Rural Areas Strategy

Volume 2

Agricultural Land Capability Assessment

9 November 2005

SUNRAYSIA ENVIRONMENTAL
soils · science · sustainability

For

Maunsell AECOM
Level 9 161 Collins Street
MELBOURNE VIC 3000

SUNRAYSIA ENVIRONMENTAL
soils • science • sustainability

3 The Crescent
Mildura, VIC 3500.
Ph: (03) 5023 3643
Fax: (03) 5021 3440
Email: office@sunenv.com.au
Web: www.sunenv.com.au

Steve ERLANDSEN
Project Supervisor
Senior Environmental Scientist
B. Ag. Sc.

Kym LUITJES
Specialist Support
Senior Consultant
B. App. Sc.

Michele NETTLEFOLD
Project Manager
Environmental Scientist
B. Sc (Env) B. Comm (Eco).

Document Revision History

Revision	Revision Date	Details	Authorised
A	3/12/2004	Rural Areas Audit Review	K Luitjes/Managing Director Sunraysia Environmental
B	20/12/2004	Rural Areas Audit Review	M Nettlefold/Project Manager
C	6/01/2005	Rural Areas Audit Review	S Erlandsen/ Manager Environmental Section
D	18/05/2005	Rural Areas Audit Review	S Erlandsen/ Manager Environmental Section
E	21/06/2005	Rural Areas Audit Review	S Erlandsen/ Manager Environmental Section

TABLE OF CONTENTS

ATTACHMENTS

EXECUTIVE SUMMARY

Sunraysia Environmental Pty Ltd was commissioned by Maunsell AECOM to provide a desktop assessment and audit of the agricultural capability of land within the rural zone and to discuss and analyse specific rural land use trends and issues. A detailed description of the level and context of agricultural production is provided.

The aim of the rural areas audit and issues review is to provide a base level of information for use in the development of a strategic framework for rural land use in the municipality.

The rural areas audit reviews the major landscape characteristics of the local area including geology, climate, and soil type to assess agricultural capability. The review also identifies potential barriers and constraints to further horticultural development.

The major finding of the rural areas audit was the identification of areas for future potential irrigation development. These areas include Nangiloc-Colignan, Thurla/Benetook and Lake Cullulleraine.

Rural issues and land use trends were also discussed and analysed where possible. Issues examined included the impact of the Deakin Report, water industry reform, residential amenity in rural zones, viability of agricultural lots, urban encroachment and the application of a rural conservation zone. The review discussed the broad trends in rural land use. Some of the issues and trends identified include :-

- The majority of land retired from irrigation occurred in the FMIT irrigation district. Retired land within the irrigation districts is most likely taken up for residential/urban development. There is little to no demand for rural residential development in the dryland agricultural area;
- Generally new irrigation developments are occurring at a larger scale outside of the pumped irrigation districts;
- Rural residential development within the rural zone (lots <2 ha) is generally scattered throughout the irrigation districts. Some small residential lots occur in clusters adjacent to roads;
- Previous Rural Residential studies have already identified areas to be rezoned to low density residential zones to meet low-density residential demand for the next 10 years. Findings of the previous studies should be incorporated into the Rural Areas Land Use Strategy. Planning for any future residential areas within the rural zone should also incorporate irrigation infrastructure maintenance, upgrade and expansion plans;
- Water reform will enable market forces to more effectively influence the operation and management of horticultural enterprises;
- The water authorities are commencing a planned process to upgrade off farm infrastructure in the pumped irrigation districts, which provides a high degree of certainty that the intensive irrigation area will continue and there will be potential for improvements in on farm efficiency;

- The issue of inefficient or stranded water infrastructure in the pumped irrigation district of Mildura needs to be taken into consideration;
- Viable property size for viticulture is considered to be approximately 15 ha, depending upon a number of assumptions. There are more constraints to consolidation of lots within the pumped irrigation districts (in the form of roads, houses, sheds etc). The average property size within the Mildura irrigation district is 8 ha and the average property size in the Nangiloc-Colignan area is 58 ha;
- Many small bona fida full time growers in the pumped irrigation districts are feeling the effects of low commodity prices, and some would leave the industry if they could excise their house block and sell the horticulture land as a going concern. Planning policy needs to be flexible enough to ensure that the productive land attached to these blocks can be consolidated with other productive land to improve viability of remaining growers;
- There is a trend to part time farmers in the pumped irrigation districts. Part time farmers swing the emphasis from viability and lot size to one of productive value of the land;
- Right to Farm is currently not a major issue in Mildura. Residential development adjacent to rural areas however, has the *potential* to trigger right to farm issues. Purchasers of rural residential lots should be well-informed of current irrigation management practices; clustering of lifestyle living allotments would enable the impacts to be reduced;
- Urban growth boundaries have recently been redefined by a retail strategy undertaken by Council. Urban boundaries should be clearly delineated to ensure the community is well informed of intended future land use; and
- The Rural Conservation Zones should be applied to small inliers of private land in the large national parks. This suggestion was put forward by the Public land manager.

The findings of this report are limited by the scope of the review, which was a desktop assessment only. The rural areas audit and broad rural land use trends identified in this report are intended to provide a base level of information to establish a rural land use framework and should not be utilised for any other purpose. A list of assumptions is provided in Section 5.4.

1.0 OBJECTIVE

The objective of the project is to undertake a limited desktop analysis of the agricultural capability of land described within the Rural Zone of the Mildura Planning Scheme. The assessment will identify and classify soils within the municipality. It will assess their ability to support agricultural production. It will also discuss access to irrigation infrastructure, lot size and distribution within the agricultural and horticultural areas to determine future agricultural viability.

The report will also specify trends and issues that are considered relevant to future agricultural production within the Rural Zone. In particular, these issues include: implications from the Deakin Project, residential and urban encroachment into rural areas, potential impacts of water reform and right to farm issues.

2.0 BACKGROUND TO REPORT

The Rural Areas Strategy is in response to the recent introduction of new rural zones for municipal planning schemes by the Victorian State Government. The new rural zones aim to :

- Recognise the state, regional and local importance of agriculture as an industry and provide greater protection for productive agricultural land;
- Provide a wider choice of zones with clear purposes and controls to match.
- Discourage ad-hoc and incompatible use and development within rural land;
- Recognise the changing nature of agricultural activities and reduce the potential for conflict between agricultural and other, more sensitive, land uses;
- Recognise that rural areas are places where people live and work;
- Recognise and protect rural areas that are environmentally sensitive;
- Remove the need for permits for minor matters.

The final combinations of new rural zones are a new Farming Zone, a new Rural Activity Zone, the new Rural Conservation Zone (already introduced) and a revised Rural Living Zone. The Victorian State Government has stated that individual Councils can now resolve how and when to incorporate the new rural zones into their respective planning schemes.

Maunsell AECOM was engaged by the Mildura Rural City Council to prepare a long-term Rural Area Strategy for the municipality.

The Rural Area Strategy aims to provide a framework to guide subdivision, development and use within the rural zone, consistent with the recent introduction of new zones for rural Victoria by the State Government as outlined above.

The audit of the rural zone should identify areas of high agricultural productivity, areas with access or potential future access to irrigation infrastructure, existing rural

living areas and areas of environmental significance. This audit will provide a basic level of information from which a broad rural landuse framework can be based.

The Review will discuss current issues relevant to rural land use to identify rural land use trends. These trends and issues can then be incorporated into the strategic rural land use framework to manage and maintain the future agricultural productivity of the region.

It is understood that the rural land use issues identified within the brief are not an exhaustive list and further relevant issues may be identified during the consultation process.

Some of the issues identified include: a review of the Deakin Project; irrigation supply infrastructure; existing small lot subdivisions in rural areas; water industry deregulation; multiple uses in rural zones; residential amenity; viability of agriculture on small lots; urban development and conservation areas within rural zones.

A Glossary is included in Appendix 1.

2.1 Study Area

The land covered by the Mildura Rural City Council consists of three major types of agricultural and horticultural production. Firstly, there are the small-scale horticultural production areas in and around the old pumped irrigation districts of Mildura, Red Cliffs and Irymple. The second type of productive agriculture is described as larger-scale horticultural production located to the east and central north of the municipality. There is also the large-scale dryland farming area generally utilised for cereal cropping and located to the south and west of Mildura.

The study area for this project is all of the land within the municipality that is subject to the provisions of the Rural Zone (illustrated within the yellow area on Map 1). The focus of the review however, will be on land situated within and adjacent to the existing irrigation districts, Mildura township and areas of rapid expansion of irrigation development such as Nangiloc-Colignan. It is anticipated that a number of the issues to be investigated will be more relevant to these areas.

The rural areas are important for a number of reasons. The economy of the region is largely reliant on the horticultural and agricultural activity, which characterises the region. The majority of the population is employed in the agricultural, wholesale and retail sectors. In turn it has been noted that the future economic growth of the region will largely depend on the expansion of the horticultural and agricultural industries (PPK 1998).

2.2 Overview of the Agricultural Sector

2.2.1 Agricultural Production

The area occupied by the Mildura Rural City Council is 2.208 million ha (Table 1). Fifty six percent of the municipality is private land (1.24 million ha) and used almost

all for agriculture. Urban land accounts for a fraction of one percent and has not been estimated. The balance of the area (965,000 ha) is public land and used for biodiversity conservation and recreation. By area, about 98 percent of the private agricultural land is dryland and a little more than two percent (28,085 ha in 2003) is irrigated. All but about three percent of private land is cleared. The ABS reports that out of the total population of 50,460 recorded in the municipality in 2001, there was a total workforce of 20,665. In that year 17.8 percent of the workforce was employed in primary production, while in 1996 the figure was19.5 percent. In 2001, 10.4 percent of the workforce was employed in manufacturing. It is reported that most of manufacturing relates to agriculture and horticulture by providing services to these industries or value adding to the outputs.

Table 1 Landuse by area (ha) for Mildura municipality in 2003

Landuse	Area (ha)[2]
Public land, all categories[1]	965,376
Private land, dryland farming	1,215,148
Private land irrigation	28,085
Total	**2,208,609**

[1]Some public land is used for dryland agriculture under license, mainly for grazing of domestic livestock.

[2]Data sourced from SMEDB 2005.

2.2.2 Dryland Farming

The semi arid climate and relatively sandy soil dictates that the land is used for dryland cereal production and sheep grazing for prime lamb meat. These two landuses are complimentary to each other although their relativity is driven by economics. The dryland farming area covers the Millewa and the area along the Calder Highway and the Mallee Highway between Murrayville and Kulwin. The extensive railway network was established 100 years ago to serve the wheat industry and continues to do so today. Grains silos were subsequently built at regular intervals along each line. There are about 500 farms in the municipality with an average size of about 2,500 ha. The number of farms is continuing to decline as farmers strive to improve economies of scale by purchasing more land. The reduction in the number of farms has been an ongoing trend since settlement. This reduction has caused a flow-on effect to the small towns in the cropping areas, which are struggling to retain local services, and this trend is likely to continue.

Grains account for about 85 percent of income for the 500 farmers in the municipality. The area is noted for production of wheat (60 percent) as well as malting barley (30 percent) and other minor crops (10 percent) including canola, lupins field peas and triticale. The wheat crop is almost all marketed as *Australian prime hard wheat,* which gives the region a marketing advantage on the world market. About 55 percent or 668,000 ha of the farming area is cropped annually. The value of the main crop types and production figures are provided in Table 2

Table 2 shows that the value of grain production for a total yield of 1.048 million tonnes at the farm gate was estimated to be worth $210 million in 2003-04. On average this would be about one third of Victoria's production. The Australian wheat industry is very efficient in world terms when compared against labour output. Farmers substitute machinery for labour to improve output per unit of labour. However productivity per unit of land is relatively low even by Australian standards. Nevertheless the cost of land genuinely reflects the value of the land for cereal production and therefore in the industry remains viable and facilitates sale of land to successful farmers it is essential that planning policy encourages efficient farmers to take whatever steps are needed to survive including accruing more land.

Table 2 Grain production and value (rounded), Mildura municipality

	[1]Area sown pa (ha)	Average local yield (tonne/ha	[1]Total Productn (tonnes)	[1]Average value ($/tonne)	[1]Farm gate value ($million pa)	Av yield Australia (tonne/ha)
Wheat	401,000	1.6	641,000	200	128	2.0
Barley	200,000	1.8	360,000	190	68	2.27
Other	67,000	0.7	47,000	290	14	[2]See below
Total	**668,000**		**1,048,000**		**210**	

[1]Data sourced from SMEDB 2005; the values and total production figures are theoretical. They are calculated from the average yields and prices and the average estimated area of production. The figures above are not based on hard data.

[2]For other crops the average Australian yield for canola is 1.6 tonne/ha, triticale is 1.9 tonne/ha, lupins is 1.49 tonne/ha, and field peas is 1.35 tonne/ha.

There are virtually no hobby farmers or "Collins Street" farmers in the Mallee to inflate land values. Most farms consist of non-adjoining and sometimes widely scattered blocks as a result of purchase of new land. Grain production is highly variable due to seasonal variation. Technology has enabled a steady but small increase in average yields and at the same time reduction in costs. The recent trend to trial direct drilling of cereals is an example. The trend to fewer, larger farms and bigger machinery is likely to continue.

2.2.3 Livestock

The sheep industry has been gradually declining in regional importance for a long period. The sheep industry earned about $9 million in 1998/99. Turnover at the three saleyards in the municipality totalled 283,000 sheep in 2002-03 and dropped to 180,000 sheep in 2003-04, with the three year average sales valued at $14 million. The value of cattle production for the municipality was less than $2 million. Economies of scale do not come as easily to the livestock industries as grain production.

2.2.4 Irrigated Horticulture

The irrigation sector is the powerhouse of the municipality and continues to expand both in area, production and value adding. The local area has many advantages for attracting high value horticulture and food processing. These advantages include ample cleared land in large parcels, access to water in the Murray River through the water market, and free draining sandy soils. There are highly developed local industries to support horticulture and water management, including consulting services, financial services, contracting services, engineering, transport, packaging and processing. Rapid change has been driven by the wine boom and facilitated by water reform. There has been a decline of the dried vine fruits industry in the last ten years. There has been steady expansion in areas of irrigation at Nangiloc, Lake Cullulleraine and Lindsay Point. The relative importance of the pumped districts is declining. Many older blocks of sultana grapes used for dried fruits have been converted to other crops. There is a trend away from multi purpose grapes to specialist wine varieties with wine grapes now accounting for well above half the total grape crop. Since water has been given value through the water market, there has been a rapid adoption of technology to improve water use efficiency and management. Technology has also benefited many of the cultural activities such as pruning, spraying and harvesting with less requirement for labour in most of the industries. The dried vine fruits industry has a strong labour requirement at harvest. Some full time small growers are "doing it tough" with low commodity prices in some of the horticultural industries.

A notable feature of local horticulture is the strong integration across the neighbouring state borders, particularly in the wine grape and citrus industries. Integration for these industries makes it difficult to provide local production data and values. There is a great deal of movement of raw and processed produce in both directions between each of the three local states. Labour and services also moves across borders. The respective industry bodies have figures for 2004 but most do not record production by state or municipality, rather they provide tri state data, the size of catchment varying for each industry. ABS figures for such a rapidly changing scene are not current. The net result is that the best recent figures are industry based, not area-focussed, and include Euston-Robinvale-Wemen, Monak-Gol Gol-Wentworth as well as Mildura municipality in what is known as Sunraysia. Some industries provide data of production in the Murray valley, which includes the addition of Swan Hill and Balranald. The wealth is shared on both sides of the river. Figures are published by the Sunraysia Mallee Economic Development Board, (SMEDB 2005). Highlight from this source for irrigated horticulture in the Sunraysia area are summarised below :

- The Murray valley produced 21 percent (400,000 tonnes) of the national wine grape crush in 2004 with a farm gate value $224.7 million;
- For the Murray valley, white wine grapes increased 34 percent on the previous year, and red wine grapes increased 18 percent;
- North west Victoria produced 69 percent (48,408 tonnes) of the national table grape crop in 2004;
- Sunraysia produced 95 percent of the national crop of dried vine fruits from 10,100 ha, yielding 27,900 tonnes worth $41.6 million in 2004;

- For citrus, the Murray valley produced 20.8 percent of the national crop in 2003-04 from 7,030 ha, 40 percent of the crop is exported;
- Sunraysia produced a total of 106,000 tonnes of vegetables from 4,240 ha worth $58 million in 2004. Carrots accounted for 23 percent of national production and asparagus was 24 percent;
- Mildura produced 1200 tonnes of mushrooms worth $3 million and was 2.3 percent of the national crop in 2004;
- Sunraysia produced 840 tonnes of olives from 770 ha, or 33.6 percent of the national crop in 2004;
- There were 4,250 tonnes of almonds produced in Sunraysia in 2004;
- There are more than 30 wineries in Sunraysia, ranging from an annual crush of 100,000 tonnes to small boutique wineries. A substantial proportion of the wine produced is exported from more than half these wineries. The proportion of local wine packaged in wine casks has steadily declined as the quality has improved;
- The value of wine produced in the Murray valley is estimated to be about $1.2 billion, which is 25 percent of the national production.

Accurate current data on the areas of various crop types are published by SunRise21. The report titled *Irrigated Horticulture of the Lower Murray Darling 1997 to 2003* or more commonly known as the *Crop Report*. Three such reports have been produced. The most recent report was published in June 2004 using data collected in 2003 and compared with previous reports. The report compares figures for 1997 and 2003 for the Murray valley and has been analysed here for the six sub regions relevant to the Mildura municipality for six crop types. SunRise 21 has collected spatial and other information relating to irrigated horticulture for all irrigated land in the region. The maps and trend analysis resulting from the survey, are periodically published.

The areas for each of the six crop types are shown in Table 3. The area of irrigated crops has expanded in each of the sub regions except for the Mildura pumped district, which has fallen. The Nangiloc Colignan area has grown substantially, accounting for more than half the total growth, mostly attributed to vine fruits. The total area of citrus is static while the area of vegetables has almost doubled. The category listed as "other" includes irrigated lucerne, pasture and other field crops.

In view of the fact that grapes are the most important crop, the Crop Report further analyses the uses of grapevine crops. The areas of the six sub regions are again highlighted for grape vines in Table 4 for the years 1997 and 2003. The total area of dried vine fruits has decreased by more than 1000 ha, with falls evenly distributed across the three pumped districts. The total areas of wine grapes and table grapes have increased substantially in all districts, although Lindsay Point and Cullulleraine do not produce table grapes.

An analysis of trends in property size for irrigated horticulture has also been conducted by Sunrise 21 2004 and is presented in Table 5. The analysis selects three ranges of property size for each of the six sub regions in the municipality and provides data for 1997 and 2003. A limitation of the data is that the minimum group for property size is less than 20 ha. The data is not particularly helpful in further

analysing the pumped irrigation districts where more than ninety percent of properties fall into this one category. Table 5 indicates that for the pumped districts the smallest category is decreasing in the number of growers, whilst the two larger categories have increased. Average property size has not significantly changed. For the private diverters the highest category has increased and the average property size has grown substantially.

There is also a small area of irrigation in the Murrayville district, based on annual vegetable crops. There is relatively good quality ground water available for stock and domestic supply and irrigation from the Duddo limestone aquifer (Mallee CMA 2003a). This aquifer is unique to the Murrayville district in the municipality. Irrigated potatoes are grown using centre pivot technology. There is no local processing undertaken and the labour requirement is low. The area of irrigation could expand subject to license approval, as more water is available. There is local opposition to irrigation at Murrayville. SunRise 21 does not provide data on the Murrayville irrigation industry.

Table 3 [1]Areas of horticultural crops (ha) in 1997 and 2003 for six sub regions in Mildura municipality

	Nangiloc Colignan priv divrs		Mildura private diverters		Red Cliffs pumped dist		Mildura pumped dist		Merbein pumped dist		Lindsay Pt, Culluller priv divrs		**Totals**	
	1997	**2003**	**1997**	**2003**	**1997**	**2003**	**1997**	**2003**	**1997**	**2003**	**1997**	**2003**	**1997**	**2003**
Grapes	2,900	4,875	705	1,005	4,080	4,315	5,690	5,555	2,750	2,895	380	680	**16,505**	**19,325**
Citrus	2,570	2,630	115	95	140	105	165	135	205	145	120	160	**3,315**	**3,270**
Nut	195	330	0	0	45	70	35	30	60	55	740	810	**1,110**	**1,295**
Fruit	335	265	25	30	55	30	90	65	55	50	0	0	**510**	**485**
Veges	355	470	20	130	200	325	80	85	40	80	10	145	**705**	**1,235**
Other	525	425	460	455	105	80	430	345	185	130	990	1,040	**2,695**	**2,475**
Totals	**6,880**	**8,995**	**1,325**	**1,715**	**4,625**	**5,625**	**6,490**	**6,285**	**3,195**	**3,395**	**2,240**	**2,833**	**24,840**	**28,085**

[1]From SunRise 21 2004

Table 4 [1]Areas of grape vines (ha) by use in 1997 and 2003 for six sub regions in Mildura municipality

	Nangiloc Colignan priv divrs		Mildura private diverters		Red Cliffs pumped dist		Mildura pumped dist		Merbein pumped dist		Lindsay Pt, Culluller priv divrs		**Totals**	
	1997	**2003**	**1997**	**2003**	**1997**	**2003**	**1997**	**2003**	**1997**	**2003**	**1997**	**2003**	**1997**	**2003**
Wine	2,665	3,900	390	620	2,265	2,860	2,380	2,530	915	1,305	375	680	**8,990**	**11,895**
Table	185	315	70	235	470	610	935	1,255	150	300	0	0	**1,810**	**2715**
Dried	50	660	245	150	1,345	845	2,370	1,770	1,670	1,290	5	0	**5,685**	**4,715**
Other	0	0	0	0	0	0	5	0	15	0	0	0	**20**	**0**
Totals	**2,900**	**4,875**	**705**	**1,005**	**4,080**	**4,315**	**5,690**	**5,555**	**2,750**	**2,895**	**380**	**680**	**16,505**	**19,325**

[1] From SunRise 21 2004

Table 5 [1]Changes in number and area of irrigation properties between 1997 and 2003 in Mildura municipality

	Year	Number <20 ha	Number 20-40 ha	Number >40 ha	Total Number	Average Irrigated area (ha)
Nangiloc Colignan	1997	62	40	44	146	46
Nangiloc Colignan	2003	63	38	55	156	58
Mildura priv divrs	1997	111	10	8	129	10
Mildura priv divrs	2003	106	10	11	127	14
Red Cliffs pumped	1997	536	18	5	559	8
Red Cliffs pumped	2003	516	21	8	545	10
Mildura pumped	1997	849	45	6	900	7
Mildura pumped	2003	798	46	11	855	7
Merbein pumped	1997	336	21	3	360	9
Merbein pumped	2003	332	21	7	360	10
Lindsay Pt - Cullulleraine	1997	10	2	13	25	83
Lindsay Pt - Cullulleraine	2003	9	2	16	27	98

[1]From SunRise 21 2004

2.2.5 Summary

The preceding discussion indicates that local irrigated horticulture and supporting industries are highly efficient and are expanding. The dried vine fruits industry has contracted over the last decade, while wine grape production has expanded dramatically. Some small growers in the irrigation districts are in trouble with low prices for their fruit. The amount of wine produced by the regions 30 wineries is about one quarter of the national production. Expansion of the irrigation industry will continue to occur through transfer of water from upstream. The area of land required for irrigation is small relative to the total area used for dryland farming. Dryland farming in the Mallee is efficient and the size of farms will continue to increase at the expense of small towns. Agriculture and horticulture will use less labour in the future however services to the industries and value adding will provide employment growth.

PART 1 RURAL AREAS REVIEW

3.1 Methodology for Capability Assessment

Agricultural Landuse Capability is defined as the "*systematic arrangement of land into various categories according to its capability to sustain particular agricultural landuses without land degradation*" (ACT Planning and Land Authority, 1999).

The assessment of Agricultural Capability relies on the identification and interpretation of land units with similar climatic, geological, landform and soil characteristics to determine landuse constraints (if any) and hazards. This information is then used to assess the capability of the land to sustain various uses. Land capability assessment involves the consideration of all the environmental factors, which may affect land use. Rural land capability is usually defined by the intensity of land use, which a soil/land system is capable of sustaining without land degradation.

This report defines land capability by analysing a number of environmental factors that may contribute to land capability within the area. Soils are mapped and classified according to a system developed by Sunraysia Environmental, which reassesses the data from the old government soil surveys to show crop suitability. The location of irrigation infrastructure, land systems and salinity risk, are also discussed.

All the factors are then combined to provide a spatial distribution of land capability and enable general comments to be made on the land capability of the Mildura region.

3.2 Landscape Characteristics

3.2.1 Climate

North west Victoria has a semi-arid climate, which is typified by a low but reasonably uniform average monthly rainfall and a relatively low mean annual temperature. As the region has generally low topographical relief with only minor variation there is little climatic change across the region (LCC, 1987).

