilities)	**Incompatible**	*Conditional* (see notes 3 & 5)	CONDITIONAL (see note 3)

Subdivision	P1	P2	P3
Rural subdivision			
- to a lot size of 4 hectares or greater	**Incompatible**	Compatible	Compatible
- to a lot size less than 4 hectares	**Incompatible**	**Incompatible**	**INCOMPATIBLE**
Special rural subdivision			
- to a lot size of 2 hectares or greater	**Incompatible**	*CONDITIONAL* (see notes 7 & 8)	*CONDITIONAL* (see note 8)
- to a lot size between 1 and 2 hectares	**Incompatible**	**Incompatible**	*CONDITIONAL* (see notes 7& 8)
- to a lot size less than 1 hectare	**Incompatible**	**Incompatible**	*CONDITIONAL* (see note 7)
Urban subdivision	**Incompatible**	**Incompatible**	Compatible (see note 1)
Industrial subdivision	**Incompatible**	**Incompatible**	Compatible (see note 1)

Table legend:

NA Not applicable within PDWSAs

\# Model Scheme Text (MST) land uses are shown **bold** in the tables. Definitions covered in MST can be found in the *Town Planning Amendment Regulations 1999*.

Table reference notes:
The following notes provide interpretive information based on the scale or type of development described in the preceding tables. They do not list of all of the conditions that would apply to a development. More detailed information about best management practices is available from Environmental Management Guidelines and Water Quality Protection Notes available for a number of listed land uses. These are available on our Internet site (**http://*www.wrc.wa.gov.au/protect/policy/***) or by contacting our regional offices.

1. Must be connected to deep sewerage, except where exemptions apply under the current Government Sewerage Policy. This Policy recognises that sewer connection may not be feasible in some areas.
2. Land use not normally acceptable, but may be approved where a community need is demonstrated or if this facility is consistent with State and Local Government planning strategies and schemes.
3. Proposal must incorporate waste management practices compatible with the water source protection objectives for the management Priority of the source protection area.
4. Conditions apply to density of accommodation (i.e. people / hectare) in Priority 2 areas.
5. Size of annual grape crush shall not exceed 500 tonnes.
6. May be approved if occupancy is of equivalent size to a single dwelling household (i.e.<10 people –defined by capacity of a septic tank based on-site wastewater treatment system).
7. An average, rather than minimum, lot size may be accepted if the proponent can demonstrate that the water quality objectives of the source protection area are met, and caveats are placed on titles of specified blocks stating that further subdivision cannot occur.
8. Lots should only be created where land capability assessment shows effective on-site soakage of treated wastewater. Conditions apply to siting of wastewater disposal systems in areas with poor land drainage and / or a shallow depth to groundwater, animals are held or fertiliser is applied. Alternative wastewater treatment systems, where approved by the Department of Health, may be accepted with ongoing maintenance requirements.
9. Conditions are likely to be placed via a Department of Mineral and Petroleum Resources lease, and / or as a result of Minister for the Environment and Heritage's approval after Environmental Impact Assessment.
10. Conditions apply to the storage of fuels and chemicals, the depth of excavation related to the water table and rehabilitation criteria. Underground fuel or chemical storage tanks are prohibited in

    Priority 1 and 2 areas within Underground Water Pollution Control Areas.
11. Conditions apply to regulate fertiliser and pesticide application.
12. May be approved if animal stocking levels (animals per hectare) are consistent with the priority source protection area objectives.
13. This does not include stockyards used on farms or pastoral leases for animal husbandry.
14. Conditions may be imposed to cover design, construction of infrastructure and the types of goods.
15. May only be approved if "Home Occupation" is part of existing residence.
16. Limited to one residential building per property.
17. Includes land or buildings used for the showing, competition or training of horses and riding schools.
18. Includes any land, building or structure used for the housing, keeping and feeding of horses, asses and mules and associated incidental activities.
19. In accordance with *Community Services (Child Care) Regulations 1988*: A child care service provided to a child in a private dwelling in a family of or domestic environment. No more than 5 children of pre-school age and no more than 7 children under 12 years of age, including the children of the licensee or permit holder.
20. No more than 2 employees and less than or equal to a 50 square metre home business area. Compatible if only an office/ administrative business (ie, no refuelling, repair or maintenance of commercial/ business vehicles, and no activities involving on-site use or storage of chemicals).
21. Employees shall be members of the household and less than or equal to a 20 square metre home business area. No provision for refuelling, repair or maintenance of commercial/ business vehicles or on-site use or storage of chemicals.
22. Used tyre use, storage and disposal are subject to *Used Tyre Regulations 1996*, administered by the Environmental Regulation Division of this agency.

