RAP 1

GOVERNMENT OF WESTERN AUSTRALIA

BUNBURY - MANDURAH REGION WATER RESOURCES REVIEW AND DEVELOPMENT PLAN SUMMARY REPORT 1996

WATER RESOURCE ALLOCATION AND PLANNING SERIES

WATER & RIVERS COMMISSION REPORT WRAP 1 1996

WATER AND RIVERS COMMISSION

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BUNBURY - MANDURAH REGION WATER RESOURCES REVIEW AND DEVELOPMENT PLAN SUMMARY REPORT 1996

A pamphlet designed to provide the community with an outline of the water resources in the Bunbury - Mandurah Region and the probable future usage of that water in the region

Water and Rivers Commission
Policy and Planning

WATER AND RIVERS COMMISSION
WATER RESOURCE ALLOCATION AND PLANNING SERIES
REPORT NO WRAP 1 1996

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Summary

Introduction

This booklet provides a concise outline of the existing and potential water resources as well as an insight into the possible future growth rates of population, industry and agriculture in the Bunbury - Mandurah Region. More detail may be found in the main report entitled Bunbury - Mandurah Region Water Resources Review and Development Plan (1996).

The Bunbury - Mandurah Region is currently experiencing significant growth. The town of Australind, with an annual growth rate of almost 4%, is one of the fastest growing towns in Western Australia. Expansion proposals for the Kemerton Heavy Industry area indicate a growth in water consumption of 4 to 6 times the current water usage, and developments in the Collie Basin indicate potential dramatic changes in water consumption patterns. These, coupled with the possible changes in management of the irrigation districts, mean that a strategic understanding of the development of the region and the resulting impact on the region's water resources is essential. This booklet is intended to contribute to that understanding.

The study area comprises three river basins (WAWRC, 1987). These are the Preston (611), Collie (612) and Harvey (613) River Basins. The total area of these three basins is 6886 km^2. The City of Bunbury and the Shires of Collie, Dardanup, Harvey and Waroona are fully contained within the study area. The Shires of Boyup Brook, Capel, Donnybrook - Balingup, Murray, West Arthur and Williams are partly contained within the study area.

There are a total of twenty towns and subdivisions in the study area. The major towns are Australind, Bunbury, Collie, Dardanup, Eaton, Harvey and Waroona. The other townsites are Allanson, Binningup, Brunswick Junction, Boyanup, Burekup, Donnybrook, Hamel, Myalup, Park Ridge, Preston Beach, Roelands, Wokalup and Yarloop/Wagerup.

A large proportion of the study area has been cleared for agriculture, particularly in the Collie catchment. This has resulted in significant degradation of water and soil resources. The western edge of the South West Irrigation Area is affected by high saline groundwaters. Most natural forest cover occurs in state forest, national parks and other reserves. These are located mainly east of the Darling Scarp. Remnant vegetation exists on private land, particularly along the coast.

The study area of the Bunbury - Mandurah Region Water Resources Review and Development Plan is shown in Figure 1.

Water Resources

Water resources in the region can be divided into two components; surface water and groundwater.

The surface water resources include the region's rivers, streams, wetlands, pools, lakes and associated estuaries, plus lakes and wetlands which are not associated with any river. The region has many surface rivers and streams, most of which have the potential to be dammed. The surface water resources referred to in this booklet are shown in Figure 2, Figure 3 and Figure 4.

The region's groundwater resources are contained within the Perth and Collie Basins. The region does not conform precisely to the groundwater area boundaries, however, it does contain the South West Coastal, Bunbury and Collie Groundwater Areas and two subareas of the Murray Groundwater Area and the Busselton - Capel Groundwater Area. The groundwater resources are illustrated in Figure 6 and Figure 7.

This very preliminary assessment has indicated that in some cases environmental values are likely to be significantly affected by water resource development, while other potential developments may remain relatively unconstrained.