The average rainfall is approximately 250 mm but there is considerable variation from year to year. Rain occurs more reliably in the winter months, however, there are highly variable and unpredictable summer rains.

Winters are generally cool with moderate frost risk. Summers are hot with temperatures exceeding 40°C (LCC 1987) perhaps five to 10 times in a season.

3.2.2 Geology and Hydrogeology

The geology in the Mildura area consists of Tertiary sediments including the Parilla Sand, which is overlain by the Blanchetown Clay Unit. Quaternary aeolian dune deposits of the Woorinen Formation generally overlie the Blanchetown Clay (Golder Associates 2004). The Woorinen Formation is located across much of the Mildura region. The Woorinen Formation consists of parallel dunes orientated east-west, incorporating sand, limey, reddish, clayey soils including paleosols with prominent caliche horizons (Van de Graff et al 2000).

Along the Murray trench at Lake Cullulleraine is the Coonambidgal Formation. This is an upper fluvial terrace consisting of clays, sands and sandy clays which are often grey with slight soil development. South of Red Cliffs there is an area of lower fluvial terraces of the Coonambidgal Formation, which has the same deposition as the upper terraces (Van de Graff et al 2000).

The Parilla Sand is the major regional aquifer beneath the Mildura area. A perched groundwater system is sometimes present above the semi-confining Blanchetown Clay layer within the Woorinen Formation.

There is currently a groundwater mound around the Mildura region situated at about 10-15m higher than the pre-irrigation level (LCC 1987). This groundwater mound forms a pressure variance and causes the groundwater to flow west and into the Murray River increasing the salt loads deposited in the River. This issue is well documented. It is discussed in more detail in Section 3.3.2.

3.2.3 Geomorphology and Topography

The subject land is part of the Mallee dunefield system, in which the topography is generally flat to gently undulating. The Mallee dunefields are typified by aeolian (windblown) deposits on the surface usually moulded into a number of dune types with intervening plains (swales) that are well above the flood level of the Murray River. The Mildura city and residential area are located in a relatively level plain with minor undulations.

The soils at the surface are aeolian deposits of the Woorinen Formation characterised by gradual increases in clay, carbonates (limestone) and soluble salts at depth. Soils consisting of fine windblown clays generally give rise to calcareous clay soils and mixtures of the fine clays and courser gravel materials give rise to calcareous earths and sandy duplex soils (LCC 1987).

3.2.4 Soil Type (Crop Suitability)

Between 1939 and 1941, each of the Irrigation Districts of Merbein (3,320 ha), Mildura (6,943 hectares) and Red Cliffs (4,858 ha) had a soil survey carried out by the Division of Soils, Council for Scientific and Industrial Research, and the Victorian Department of Agriculture. A soil survey of the Nangiloc-Colignan area (4,453 ha) was completed in 1986, in a joint project between the State Chemistry Laboratory, Victorian Department of Agriculture and the State Rivers and Water Supply Commission.

The soil surveys classified and mapped the soils into a number of types and phases. A detailed description is given of each type and phase with soil types showing the usual relationships between elevation and texture, the lighter types on the higher land and the finer, heavier textures lower in the landscape.

Comments are made about suitability of the soils to various crops, however most emphasis is given to their absorptive capacities for irrigation water, their inherent salinity and the nature of the soil profile as a guide to the drainage requirement and technique.

From a crop suitability perspective, the level of definition between the soil types and phases in the soil surveys is unnecessarily complex. For easier interpretation, the soil profiles of each type and phase have been assessed against a set of criteria developed by Sunraysia Environmental for fine scale crop suitability investigations in these soils.

The criteria take account of physical and chemical impediments to root penetration and whether they can be readily ameliorated, potential rooting depth and soil drainage characteristics. A detailed description of the criteria utilised to classify the soils is included in Appendix 2. The assessment procedure also assumes an efficient pressurised irrigation system and the ability to install artificial sub surface drainage if necessary.

Maps 2a, 2b, 2c and 2d illustrate the soil suitability for crops within each of the irrigation districts and throughout the Nangiloc – Colignan irrigation area respectively.

The information presented on the Crop Suitability Maps (Map 2a, 2b, 2c, and 2d) should be interpreted as follows:

- Green colouring, land is suitable for avocado, citrus, almonds, stone fruit, grapes, olives and vegetables;
- Blue colouring, land is suitable for citrus, almonds, stone fruit, grapes, olives, vegetables and pasture;
- Orange colouring, land is suitable for stone fruit, grapes, olives, vegetables and pasture;
- Red colouring, land is recommended for exclusion from development to most horticultural crops.

It is noted that within each of the irrigation areas there is only a small area of soils, which are considered unsuitable for crops. The Nangiloc–Colignan area contains a number of patches of land, which are classified as unsuitable. These unsuitable areas are most likely swales between dune areas and/or saline basins. They may also be areas formerly part of the Murray River floodplain where dunes have advanced across the landscape from the west leaving some of the floodplain exposed within the dunefield.

3.2.5 Land Systems

A land system contains a regular pattern of land components, which have different potentials and management requirements (LCC 1987). Land system classification is utilised for regional planning and is relevant at large scales only. No one factor determines productivity of a land system. The productivity is characterised by the combination of climate, geology, landforms, soils and vegetation. In the Mallee for example, ridges, plains above flood level, and east west dunes are common landforms. Their relative frequency in the landscape has been mapped giving rise to about 20 land systems. The relativity of coarse textured and fine textured soils are also taken account in the land system classification.

A map of the land systems of the Mallee is reproduced in Map 3 along with a description of the land system units distributed throughout the study area.

Map 3 illustrates that a large proportion of the Mildura area is within a land system of "scattered east west dunes on Raak and Tyrrell depressions". The land system is abbreviated by the **PEfc2** label in the map. The PEfc2 is an abbreviation for **P=plains dominant, E=east west dunes, f=fine textured soils more frequent than, c=coarse textured soils, and 2 relates to a range of rainfall.** In the abbreviation the landform characteristic, which is more dominant and/or frequent is listed first. This landform generally contains heavier textured soils, which due to the clay content, are not freely draining. The impermeable clay layer is generally quite shallow in this land system, with the majority of the area on the plains and only small isolated dunes present. For these reasons this land system is not considered to be highly suitable for irrigation/agricultural development.

The land system abbreviated **RPEfc2** – "scattered east west dunes on ridges" (**R=ridges**) and plains consist of deeper more freely draining soils. This system is illustrated as being located to the west of Mildura and also to the east. The system consists of weakly formed dunes with deep sands and clays at depth. As the soils are free draining and not impeded by shallow clays they are more suitable for irrigation development.

The land system **EPfc2** – "closely spaced east west dunes with compact cores" is located towards the east of Mildura within the Nangiloc–Colignan irrigation area. As the dunes within this system are well formed they contain very deep sandy soils, which as discussed are well suited to irrigation development. The land system will also contain some shallow depressed areas (swales) between the dunes. The swales generally contain heavier soils and shallow clays, which due to their lesser drainage characteristics and the potential for salt accumulation are not as suitable for irrigation.

3.2.6 Water Resources

The Murray River is the main permanent natural supply of surface water to the region. A fresh groundwater aquifer is extensively used in the Murrayville area for stock, domestic supply and irrigation of row crops. Although the Murray River is technically within the Wentworth Shire, its water is important to the region for urban, irrigation and stock and domestic water supply (Mallee CMA 2003a). The Murray

River's southern anabranches, however, such as the Chalka, Carwarp, Lindsay, and Wallpolla Creeks are included in the Mildura municipality.

With its porous aeolian sediments and semi-arid climate, the Mallee lacks any reliable runoff from rainfall (LCC 1987), which highlights the importance of the Murray River for permanent and reliable water supply to the region.

The suitability of water for domestic, agricultural and aquatic life depends on its quality. Water quality is generally defined by a number of parameters including temperature, turbidity, dissolved oxygen and concentration of dissolved salts. The total dissolved salts concentration (TDS) or salinity describes the concentration of dissolved salts in the water, principally sodium chloride, which is a common indicator of water quality for domestic and agricultural use.

All streams carry some levels of salts derived from rock/stream bed erosion, rainfall and groundwater discharge. The amount of salt in the Murray River is diluted due to the large volumes of water that the river contains. Generally the Murray River averages about 200 mg TDS/L within the municipality (LCC 1987). In general 1000 mg TDS/L is the upper limit for water for domestic use (LCC 1987).

Groundwater resources in the area depend upon the salinity levels of the water and the volumes that can be extracted, which in turn depends on the type of rock strata that the water is stored in and their permeability and rates of recharge.

In the Mallee, the groundwater is of good quality in the Murrayville area, but mainly saline elsewhere. In the south, groundwater movement is generally to the north and in the north groundwater movement is generally to the west (LCC 1987). Groundwater discharge in the central Mallee creates inland salinas (eg west of Ouyen) and saline lakes (eg Pink Lakes). Groundwater discharge also occurs into the bed of the Murray River and this is a major contributor of salt load to the river. The flow to the river is a natural process that has increased since European settlement (Mallee CMA 2003b).

3.2.7 Flora and Fauna

The Mallee region is home to Victoria's most diverse flora and fauna populations, including many unique flora species. The Mallee is a particularly significant region as it represents the boundary between the arid zones to the north and cooler moist climes to the south. The Mallee is characterised by extreme temperatures and low rainfall, but surprisingly supports a diverse number of habitats, vegetation communities and flora, and fauna species (Mallee CMA 2003a).

The influence of the Murray River and adjacent floodplain on the semi-arid terrestrial environment creates a range of unique habitats for flora and fauna species, many of which would otherwise be unable to survive in the area.

The flora of the Mallee is diverse and unique in Victoria, with approximately 1000 vascular plant species (including 11 mallee eucalypts, 5 other eucalypt species).

Animals include; 300 bird species, 29 species of mammal and 77 species of reptile. The Mallee represents the range of extremities of many species, and local populations, which also occur to the north and south of the region. These species are likely to be genetically distinct, and therefore important from a biodiversity perspective (Atlas of Victorian Wildlife 1996 - data base).

Although one third of the Mallee is protected as public land, conservation of biodiversity on private land and roadsides is vital. Many of the fifty *ecological vegetation classes* identified are under-represented on public land. This is because the large blocks of Public land were mostly on the poorer soils unsuitable for agriculture, and are therefore unrepresentative of the better soils. Only three per cent of the native vegetation originally occurring on private land remains. Much of the remnants are declining in quantity and quality. Remnants are protected by legislation, but will continue to decline unless measures are taken to enhance quality and improve connectivity. The grassy woodlands (covering a range of Murray pine/buloke and belah dominant vegetation classes) are under represented on public land and in severe decline on private land (Mallee CMA 2004).

The roadsides of the Mallee are often the main intact habitat in a local area, and also have value as corridors for wildlife. However, roadsides are also under threat from many pressures including irrigation development and other adjoining land use (Mallee CMA 2004).

Individual species of flora or fauna and communities of flora can be described as threatened if they are at risk of becoming extinct. Flora and fauna become threatened through a range of factors that may be natural or human induced. A plant population or vegetation community may be destroyed by fire; over grazed by herbivores; out competed by introduced plants, or by land clearance for development, horticulture or agriculture. Fauna may become extinct in an area following habitat loss. As the distance between suitable habitat patches become greater, it is more difficult for fauna to disperse to other populations, forage for resources and breed with other individuals. One of the biggest threats to Mallee wildlife is the loss of habitat through development and use of land management which results in changes in habitat composition, habitat quality and habitat fragmentation (Mallee CMA 2004).

Changes in land use, habitat loss, fragmentation and degradation of available habitat and altered fire regimes have contributed to the decline of many species of flora and fauna in the Mallee. Predation by foxes, wild dogs, and feral cats, competition by pest plants (African boxthorn, bridal creeper) and total grazing pressure (rabbits, kangaroos, feral pigs and livestock) also have a big impact (Mallee CMA 2004).

Two examples of endangered species (in Victoria), which locally are under a great deal of pressure, are the carpet python and regent parrot (*Flora and Fauna Guarantee Act* 1988).

The carpet python lives in mature black box and river red gum woodlands along the floodplain of the Murray River. The Carpet python is threatened by the loss of available habitat caused by the removal of woody debris from the ground. Both the Regent Parrot and carpet python depend on old habitat trees with nesting hollows for

breeding (Mallee CMA 2003a). The loss of the very large old trees and grassy understorey as a result of salting, intensive land use or over-grazing by livestock, rabbits and kangaroos and predation by foxes and feral cats are also threatening the long-term survival of the carpet python and regent parrot. Although much of the floodplain is protected to some degree by its status as public land, reptiles and other fauna are still at risk from irrigation infrastructure, construction of access tracks and many of the threats mentioned above. Close proximity of urban areas or lifestyle development on or near the Murray River floodplain increases the impacts on both these threatened species within public and private land.

The regent parrot has another special requirement to survive. It relies on roadside corridors to feed in and to gain access to feeding grounds in large patches of mallee each day. The parrots return to the red gum forests daily for nesting and breeding. These parrots are threatened by destruction or fragmentation of corridors along roads and on private land. This threat is particularly evident in the irrigation areas, and within 20 km of the riverine corridor. Steps have been taken in the Nangiloc Colignan area to conserve mallee remnants and improve connectivity during irrigation development. Incremental loss of mallee vegetation from roadsides and remnants within the 20 km zone places further pressure on the Regent Parrot (Mallee CMA 2004). Intensive irrigation development adds pressure on roadside corridors and scattered single trees. Increased intensity of lifestyle living blocks also adds pressure on flora and fauna both on private land and nearby public land and roadsides. The most sensitive areas potentially impacted on by lifestyle living are areas of riverine forest on public and private land along the Murray River corridor. Roadsides containing mallee that link with the floodplain are also in need of additional protection (Mallee CMA 2004).

Threatened species and native vegetation are already protected by several mechanisms. These include clearing controls under the *Planning and Environment Act* 1987, protection as public land, and the *Flora and Flora Guarantee Act* 1988.

Two projects under development by the Mallee CMA, DPI and DSE will contribute to future protection of biodiversity when irrigation development occurs (pers. comm. I Ballantyne, Mallee CMA 2005). One project is the “buffers” project, which will identify criteria to determine effective buffer width to separate new irrigation development from native vegetation. The issue of buffers for new development should be identified as being likely to inform the planning scheme.

The second project is developing a “Biodiversity Asset Decision Support Tool”. Again this is likely to inform the planning scheme. Mildura Rural City Council is involved in the project, which is initially developing a Geographic Information System of a pilot area at Boundary Bend, but will eventually include other areas such as Nangiloc Colignan. The imminence of these projects warrants reference in the planning amendment.

3.3 Landuse

3.3.1 Irrigation Infrastructure

Map 1 illustrates the general location of the gazetted pumped irrigation districts of Merbein Mildura and Red cliffs, and major areas of private diverter irrigation in the municipality. Maps 2a, 2b, 2c and 2d illustrate the boundaries of the irrigation districts more clearly. The three local irrigation districts have their water delivery and drainage infrastructure managed collectively by the two water authorities. Private diverters access water from Murray River frontage and in a small number of cases, through utilising irrigation authority infrastructure to deliver water outside the gazetted districts. The location of private diverters is illustrated within the maps reproduced from the Crop Report (SunRise21 2004). There is a heavy concentration of private diverters in the Nangiloc - Colignan area. Other clusters of private diverters are at Kings Billabong, Ranfurly Way, Yelta, Lake Cullulleraine and Lindsay Point.

Lower Murray Water delivers both irrigation water and stock and domestic water to growers in the irrigation districts of Merbein and Red Cliffs. First Mildura Irrigation Trust (FMIT) manages the provision of irrigation water within the Mildura irrigation district. Both Lower Murray Water (previously Sunraysia Rural Water Authority) and FMIT are statutory authorities under the *Water Act* 1989. They both manage the provision, operation and protection of water supply systems and the efficient use of water. The water authorities maintain the off farm infrastructure including pumps, pipelines, channels and sub surface drainage disposal system. Maintenance is conducted in a planned way in addition to emergency response, with a view to retaining the long-term productive capacity of the growers and the district.

Lower Murray Water also manages the licensing of private diversion activities from the Murray River between Nyah and the South Australian border. Private diverters manage operation and maintenance of their own respective infrastructure consistent with their water licences. Table 6 outlines the basic areas and the amount of water pumped in each irrigation district in 2003.

Future access to irrigation infrastructure is discussed in more detail in the Trends and Issues section.

Brief discussions with representatives from the First Mildura Irrigation Trust (FMIT) and Lower Murray Water (LMW) indicated that a large amount of irrigation development has been occurring in the Nangiloc–Colignan irrigation areas, Lake Cullulleraine and also in other neighbouring municipalities along the Murray River. Table 3 demonstrates these observations. Location of future irrigation development is discretionary, being driven by proponents in areas where large parcels of cleared land are available with suitable soil. These parcels are generally within 5 to 10km of the river and must be in the *Low Impact Zone* for river salinity, refer to Section 3.3.2.

Master Plan for First Mildura Irrigation Trust

The First Mildura Irrigation Trust has completed an important document known as *Environmental and Water Savings Infrastructure Master Plan* (URS 2005). The

Master Plan will provide the Trust with a framework for managing the replacement of off farm assets over the next 50 years in the Mildura pumped district. It is not a detailed final plan. It will guide investment, help decide future operation and maintenance strategies for both irrigation and drainage infrastructure. The Master Plan states that water supply infrastructure in the Benetook and Mid areas is in good condition and will not require refurbishment for some time. However the older Central system that receives water from open channels is in need of modernisation. The Central system is comprised of four sub systems, known as L, K, T, and C and accounts for about 5000 ha or 75 percent of the total system.

Table 6 Comparison of Irrigation Districts and Private Diverters, Mildura municipality[1]

	Red Cliffs (LMW)	**Mildura (FMIT)**	**Merbein (LMW)**	**Nangiloc Coligna**	**Yelta Mildura**	**Lindsay Cullull**
Type	Pumped District	Pumped District	Pumped District	Private Diverters	Private Diverters	Private Diverters
Area of gazetted district, 2003.(ha)	Not available	7,779	Not Available	Not Applic	Not Applic	Not Applic
Area of irrigation, 2003 (ha)	5,195	6,400	3,680	9,115	1,745	2,835
Water pumped, 2003-04 (ML)	42,245	47,064	28,956	Not Avail	Not Avail	Not Avail
Number of irrigators, 2003	545	1,226	360	156	127	27
Number of gardens supplied, 2003	450 (estimate)	1,030	280 (estimate)	Not Applic	Not Applic	Not Applic

[1] From SunRise 21 2004, FMIT 2004 and SRWA 2004

The Master Plan looked at eight options for a future supply system and selected a fully pipelined high-pressure system using relift pumps to provide the pressure. The entire system would eventually be replaced at a rate determined by parts of the existing system reaching the end of useful life. The Master Plan states that the Trust will not replace infrastructure where there will be urban development in the next 50 years. Detailed planning of renewals will need to take account of urban encroachment.

The Trust has begun its program to upgrade the supply system with construction of a new water storage at Dow Avenue and replacement of the Seventeenth Street Channel with a pipeline (T North sub area) and associate works. The cost of these projects is estimated to be $6,557,200. Works are expected to be completed in 2006. Further

works are planned in sub areas K, L, T and E totalling $2.2 million in the next four years and almost $80 million will be spent on the remainder of the system within fifty years.

Improvement to the supply system will increase the efficiency of irrigation and may therefore benefit the environment and viability of growers.

The sub-surface drainage system collects drainage water from most properties in the district. Disposal is to several receival points including the Murray River, Lake Ranfurly, Lake Hawthorn, and a number of evaporation basins within the district or to the west. Maintenance mainly involves clearing of blockages of tree roots or Calcium deposition using pressurised water. The system is in relatively good condition with life expectancy estimates varying from 32 years to 66 years. However the Master Plan outlines replacement to progressively be done over fifty years commencing in 2005. The Master Plan assessed four options for refurbishment and recommended that replacement of drainage assets be at failure with a gravity collection/pumped discharge system and inland outfall. The current drainage system is mostly gravity with pipelines up to six metres below the surface. Replacement with a shallower pumped drainage system will allow far greater flexibility and ease of maintenance. A key initiative is that all drainage will be eventually directed to evaporation basins remote from the river. Areas earmarked for urban development over the next fifty years will not have the drainage system renewed.

The Master Plan recognises that urban encroachment has and will continue to erode the area of the Trust's operations. The Trust recognises that the new Sixteenth stormwater drain being constructed by Council will direct urban development commencing from Lake Hawthorn and working anti-clockwise in nodes around the perimeter of the existing urban area.

The plan suggests a number of strategies for the Trust to reduce under utilised or stranded infrastructure.

The Master Plan conveys a high level of certainty that the Mildura irrigation district will continue and there is every intention of undertaking a comprehensive renewal of the water supply and drainage infrastructure. The plan gives a high level of certainty in formulating planning policy for the new farming zone.

Infrastructure Replacement for Lower Murray Water

Lower Murray Water has embarked on preparing a similar infrastructure replacement plan for the Merbein and Red Cliffs pumped districts. A tender for "*Development of Water Infrastructure Replacement Plans for the Robinvale, Merbein and Red Cliffs Irrigation Districts*" has been awarded to URS. Water delivery infrastructure in the districts has an average life expectancy of 31 years and the system was designed to supply annually five flood irrigations on a roster in summer. The infrastructure consists of the main supply pumping stations at Merbein and Red Cliffs, which are in good condition, and channel and pipelines many of which need upgrade probably to high-pressure pipelines. Growers have generally moved to more efficient water management practices with pressurised application widely adopted and ordering of water rather than relying on a roster. The specifications for the tender asks for an

engineering assessment and design after consideration of options for refurbishment of the supply system. There are six sub-districts in Merbein and seven in the Red Cliffs district. Stranding or under utilization of infrastructure is not an issue for the Merbein and Red Cliffs districts at this stage.

This planning project strongly demonstrates the intention to upgrade the infrastructure in the Merbein and Red Cliffs districts. It is highly likely that irrigation will continue, and that water use efficiency could be improved on farm as a consequence of the off farm upgrades to infrastructure.

Combined Business Case

A second part to the tender for LMW is to prepare a *Business Case for Sunraysia Irrigation Water Supply Infrastructure Replacement*, which includes the pumped districts for both the First Mildura Irrigation Trust and Lower Murray Water. The Business Case will look at options for replacement of the combined water supply assets in the three districts. The business case will be put to both the State and Commonwealth governments for funding. The document will evaluate public and private benefits to demonstrate cost sharing arrangements between growers and the two levels of Government.

3.3.2 Salinity

Salinity has been under investigation in the Mallee for many years. In the early 1990's four locally prepared salinity management plans were endorsed by the Victorian Government. Since then the salinity plans have been implemented by land managers and local key stakeholders, with support from Government. Implementation has proceeded along agreed cost sharing arrangement between growers and Governments. A revised integrated draft plan is now with the State Government awaiting approval (Mallee CMA 2003b).

The semi arid Mallee environment has accumulated a large amount of salt in the landscape. The mobilisation of salt in the soil through water movement laterally or vertically may give rise to a salting problem. When the watertable is within two metres of the surface, capillary action will cause groundwater to rise and concentrate dissolved salts on the surface with well-documented effects on plant life and infrastructure (Mallee CMA 2003b).

The entire region is underlain by a highly saline aquifer known as the Parilla Sand aquifer. This aquifer is mostly confined from above by the relatively impermeable Blanchetown Clay. It varies in depth from near to surface to at least 30 m below ground level. The Parilla Sand is sloping to the north and northwest and outcrops in the bed of the Murray River and other points in the landscape of low elevation. Natural saline basins caused by outcropping of the regional watertable are common in the municipality (Mallee CMA 2003b).

The Woorinen Formation, which sits above the Blanchetown Clay is more permeable. Rainfall or irrigation water passing downward through the soil past the root zone forms a perched watertable above the Blanchetown Clay of relatively low salinity.

Establishment of a perched watertable is common in irrigation areas after several years of irrigation. In order to prevent perched water from depositing salts on the surface, a sub-surface tile drainage system has been installed throughout the pumped districts and at Nangiloc-Colignan. Tile drainage enables excess irrigation or rainwater to be removed from the profile, preventing the accumulation of salt in the root-zone. Pipelines collect the drainage water and convey it to either evaporation basins or to discharge in the Murray River. Improvement in water use efficiency since implementation of the commencement of the salinity plans has reduced the volume of drainage water requiring disposal. Actions to improve water management include metering of flow and conversion of on farm infrastructure to a pressurised system instead of furrow irrigation (Mallee CMA 2003b).

In areas where the Blanchetown Clay is less than four metres below ground level, drainage does not operate as effectively. This feature is a problem for both horticulture and urban development. Council has recently adopted a planning tool (REM 2004) to assist developers and Council identify salinity risk and implement measures to avoid salting in new residential subdivisions.