More information

We welcome your comments on this note. It will be updated from time to time as feedback is received or land-use activity standards change. We are progressively developing Water Quality Protection Notes and Environmental Management Guidelines covering the land uses described in the land use tables.

If you wish to comment on this note, please contact our Resource Quality Branch at the Hyatt Centre in East Perth.
Phone: (08) 9278 0300 (business hours);
Fax: (08) 9278 0585; or
E-mail: Use {feedback} section at our Internet address (*http://www.wrc.wa.gov.au)*, citing the topic & version.

Appendix 2: Landuses within the Kununurra water reserve

Photograph 1. Typical bore headworks (Bore 1/70)

Photograph 2. Tourist plane refuelling site

Photograph 3. Wastewater treatment lagoons

Photograph 4. Rubbish on banks of Lake Kununurra

Glossary

Abstraction	Pumping groundwater from an aquifer.
Allocation	The quantity of groundwater permitted to be abstracted by a bore licence, usually specified in kilolitres/year (kL/a).
Alluvium (alluvial)	Detrital material which is transported by streams and rivers and deposited.
Aquifer	A geological formation or group of formations able to receive, store and transmit significant quantities of water.
Bore	A narrow, lined hole drilled to monitor or withdraw groundwater.
Catchment	The area of land which intercepts rainfall and contributes the collected water to surface water (streams, rivers and wetlands or groundwater.
Confined aquifer	An aquifer that is confined between shale and siltstone beds and therefore contains water under pressure.
Diffuse Source Pollution	Pollution originating from a widespread area, eg, urban stormwater runoff, agricultural runoff.
Effluent	The liquid, solid or gaseous wastes discharged by a process, treated or untreated.
Groundwater	Water that occupies the pores and crevices of rock or soil.
Hydrogeology	The study of groundwater, especially relating to the distribution of aquifers, groundwater flow and groundwater quality.
Leaching / leachate	The process by which materials such as organic matter and mineral salts are washed out of a layer of soil or dumped material by being dissolved or suspended in percolating rainwater, the material washed out is known as leachate. Leachate can pollute groundwater and waterways.
m AHD	Australian Height Datum. Height in metres above Mean Sea Level +0.026 m at Fremantle.
Nutrient Load	The amount of nutrient reaching the waterway over a given time (usually per year) from its catchment area.
Nutrients	Minerals dissolved in water, particularly inorganic compounds of nitrogen (nitrate and ammonia) and phosphorus (phosphate) which provide nutrition (food) for plant growth. Total nutrient levels include the inorganic forms of an element plus any bound in organic molecules.
Pesticides	Collective name for a variety of insecticides, fungicides, herbicides, algicides, fumigants and rodenticides used to kill organisms.

Point Source Pollution	Specific localised source of pollution, eg, sewage or effluent discharge, industrial waste discharge.
Pollution	Water pollution occurs when waste products or other substances, eg, effluent, litter, refuse, sewage or contaminated runoff, change the physical, chemical, biological or thermal properties of the water, adversely affecting water quality, living species and beneficial uses. Public Water Source Area
Public Water Source Area	(PWSA) As for UWPCA, but allowing the taking of groundwater for public supplies.
Recharge	Water infiltrating to replenish an aquifer
Recharge area	An area through which water from a groundwater catchment percolates to replenish (recharge) an aquifer. An unconfined aquifer is recharged by rainfall throughout its distribution. Confined aquifers are recharged in specific areas where water leaks from overlying aquifers, or where the aquifer rises to meet the surface.
Runoff	Water that flows over the surface from a catchment area, including streams.
Saltwater intrusion	The inland intrusion of saltwater into a layer of fresh groundwater.
Scheme supply	Water diverted from a source (or sources) by a water authority or private company and supplied via a distribution network to customers for urban, industrial or irrigation use.
Storage reservoir	A major reservoir of water created in a river valley by building a dam.
Stormwater	Rainwater that has run off the ground surface, roads, paved areas and usually flows into drains.
Treatment	Application of techniques such as settlement, filtration and chlorination to render water suitable for specific purposes including drinking and discharge to the environment.
Unconfined aquifer	An aquifer containing water, the upper surface of which is lower than the top of the aquifer. The upper surface of the groundwater within the aquifer is called the watertable.

Underground Water Pollution Control Area	UWPCA) An area defined under the Metropolitan Water Supply Sewerage and Drainage Act, in which restrictions are put on activities that may pollute the groundwater.
Wastewater	Water that has been used and would normally be treated and discarded. Wastewater usually contains significant quantities of pollutant.
Water quality	The physical, chemical and biological measures of water.
Watertable	The upper saturated level of the unconfined groundwater.
Wellfield	A group of bores to monitor or withdraw groundwater.

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