Water Use Projections

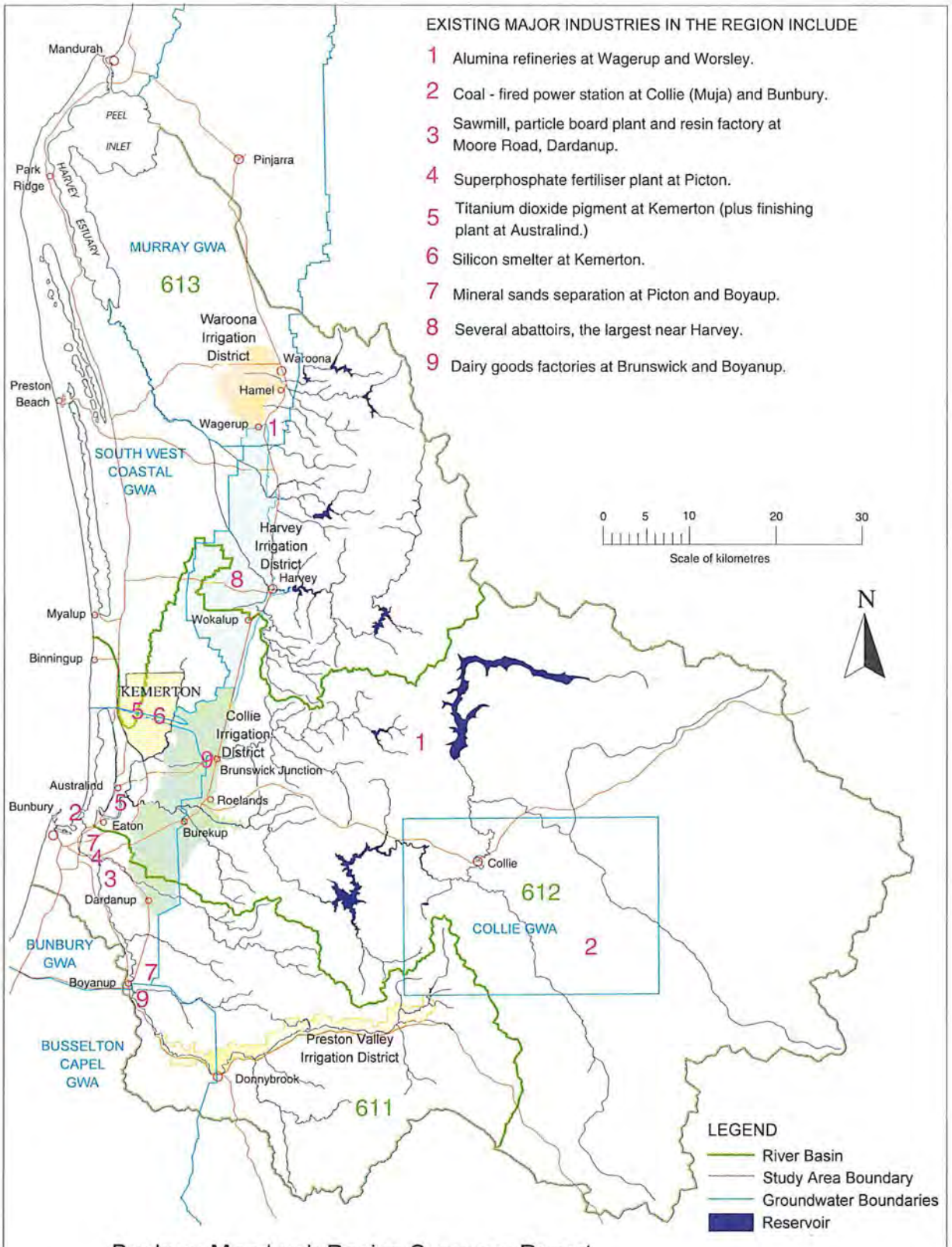
Population and water demand projections were undertaken. Population projections for each town were undertaken to form the basis of the town water supply projections. Based on these water demand projections, water source development options for each water supply were offered. Water demand projections for industry and agriculture were undertaken also.

Conclusions

At present the potential available surface water greatly exceeds the regional demand. This situation will also prevail in 2025 provided there is no augmentation to Perth. The potential surface water supply and likely demand within each basin is presented in Figure 17. Essentially, the potential exists for extensive development of surface water sources to meet future demands within the region. Surplus capacity also exists to cater for inter - basin transfers.

At present less than half of the potential available groundwater is being utilised in the Preston River Basin (611). By the year 2025 the demand for groundwater in Basin 611 is expected to remain less than half of the potential available groundwater. More than half of the potential available groundwater is being utilised in the Collie River Basin. By the year 2025 no excess groundwater will be available in this basin. Only a small portion of the available groundwater within the Harvey River Basin is currently utilised and the demand for groundwater in this basin is not expected to increase greatly by the year 2025. The potential groundwater supply and likely demand within each basin is presented in Figure 18.

Harris Dam Spillway



Bunbury-Mandurah Region Summary Report
STUDY AREA

Figure 1

Surface Water Resources

The surface water resources include the region's rivers, streams, wetlands, pools, lakes and associated estuaries, plus lakes and wetlands which are not associated with any river. The region has many surface rivers and streams, most of which have the potential to be dammed. Surplus available surface water will be foregone for development where the diversion development, such as a dam, would have an unacceptably adverse impact on environmental/social issues. Specific constraints will be determined for each development according to the downstream environmental/social needs and other issues through the environmental impact assessment process which is administered by the Department of Environmental Protection (DEP) and the Environmental Protection Authority (EPA). Development of any surface water resources must pass through this process before it is implemented.