The perched watertable slowly permeates through the Blanchetown Clay and increases the pressure of the underlying regional groundwater. This phenomenon has caused the groundwater mound beneath areas of extensive irrigation such as the pumped districts. The result is lateral movement of regional groundwater in response to slope and pressure gradient. Lateral movement in the Parilla Sand is particularly important as it threatens water quality in the Murray River. Measures are taken locally to offset the impact of salt load to the river. The river has always acted as a natural drain for salt and now the salt balance in the river is well documented and regulated. The salt displaced to the river from all sources is monitored so Victoria can comply with its obligation under the Murray Darling basin agreements. Each year an audit is conducted to determine the respective increases and reductions to the total salt load for the Mallee region. The Mallee CMA will take steps to "claw" back salinity credits when the balance falls into arrears. A number of salt interception schemes or drainage diversion are already in place to reduce river salinity (Mallee CMA 2003b).

For every new irrigation development where water is transferred into the region there is a salinity impact on the river. The size of the impact for the Victorian Mallee can be calculated according to the underlying geology and groundwater movement at any location. Studies of the salinity impacts coupled with the appropriate policy framework established by the salinity plans, has given rise to the salinity impact zones. Map 4 illustrates the location of the designated *High Impact Zone* and *Low Impact Zones* for river salinity. Water cannot be permanently transferred into the *High Impact Zone*. Most of the local pumped districts are in the *High Impact Zone* (Mallee CMA 2003b)

Developers of new irrigation must pay a levy for water transferred into the Mallee, which reflects the salinity impact of the location on the river. The levy ultimately contributes to funding works to reduce salt credits. Large areas of new irrigation development will occur in the Low Impact Zones (Mallee CMA 2003b).

Dryland salinity impacts areas of low elevation and is caused by either perched or regional groundwater (Mallee CMA 2003b). These areas should be avoided in any change to more intensive landuses. The issue of dryland salinity sites in the Rural Zone should be further analysed for a possible planning response. As mentioned above, Council has a process for developers to determine salinity risk for new urban subdivisions on the margins of the existing urban area. The risk levels are now on a salinity overlay based on a preliminary assessment of risk levels (REM 2004). The Mallee CMA has mapped the depth to groundwater and saline discharge areas for the whole of the dryland area, and this dataset could be adapted to identify salinity risk in the dryland. The issue of a salinity overlay for the dryland farming area warrants a planning response.

3.3.3 Public Land

Public land (965,376 ha) makes up a significant proportion (43.6 percent) of the municipality. Public land, particularly National Parks and reserves, are important environmental areas. The areas support diverse ecosystems and protect areas of important flora, fauna, cultural, and scientific significance. Public land, including State Forest, also provides valuable tourism and recreational use (Mallee CMA 2003a).

In addition to the Big Desert Wilderness, there are major National and State Parks in the municipality. National Parks include Hattah-Kulkyne, Murray Sunset and Wyperfeld National Parks, and Murray Kulkyne Park. National Parks are defined as extensive areas of public land of nation-wide significance. These parks contain significant areas of landscape, flora, fauna and cultural value. There are at least 12 small isolated parcels of private land within the three large National Parks. Also of note is the King's Billabong Wildlife Reserve, which is located immediately east of the Mildura and Red Cliffs pumped districts. There are also a number of smaller Flora and Fauna Reserves and Bushland Reserves throughout the rural area including within the pumped districts.

There is a 60 m wide Public Purposes Reserve running along the bank of the Murray River with adjoining State Forest. The Land Conservation Council has recommended (LCC 1989) that the land be used for a limited number of activities including restricted timber production, apiculture, hunting, stock access, dispersed camping, pump sites and legal access (Mallee CMA 2003a).

Public land classified as State Forest is common both along the river and in the dryland area. State Forest is intended for multiple use and is important for recreation, particularly for certain organised groups that occupy portions under management agreements (Mallee CMA 2003a).

Map 5 illustrates the distribution of public land in the vicinity of Mildura pumped districts, including the inliers of private land. It is appropriate to incorporate these isolated parcels of private land in the rural conservation zone.

The presence of large blocks of State Forest to the south and west of Mildura is a barrier to contiguous horticultural expansion of the FMIT pumped district immediately to the southwest of the existing district.

The very large area of public land in the municipality comprised of many small and some large blocks and linear parcels potentially has issues for land use. For the dryland farming area, which is by far the dominant adjoining landuse, the main issues are transfer of weeds and pest animals in both directions. The other significant issue is the risk of wildfire to houses and agriculture in the vicinity of the boundary, Conversely there is a risk to the public land from fire starting on the adjoining private land. The planning scheme currently has provision for buffers of 100 m on private land which DSE suggests is adequate.

The issue of buffers on the perimeter of any new irrigation development adjoining native vegetation was discussed in Section 3.2.7 that could also apply to a buffer against public land. There could be a planning response to protect Murray River floodplain habitat from the impact of intensive lifestyle living on adjoining private land.

3.3.4 Land Capability

It has been noted that soil itself is not the sole limiting factor in determining the location of productive agricultural land, particularly for irrigated horticulture. Land Capability is the product of a number of different factors.

Depth to the clay layer in the soil profile has implications for salinity and drainage for horticulture and urban development particularly if the depth of clay is less than four metres below ground level (REM 2004). Map 2 illustrates the distribution of soils throughout the irrigation districts and generally illustrates that there are few areas within each of the districts that are not suitable for irrigated crop production. Map 3 illustrates the distribution of land systems in the northern Mallee. The more productive land systems, in particular the scattered east west dunes on ridges and plains (which generally support the Pine Belah woodland vegetation communities) are located to the south west and west of Mildura.

Parcel size is an important consideration in land capability. Large allotments are likely to have fewer constraints than small allotments, leading to economies of scale. The presence of remnant vegetation may be regarded as a constraint to land capability for horticulture, given that native vegetation is protected under the *Planning and Environment Act* 1989. The degree of constraint will depend on the total area of remnants and the degree of fragmentation and dispersal of the fragments of native vegetation in a parcel of land. Remnants may be as small as scattered old single trees. The dryland farming areas typically to the south and west of Mildura have about three percent of their area as remnants. Saltpans or drainage basins are a constraint if present, although the majority of the latter features are located in gazetted areas of public land.

Poorer soils can often be ameliorated by technology and management practices at some cost, but if access to necessary infrastructure is lacking, the best soils will not be utilised to their full potential. Map 1 demonstrates access to irrigation infrastructure. Future irrigation development will rely on expansion from either the existing irrigation districts as illustrated in the Maps 2 a, 2b and 2c, to the southwest away from the Murray River. Where established infrastructure is unavailable, further irrigation development will rely on access directly to the Murray River or to other reliable diversion points, for example Lake Cullulleraine.

Expansion of the Mildura pumped district for large-scale horticultural development is constrained by the presence of Public land. This is an issue particularly to the south west of Mildura, which is bounded by Public land. Any new development proposal, which would rely on sourcing water from the perimeter of the existing pumped districts, may find there is insufficient capacity in the existing water supply infrastructure for large-scale irrigation. Future development to the south-west would require a long and large new pipeline. This would only be economically attractive when all the other less expensive options in the region have been used. New private development will require water delivery infrastructure that increasingly is more remote from the river.

Another factor in land capability is the salinity impact zoning which determines the salinity impact of irrigation on the Murray River. The salinity impact for most of the pumped districts is classified as within the High Impact Zone (Map 4).

These factors are considered in determining and locating potential agriculturally productive land. Broadly, areas identified as having suitable soils and or land systems, access or future potential access to irrigation water and drainage systems, low salinity risk and are unbounded by public land could potentially be very productive agricultural land. Areas identified from this review as capable of supporting future production include the Nangiloc-Colignan area and infill to the Calder Highway, Thurla/Benetook areas and Lake Cullulleraine. Map 6 illustrates the general location of these potential future irrigation development areas.

For the dryland farming area, which occupies most of the current rural zone, the land capability is strongly focussed on production of cereals. The minimum size in the new farming zone should be 100 ha to allow consolidation or transfer of land but at the same time protect the current landuse.

For the irrigated area where land use is more intensive the minimum area needs to be less than 100 ha. Access to water, power and transport are important determinants for land capability. It is suggested that provision of a private diverter pump and pipeline to deliver irrigation water from the river to a property may be uneconomic for anything less than 20 ha of production.
For a grower in the pumped district this constraint does not apply, as there are existing pipelines and channels throughout the districts and the minimum should be less than 20 ha. This issue is discussed later in this report.

In establishing a minimum lot size for excisions, the area of land needs to be large enough to take account of effective long-term disposal of effluent on site.

PART 2 TREND AND ISSUE ANALYSIS

4.1 Methodology of Reviewing Issues and Trends

Rural landuse trends and issues were reviewed utilising a number of methodologies. Initially a brief consultation phase was conducted to scope out the broad rural issues in Mildura. The consultation incorporated comments from First Mildura Irrigation Trust, the Rural Counselling Services, Lower Murray Water, the Victorian Farmers Federation, the Department of Primary Industries and the Mallee Catchment Management Authority.

Consultation was also conducted in conjunction with Council officers and Maunsell through three stakeholder meetings in Mildura in December 2004. A total of 60 people attended these meetings. Council invited representatives from Government agencies, industry groups and landholders to be involved in the three stakeholder meetings.

A brief analysis was conducted of the planning approvals issued within the Rural Zone in the last five years. The review particularly concentrated on the location of subdivisions/housing excisions and the number and location of dwellings that were approved.

A spatial analysis was completed to determine the distribution of rural lots and lot size to establish broad trends in rural land use. Crop Survey data from SunRise 21s Crop Report were also reviewed to identify trends within the irrigation districts.

It is noted that a number of the rural landuse issues are very complex. A broad analysis and desktop review of the trends required a large number of assumptions to be applied in order to simplify the issues for analysis purposes. These assumptions and others are listed in Section 5.2.

4.2 Deakin Project

The *Alfred Deakin Irrigation Development Feasibility Study* aimed to investigate an efficient framework for future irrigation development of the region. The study was commissioned in June 2000 and tabled with the Deakin Coordination Committee in June 2001. The study was widely circulated and discussed during an extensive stakeholder consultation phase, which resulted in many submissions being received. The Deakin Coordination Committee reviewed the recommendations from the Feasibility Study and provided recommendations to the Minister for Water *(Deakin Final Committee Report*, October 2002). The Minister provided a response in July 2003, which indicates support for some recommendations and a commitment from Government of $300,000 towards implementing the recommendations. Although a number of the recommendations from the project will be followed up, the Deakin Project is unlikely to proceed as initially envisaged.

The rapid but unforeseen growth of new irrigation development in the Mallee since 1994, has resulted in Mildura becoming one of the fastest growing rural areas in Australia. Any new green-field irrigation development needs to meet stringent minimum standards consistent with the Nyah to South Australian Border on an individual case-by-case basis. There is no overall framework however to coordinate sustainable growth beyond individual property scale. The Nangiloc-Colignan area is an example where random irrigation development is evident. Haphazard or uncoordinated development could sub-optimise the overall potential of the region. In order to sustain the strong rate of growth it is critical that high level planning is in place to link the use of water and land to the needs of the environment and industry. The objective of the Deakin Project was to achieve planned growth over a considerable timeframe based on new, privately owned, shared infrastructure. The issue of coordinated irrigation development should be further investigated to determine if a planning response is warranted.

It should be noted that the recommendations to the Minister from phase 1 of the Deakin Project referred to by Council in the tender brief for the Rural Areas Study, are more accurately described as a series of actions. They establish a number of additional assessments and proposed structures and processes to be implemented. The main recommendations are listed below, along with the Government response and comment on any implications for the Rural Area Strategy Review.

Committee Recommendation 1 *A regional Working Group investigates and reports on water availability and the impacts of further development on conditions of supply for existing growers. Irrigators, both private diverters and those in the pumped districts, should be notified as to increasing likelihood of some intra seasonal rationing of water. That such rationing is applied proportionally across all irrigators including private diverters downstream of the Barmah Choke.*

The Government supports the formation of a Working Group to investigate water availability, ensuring that the interests of both existing users and new developments are considered.

Comment
Notification of rationing of water is already occurring at peak irrigation season. However, the frequency and duration of rationing may increase, as large new irrigation developments begin drawing water transferred into the Mallee. Further activation or sale of sleeper and dozer licences and unused water rights within the Mallee will compound this impact. There is little or no opportunity for pumped district irrigators to individually construct buffering water storages on their own land to off set these periods of restrictions. FMIT is in the process of constructing a buffering storage to serve part of their district. Many private diverters already use buffering storages or have opportunity to build them. The trend to more rationing of water may hasten the sale of water and departure of irrigators out of the pumped districts with those requiring heavy water application in mid to late summer on the shallower soils that need water more often being most affected. Departures are most likely to occur near the urban interface but this may change if economic conditions of some industries remain poor. The Working Group may be able to come up with ways of improving water availability.

Committee Recommendation 2 *That the existing planning and environmental Working Group is resourced to establish the Regional Task Force as soon as possible.*

The Government supports the recommendation adding that the task force and working group must ensure there is net environmental gain. Recognising the significance of planning and environmental issues raised by the Committee, the *Deakin Irrigation and Sustainability Committee* should consider moving as directly as possible towards establishing the *Planning and Environmental Taskforce*.

Comment
This Task Force is likely to improve the planning processes for new development through better coordination of development opportunities. It would be appropriate for Council have active input to the Task Force.

Committee Recommendation 3 *A regional horticultural Working Group be established to improve linkages between industry and key stakeholders and government agencies to strengthen the competitive advantage of the region.*

The Government supports the improvement of linkages between industry, key stakeholders and government. The Horticultural Industry Working Group should be formed.

Comment
Developing a plan for improving competitive advantage to attract new investment is short of implementing the plan and getting results. The strengthening of local competitive advantage may assist small growers in the pumped districts to sell produce for a higher price and improve viability. Conversely some would see the added competition arising from new investment as reducing the market for small growers and providing unfair competition. Developing competitive advantage would certainly have potential to improve the overall economy of the region and maintain or increase the rate of growth.

Committee Recommendation 4 *The region's water authorities work collaboratively under a joint arrangement to investigate strategies and options to attract and guide new investment in Greenfield site. Including options and recommendations contained in the* Price Waterhouse Coopers *Partnership Victoria Report.*

The proposed Working Group should be formed with the purposes of investigation of potential cost savings and infrastructure and supply sharing opportunities; joint management of detailed design plans for the region's infrastructure upgrades; and preparation and presentation of a cohesive co-ordinated regional plan for new development and infrastructure upgrades. In addition the group should review in partnership with the Victorian Government the opportunity to proceed with the recommendation contained within the Price Waterhouse Coopers *Partnership Victoria Report.*

Comment
Further cooperation of the water authorities will benefit growers and improve the chances of major infrastructure upgrades proceeding and supply sharing and joint arrangements being put in place.

Committee Recommendation 5 *The Minister seek support of governments to progress the URS report business case to invest $250 million in off farm infrastructure upgrades and that this be shared in a ratio of 30:30:30:10, being the contribution from the Federal Government, State Government, existing growers and developers respectively.*

The Government has responded by seeking further investigation of the options including less costly options and that the benefits and costs be appropriately identified and attributed.

Comment
The upgrading of off farm infrastructure in the pumped districts will create opportunities to improve on farm wateruse efficiency, hence leading to increasing the viability of some growers. This in turn may encourage growers to stay on the land. Many growers will need to invest in on farm infrastructure and adopt higher technology to improve water use efficiency. Incentives available to growers through salinity management plans will assist. The Government response however of a detailed assessment of the options means that there will be a long period prior to the commencement of any large scale works. The FMIT works already mentioned are being done using the Trust's reserves. As discussed in Section 3.3.1 the FMIT Master Plan is completed while Lower Murray Water is expecting completion of its plan in spring 2005.

Committee Recommendation 6 *That the Minister approves the public release of the Committee's Final Report and resource communication activities require for the proposed second phase.*

The Minister advises that the report should be released along with the Government's response.

No comment

Committee Recommendation 7 *A short term focussed Deakin Irrigation Sustainability Committee be appointed to lead the detailed work required to support the growth of new irrigation and improve land and water management and planning through the working groups mentioned previously. The Committee will also convene a formal working group of the water authorities.*

The Government supports the continuation of the work of the Deakin Committee through the Deakin Irrigation Sustainability Committee.

Comment
Part of the work of this committee may assist decision makers to determine the effects of proposed development on other public facilities and services, housing and skilled

labour. New irrigation development that proceeds may provide an attractive option to existing growers to be managers, contractors or employees, whilst they continue to live on their current properties as producers. This has been the case for the last decade. On the other hand it may also encourage current growers to excise their residences from their fruit blocks and sell their own horticultural enterprise to take up these opportunities. Growers that sell there blocks may well desire to remain in their current residences. A third scenario is that existing growers in the pumped districts could become owners or part owners of new irrigation developments outside the current pumped districts. The option of a grower remaining in the current residence while retaining or selling the fruit block is present.

The net impact of additional new irrigation development outside the pumped districts is unclear. It is considered likely that a ready source of skilled work force will be available from the pumped districts. Continuing expansion of irrigation will guarantee the ongoing enlargement of the consolidated urban area within the Mildura pumped district. Irrigation is the primary source of wealth in the local community and is driving growth. Expansion will also put further pressure on excision of house blocks from fruit blocks in Mildura, Red Cliffs and Merbein pumped districts. The reason for this is that it appears that a proportion of people wishing to live in Mildura want to experience lifestyle living. The only real alternative to suburbia is a residence amongst the vines. There is no lifestyle living demand in the dryland area.

Another source of pressure for excision is to accommodate family as they retire and hand over to offspring. While another pressure relates to growers wishing or being forced to leave the industry due to economic circumstances. Under these conditions most growers would wish to continue to reside in their dwelling and detach it from the horticultural land. It is difficult to qualify the reasons for retirement of irrigated land, as Council did not seek to involve the owners of horticultural land in the consultation meetings apart from those with an interest in the non-urban break at Irymple. Table 6 illustrates the trends in retirement of land from irrigation since 1997. It is clear that the majority of land retired from irrigation is within the Mildura pumped district with a net area of 265 ha retired. Most of this land would be utilised in urban expansion on the perimeter of the existing residential area. URS 2005 reports that 40ha per annum of the Mildura pumped district is converted to urban land each year. Over the six year interval between 1997 and 2003, it can be concluded that 240 ha was therefore converted to urban use.

At the time of the crop survey in 2003 does not appear to be large areas of vacant or abandoned horticultural land from which water has been traded except in the vicinity of the urban fringe. The area of vacant or abandoned horticultural land throughout the pumped districts may increase rapidly if difficult economic conditions continue for small growers. This prediction has not been able to be quantified.

It is possible that there could be a demand for more housing around Red Cliffs in response to the continuing expansion of Southcorp winery complex and the Nangiloc-Colignan irrigation area. This demand could be investigated as part of the residential strategy for Red Cliffs, however there is already sufficient land zoned for this purpose at Red Cliffs. The demand for an urban area at Nangiloc may also warrant further investigation.

Committee Recommendation 8 *That Government makes available $1 million for the establishment and operation of this Committee and its 4 working groups.*

The Victorian Government is to provide funds of $300,000 towards the continued work of the committee with a requirement that the water authorities match these funds.

No comment

4.2.1 Discussion

The Deakin project as envisaged in the SMEC reports is unlikely to proceed. Equivalent new irrigation development however, will continue in the Mallee in the Low Impact Zone at the rate that economic factors dictate. The influence of the next stages of the activities of the Deakin Committee will facilitate new development. Irrigation development will further strengthen Mildura's rate of growth and status as a leading producer of food. In doing so continuing expansion will also put pressure on marginal producers and may promote the departure of growers from horticulture in the pumped districts. Departures may favour the less suitable soil types but soil type is only one of many factors. However the vast majority by area of land being retired in the past six years is going to urban development.

Regional economic growth in future will put added pressure on the market for more lifestyle properties or residential blocks in the pumped districts and the main central urban area. It will be important to ensure that the best horticultural land is protected for horticulture in preference to the poorer land, although in some cases the poorer land is also poor for residential development. This issue requires a planning response.

4.3 Excisions and Small Lot subdivisions – Residential Development

4.3.1 Trends in Excisions and Small lot Subdivisions.

A brief assessment of residential land use within the irrigation districts was carried out reviewing the data published by SunRise 21 (SunRise 21 2004). A summary of the key attributes and trends that relate to property ownership for irrigated horticulture are shown in Table 7 for the three local irrigation districts, their extensions, and private diverters at Nangiloc-Colignan, and King's Billabong, Ranfurly Way, Yelta, Lake Cullulleraine - Lindsay Point.

There is an opportunity for Council to better utilise information from the *Crop Report*. An example could be to analyse emerging trends in horticulture, including the extent and location of land retired from horticulture. Council could purchase the collection of additional spatial information by SunRise 21 during the next survey to

be conducted in 2005. This spatial dataset would provide more accurate information on some of the trends than is currently available.

Table 7 [1]Trends in property ownership for irrigated horticulture for irrigation areas in Mildura municipality between 1997 and 2003

Area Property feature	Nangiloc Colignan priv divs	Red Cliffs pumped dist	Mildura pumped dist	Merbein priv divs	Yelta Mildura priv divs	Lindsay Pt-Cullull priv divs
Productive area **1997** (ha)	6,780	4,680	6,525	3,310	1,200	2,245
Productive area **2003** (ha)	9,115	5,195	6,400	3,680	1,300	2,835
Productive area change (ha)	+2,335	+515	-125	+370	+100	+590
Mean property size **1997** (ha)	46	8	7	9	10	83
Mean prop size **2003** (ha)	58	10	7	10	14	98
Number of hort. props **1997**	146	559	900	360	129	25
Number of hort. props **2003**	156	545	855	360	127	27
New irrign devt 1997-2003 (ha)	2,340	525	140	385	425	590
Retired land **1997-2003** (ha)	5	10	265	15	10	0
Retired land **1997-2003** est'd no parcels	2 small	41 small	100 small 30-50 large	36 small	5 small	0

[1] from SunRise 21 2004.

For example to provide trends on irrigated land ownership of properties of less than 20 ha; and property size and use for lifestyle living, tourism or value adding land uses in the new farming zone.

This review reiterated the trend that the majority of land retired from irrigation use occurred in the First Mildura Irrigation Trust irrigation district. Table 7 outlines the trends in property ownership in the selected irrigation areas between 1997 and 2003.

From the Crop Report it has been estimated that approximately 100 small parcels and 30 to 50 large parcels have been retired from irrigation use within the Mildura irrigation district. The 30 to 50 large parcels of horticultural land retired over the six year period are adjacent to the existing urban fringe. It is reported (URS 2005) that 40 ha per year of the Mildura district is being converted to urban landuse. This accounts for 240 ha over six years leaving about 25 ha to be distributed between the 100 small parcels of retired land (Table 7).

The conclusion drawn is that the total area occupied by new lifestyle living use is relatively small when compared with the rate of urban expansion.

A number of small lots (7-8 per annum) are also being retired from irrigation in the Red Cliffs and Merbein districts. It is most likely that the lots that are being retired are being utilised for residential use or small business that relates to horticulture or tourism. Once irrigation water is traded outside the pumped irrigation districts it cannot be traded back into these areas. A large proportion of the land within the irrigation districts is classified as being within the high impact zone area in terms of their potential salinity impact on the Murray River. The land cannot be irrigated again unless water is traded from within the *High Impact Zone*. The lots within the pumped irrigation districts are too small (approximately 4 ha) for dryland agricultural use and are often used for horse related activities.

A brief review of the town planning approvals for subdivision in the Mildura Rural City Council area from the period 2000 – 2004 reaffirms the trend of demand for residential land within the Mildura irrigation area. It was noted that the vast majority (50 percent) of subdivision approvals are occurring in the area directly adjacent to Mildura (including Irymple, Nichols Point, Cabarita, Cardross, Birdwoodton and Koorlong). Approximately 30 percent of the remaining subdivisions have occurred in the Red Cliffs area (including Yatpool and Carwarp) and the remaining 20 percent in the Merbein area (including Yelta, Merbein South and Merbein West). Very few subdivisions were applied for in the dryland agricultural area. Over the five-year period reviewed approximately four subdivisions were approved in the Ouyen area and one subdivision was approved in the Millewa area indicating that there is little demand for rural residential lots in the dryland agricultural area.

Maps 7a, 7b and 7c illustrate the spatial distribution of lot sizes throughout the irrigation districts. As illustrated by each of the maps there is a nucleus of smaller lots, which consists primarily of the retail/urban areas within each of the irrigation districts. These areas are generally zoned for business activities and or urban/residential use. The rural residential lots for the purposes of this analysis are assumed to be approximately less than or equal to 2 ha in size. It can be noted from the maps that their distribution is scattered throughout the irrigation districts. Some of the 0-2 ha lots occur in clusters along roads, however, larger lots often surround clusters of small lots and they are relatively isolated, indicating that they may be located within existing horticultural land use. Due to the close proximity of the horticultural area to urban Mildura, house lots excised in this area have good access to infrastructure and community services.

From the planning approval data it appears there is little demand to excise houses from large-scale properties. Given the nature of dryland agriculture and the large property scale operations a housing excision in these areas may result in the dwelling being isolated from basic residential services.

4.3.2 Previous Rural Residential Studies

O'Neil Pollock & Associates Pty Ltd prepared a '*Rural Residential Study Review*' for the Mildura Rural City Council in 2003. The aim of the study was to assess the provision of rural residential lots within the municipality to determine if there was a need to rezone more land for low-density/rural residential development.

The report investigated a random sample of 15 permits and completed a search of Council planning department records. The report analysed that approximately 23 new Housing Opportunities (lots less than 2 ha) were created in the Rural Zone each year and approximately 23 dwellings in the rural zone are being constructed each year.

The report notes that rural living opportunities had historically been met in the Rural Zone by the creation of lots of less than 2 ha and more recently through the approval of permits for realignment of allotment boundaries. Based on Council adopting a policy position that discourages excisions from properties less than 10 ha but allows for the creation of some small lots via boundary realignment it was estimated that approximately 15 rural residential lots could be created for residential use in the Rural Zone each year.

The report recommended that Council should discourage lot excisions on properties within the rural zone that are less than 10 ha but enable the creation of some vacant residential lots in the Rural Zone on condition that there is a trade off in the form of lot consolidation. Providing this policy position was held by Council, the report concluded that the 15 rural lots provided each year plus a further provision of 82 ha of low density residentially zoned land would be sufficient to provide rural residential/low density residential living opportunities as demanded for the next 10 years. The areas recommended for future low-density residential development include land at Lake Hawthorn, Nichols Point and Koorlong.

The study notes that there are planning provisions to allow excision of existing houses within the Rural Zone using Section 173 Agreements under the *Planning and Environment Act* 1987. Section 173 Agreements are attached to the title when subdivisions are approved in the Rural Zone to prevent any further division of the remaining land. This planning scheme provision will eventually phase out housing excisions from the Rural Zone, whilst retaining the opportunity for those who have already invested in housing infrastructure on a rural property to gain a return on their investment by housing excision (O'Neil, Pollack et al 2003).

Although not completed in this review, it would be useful to further investigate the locations where there is a potential for future housing excision. This analysis would determine where future residential landuse may occur within the Rural Zone. This

type of analysis would require a detailed investigation of the title information of lots within the Rural Zone and ground truthing and/or consultation phases to more accurately identify future potential housing excision and intended property use.

Additional studies that have been completed should be considered in planning for long-term rural residential development. These studies include the First Mildura Irrigation Trusts future infrastructure planning through its Master Plan. As discussed in Section 3.3.1, this plan will be essential to identify what irrigation infrastructure will be upgraded and outlines an approach for decommissioning of inefficient infrastructure. Lower Murray Water is in the process of preparing a similar infrastructure renewal plan. Information from these and other studies may help plan for the expansion of future irrigation.

There are implications of closer subdivision in rural areas on Council's planning for residential service provision (secondary roads, stormwater and garbage collection) and services provided by the water authorities (garden water, irrigation water, potable water and sewerage). Proponents of most separate small lot excisions would not have an expectation of potable water or reticulated sewerage being available. The same expectation would apply to removal of stormwater, which generally soaks into the ground and is picked up by the irrigation drainage system. Garbage collection is currently available along most roads in the irrigation districts so additional pickups would improve efficiency of operation. Given that most roads in the rural areas of the irrigation districts are sealed, provision of new sealed roads is not a significant factor. However additional traffic in some areas may ultimately require improved traffic signs, intersection design etc. Blocks being excised need to be sufficiently large enough to enable effective disposal of sewage using on site disposal. Rural living allotments should not be more than 1ha in area as generally more than this is difficult to manage in the long term, and wastes productive land that could remain as irrigated horticulture.

For multi-lot subdivisions if they occur in the Rural Zone, there is more likely to be a need and an expectation for at least some of the infrastructure services to be available. For instance if there are internal sealed roads, kerbs and channelling in a development, then some form of stormwater disposal system is needed. Often the only option would be to drain stormwater to an excavated sump or direct it to a drainage basin or low point nearby. The clustering of excisions into local areas certainly makes the provision of services more efficient, but for more isolated sites not all of the essential services will be available. In particular potable water supply and sewerage disposal will not be widely available. However garden water from the irrigation supply will always be available to small lots from the water authorities. In the case of stormwater the best result could be clusters subdivisions without providing kerb and channelling using land disposal of stormwater.

The clustering of residential lots in rural areas to enable efficient provision of services should be encouraged in a planning response. Increased traffic on local roads may increase the need for road improvements in the long term.

The demand for additional Council services in the private diverter areas, such as Nangiloc-Colignan is not such an issue. As there are few excisions and plenty of

space for stormwater disposal these issues are minor. The main issue could be demands to have dirt or gravel roads sealed for both horticultural traffic and residents. Any subdivisions or excisions should be encouraged through planning policy to front existing sealed roads.

Areas noted for future irrigation expansion may also drive demand for accommodation and/or residential land use within particular areas. It has been noted, for example, that due to the expansion of irrigation development within the Nangiloc-Colignan area, there is demand for accommodation within this area due to the increased labour requirements.

4.4 Multiple Uses on Horticultural Properties

The Mildura Rural City Rural Areas Policy discourages the use of rural land for commercial and industrial uses that are not related to/or support agricultural activity.

A brief review has been conducted of commercial, industrial and other uses approved in the Rural Zone over the last five years. The majority of commercial and industrial activities approved in the Rural Zone include, wineries, offices, rural accommodation and other rural industries. It appears that these 'rural industries' are generally being located in Mildura and near surrounds, Red Cliffs and Merbein with very few rural industries being approved outside these areas in the last five years. There is no distinct trend in the number of rural industries approved over this time or the type. However, there were a number of wineries approved each year over the five years.

A brief ground-truthing exercise was conducted to determine the type and distribution of commercial/industrial land uses within the near Mildura area. Photos 1 to 5 in Appendix 3 illustrate the broad range of commercial uses noted within the Rural Zone. There were no obvious trends in the distribution of the "Multiple Uses" throughout the Rural Zone. Multiple-use in the new Farming Zone should be focussed on value adding to agriculture.

The type of multiple use activities appropriate in the new Farming Zone are:

- primary produce sales;
- rural industry;
- winery;
- rural store;
- bed and breakfast, should be a permitted use if it supports an agricultural activity.

The uses that attract high visitor numbers should be located on good roads. The preferred location of the uses is not rigid, and will depend on where the proponents land is situated. High exposure sites have a greater chance of being economically viable but may cause traffic problems if on a main road or highway.

Inappropriate uses in the Farming Zone could include: transport depot, car sales and servicing, retail of non local goods, engineering workshop, building supplies, manufacturing, fuel or chemical sales.

The uses and issues discussed above warrant a planning response.

4.5 Impact of Water Deregulation

The Victorian Government Whitepaper - *Securing Our Water Future Together* was published in June 2004 and outlines Victoria's approach to water reform for the next 15 years. The Whitepaper contains policies and actions some of which may have implications for local irrigated areas and Rural Zones.

Victoria committed strongly to water reform in 1989 with the passing of radical new legislation (*Water Act* 1989). This legislation coupled with the operational framework provided by the *Nyah to South Australian Border Salinity Management Plan* in 1992 resulted in water trade commencing locally in 1994. The impact of the initial stages of deregulation (primarily water trade) has now had ten years to emerge. Table 6 shows that water trade has enabled development of 2335 ha of new irrigation to occur at Nangiloc-Colignan between 1997 and 2003, an increase of 34 per cent. In addition dryland farming areas outside (but close to) the perimeter of the Merbein (370 ha) and Red Cliffs (515 ha) pumped districts have been developed for irrigation. Victoria's commitment to the cap on any new diversions of water from the Murray Basin in 1996 was another important milestone in water reform. The Whitepaper clarifies and strengthens water reform in Victoria and further commits to implementing the *National Water Initiative*. Relevant important actions in the Whitepaper are outlined below, and recent and future local trends are discussed and outcomes identified.

The Whitepaper commits the Victorian Government to:

Action 1 *Improving security for all users, and pricing of water to provide an incentive for conservation, and value adding by further expanding water markets.*

Comment
Security of supply is important particularly for growers with perennial crops in the semi arid environment of Mildura. Most local horticulture is based on high security water. A key uncertainty in respect to water relates to delivery issues at peak times in January and February each year. It is well known that the capacity of the river to deliver water through the Barmah Choke is limiting deliveries to the Mallee at the peak time of irrigation. An increase in price of water will put further pressure on small growers and may hasten departure of some from the industry or encourage pursuit of more off farm income.

Action 2.1 The Government will extend the water allocation framework to provide for secure tradeable entitlements to recycled water and urban stormwater.

Comment
This may give irrigation drainage and other wastewater a value as the cost of new water increases and there is less river water available. This water however will not be available to the majority of growers in the pumped districts unless it is mixed with river water or a separate delivery system is installed. This action is not expected to affect the rate of retirement of land or the viability of growers in the local area.

Action 2.2 *Securing environmental water reserves by: reconfiguring irrigation services, providing upgraded infrastructure for distribution, recycling, system management, donation of water to the environment and water purchase on the open market.*

Comment
In order to create water savings for the environment there are several initiatives proposed with strong emphasis on improving irrigation infrastructure. This will have positive implications for growers in the pumped districts. The Whitepapers states "that any plan to alter or build irrigation infrastructure may need support from landuse controls under the *Planning and Environment Act* 1987, since infrastructure viability can be determined by a conflicting landuse (eg urban encroachment or hobby farm development)." Water purchase on the open market by Government will see some local growers in the pumped districts selling their water and moving out of the industry. As indicated in Table 7 there has been a small but steady rate of land retirement from irrigation in the pumped district since 1997, but by area a high proportion of the land retired is for urban development. Single lot excisions account for a relatively small total area, as discussed in Section 3.3.1. The net effect of the actions listed in *2.2* is likely to increase the rate of departures on the urban fringe and increase the demand for excisions of residential blocks from horticultural properties throughout the pumped districts. More than half the excisions occurring are likely to be in the Mildura district.

Action 2.3 *Sales water (low security water) becoming legally recognised by creation of a new lower reliability tradable water entitlement in northern Victoria.*

Comment
This will give a firmer base for growers to gain access to additional water.

Action 4.1 *Unbundling water entitlements, i.e. separating rights into its three components: water volume, water delivery access and water application to land.*
Comment
Unbundling of water rights into the three components will have the effect of slowing abandonment of infrastructure by charging for delivery access after water is sold. The rights to a share of delivery infrastructure will be charged separately and can also be sold. It is likely that there will be an increased departure of water from the pumped irrigation districts as the net result of these changes. Unbundling will allow water entitlements held by private diverters to move to an ongoing water share with unlimited tenure. This will bring security to parity with a water right in pumped districts, thus improving security for entitlement holders. The net effect here is to favour growers outside pumped irrigation districts. The issues relating to water

application to land are discussed in Section 4.10 below. The Whitepaper does not specify when the legislation will be passed to enable unbundling to occur.

Action 4.3 *Twenty percent of sales water to go to the environment.*

Comment
This may create hardship for some local growers that depend on low security water purchased on an annual basis, as the amount of low security water available will be reduced. The overall impact however is likely to be small.

Action 4.7 *Phasing out of delivery services (or investigating other options) where customer base is declining and the cost of keeping a service (water supply and drainage) is becoming unaffordable.*

Comment
It should be noted that the current limit on total volume of annual water trade out of the pumped districts is two percent of the Bulk Water Entitlement. When entitlements are unbundled the two percent rule will not work in its current form, since water shares will not always be tied to particular areas. Slowing down abandonment or stranding of water infrastructure is the prime purpose of the two percent rule. Charges for access to delivery infrastructure will take the place of the rule in softening the effect of trade on remaining irrigators.

Underutilization of assets is a crucial and current issue for the expansion of the main urban area around Mildura into the FMIT water supply district. Urban expansion has led or is leading to reduced efficiency or at worst stranded water supply and drainage assets. Any loss of horticultural land in the three pumped districts will contribute incrementally to underutilization of assets and ultimately to stranding of assets. Any loss of land from irrigation to non-irrigation contributes to this issue. The Whitepaper will give water authorities a process and options to handle stranded infrastructure and in doing so reduce the long-term costs of the issue. The FMIT also seeks to facilitate the orderly retirement of infrastructure in conjunction with the implementation of the Master Plan. The plan lists a number of structural adjustment options. The combination of options used will be determined by the Board of FMIT, and depend on the circumstances prevailing at the time. The issue of stranded or under-utilised infrastructure mainly relates to urban encroachment into the Mildura irrigation district, but may also apply to a lesser extent to lifestyle living areas.

One of the adjustment options proposed is for FMIT to have input into the zoning process for the Mildura irrigation district so that water infrastructure issues are taken into account.

Other options include exit fees on irrigation land being retired, or applying a local cap on water trade. When land is to be retired from irrigation strategies have been identified to achieve decommissioning of an area that is inefficient, or continue with higher charges, or impose compulsory retirement of land.

Action 4.10 *Investigating introducing tradeable salinity impact permits at property level.*

Comment
The introduction of tradable salinity permits at property level would encourage some growers in the pumped districts (high impact zone) to sell their permit. The net effect of tradable permits is not clear.

Action 4.10 *Implementing regional salinity management plans.*

Comment
The *Sunraysia Salinity Management Plan 1993* enables a great deal of technical advice and training to be given to growers at Government cost. Advice is coupled with cost sharing of prescribed on ground works between Government and grower via the Mallee Catchment Management Authority and the Department of Primary Industries. The impact of the plan is probably to encourage growers to become more water use efficient and hence, more viable at some cost to the grower.

Action 4.10 and 4.11 *Adopting water use licences for existing irrigators, which set minimum standards for water application, based on regional salinity management plans.*

Comment
The compulsory adoption of Wateruse Licences (in effect, salinity management plans at property scale) for existing irrigators may encourage unprofitable growers to leave the industry.

4.5.1 Discussion

The average volume of permanent water traded into the Mallee between 1994 and 2001 was about 9000 ML/annum. This trend is expected to continue, with further new irrigation development occurring outside the pumped irrigation districts along the Murray River corridor. Water is also being traded out of the pumped districts although this is presently capped at a maximum of two per cent of the Bulk Water Entitlement of the district. However, the cap has not been the limiting factor. The cap on water trade is expected to be lifted, as indicated in Chapter 4 of the Whitepaper but the timeframe is unknown. New water cannot be permanently transferred into the pumped districts because these fall largely within the High Impact Zone for river salinity.

Further water reform will stimulate the continuing expansion of irrigated horticulture in the region. Locally expansion will continue at Nangiloc–Colignan and Lake Cullulleraine, although the future annual rate of expansion is not known. Expansion may also continue around the periphery of the pumped districts at Merbein South and Thurla-Benetook. Expansion directly from the Mildura district is limited by the presence of Public land and distance from a water source given the current capacity and condition of infrastructure on the edges of the districts. At some point in the future, we will see planned renewal of irrigation supply infrastructure in the pumped districts as discussed in Section 3.3.1 of this report.

It therefore follows, that there will be continuing expansion of industries that support horticulture and water supply. Supporting industries include technical and financial services, materials, equipment, processing, transport and labour. A strong and growing local economy is almost assured.

The primary driver for trends in growth and departures in the horticultural industries is the price of the commodities produced. The factors discussed above may further encourage larger more efficient irrigation developments outside the pumped districts and a loss of growers from the pumped districts. Some of the water reform measures will directly increase the cost of production particularly for smaller holdings. Amalgamation of small properties in the pumped districts in most cases leads to partial improvements in economies of scale. Doubling the size of a 12 ha management unit does not create a large horticultural farm in regional or national terms, but certainly helps bring economies of scale. There are barriers to achieving perfect economies of scale. One obstacle to economies of scale throughout the pumped districts is the small size of allotments. The universal distribution of small allotments means short crop row length, which is inefficient for mechanised operations. In order to increase property size additional parcels need to be purchased by growers, which are more often than not separated from the home property. Even for adjoining properties efficiencies are restricted by the presence of houses, sheds, channels, roads and other intervening land uses. The issue of Council supporting and facilitating the increase in property size in the pumped districts is crucial and warrants a planning response.

Another variable in the pumped districts is land prices, which are inflated by the influence of off farm income of growers and lifestyle seekers entering the property market. Another influence is the value for urban use being applied close to the existing urban area. The extent of skewing of land values by factors other than the horticultural productivity is not uniform and not documented.

The net outcome of water reform will tend to favour larger efficient properties usually associated with horticultural enterprises located outside the pumped districts. Commodity prices remain the primary driver. Within the pumped irrigation districts there is likely to be an accelerating trend of growers leaving the industry, but this is starting from a low base and will predominantly occur mostly near the urban growth areas. However, there are many other factors that influence the trends apart from water issues.

In summary the reasons for retirement of irrigated land is suggested to be for the following:

- The majority of land being retired is on the urban fringe and growers either sell directly to developers or take the decision to not upgrade their properties, instead sell the water and continue to reside on the property;
- Growers not close to the urban fringe, leaving the industry and excising the house block of less than 2 ha to remain on site, and selling all their water, thus departing from horticulture. The reason s for a grower leaving the industry is either due to unviability, ill health, old age, marriage breakdown or career change;

- Growers not close to the urban fringe, excising a house block of less than 2 ha for immediate family to build a residence.

4.6 Right to Farm Issues

Right to farm issues generally arise when non-compatible land uses are established adjacent to agricultural landuse and the activities within one landuse may affect the amenity of the other.

In the case of agriculture and horticulture, non-compatible landuses such as residential development may be located in close proximity to rural areas. Residential development has the potential to impact on their "right to farm" or their right to incorporate usual farming practices to manage their properties. Rural management practices such as the use of chemicals (particularly chemical sprays), dust and noise may adversely impact on adjoining residential development and amenity.

A common feature of the Mildura region particularly development within the First Mildura Irrigation Trust pumped district is the use of land for agricultural production alongside residential uses.

The distributed nature of rural residential land amongst existing horticultural properties and productive areas means that the potential for right to farm issues is high.

Advice from the Victorian Farmers Federation (VFF), FMIT and Lower Murray Water it was suggested that "Right to Farm" was not considered a major issue within the municipality. The VFF could not recall any complaints registered from the region (Simon Price VFF pers. comm. 2004).

On discussion with the FMIT it was noted that 'Right to farm' may not be an issue in the region as people living in rural residential areas generally have a good understanding of horticultural and agricultural practices. This may be because they have family involved in the industry, have recently retired from the industry or lived in the area for a long period.

Although the current status appears that right to farm is not a major issue at the moment in Mildura, the creation of residential lots in the rural zone may provide the potential for future right to farm issues. That is, people that have a limited understanding of farm management practices may one day own and occupy rural residential lots. These people may view the adjacent management practices as impacting on their residential amenity. It would be important to insure that all potential owners/occupiers of rural residential lots have the ability to access information to understand usual horticultural management practices to avoid right to farm becoming an issue in the new farming zone.

The potential for right to farm issues to emerge in the pumped irrigation districts needs to be considered. When rural living lots are established, right to farm issues

should be considered in siting these lots. Even more appropriate, clustering would reduce the edge effect and allow for more efficient use buffers against horticultural land. Other strategies could be to consider size and configuration of clusters and to consider building envelopes be identified. A planning response to encourage clustering and recognition of right to farm issues is appropriate. Right to farm issues can be avoided in the planning process by not allowing hammerhead shaped excisions in horticultural use land.

It is unlikely that right to farm will emerge as an issue in the dryland farming area or the main private diverter irrigation areas.

4.7 Viability of Smaller Horticultural Holdings

The consideration of viable lot size is important when determining subdivision limitations and the future potential and capability of horticultural and other agricultural enterprises.

The Sunraysia Rural Counselling Service advised that based on their experience the average viable lot size for viticulture is approximately 15 ha without off farm income (pers. comm., Oct 2004).

This estimate of a 'viable agricultural lot size' is dependant on a number of assumptions. For instance, agricultural viability depends not only on lot size but also on the level of technology, rate level, amount of on farm investment, level of debt, management skills, off farm income, market fluctuations and seasonal variations. The level of income that is considered 'viable' is also determined by a number of assumptions. The economics of growing a particular crop will also vary depending on market conditions at any particular time.

Many growers in the pumped districts have off farm income to supplement their enterprise. The proportion of off farm income varies from bona fida growers supplementing the farm to survive, through to people completely unreliant on their farm who use horticulture as a hobby. The role of part time growers in the pumped districts continues to increase as the business community expands in Mildura. Off farm income can take a number of forms including a spouse with external employment, a grower who also works as a contractor or part time labourer. At the other end of the scale there are full time business owners or salaried employees who either have large horticultural holdings or small but efficient holdings. They all contribute to the State's total agricultural output.

The planning scheme should recognise and encourage the trend to part-time farmers and the role of off farm income. The emphasis in the planning scheme should lean to protection of productive land and not just wholly to protecting viable holdings. Nevertheless the importance of full time family farms also needs to be recognised and supported in the planning scheme.

The Mildura irrigation district generally consist of allotments of approximately 4 ha while Red Cliffs and Merbein districts are slightly larger. As discussed previously there has been considerable enlargement of some properties in the pumped districts through purchase of additional blocks. Map 8 illustrates the distribution of properties greater than 15 ha. Properties consist of allotments in the same ownership (as provided from Council rate information). Map 8 however, does not illustrate lots less than 15 ha that are managed in conjunction with other small lots where they are not adjacent to one another. Additionally this analysis does not consider lots smaller than 15 ha that may be managed jointly but owned by different family members.

Map 8 illustrates that the larger properties are distributed throughout the private irrigation areas and further from the urban areas within each of the pumped irrigation districts. The Nangiloc Colignan irrigation area contains the greatest number of large irrigation properties.

Brief discussions with Lower Murray Water indicated that they had generally noticed a trend to increase the size of the holdings by land managers purchasing additional horticultural lots. The blocks are not necessarily adjacent or able to be consolidated but some efficiency can still be gained by utilising the same machinery for production, reduced management fees and labour.

The enlargement of horticultural holdings to achieve economies of scale should be encouraged by the planning scheme. The fact that every 4 ha allotment probably has a house, is a constraint, particularly if the house is not on a separate title. One way of overcoming one of the barriers to property enlargement is the use of vinculums. This facility enables consolidation of two allotments into one to enable excision of a small lot. The planning policy needs to specify that vinculums must only be applied to adjoining titles or those adjoining but separated by a road or channel. Vinculums that join parcels of land remote to each other should not be allowed.

It follows from the discussion on viability and productive land for horticulture that for private diverters, the minimum property size should be 20 ha. This minimum is a little more than the nominal viable property size of 15 ha for viticulture discussed above. For Nangiloc Colignan 60 percent of the 156 properties exceeded 20 ha in 2003 while the average property size was 58 ha and both these indictors are increasing (Table 5). These indicators are even higher for Cullulleraine and Lindsay Point areas. Establishing this minimum of 20 ha would seem to be consistent with the current situation and requires a planning response.

For the 106 private diverters immediately adjacent to the pumped districts at Yelta, Ranfurly Way, Kings Billabong etc, the data is not as clear-cut. Only 17 percent by number were greater than 20 ha and the average property size was 14 ha in 2003. It may be appropriate to include these areas in the same 20 ha minimum as other private diverter areas or for convenience include them in the pumped districts. From a land management view it would be best to include these areas with the pumped irrigation districts.

For the three pumped irrigation districts it is recommended that the current minimum lot size of 10 ha for subdivision remains in place. It is noted that there has been

considerable discussion surrounding this minimum, with a suggestion that the minimum should relate to the current common allotment size of 4 ha (or a multiple) for the Mildura irrigation district. This suggestion is made on the basis that a 4 ha minimum would enable excision of an unviable grower's dwelling from their irrigated land and allow sale of the land to other growers to make them viable. The point has been made that there is a grave risk that in the current poor economic climate for some sectors of horticulture, there will soon be an increase in abandoned fruit blocks. These blocks will be unable to be sold because the attached dwelling, which is being used by the former grower who will rely totally on off farm work. A major risk to the industry is that abandoned vineyards will be a source of diseases and pests for the neighbouring blocks.

However there are a number of potential implications of reducing the minimum below 10 ha. While 4ha lots might be predominant in the Mildura irrigation district, there are larger lots in the Mildura district and the other districts that would be capable of further subdivision - an outcome that might create defacto rural living lots rather than smaller horticultural lots. This in turn may have implications for the horticultural viability of the area, future FMIT infrastructure, the land take-up projections in the Mildura Residential Strategy and the rezoning and development of Low Density Residential land. A change to 4 ha subdivision minimum would not assist in achieving the strategies that seek the creation of larger more efficient horticultural holdings.

The implications of adopting a 4 ha minimum would require substantial analysis and justification. The opportunity for growers leaving the industry to remain in their dwellings is principally reliant on the excision and realignment provisions in the planning scheme. In terms of excisions in the current scheme, Council's adopted policy establishes that excisions will only be supported in the areas where the parent lot is 10 ha. Although this appears restrictive the basis is well established.

Resubdivision (boundary realignment) is the more critical factor. It provides the opportunity to create a small lot for a dwelling but on the basis that the remainder of the land is consolidated with other land for irrigated horticulture to continue. Provided that appropriate conditions are established, this policy will have great benefit in driving consolidation, leading to fewer, more viable growers.

4.8 Urban Development

Council has undertaken a number of studies to investigate preferred locations for future, industrial and retail development.

The most recent strategy that has been completed and accepted by Council is a *Review of the Mildura Retail Strategy 2000* (Maunsell 2004). The key objective of the report was to provide an up to date retail activity audit for the major retail centres within the municipality including the City Heart, Mildura Centre Plaza and the Fifteenth Street Precinct. The review was then to determine the future roles of each

of the centres and the amount of additional floor space required to accommodate the demand for retail activity to 2021.

Strategy recommendations coming out of the report include the finding that the focus of new retail development should be directed towards the three existing major retail concentrations with any future residential development areas serviced only by local stores. The City Heart was identified to be retained as the primary retail centre. The Mildura Centre Plaza Precinct was identified to continue to be utilised for its sub-regional role. The Fifteenth Street Precinct should be promoted as the bulky goods location and that this Business area be extended by 15-20 ha along the western side of Benetook Avenue north of the intersection with Fifteenth Street.

In Mildura a large proportion of horticultural land is located on the fringe of existing urban and residential development. Photo 6 in Appendix 3 illustrates the Urban Fringe relative to existing horticultural development. The proximity to urban development may provide an advantage to agricultural producers in terms of access to markets, infrastructure, services and facilities (Research Planning and Design Group 2000). The report notes, however, that urban development into these fringe areas needs to be appropriately managed to ensure that the capacity of agricultural and horticultural land in these areas is maintained. Areas of future urban expansion also need to be clearly defined well into the future. Well-planned urban development would remove the risk of landholder expectations to sell horticultural/agricultural properties for urban use, unnecessarily and sometimes unrealistically increases the cost of agricultural land. Well-planned urban development additionally reduces the cost of infrastructure by ensuring that existing and future infrastructure is efficiently utilised.

With the completion of the *Review of the Retail Strategy* it would appear that the Council has a well-developed urban expansion strategy. It would be important to ensure that the wider community is well informed on future urban expansion plans.

The *Irymple Urban Growth Boundary and Greenbelt Review* (Research Planning and Design Group 2000) notes that rural uses are generally not compromised by urban development.

4.9 Application of Environmental Zones

The Mallee region contains a number of environmentally significant areas that should be protected and maintained.

Current protection of environmentally significant areas within the Mildura Planning Scheme includes the State Policy on environmental protection. This policy outlines the objectives and strategies to achieve catchment planning and management, water quality protection, floodplain management, salinity management, air quality, noise abatement, soil contamination and flora and fauna.

The Mildura planning scheme additionally contains an environmental significance overlay, which identifies land that may be affected by environmental constraints to promote development on that land is which is compatible with identified environmental values. The overlay covers a limited corridor along the Murray River between Yelta and Hattah.

Map 9 illustrates the location of areas with environmental significance as identified by Council's Environmental Overlay within the planning scheme. A portion of the Environmental overlay covers land zoned Rural. The vast majority of the land identified in the overlay is located to protect and enhance the natural values of the Murray River and its associated wetlands and anabranches. The forested areas of the Murray River floodplain additionally provide important habitat for the threatened populations of carpet python and regent parrot amongst a suite of other species. There are many wetlands of high significance along the Murray corridor and not all of these wetlands are protected by high public land status. The environmental overlay basically discourages developments on the Murray River floodplain that are not associated with or essentially reliant upon the River. In referring to the land capability information it is noted that much of the floodplain immediately adjacent to the river is unsuitable for agricultural development, consisting of heavy clays with high sodicity and subsequent shrink swell properties. The floodplain is also in the High Impact Zone for river salinity. There is also the issue of risk of flooding to any development built within the one in 100 year flood zone, and the incremental effect that each development may have on the overall extent and severity of flooding.

Areas with a high environmental significance should be protected from agricultural production and related activities and appropriately managed to maintain their environment values. It is noted however that some environmentally sensitive areas may be able to support agricultural/horticultural activities provided that they are appropriately managed to protect specific environmental values. It may be relevant to sub categorise these areas into the Rural Conservation Zone. Corridors and remnants of Mallee in the Nangiloc-Colignan area are an example of a specific environmental value that should continue to be protected for the Regent Parrot whilst the area is managed for agricultural production. The protection of Regent Parrot flight paths by a planning response warrants further investigation.

Along with environmental values a Rural Conservation Zone could also be used to protect other landscape values including their historic, archaeological, scientific, landscape fauna habitat and cultural values.

There is the potential to identify and recognise important habitat links for threatened species, within the Rural Zone and incorporate them into the Rural Conservation Zone to identify the specific conservation values that are to be protected.

Identification of areas that have environmental and other limitations and could potentially support agricultural activities requires further investigation. Application and use of a Rural Conservation Zone should be discussed in more detail with the Department of Sustainability and Environment and the Mallee Catchment Management Authority.

As previously mentioned the small inliers of private land in the three major national parks are the only areas that should be zoned in the rural conservation zone at this stage.

5.0 KEY FINDINGS

5.1 Key Findings of the Rural Zone Audit

- The land within the Rural Zone is an asset as the Mildura economy relies largely on the horticultural and agricultural activity within this zone;
- Land Capability within the Rural Zone is dependant upon a number of factors, these include:-
    - Climate;
    - Geology;
    - Landforms and topography;
    - Hydrogeology;
    - Soils;
    - Land systems; and
    - Access to water/irrigation infrastructure.
- Barriers to future horticultural expansion include:-
    - Areas of environmental and or landscape significance;
    - Salinity impacts on site and designated High Impact Zones precluding future irrigation development; and
    - The location of Public land; and

- A desktop review of the above factors suggests that future irrigation development and expansion is likely to occur in the Nangiloc-Colignan, Thurla/Benetook areas and near Lake Cullulleraine.

5.2 Key Findings from the Rural Issues and Trend Analysis

The Deakin Report

- The Deakin Project was intended to provide a management framework for future irrigation development and the planned provision of shared irrigation infrastructure. The Deakin Project in terms of a targeted defined area has now been abandoned but various committees and sub-projects will continue to investigate options to improve co-ordination and planning of future irrigation development.

Small Lot Subdivisions

- The majority of land retired from irrigation use occurred in the Mildura district of the First Mildura Irrigation Trust. The majority (50 percent) of subdivision approvals in the rural zone are occurring in the areas directly adjacent to Mildura (including Irymple, Nichols Point, Cabarita, Cardross, Birdwoodton and Koorlong). Approximately 30 percent of the remaining subdivisions have occurred in the Red Cliffs area (including Yatpool and Carwarp) and the remaining 20 percent in the Merbein area (including Yelta,

Merbein South and Merbein West). It appears there is little demand for rural residential lots in the dryland agricultural area;

- The spatial distribution of rural residential lots (<2 ha) are generally scattered throughout the irrigation districts with some small clusters along roads.

Previous Residential Studies

- A previous rural residential land use study completed for the Mildura local government area. The study notes that there is enough rural residential land available to meet demand for the next 10 years providing:-
    - approximately 82 ha of land is rezoned from rural to low density residential development; and
    - the Council allows some housing excision/boundary realignment in the rural zone.

- The study notes that all housing excision boundary realignment on lots less than 10 ha should be approved only if some form of lot consolidation can be achieved;

- The planning of future rural residential areas should take account of the water authorities' plans for irrigation infrastructure upgrade and expansion and land capability and other constraints.

Multiple Uses on Horticultural Properties

- The majority of rural industries approved in the Mildura area over the last five years include wineries, offices, and accommodation. There is no distinct trend in their location throughout the rural zone.

Water Reform

- Water reform will enable market forces to more effectively influence the operation and management of horticultural enterprises. This means that reform will favour larger efficient properties with economies of scale. The reform may accelerate the trend of growers leaving the industry within the pumped irrigation districts. It is noted however, that many other factors may still impact on the market and therefore on property management.

Right to Farm

- Even though the Mildura horticultural area is characterised by horticultural enterprises adjacent to residential uses, right to farm to date has not been a significant issue. The high level of community knowledge of the irrigation industry may explain why right to farm is not a significant issue. The potential for right to farm issues to arise may be reduced by ensuring that purchasers of rural residential lots are well informed of horticultural practices. Clustering of Residential development will reduce the risk of right to farm issues emerging.

Viability of Smaller Horticultural Holdings

- On discussions with the Sunraysia Rural Counselling Service, 15 ha was generally considered to be a viable lot size for viticulture. A number of assumptions have to be applied to define viability;
- Generally the 15 ha lots are distributed towards the edges of the irrigation districts. Nangiloc-Colignan contains the greatest proportion of larger horticultural lots;
- There is an increasing trend to part time farmers in the pumped districts, which puts emphasis on agricultural production rather than size of holding and viability;
- The minimum lot size for subdivision in the new farming zone should be 20 ha in the main private diverter areas;
- The minimum lot size for subdivision in the new farming zone should be 100 ha in the dryland farming area;
- The minimum lot size for subdivision in the pumped irrigation districts in the new farming zone should remain at 10 ha. Although this minimum is contentious, resubdivision by boundary realignment is the critical factor in addressing the need to create a small lot for a dwelling. This is made on the basis that the remainder of the land is consolidated with other productive land. This then provides a dual outcome of encouraging consolidation and enabling unviable growers to remain in an excised dwelling after leaving the industry.

Urban Development

- Council has recently undertaken a Retail Strategy, which defines and locates areas required for urban expansion. It is important to clearly delineate urban growth boundaries to ensure that landholder expectations and land values are realistic.

Application of Environmental Zones

- The Mildura planning scheme contains some provision to manage areas of environmental significance within the Rural Zone. There may be other areas within the rural zone that have environmental and other limitations. These areas may still be able to be utilised for agricultural production providing they are managed appropriately. Identification and application of a rural conservation zone should be targeted to the small parcels of private land located within the three National Parks.

5.3 Report Limitations

This report is a desktop review only with limited ground truthing. The rural issues that were investigated and reviewed are complex and a large number of assumptions were applied in the analysis. It is important to apply the assumptions to the broad findings of the report.

The report is limited by the data available for analysis. Information, for example, on properties managed by the one landowner and/or family is not publicly available.

Additionally some of the rural issues require further detailed investigation to more accurately identify trends in rural land use.

The report is intended to provide a land capability assessment and broad analysis of rural land use trends as base information for use in the development of a strategic framework for the Rural Areas. The findings and broad trends identified in this report should not be used for any other purpose.

5.4 Assumptions

This report has stated or inferred many assumptions. The order of assumptions given does not conform to any sequence in the report or follow a logical progression. The assumptions are listed below:

- That expansion of irrigation will continue to occur at the current rate outside the pumped irrigation districts;
- That labour, contractors and management skills to support new irrigation development outside the pumped districts will in part come from growers in the pumped districts;
- That more green-field irrigation development will result in continued growth of urban Mildura;
- That expansion of both irrigation and the urban area will create a continuing demand for lifestyle living, hence demand for small block excisions;
- That most of the demand for excisions will continue in the Mildura pumped district;
- That off farm income is common and vital for many growers in the pumped districts;
- That the pumped districts are a long term local feature and new investment will be made to renew off farm irrigation infrastructure;
- That soil quality is not a strong determinant in viability of irrigation in the pumped districts;
- That retirement of small parcels of land from irrigation is generally for the purpose of building a dwelling;
- That for horticultural industries production figures for the Murray valley and Sunraysia are a good indicator of the production within the municipality;
- That on farm wateruse efficiency improvements will follow improvements to the off farm water delivery infrastructure;
- That continuing expansion of irrigation will contribute to marginal growers leaving the industry;
- That there is no recognisable pattern of distribution of small lot excisions within each respective pumped district, apart from some historic clusters along some roads;
- That there is no recognisable pattern of distribution of large horticultural holdings within each respective pumped district;
- That any parcel of land of 2 ha or less in the horticultural area is for a residential use;

- That if Government enters the water market to buy water for the environment this will increase the rate of departure of water from land or departure of unviable growers mainly on the urban fringe;
- That unbundling of water entitlements will increase the rate of departure of water from land or departure of unviable growers mainly on the urban fringe;
- That lifting of the 2 percent cap on water trade out of the pumped districts will increase the rate of departure of water from land or departure of unviable growers;
- That increasing property size in irrigated horticulture by addition of geographically separated lots, does not give full economies of scale;
- That in suggesting a minimum viable property size for viticulture, a grower has a certain level of management skill, no off farm income, debt level is not excessive, and the property has been updated at the appropriate times to a reasonable level with suitable grape varieties, appropriate trellising, watering system and equipment; and
- That cereal cropping will continue as the dominant landuse in the dryland.

6.0 REFERENCES

ACT Planning and Land Authority (1999) *Land Capability Assessment Guidelines*, ACT Planning and Land Authority, Canberra, Australia.

http://www.actpla.act.gov.au/plandev/planning_register/register_docs/landcapabilitygl5a.pdf

FMIT (2004) *Annual Report 2003-2004* First Mildura Irrigation Trust, Mildura, Victoria.

Golder Associates Pty Ltd (2004) *Hydrological Assessment Sterling Drive Mildura Victoria*, Golder Associates Pty Ltd, Victoria.

LCC (1987) *Mallee Area Review*, Land Conservation Council, Melbourne, Victoria.

LCC (1989) *Mallee Area Review Final Recommendations*, Land Conservation Council, Melbourne, Victoria.

Mallee CMA (2003a) *Mallee Regional Catchment Strategy*, 2003-2008 Mallee Catchment Management Authority, Mildura, Victoria.

Mallee CMA (2003b) *Draft Victorian Mallee Salinity and Water Quality Management Plan*, Mallee Catchment Management Authority, Mildura, Victoria.

Mallee CMA (2004) *Mallee Native Vegetation Plan* (draft for public consultation August 2004) Mallee Catchment Management Authority, Mildura, Victoria.

O'Neil Pollack and Associates (2003) *Rural Residential Study Review 2003* for the Mildura Rural City Council. Victoria. Australia.

Penman F, Hubble G.D, Taylor J.K, Hooper P.D (1940) A *Soil Survey of the Mildura Irrigation Settlement, Victoria*. CSIR. Bull No. 133. Melbourne.

PPK Environment & Infrastructure Pty Ltd (1998), *Regional Land Use Strategy Volume 1. The Strategy (Draft)* for Sunrise 21, Mildura Rural City Council and Wentworth Shire Council. South Melbourne. Australia.

REM (2004) *Final Report – Assessment Tool to Determine Potential Risks of Urban Salinity (Phase II)*, Resource & Environmental Management Pty Ltd, South Australia.

Research Planning and Design Group (2000) *Irymple Greenbelt Review* Prepared for the Rural City of Mildura, Mildura, Victoria.

Sunraysia Environmental Pty Ltd. (1991-2004) *Soil Survey Reports* (various), Mildura, Victoria.

SMEDB (2005) *Grow Mildura Region*, Sunraysia Mallee, Economic Development Board, Mildura Victoria.

SRWA (2004) *Annual Report 2003-2004* Sunraysia Rural Water Authority, Irymple, Victoria.

Sunrise 21 (2004) *Irrigated Horticulture of the Lower Murray – Darling*. Mildura, Victoria.

URS (2005) *Environmental and Water Savings Infrastructure Master Plan*, URS for First Mildura Irrigation Trust, Mildura, Victoria.

Van de Graff and Associates Pty Ltd (2000) *Report on a brief investigation of soils located near Mildura for the purposes of expanding the Mildura Irrigation Region for SMEC*, Mildura, Victoria.

APPENDICES

Appendix 1 Glossary

Appendix 2 Soil Suitability Criteria

Appendix 3 Colour Plates

Appendix 1

Glossary

Glossary

BMP or Best Management Practice – a philosophy of management whereby the only actions employed are those that, on balance, are based on the best available management information.

Biodiversity – The variety of all life-forms, the different plants, animals and micro-organisms, the genes they contain, and the ecosystems of which they form a part.

Biodiversity Action Plans - summarise the key biodiversity assets of the bioregion, and the actions and tools required to achieve statewide biodiversity goals. They will form a subset under each of the regional native vegetation plans

Bioregions – biogeographic areas that capture the patterns of ecological characteristics in the landscape or seascape, providing a natural framework for recognising and responding to biodiversity values

Categories of threat to vascular plants in Victoria (Source Gullan *et al,* 1990).

- **Endangered** – In Victoria: rare and at risk of disappearing from the wild state if present land use and other causes continue.
- **Vulnerable** – In Australia: not presently Endangered but at risk of disappearing from the wild over a longer period (20 to 50 years) through continued depletion.
- **Rare** – In Australia: rare but overall not currently considered Endangered or Vulnerable.
- **Depleted** – Not rare in Victoria in the wild state, but considered threatened: regeneration is problematic or less than necessary to replace losses, and the populations are continuing to decrease. This category is used for those plants that may occur over their former range but are markedly less common and continuing to decline, and also for those plants whose range is now substantially reduced with satisfactory regeneration only in a very small proportion of that range.

Appendix 1 Glossary

Conservation Covenant – A voluntary agreement between a landowner and Trust for Nature to safeguard bushland, plants and animals. The covenant is registered on the title and binds future owners of the land.

Corridor – A linear habitat that may link patches of habitat in the landscape and be a pathway for movement of wildlife.

Cost Benefit Analysis - a technique used to financially compare alternative courses of action by assigning dollar values to all outlays and outcomes of the actions.

Cost Sharing - where a number of parties involved in a project share the financial or other burden of the project.

Discharge – Area where groundwater reaches the soil surface leading to concentration of any dissolved salts

DPI – Department of Primary Industries (Victoria).

DSE - Department of Sustainability and Environment (Victoria).

Ecological Processes – fundamental processes that underpin the structure and function of a defined ecosystem.

Ecosystem – collection of communities of organisms and their abiotic features interacting as a unit in some manifestly obvious manner, but usually having no defined boundary.

Ecosystem Services - are the essential ecological processes and life support systems that local ecosystems (thus biodiversity) provide. They include;

- clean air and water;
- regeneration processes (nutrient cycling, filtration, seed dispersal, pollination);
- production of goods (food, pharmaceutical's, genetic resources);
- stabilising processes (soil and climate stability, pest control, regulation of hydrology, detoxification);
- life fulfilling functions (aesthetics, cultural, spiritual inspiration); and
- options for the future

Electrical conductivity or EC – is a standard used to measure the amount of salts in water or soil. The Murray River locally is about 200 to 300 EC, while at Morgan it is 800EC. Regional groundwater is about 50,00EC.

Appendix 1 Glossary

EVC - Ecological Vegetation Class. A type of native vegetation classification system that is described through a combination of its floristic, life form, and ecological characteristics, and through a detailed classification through inferred fidelity to particular environmental attributes. Each EVC includes a collection of floristic communities (i.e. a lower level in the classification that is based solely on groups of the same species) that occur across a biogeographic range, and although differing in species, have similar habitat and ecological processes operating.

Floodplain – the area of land laid down by the action of a river, and which will potentially be inundated in a major flood in the river. Parts of a floodplain are protected from flooding by structures such as roads or levee banks, which usually increases the intensity of a flood elsewhere.

FFG – *Flora and Fauna Guarantee Act* 1988, lists and provides for protection of rare and threatened species.

Geographic Information System (GIS) - a computer based information system that stores, analyses and displays spatial and geographic data.

Groundwater mound – the elevated regional water table beneath the pumped districts caused by intensive irrigation and leakage into the Parilla Sand aquifer through the Blanchetown Clay above it.

Habitat - the living space of a species or community providing a particular set of environmental conditions.

Hydrogeology – the study of water beneath the root zone.

Indigenous – Native to a particular area; not introduced.

Integrated Catchment Management (ICM) – a process whereby the various parties and interests in a catchment are brought together through regional land and water management plans to achieve whole catchment improvements.

Land capability – relates to the ability of land to be used for a range of uses. A land capability assessment considers soil, hydrogeology, biodiversity, flooding, elevation, slope, climate etc.

Landcare - voluntary community land management groups and associated land, water and nature conservation activities.

Appendix 1 Glossary

Land degradation - undesirable changes in plant or animal composition or abundance or soil and land surface characteristics. It may be irreversible within the bounds of economic management.

Landform – surface features in a landscape. There are about ten landforms occurring in the Mallee including east west dunes, swales, floodplains and lunettes

Land system.-.used in mapping and classifying land to group regular patterns of landforms.

LCC - Land Conservation Council. A now defunct statutory body established by the Victorian State government to provide advice on public land use and management.

Landuse – the type of enterprise conducted on a parcel of land, such as housing, agriculture, horticulture, industrial etc. Landuse is regulated by the planning scheme.

Mallee CMA - Mallee Catchment Management Authority. Established by the Victorian state government in 1997 to advise the Minister on catchment condition, land and water management activities and develop and implement regional plans. One of ten such authorities operating in Victoria.

Mallee - the term is used in this document to mean the area of northwest Victoria defined under the *Catchment and Land Protection Act* 1994 as the Mallee CMA catchment or Mallee CMA region, and a waterway management district under the *Water Act* 1989. These are referred to throughout the plan as the "Mallee", although areas containing Mallee characteristics lie outside this administrative boundary.

Murray trench – the shape of the former Murray River valley prior to filling with riverine sediments;

Native vegetation – All plants that are indigenous to Victoria, including trees, shrubs, herbs, and grasses.

Net gain – is where, over a specified area or period time, losses native vegetation and habitat, as measured by a combined quality – quantity measure (habitat hectare), are reduced, minimises and more than offset by commensurate gains.

NVR - Native Vegetation Retention controls.

Parks Victoria - Government delivery arm for DSE, manages reserved public land in Victoria including national parks.

Perched water table – saturated soil where water draining from the surface is restricted from permeating downwards by a relatively impermeable clay layer, which in the Mallee is usually the Blanchetown Clay.

Perennial – Living for at least several years, and usually flowering each year.

Permanent protection – protection of a natural asset on private land through a legal agreement attached to the title; or land management by the Crown or statutory authority for conservation.

Pests – pest plants or pest animals declared in accordance with the *Catchment Land Protection Act* 1994.

Precautionary principle – To avoid wherever practicable serious or irreversible damage to the environment and an assessment of the risk weighted consequences of various options. When dealing with threats of serious or irreversible environmental damage lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

Private diverter - irrigators that build, own and operate their own water delivery infrastructure under a water license.

Pumped irrigation district – the gazetted irrigation districts of Mildura, Merbein, and Red Cliffs; and others outside scope of this report. Irrigation water is distributed to growers by a water authority via large shared infrastructure. Originally developed by government with small closely spaced blocks.

RCS – Regional Catchment Strategy.

Reference area – Tracts of public land containing viable samples of one or more land types that are relatively undisturbed and that are reserved in perpetuity.

Recharge – Area in which surface water enters the soil and passes through and beyond the root zone to become groundwater.

Regeneration – The natural regeneration of vegetation. Natural regeneration contributes to the vegetation cover when the dominant species of the pre-existing vegetation types re-establish, but is less than 10 years of age.

Regional groundwater – in the Mallee this is highly saline water sitting in what is known as the Parilla Sand, an aquifer that is confined between two clay layers,

typically the top of the Parilla Sand is between 2 and 20 metres below the surface and under minor pressure.

Remnant Vegetation – Native vegetation remaining after an area has otherwise been cleared.

Riparian – relates to the corridor of land close to a riverbank or stream bank.

Salinity Impact Zones – these have been compiled through extensive investigations to determine for any area of land the impact of irrigation on the Murray River. The zones are grouped into *high impact zone* and a number of *low impact zones*, which are levied according to the salinity impact.

Salinity Management Plan – community and government agreed plans to tackle to causes and symptoms of salinity, and share the cost of implementation according to the public or private benefit.

Sleeper and dozer water licenses – unused water either short or long term in comparison to the volume for use on the license.

Species - a group of organisms which are biologically similar and capable of breeding and producing fertile offspring with each other but usually not with members of other species.

SPPF – State Planning Policy Framework. This sits in the front of the municipal planning scheme.

Stakeholder - any person, or collection of persons, institution, organisation, agency, department, authority, club, association or the like which has an interest in, or association with a physical area or issue.

Trust for Nature (TFN) - independent body established under the *Victorian Conservation Trust Act* 1972 to enable people to bequeath land or money to purchase/conserve Victoria's most threatened habitats.

Threatening processes – actions, either human induced or otherwise biotically or abiotically induced such as habitat disturbance or destruction or pollution that threaten the survival, abundance or evolutionary development of a species, population or ecological community.

Appendix 1 Glossary

Total grazing pressure – the total impact of all grazing animals on a particular area, including the impact of domestic stock, feral animals and native grazers.

Unbundling – relates to separating the three components of a water right- a share of the capacity of the delivery system in a pumped district, a volume of water that is available for use, and the ability to put the water onto the land

VFF – Victorian Farmers Federation. The Federation represents farmer members through a branch structure and commodity groups.

VPP – Victoria Planning Provisions, sit at the front of each planning scheme.

Appendix 2

Soil Suitability Criteria

Assessment Criteria Used to Classify Soils in Terms of Crop Suitability

Class 1

- Minimum 60cm of unimpeded potential root depth over powder calcium carbonate.
- Minimum 50cm of unimpeded potential root depth over horizon of calcium carbonate rubble (minimum 40% of horizon to be rubble).
- No structural root or water impedance within 1.5m of surface.
- Low permeability clay deeper than 1.5m below the surface.
- Soil salinity below levels that could cause crop loss.

Class 2

- Unimpeded potential root depth of 40cm to 59cm over powder calcium carbonate.
- Unimpeded potential root depth of 30cm to 49cm over horizon of calcium carbonate. rubble (minimum 40% of horizon to be rubble).
- Minimum 50cm over a pan that can be readily ameliorated.
- Low permeability clay deeper than 1.0m below the surface.
- Salinity within the potential rootzone able to be readily leached with the installation of artificial drainage.
- Following amelioration of any pans, permeability and drainage not significantly restricted to 1.0m.

Class 3 (Marginal)

- Unimpeded potential root depth of greater than 25cm but less than 40cm over powder calcium carbonate.
- Unimpeded potential root depth of 15cm to 29cm over horizon of calcium carbonate rubble (minimum 40% of horizon to be rubble).
- Minimum 20cm over a pan that can be readily ameliorated.
- No impediment to infiltration other than agricultural pans.
- Following amelioration of any pans, permeability and drainage not significantly restricted to 0.6m.
- Low permeability clay deeper than 0.6m below the surface.
- Salinity within the potential rootzone able to be readily leached with the installation of artificial drainage.

Appendix 3

Colour Plates

Appendix 3 Colour Plates – Mixed Land Use

Photo 1. Art Gallery, Cureton Ave Kings Billabong, not dependant on horticulture

Photo 2. Caravan Park Sturt Highway near airport

Appendix 3 Colour Plates – Mixed Land Use

Photo 3. Fire wood supplies set amongst horticulture on marginal land in Walnut Ave


Photo 4. Milburn Park Winery amongst vines Fifteenth St Irymple Sth

Appendix 3 Colour Plates – Mixed Land Use

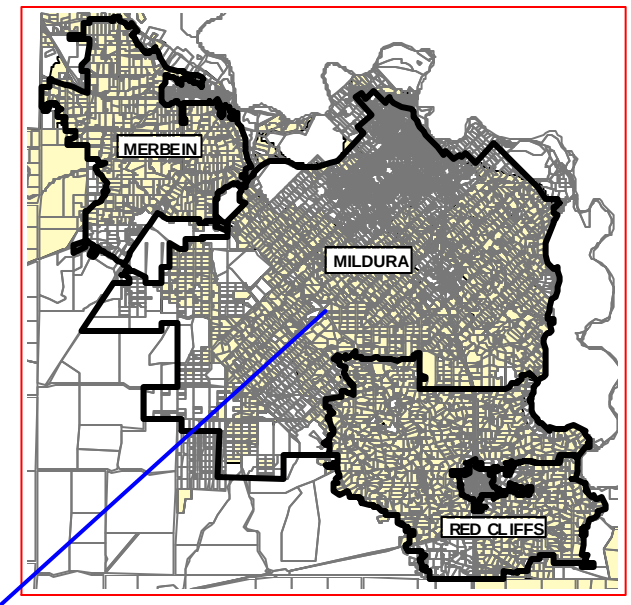
Photo 5. Large horticultural nursery Fifteenth Street near Irymple

Attachments

Maps

Map 1

Mildura Rural City Council
Rural Zone
Irrigation District Boundaries
Private Diverters



Lindsay Point
Yelta
Lake Cullulleraine
Karadoc
Iraak
Nangiloc
Colignan
Hattah-Kulkyne National Park
Murray - Sunset National Park
Ouyen
Underbool
Murrayville
Big Desert Wilderness Park
Wyperfeld National Park

Legend

- Mildura Rural Zone
- Cadastre Parcels
- Irrigation District Boundaries
- Location of Private Diverters

Information has been sourced from aerial photo interpretations, Vicmap parcel & property data, aerial photos supplied by SunRise 21, and soil survey data interpreted by Sunraysia Environmental.

While every effort has been made to ensure map accuracy, Sunraysia Environmental takes no responsibility for the spatial accuracy of information displayed on this map.

Prepared on the 30th of November, 2004.
For : Mildura Rural Areas Project

By :

SUNRAYSIA ENVIRONMENTAL
soils • science • sustainability
3 The Crescent
Mildura, VIC 3500
Ph: (03) 5023 3843
Fax: (03) 5021 3440
Email: office@sunenv.com.au
Web: www.sunenv.com.au

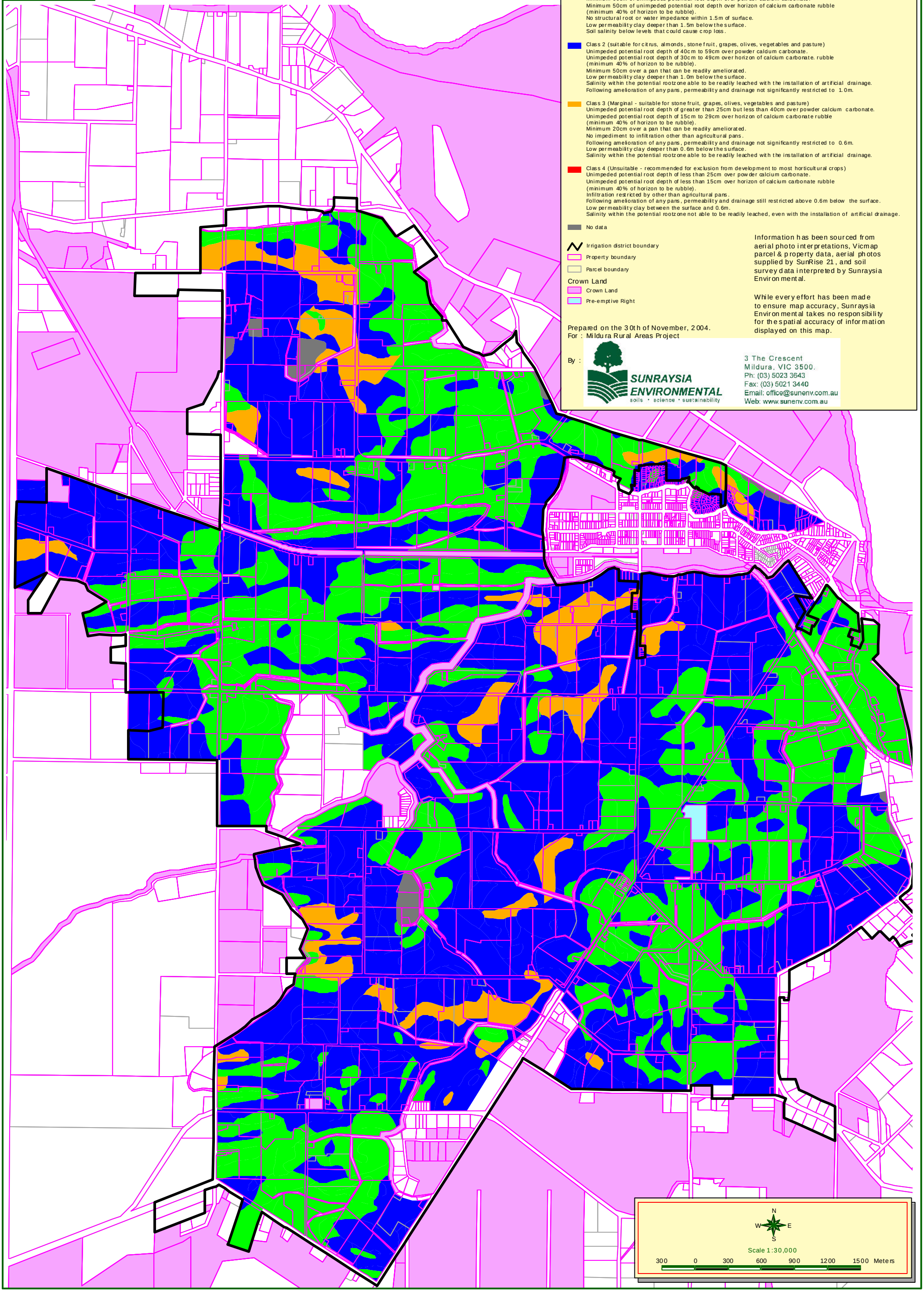
N
W E
S

Scale 1:600,000

10 0 10 20 30 40 Kilometers

Map 2a

Mildura Rural City Council
Merbein - Soil Suitability



Legend

Soil Suitabilty

- Class 1 (suitable for avocado, citrus, almonds, stone fruit, grapes, olives and vegetables)
  Minimum 60cm of unimpeded potential root depth over powder calcium carbonate.
  Minimum 50cm of unimpeded potential root depth over horizon of calcium carbonate rubble (minimum 40% of horizon to be rubble).
  No structural root or water impedance within 1.5m of surface.
  Low permeability clay deeper than 1.5m below the surface.
  Soil salinity below levels that could cause crop loss.
- Class 2 (suitable for citrus, almonds, stone fruit, grapes, olives, vegetables and pasture)
  Unimpeded potential root depth of 40cm to 59cm over powder calcium carbonate.
  Unimpeded potential root depth of 30cm to 49cm over horizon of calcium carbonate. rubble (minimum 40% of horizon to be rubble).
  Minimum 50cm over a pan that can be readily ameliorated.
  Low permeability clay deeper than 1.0m below the surface.
  Salinity within the potential rootzone able to be readily leached with the installation of artificial drainage.
  Following amelioration of any pans, permeability and drainage not significantly restricted to 1.0m.
- Class 3 (Marginal - suitable for stone fruit, grapes, olives, vegetables and pasture)
  Unimpeded potential root depth of greater than 25cm but less than 40cm over powder calcium carbonate.
  Unimpeded potential root depth of 15cm to 29cm over horizon of calcium carbonate rubble (minimum 40% of horizon to be rubble).
  Minimum 20cm over a pan that can be readily ameliorated.
  No impediment to infiltration other than agricultural pans.
  Following amelioration of any pans, permeability and drainage not significantly restricted to 0.6m.
  Low permeability clay deeper than 0.6m below the surface.
  Salinity within the potential rootzone able to be readily leached with the installation of artificial drainage.
- Class 4 (Unsuitable - recommended for exclusion from development to most horticultural crops)
  Unimpeded potential root depth of less than 25cm over powder calcium carbonate.
  Unimpeded potential root depth of less than 15cm over horizon of calcium carbonate rubble (minimum 40% of horizon to be rubble).
  Infiltration restricted by other than agricultural pans.
  Following amelioration of any pans, permeability and drainage still restricted above 0.6m below the surface.
  Low permeability clay between the surface and 0.6m.
  Salinity within the potential rootzone not able to be readily leached, even with the installation of artificial drainage.
- No data

- Irrigation district boundary
- Property boundary
- Parcel boundary

Crown Land

- Crown Land
- Pre-emptive Right

Information has been sourced from aerial photo interpretations, Vicmap parcel & property data, aerial photos supplied by SunRise 21, and soil survey data interpreted by Sunraysia Environmental.

While every effort has been made to ensure map accuracy, Sunraysia Environmental takes no responsibility for the spatial accuracy of information displayed on this map.

Prepared on the 30th of November, 2004.
For : Mildura Rural Areas Project

By :

SUNRAYSIA ENVIRONMENTAL
soils • science • sustainability

3 The Crescent
Mildura, VIC 3500.
Ph: (03) 5023 3643
Fax: (03) 5021 3440
Email: office@sunenv.com.au
Web: www.sunenv.com.au

N
W E
S

Scale 1:30,000

300 0 300 600 900 1200 1500 Meters

Map 2b

Mildura Rural City Council
Mildura - Soil Suitability

Legend

Soil Suitabilty

Class 1 (suitable for avocado, citrus, almonds, stone fruit, grapes, olives and vegetables)
Minimum 60cm of unimpeded potential root depth over powder caldum carbonate.
Minimum 50cm of unimpeded potential root depth over horizon of calcium carbonate rubble
(minimum 40% of horizon to be rubble).
No structural root or water impedance within 1.5m of surface.
Low permeability clay deeper than 1.5m below the surface.
Soil salinity below levels that could cause crop loss.

Class 2 (suitable for citrus, almonds, stone fruit, grapes, olives, vegetables and pasture)
Unimpeded potential root depth of 40cm to 59cm over powder calcium carbonate.
Unimpeded potential root depth of 30cm to 49cm over horizon of calcium carbonate rubble
(minimum 40% of horizon to be rubble).
Minimum 50cm over a pan that can be readily ameliorated.
Low permeability clay deeper than 1.0m below the surface.
Salinity within the potential rootzone able to be readily leached with the installation of artificial drainage.
Following amelioration of any pans, permeability and drainage not significantly restricted to 1.0m.

Class 3 (Marginal - suitable for stone fruit, grapes, olives, vegetables and pasture)
Unimpeded potential root depth of greater than 25cm but less than 40cm over powder calcium carbonate.
Unimpeded potential root depth of 15cm to 29cm over horizon of calcium carbonate rubble
(minimum 40% of horizon to be rubble).
Minimum 20cm over a pan that can be readily ameliorated.
No impediment to infiltration other than agricultural pans.
Following amelioration of any pans, permeability and drainage not significantly restricted to 0.6m.
Low permeability clay deeper than 0.6m below the surface.
Salinity within the potential rootzone able to be readily leached with the installation of artificial drainage.

Class 4 (Unsuitable - recommended for exclusion from development to most horticultural crops)
Unimpeded potential root depth of less than 25cm over powder caldum carbonate.
Unimpeded potential root depth of less than 15cm over horizon of calcium carbonate rubble
(minimum 40% of horizon to be rubble).
Infiltration restricted by other than agricultural pans.
Following amelioration of any pans, permeability and drainage still restricted above 0.6m below the surface.
Low permeability clay between the surface and 0.6m.
Salinity within the potential rootzone not able to be readily leached, even with the installation of artificial drainage.

No data

Irrigation district boundary
Property boundary
Parcel boundary

Crown Land

Crown Land
Pre-emptive Right

Information has been sourced from aerial photo interpretations, Vicmap parcel & property data, aerial photos supplied by SunRise 21, and soil survey data interpreted by Sunraysia Environmental.

While every effort has been made to ensure map accuracy, Sunraysia Environmental takes no responsibility for the spatial accuracy of information displayed on this map.

Prepared on the 30th of November, 2004.
For : Mildura Rural Areas Project

By :

SUNRAYSIA ENVIRONMENTAL
soils • science • sustainability

3 The Crescent
Mildura, VIC 3500.
Ph: (03) 5023 3643
Fax: (03) 5021 3440
Email: office@sunenv.com.au
Web: www.sunenv.com.au

N
W E
S

Scale 1:60,000

500 0 500 1000 1500 2000 2500 3000 Meters

Map 2c

Mildura Rural City Council
Red Cliffs - Soil Suitability

Legend

Soil Suitabilty

Class 1 (suitable for avocado, citrus, almonds, stone fruit, grapes, olives and vegetables)
Minimum 60cm of unimpeded potential root depth over powder calcium carbonate.
Minimum 50cm of unimpeded potential root depth over horizon of calcium carbonate rubble (minimum 40% of horizon to be rubble).
No structural root or water impedance within 1.5m of surface.
Low permeability clay deeper than 1.5m below the surface.
Soil salinity below levels that could cause crop loss.

Class 2 (suitable for citrus, almonds, stone fruit, grapes, olives, vegetables and pasture)
Unimpeded potential root depth of 40cm to 59cm over powder calcium carbonate.
Unimpeded potential root depth of 30cm to 49cm over horizon of calcium carbonate rubble (minimum 40% of horizon to be rubble).
Minimum 50cm over a pan that can be readily ameliorated.
Low permeability clay deeper than 1.0m below the surface.
Salinity within the potential rootzone able to be readily leached with the installation of artificial drainage.
Following amelioration of any pans, permeability and drainage not significantly restricted to 1.0m.

Class 3 (Marginal - suitable for stone fruit, grapes, olives, vegetables and pasture)
Unimpeded potential root depth of greater than 25cm but less than 40cm over powder calcium carbonate.
Unimpeded potential root depth of 15cm to 29cm over horizon of calcium carbonate rubble (minimum 40% of horizon to be rubble).
Minimum 20cm over a pan that can be readily ameliorated.
No impediment to infiltration other than agricultural pans.
Following amelioration of any pans, permeability and drainage not significantly restricted to 0.6m.
Low permeability clay deeper than 0.6m below the surface.
Salinity within the potential rootzone able to be readily leached with the installation of artificial drainage.

Class 4 (Unsuitable - recommended for exclusion from development to most horticultural crops)
Unimpeded potential root depth of less than 25cm over powder calcium carbonate.
Unimpeded potential root depth of less than 15cm over horizon of calcium carbonate rubble (minimum 40% of horizon to be rubble).
Infiltration restricted by other than agricultural pans.
Following amelioration of any pans, permeability and drainage still restricted above 0.6m below the surface.
Low permeability clay between the surface and 0.6m.
Salinity within the potential rootzone not able to be readily leached, even with the installation of artificial drainage.

No data

Irrigation district boundary
Property boundary
Parcel boundary

Crown Land
Crown Land
Pre-emptive Right

Information has been sourced from aerial photo interpretations, Vicmap parcel & property data, aerial photos supplied by SunRise 21, and soil survey data interpreted by Sunraysia Environmental.

While every effort has been made to ensure map accuracy, Sunraysia Environmental takes no responsibility for the spatial accuracy of information displayed on this map.

Prepared on the 30th of November, 2004.
For : Mildura Rural Areas Project

By :

SUNRAYSIA ENVIRONMENTAL
soils • science • sustainability

3 The Crescent
Mildura, VIC 3500.
Ph: (03) 5023 3643
Fax: (03) 5021 3440
Email: office@sunenv.com.au
Web: www.sunenv.com.au

N
W E
S

Scale 1:35,000

300 0 300 600 900 1200 1500 1800 Meters

Map 2d

Mildura Rural City Council
Karadoc Irrak Nangiloc Colignan
Soil Suitability

Karadoc

Iraak

Colignan

Legend

Soil Suitabilty

Class 1 (suitable for avocado, citrus, almonds, stone fruit, grapes, olives and vegetables)
Minimum 60cm of unimpeded potential root depth over powder calcium carbonate.
Minimum 50cm of unimpeded potential root depth over horizon of calcium carbonate rubble (minimum 40% of horizon to be rubble).
No structural root or water impedance within 1.5m of surface.
Low permeability clay deeper than 1.5m below the surface.
Soil salinity below levels that could cause crop loss.

Class 2 (suitable for citrus, almonds, stone fruit, grapes, olives, vegetables and pasture)
Unimpeded potential root depth of 40cm to 59cm over powder calcium carbonate.
Unimpeded potential root depth of 30cm to 49cm over horizon of calcium carbonate rubble (minimum 40% of horizon to be rubble).
Minimum 50cm over a pan that can be readily ameliorated.
Low permeability clay deeper than 1.0m below the surface.
Salinity within the potential rootzone able to be readily leached with the installation of artificial drainage.
Following amelioration of any pans, permeability and drainage not significantly restricted to 1.0m.

Class 3 (Marginal - suitable for stone fruit, grapes, olives, vegetables and pasture)
Unimpeded potential root depth of greater than 25cm but less than 40cm over powder calcium carbonate.
Unimpeded potential root depth of 15cm to 29cm over horizon of calcium carbonate rubble (minimum 40% of horizon to be rubble).
Minimum 20cm over a pan that can be readily ameliorated.
No impediment to infiltration other than agricultural pans.
Following amelioration of any pans, permeability and drainage not significantly restricted to 0.6m.
Low permeability clay deeper than 0.6m below the surface.
Salinity within the potential rootzone able to be readily leached with the installation of artificial drainage.

Class 4 (Unsuitable - recommended for exclusion from development to most horticultural crops)
Unimpeded potential root depth of less than 25cm over powder calcium carbonate.
Unimpeded potential root depth of less than 15cm over horizon of calcium carbonate rubble (minimum 40% of horizon to be rubble).
Infiltration restricted by other than agricultural pans.
Following amelioration of any pans, permeability and drainage still restricted above 0.6m below the surface.
Low permeability clay between the surface and 0.6m.
Salinity within the potential rootzone not able to be readily leached, even with the installation of artificial drainage.

No data

Irrigation district boundary
Property boundary
Parcel boundary

Crown Land
Crown Land
Pre-emptive Right

Information has been sourced from aerial photo interpretations, Vicmap parcel & property data, aerial photos supplied by SunRise 21, and soil survey data interpreted by Sunraysia Environmental.

While every effort has been made to ensure map accuracy, Sunraysia Environmental takes no responsibility for the spatial accuracy of information displayed on this map.

Prepared on the 30th of November, 2004.
For : Mildura Rural Areas Project

By :

SUNRAYSIA ENVIRONMENTAL
soils • science • sustainability
3 The Crescent
Mildura, VIC 3500.
Ph: (03) 5023 3843
Fax: (03) 5021 3440
Email: office@sunenv.com.au
Web: www.sunenv.com.au

N
W E
S

Scale 1:75,000

1 0 1 2 3 Kilometers

GEOMORPHIC UNIT	LAND SYSTEM SYMBOL (See Key)	DOMINANT DEPENDENT FEATURES		CORRELATION WITH LAND SYSTEMS IN 1974 LCC REPORT
		INDIGENOUS VEGETATION	SOILS (In order of occurrence)	
MALLEE DUNEFIELD				
Very closely-spaced, reddish-yellow, e-w dunes with soft cores —				
on plains and ridges	EPRcf2 EPRcf3	Low mallee scrub	Reddish yellow sands Sandy red duplex soils Calcareous earths	Central Mallee
on plains in Raak depression	EPcf2			
Sandplains with scattered reddish-yellow, e-w dunes in Noora depression	PEcf2	Low mallee scrub	Sandy red duplex soils Reddish yellow sands Calcareous earths	
Closely-spaced e-w dunes with compact cores —				
on plains and ridges in north	EPRfc2 EPRfc3	Mallee scrub	Calcareous earths Sandy red duplex soils	Central Mallee, Tempy
on plains in Raak depression	EPfc2			
on plains in Noora depression	EPfcl2	Mallee scrub	Shallow loams on limestone Sand red duplex soils	Central Mallee
Scattered e-w dunes —				
on plains and ridges in south	PREfc3	Mallee scrub	Calcareous clays Calcareous earths Sandy red duplex soils	Hopetoun
on ridges and plains in north	RPEfc2 RPEfc3	Pine-belar woodland Tall mallee scrub	Calcareous earths Sandy calcareous earths	Millewa
on plains and ridges fringing the Noora depression	PREfcl2	Grassy pine-belar woodland Mallee scrub	Shallow loams on limestone Calcareous earths Sandy calcareous earths	Central Mallee
on plains in Raak and Tyrrell depressions	PEfc2 PEfe3	Tall mallee scrub Grassland	Grey gypseous clays Sandy red duplex soils	Hopetoun
Weakly-oriented dunes on plains and ridges in south	WPRf3	Mallee scrub	Calcareous earths Calcareous clays	Boigbeat
Plains, ridges and areas of weakly-oriented dunes in south	PWRf3	Tall mallee scrub Mallee scrub	Calcareous clays Calcareous earths	Culgoa
Locally high ridges without linear dunes —				
Yarrara, Robinvale Walpeup	Rf2 Rf3	Pine-belar woodland Mallee scrub	Calcareous earths	Boigbeat
Evaporative basin plains —				
plains with gypseous dunes in depressions	PYfz2 PYfz3	Samphire shrubland Saltbush shrubland Tall mallee scrub	Calcareous earths Saline loams Shallow loams on copi	Raak
	PYcf2	Low mallee scrub	Sandy red duplex soils Shallow loams on copi	Berrook
saltpans in Raak depression	Pz2	—	Saline clays	Raak
sandplains and saltpans in Raak depression	Pcz2	Grassland Pine-belar-buloke woodland	Sandy red duplex soils Saline clays	Raak
lunettes (also in Riverine Plain)	Lf2 Lf3	Pine-belar woodland Pine-belar-buloke woodland Tall mallee scrub	Red duplex soils Yellow duplex soils	Raak, Lindsay Island
Clay plains and sandplains in Raak depression	Pfc2 Pcf2	Grassland Pine-belar-buloke woodland Tall mallee scrub	Sandy red duplex soils Grey gypseous clays Calcareous earths	Berrook
Irregular pale dunes, closely to widely-spaced —				
on plains and ridges	IPRc2	Low mallee scrub	Pale sands	Berrook
	IPRc3 IPRc4	Low mallee scrub Heath		Big Desert 2
on plains in Raak and Noora depressions	IPc2	Low mallee scrub		Berrook
Very closely-spaced pale e-w dunes —				
on plains and ridges	EPRc2	Low mallee scrub	Pale sands	Berrook
	EPRc3 EPRc4	Low mallee scrub Heath	Sandy mottled duplex soils Calcareous earths in east	Big Desert 1
on plains in Raak depression	EPc2	Low mallee scrub	Pale sands Sandy mottled duplex soils	Berrook
on plains in Noora depression	EPcl2			
RIVERINE PLAIN				
Present flood plains —				
beside Murray River and some creek courses in Mallee Dunefield	Ffc2 Ffc3	Redgum and blackbox woodland Grassland	Grey clays Grey sands	Lindsay Island Tyrrell Creek
with areas of sandy weakly-oriented dunes, Kulkyne	FWcf2	Redgum and blackbox woodland Pine woodland Mallee scrub	Grey sands Reddish yellow sands Grey clays	Lindsay Island
Higher alluvial plains —				
terraces beside Murray River and some creek courses in Mallee Dunefield	Pf2	Saltbush shrubland Blackbox woodland	Red and brown duplex soils, saline at depth	Neds Corner
	Pf3₁	Grassland Blackbox and buloke woodland	Red duplex soils Grey clays	Tyrrell Creek
terraces with e-w dunes west of Mildura	PEfc2	Bluebush shrubland	Sandy red duplex soils Red and brown duplex soils, saline at depth	Neds Corner
broad plains in south-east	Pf3₂	Blackbox- buloke open woodland	Red brown clays Grey clays	Wycheproof

Map 3 Landsystems

Ffc2
Pf2
PEfc2
RPEfc2
Rf2
EPRfc2
EPRcf2
EPfc2
EPcf2
Pz2
PYfz2
Poz2
Pcz2
Lf2
EPRcf2
PYfz2
FWcf2

Map 4

Mildura Rural City Council
Salinity Impact Zones

Legend
Salinity Impact Zones
Low High
Current Irrigation District Boundaries
Cadastre Parcels

Lindsay Point
Lake Cullulleraine
Merbein
Mildura
Red Cliffs
Karadoc
Iraak
Nangiloc
Colignan
Murray - Sunset National Park
Hattah-Kulkyne National Park

Information has been sourced from aerial photo interpretations, Vicmap parcel & property data, aerial photos supplied by SunRise 21, and soil survey data interpreted by Sunraysia Environmental.

While every effort has been made to ensure map accuracy, Sunraysia Environmental takes no responsibility for the spatial accuracy of information displayed on this map.

Prepared on the 30th of November, 2004.
For : Mildura Rural Areas Project

By :

SUNRAYSIA ENVIRONMENTAL
soils • salinity • sustainability
3 The Crescent
Mildura, VIC 3500.
Ph: (03) 5023 3843
Fax: (03) 5021 3440
Email: office@sunenv.com.au
Web: www.sunenv.com.au

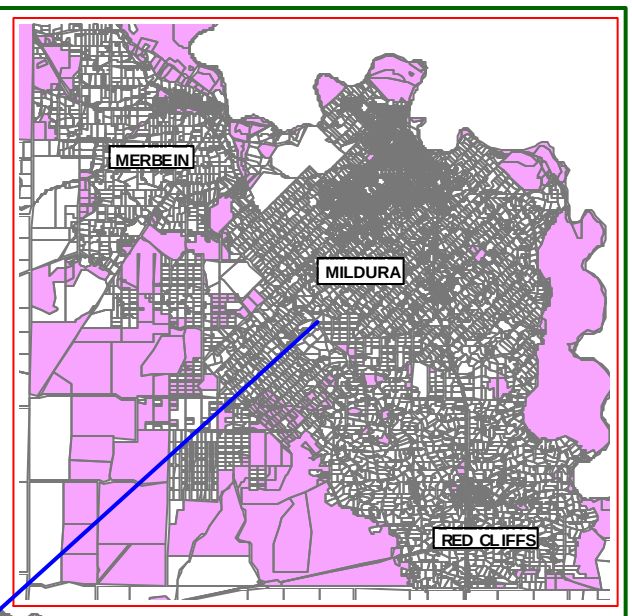
N
W E
S

Scale 1:400,000

5 0 5 10 15 20 Kilometers

Map 5

Mildura Rural City Council
Public Land



Lindsay Point
Yelta
Lake Cullulleraine
Karadoc
Iraak
Nangiloc
Colignan
Hattah-Kulkyne National Park
Murray - Sunset National Park
Ouyen
Underbool
Murrayville
Big Desert Wilderness Park
Wyperfeld National Park

Information has been sourced from aerial photo interpretations, Vicmap parcel & property data, aerial photos supplied by SunRise 21, and soil survey data interpreted by Sunraysia Environmental.

While every effort has been made to ensure map accuracy, Sunraysia Environmental takes no responsibility for the spatial accuracy of information displayed on this map.

Prepared on the 30th of November, 2004.
For : Mildura Rural Areas Project

By :

SUNRAYSIA ENVIRONMENTAL
soils • science • sustainability
3 The Crescent
Mildura, VIC 3500
Ph: (03) 5023 3643
Fax: (03) 5021 3440
Email: office@sunenv.com.au
Web: www.sunenv.com.au

Legend

- Public Land
- Cadastre Parcels

N
W E
S

Scale 1:600,000

10 0 10 20 30 40 Kilometers

Map 6

Mildura Rural City Council
Potential for Future Irrigation Development

Legend
- Current Irrigation District Boundaries
- Cadastre Parcels
- Public Land
- Mildura Rural Zone

Merbein
Wargan
Mildura
Red Cliffs
Lake Cullulleraine
Thurla / Benetook
Karadoc
Iraak
Calder Hwy
Nangiloc
Colignan
Hattah-Kulkyne National Park

Information has been sourced from aerial photo interpretations, Vicmap parcel & property data, aerial photos supplied by SunRise 21, and soil survey data interpreted by Sunraysia Environmental.

While every effort has been made to ensure map accuracy, Sunraysia Environmental takes no responsibility for the spatial accuracy of information displayed on this map.

Prepared on the 30th of November, 2004.
For : Mildura Rural Areas Project

By :

SUNRAYSIA ENVIRONMENTAL
soils • science • sustainability
3 The Crescent
Mildura, VIC 3500.
Ph: (03) 5023 3643
Fax: (03) 5021 3440
Email: office@sunenv.com.au
Web: www.sunenv.com.au

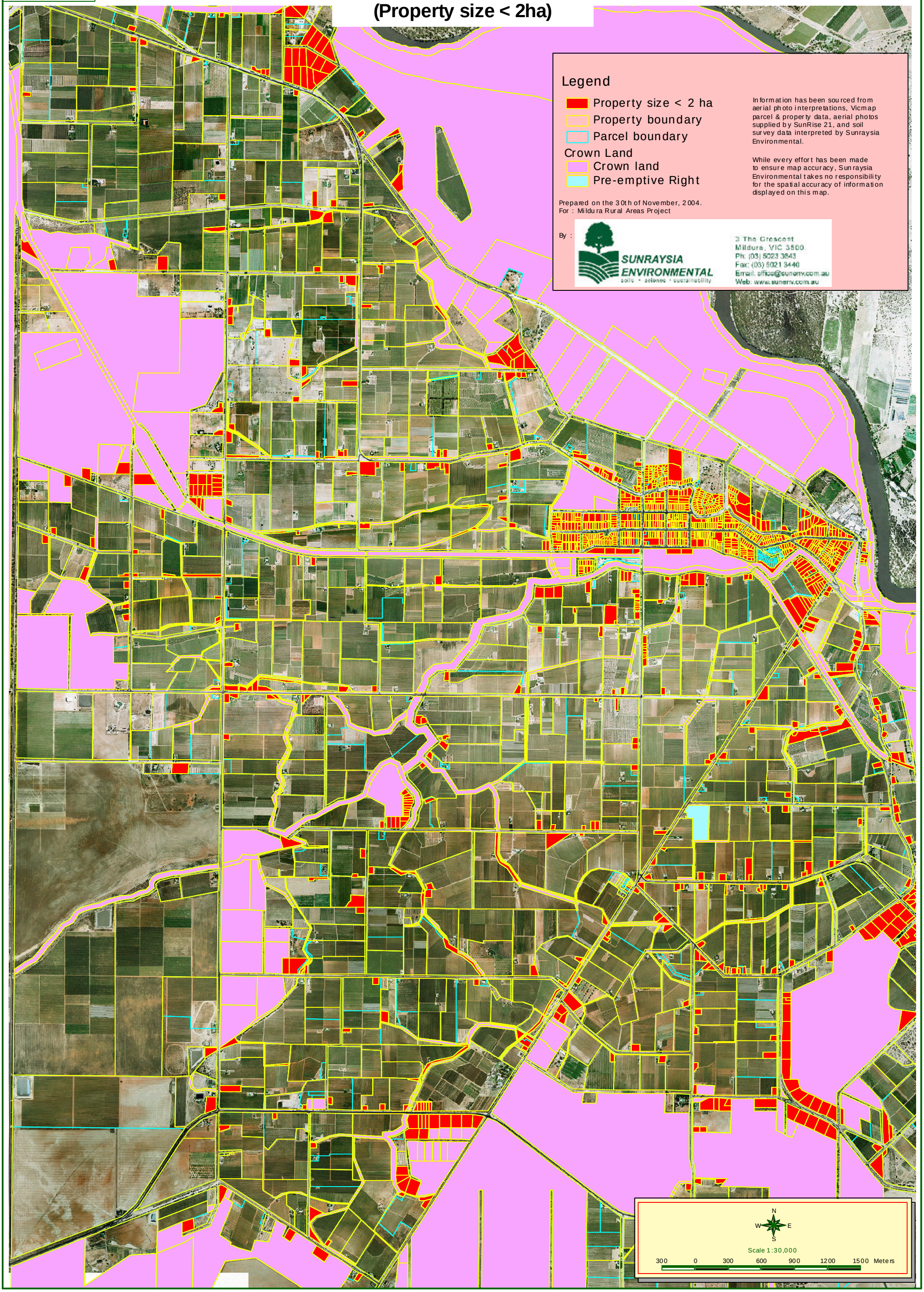
N
W E
S

Scale 1:200,000

2 0 2 4 6 8 10 Kilometers

Map 7a

Mildura Rural City Council
Merbein - Rural Residential
(Property size < 2ha)



Map 7b

Mildura Rural City Council
Mildura - Rural Residential
(Property size < 2 ha)

Legend

- Property size < 2 ha
- Property boundary
- Parcel boundary
- Low density residential development zone
- 2030 residential strategy outline

Crown Land

- Crown land
- Pre-emptive Right

N
W E
S

Scale 1:60,000

500 0 500 1000 1500 2000 2500 3000 Meters

Information has been sourced from aerial photo interpretations, Vicmap parcel & property data, aerial photos supplied by SunRise 21, and soil survey data interpreted by Sunraysia Environmental.

While every effort has been made to ensure map accuracy, Sunraysia Environmental takes no responsibility for the spatial accuracy of information displayed on this map.

Prepared on the 30th of November, 2004.
For : Mildura Rural Areas Project

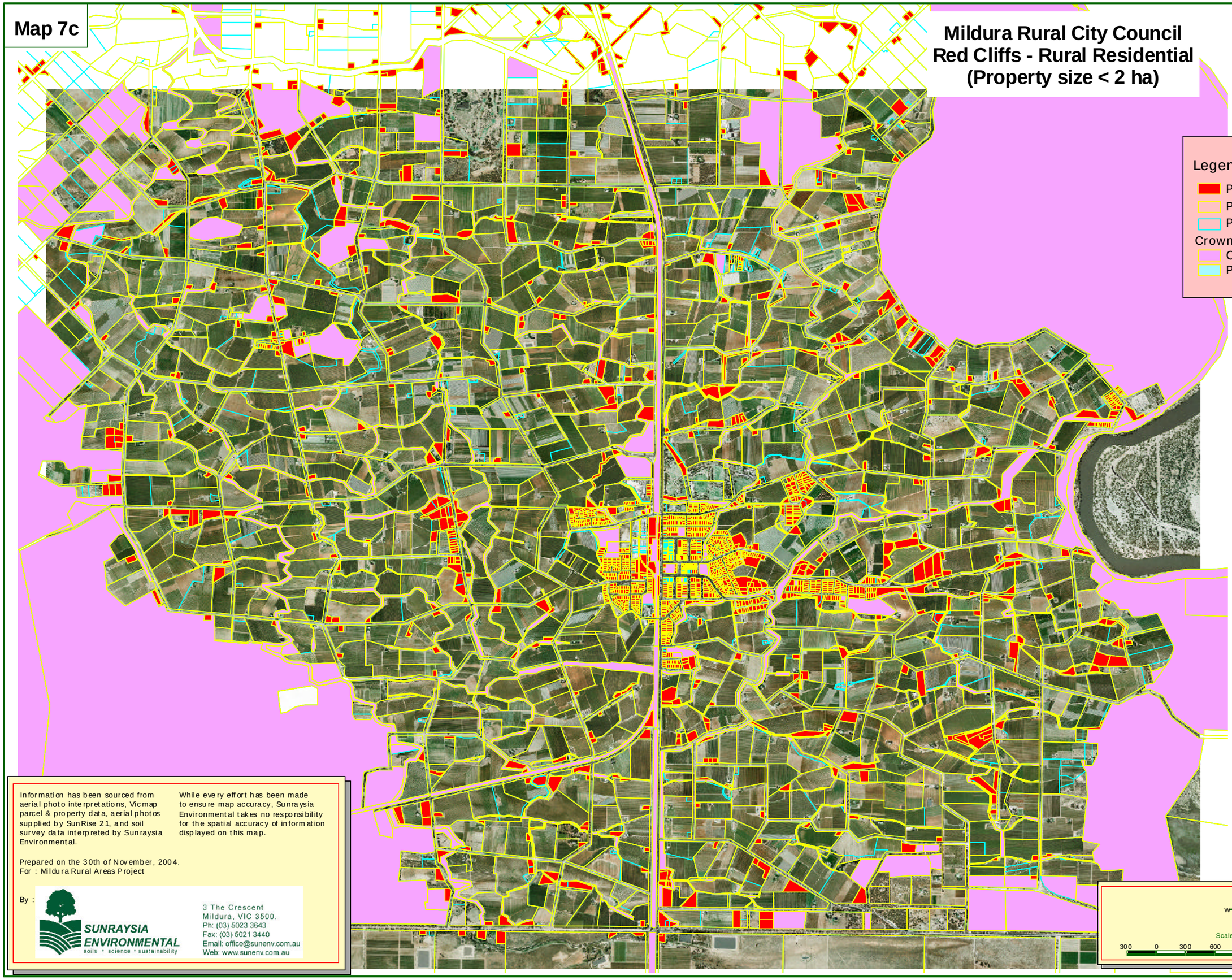
By :

SUNRAYSIA ENVIRONMENTAL
soils • science • sustainability

3 The Crescent
Mildura, VIC 3500.
Ph: (03) 5023 3643
Fax: (03) 5021 3440
Email: office@sunenv.com.au
Web: www.sunenv.com.au

Map 7c

Mildura Rural City Council
Red Cliffs - Rural Residential
(Property size < 2 ha)



Information has been sourced from aerial photo interpretations, Vicmap parcel & property data, aerial photos supplied by SunRise 21, and soil survey data interpreted by Sunraysia Environmental.

While every effort has been made to ensure map accuracy, Sunraysia Environmental takes no responsibility for the spatial accuracy of information displayed on this map.

Prepared on the 30th of November, 2004.
For : Mildura Rural Areas Project

By :

SUNRAYSIA ENVIRONMENTAL
soils • science • sustainability

3 The Crescent
Mildura, VIC 3500.
Ph: (03) 5023 3643
Fax: (03) 5021 3440
Email: office@sunenv.com.au
Web: www.sunenv.com.au

Map 7d

Mildura Rural City Council
Rural Residential (Property size < 2ha)
Karadoc Iraak Nangiloc Colignan

Karadoc

Iraak

Nangiloc

Colignan

Legend

- Property size < 2 ha
- Property boundary
- Parcel boundary

Crown Land

- Crown land
- Pre-emptive Right

Information has been sourced from aerial photo interpretations, Vicmap parcel & property data, aerial photos supplied by SunRise 21, and soil survey data interpreted by Sunraysia Environmental.

While every effort has been made to ensure map accuracy, Sunraysia Environmental takes no responsibility for the spatial accuracy of information displayed on this map.

Note: The difference in the image colour is due to a combination of infra-red and natural colour image sections.

Prepared on the 30th of November, 2004.
For : Mildura Rural Areas Project

By :

SUNRAYSIA ENVIRONMENTAL
soils • science • sustainability
3 The Crescent
Mildura, VIC 3500
Ph: (03) 5023 3843
Fax: (03) 5021 3440
Email: office@sunenv.com.au
Web: www.sunenv.com.au

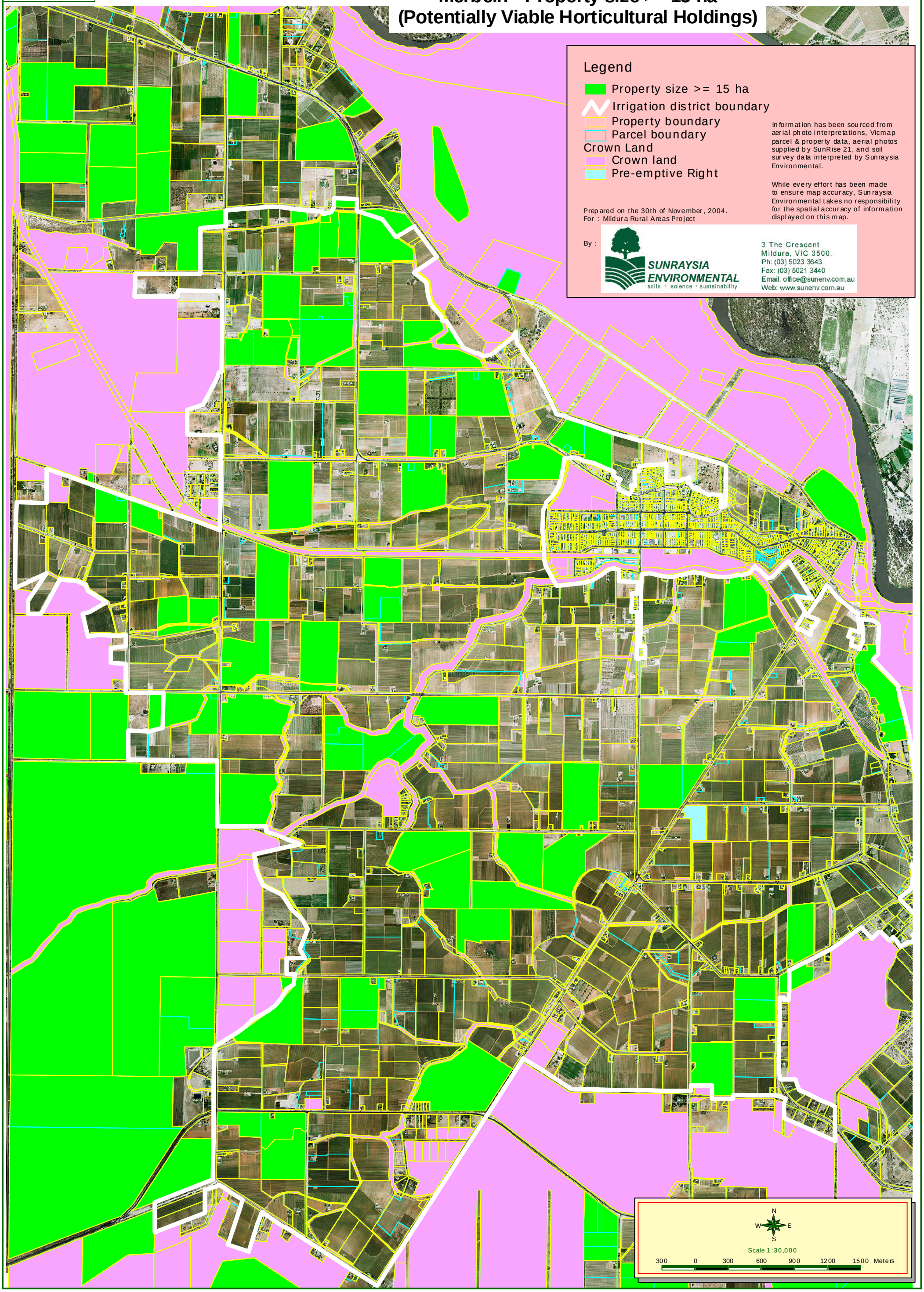
N
W E
S

Scale 1:75,000

1 0 1 2 3 Kilometers

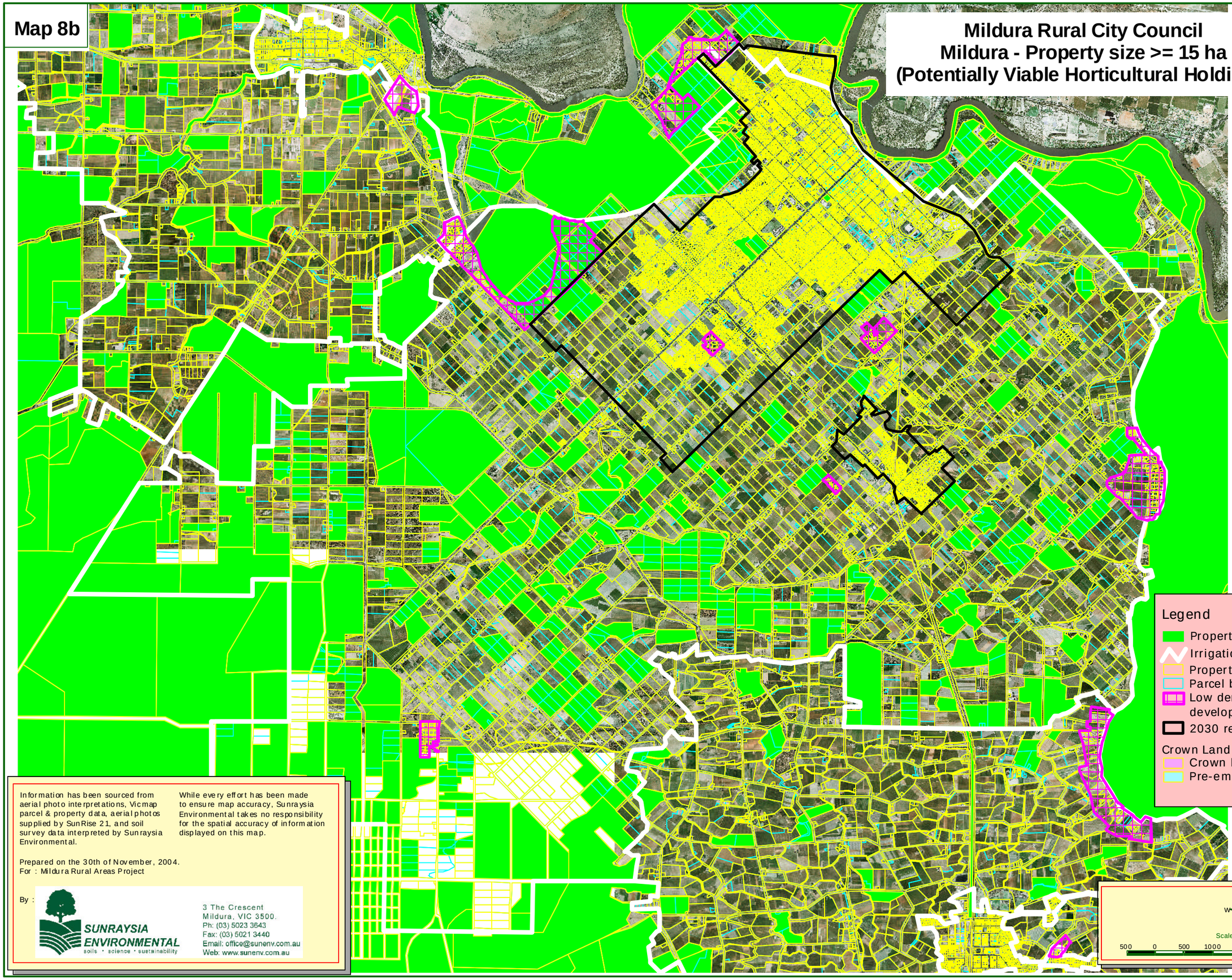
Map 8a

Mildura Rural City Council
Merbein - Property size >= 15 ha
(Potentially Viable Horticultural Holdings)



Map 8b

Mildura Rural City Council
Mildura - Property size >= 15 ha
(Potentially Viable Horticultural Holdings)



Legend

- Property size >= 15 ha
- Irrigation district boundary
- Property boundary
- Parcel boundary
- Low density residential development zone
- 2030 residential strategy outline

Crown Land

- Crown land
- Pre-emptive Right

N
W E
S

Scale 1:60,000

500 0 500 1000 1500 2000 2500 3000 Meters

Information has been sourced from aerial photo interpretations, Vicmap parcel & property data, aerial photos supplied by SunRise 21, and soil survey data interpreted by Sunraysia Environmental.

While every effort has been made to ensure map accuracy, Sunraysia Environmental takes no responsibility for the spatial accuracy of information displayed on this map.

Prepared on the 30th of November, 2004.
For : Mildura Rural Areas Project

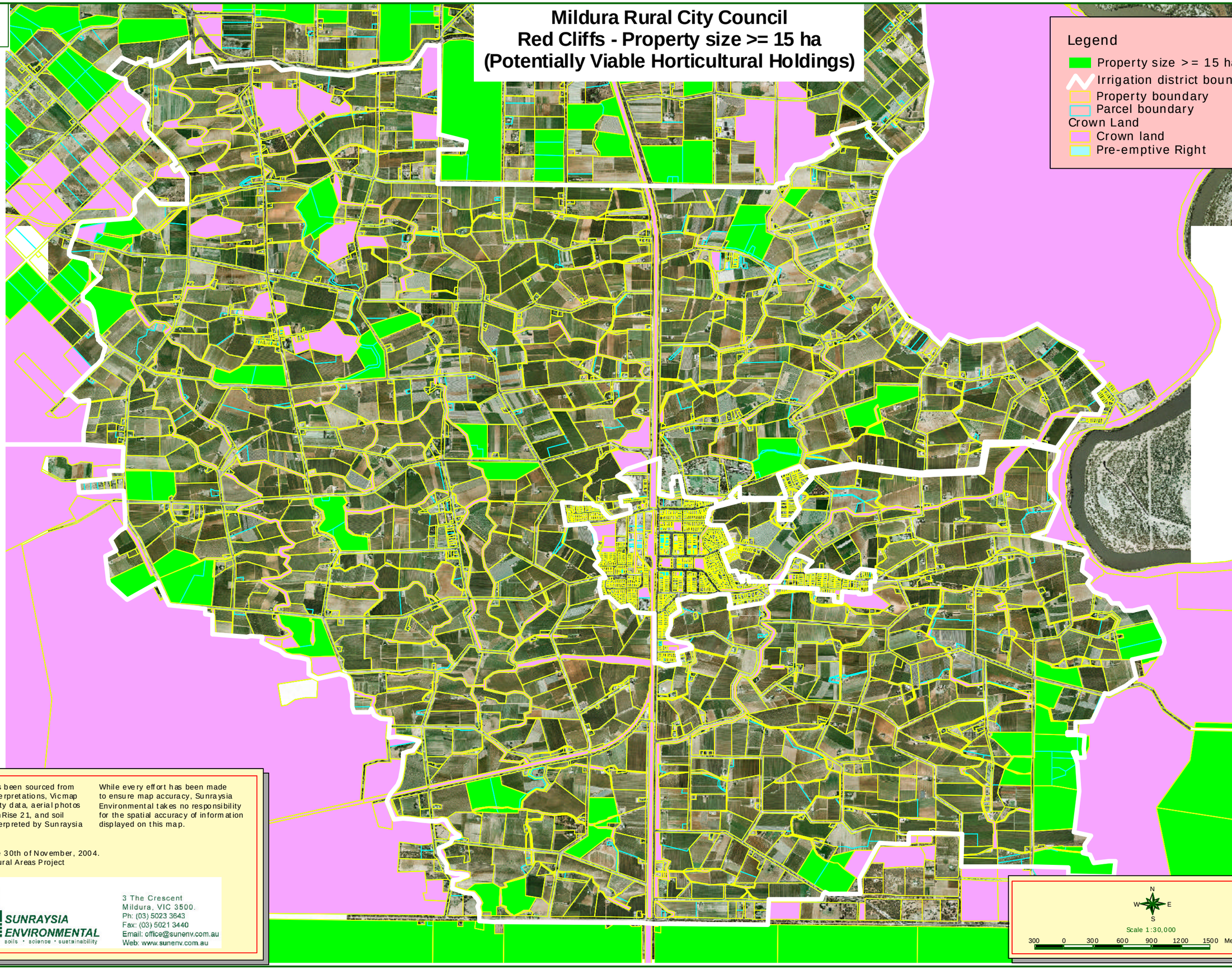
By :

SUNRAYSIA ENVIRONMENTAL
soils • science • sustainability

3 The Crescent
Mildura, VIC 3500.
Ph: (03) 5023 3643
Fax: (03) 5021 3440
Email: office@sunenv.com.au
Web: www.sunenv.com.au

Map 8c

Mildura Rural City Council
Red Cliffs - Property size >= 15 ha
(Potentially Viable Horticultural Holdings)



Information has been sourced from aerial photo interpretations, Vicmap parcel & property data, aerial photos supplied by SunRise 21, and soil survey data interpreted by Sunraysia Environmental.

While every effort has been made to ensure map accuracy, Sunraysia Environmental takes no responsibility for the spatial accuracy of information displayed on this map.

Prepared on the 30th of November, 2004.
For : Mildura Rural Areas Project

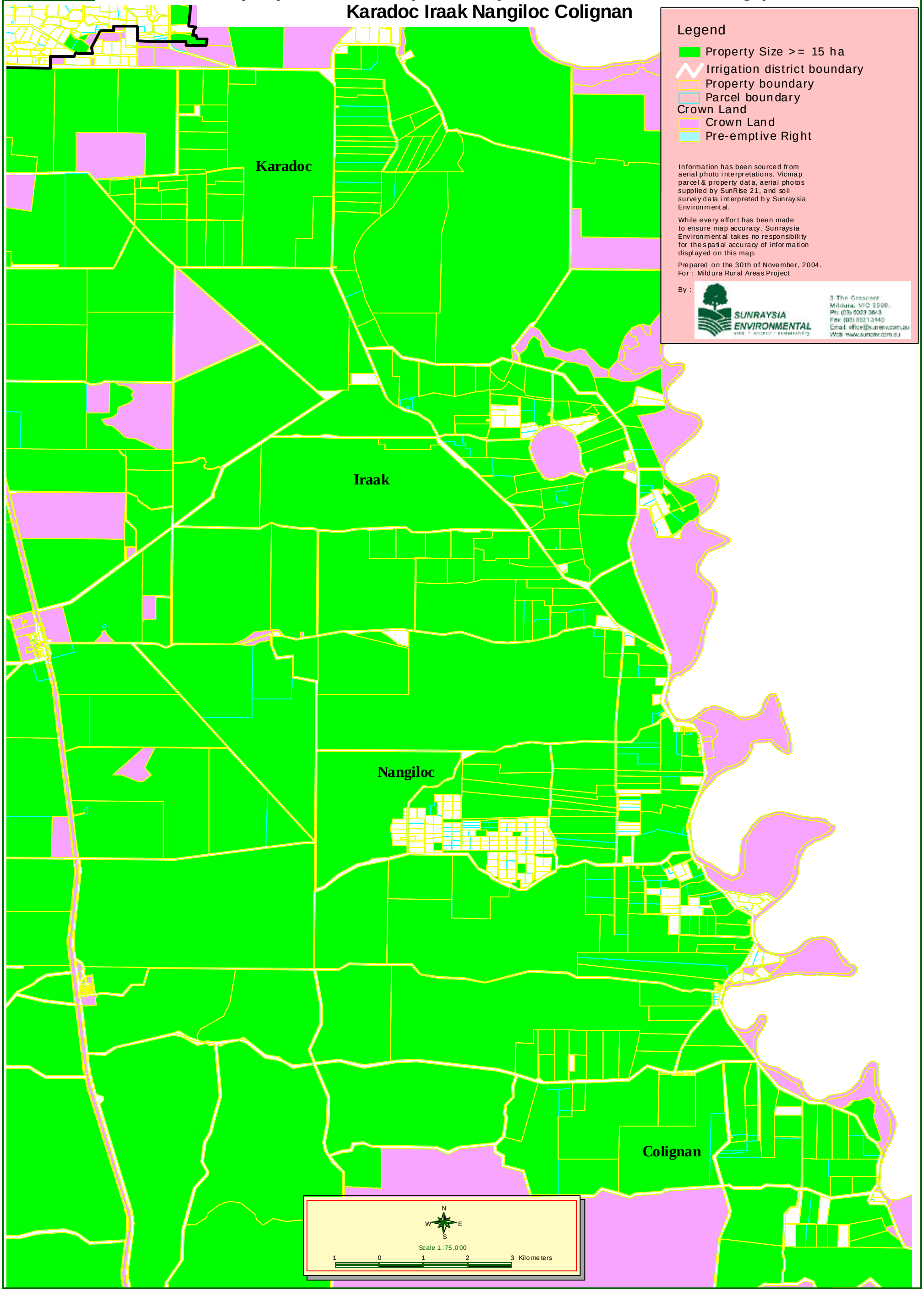
By :

SUNRAYSIA ENVIRONMENTAL
soils • science • sustainability

3 The Crescent
Mildura, VIC 3500.
Ph: (03) 5023 3643
Fax: (03) 5021 3440
Email: office@sunenv.com.au
Web: www.sunenv.com.au

Map 8d

Mildura Rural City Council
Property size >= 15 ha (Potentially Viable Horticultural Holdinga)
Karadoc Iraak Nangiloc Colignan



Legend

- Property Size >= 15 ha
- Irrigation district boundary
- Property boundary
- Parcel boundary

Crown Land

- Crown Land
- Pre-emptive Right

Information has been sourced from aerial photo interpretations, Vicmap parcel & property data, aerial photos supplied by SunRise 21, and soil survey data interpreted by Sunraysia Environmental.

While every effort has been made to ensure map accuracy, Sunraysia Environmental takes no responsibility for the spatial accuracy of information displayed on this map.

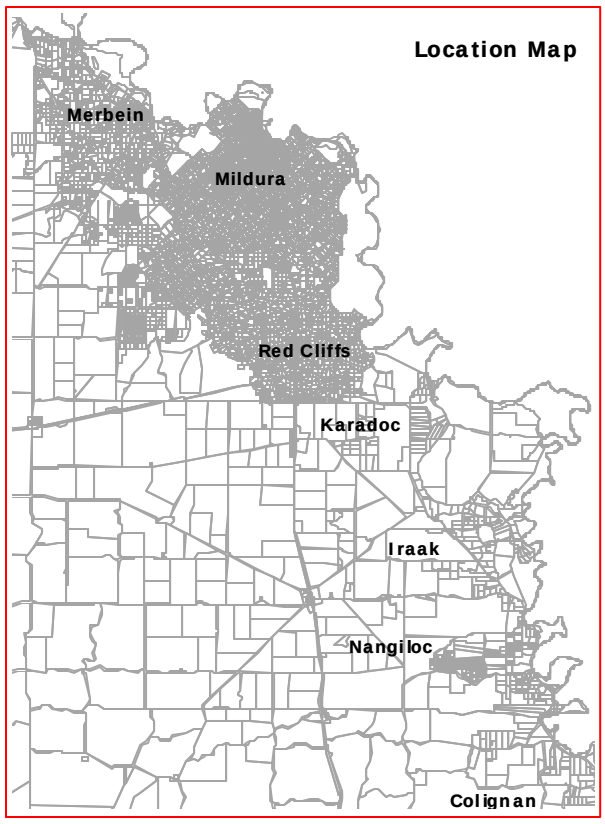
Prepared on the 30th of November, 2004.
For : Mildura Rural Areas Project

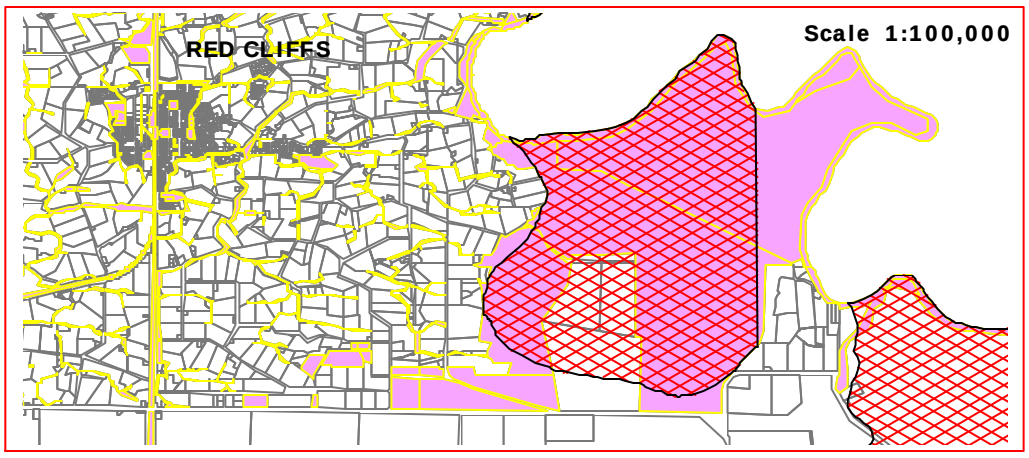
By :

SUNRAYSIA ENVIRONMENTAL
3 The Crescent
Mildura, VIC 3500.
Ph: (03) 5023 3643
Fax: (03) 5021 3440
Email: office@sunenv.com.au
Web: www.sunenv.com.au

Map 9

Mildura Rural City Council
Environmentally Sigificant Regions (ES01)



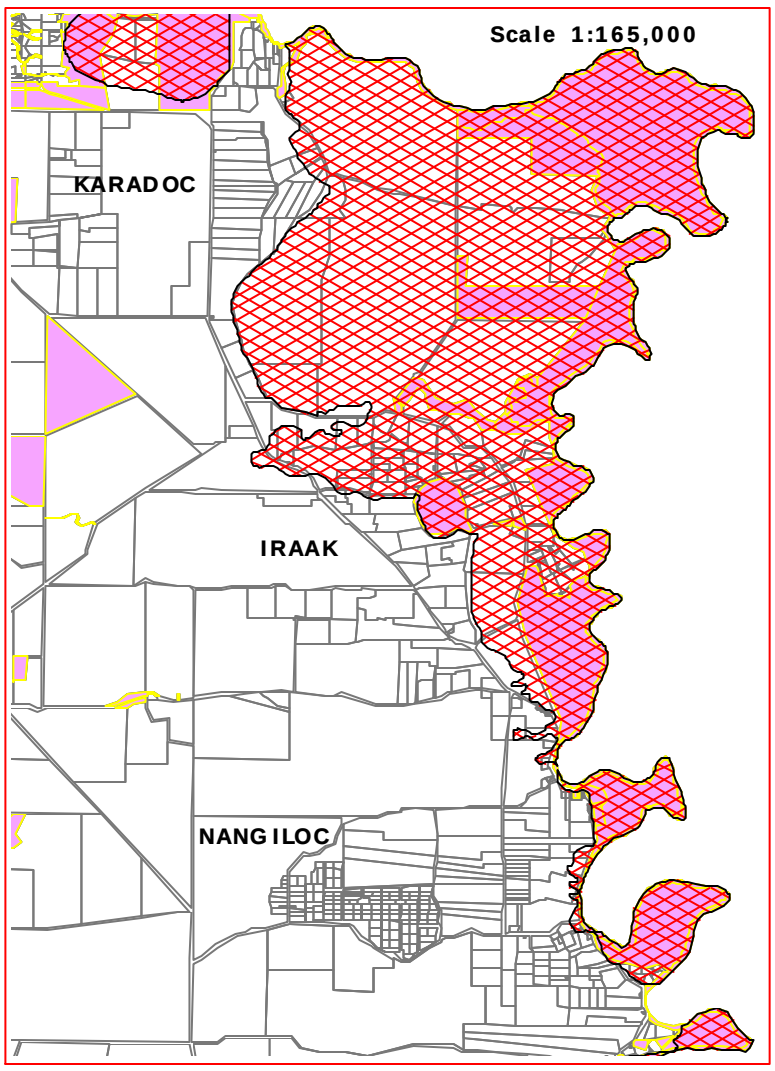


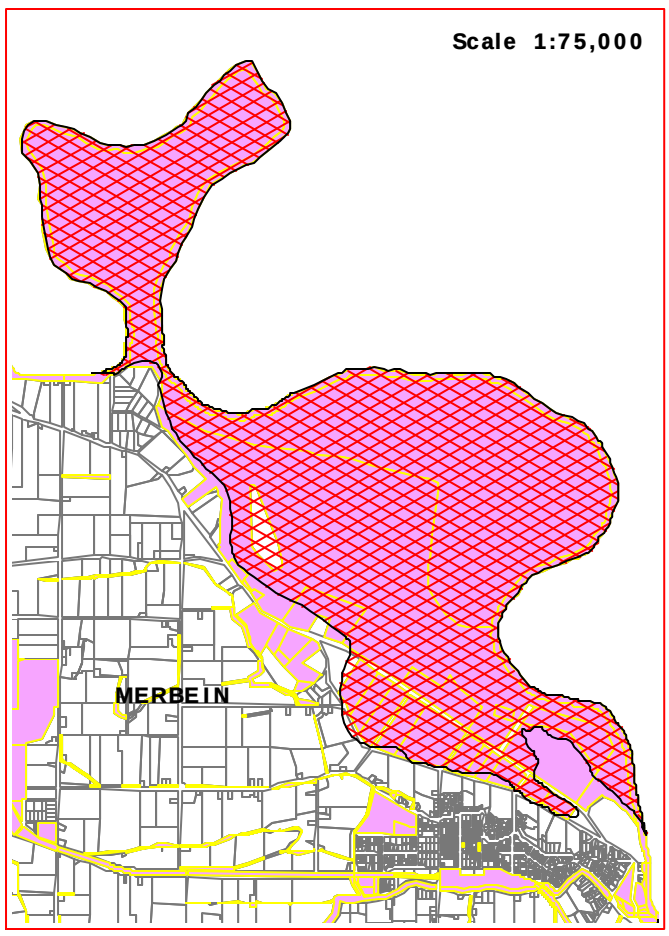
Legend

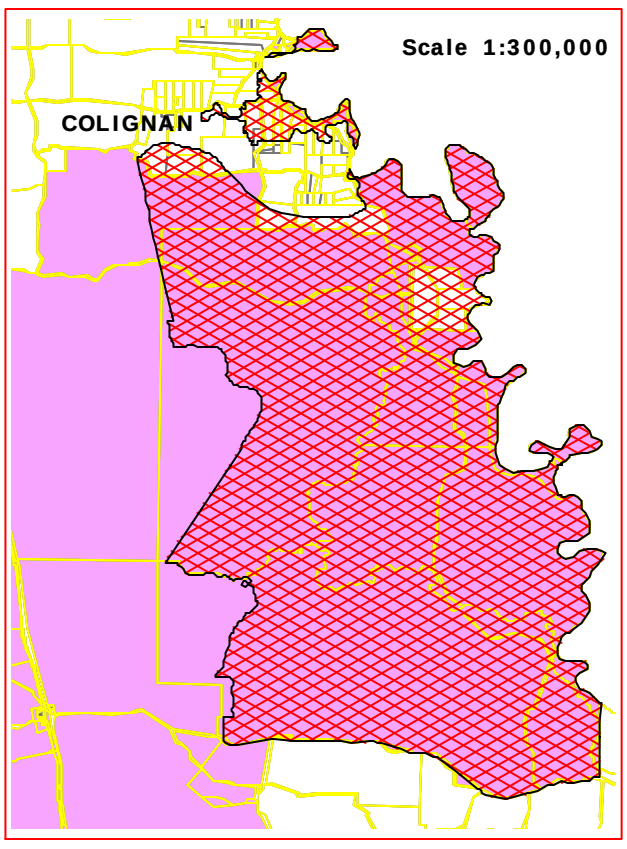
- Environmentally significant region (ES01)

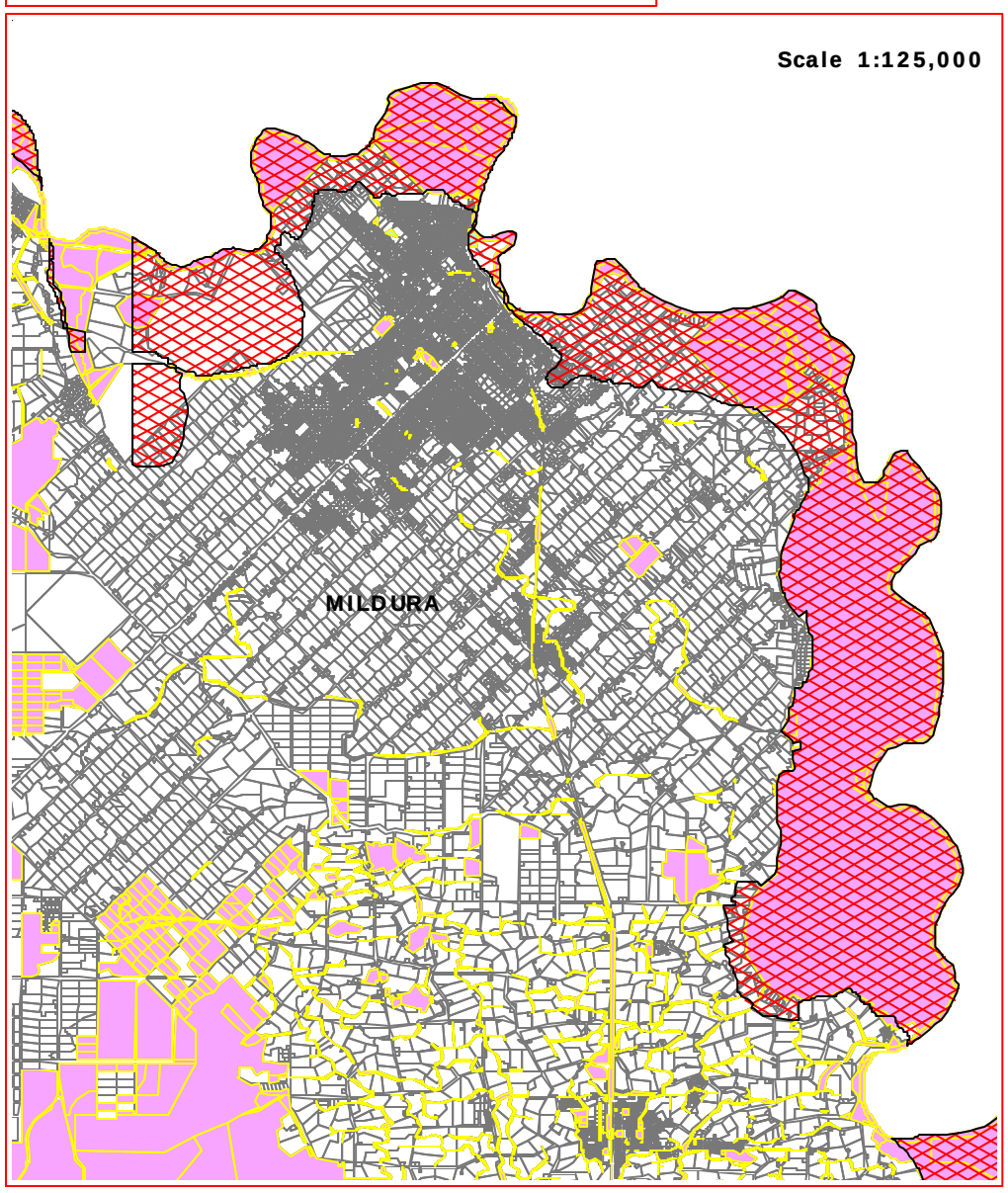
Crown Land

- Crown Land
- Pre-emptive Right
- Cadastre Parcels









Information has been sourced from aerial photo interpretations, Vicmap parcel & property data, aerial photos supplied by SunRise 21, and soil survey data interpreted by Sunraysia Environmental.

While every effort has been made to ensure map accuracy, Sunraysia Environmental takes no responsibility for the spatial accuracy of information displayed on this map.

Prepared on the 30th of November, 2004.
For : Mildura Rural Areas Project

By :

SUNRAYSIA ENVIRONMENTAL
soils • science • sustainability

3 The Crescent
Mildura, VIC 3500.
Ph: (03) 5023 3643
Fax: (03) 5021 3440
Email: office@sunenv.com.au
Web: www.sunenv.com.au