The following is a summary of the surface water resources of each River Basin.

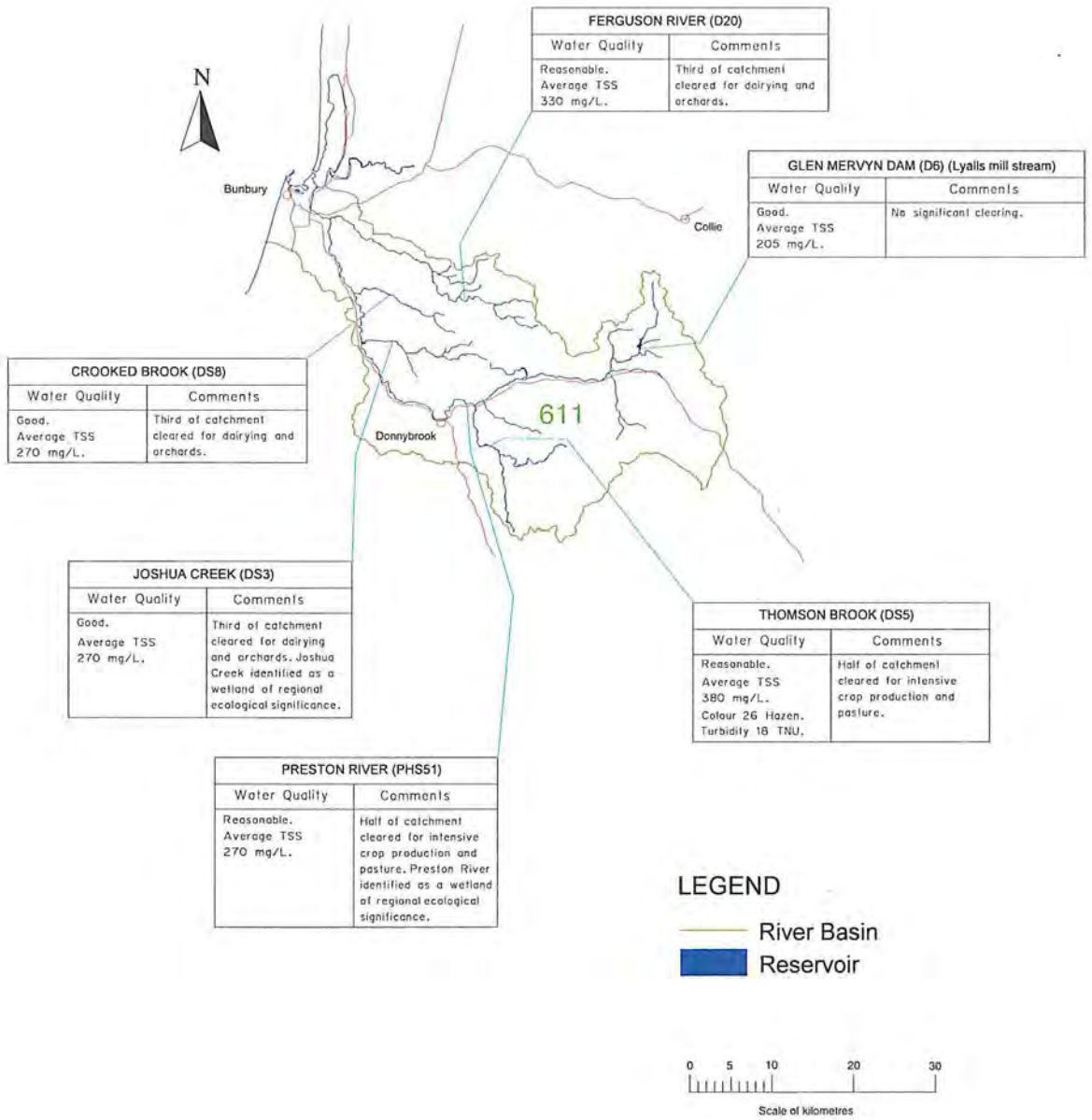
Preston River Basin (611)

The surface water resources of the Preston River Basin are generally good, although diversion of the Preston River and Joshua Creek would be constrained due to farming. The Basin has a divertible yield of 110 GL/year of which 40 GL/year is reserved for in-situ uses.

- Catchment Area (km^2): 1140
- Mean Annual Flow (GL/year): 145
- Amount Reserved For In-situ Uses (GL/year): 40
- Amount Available For Withdrawal (GL/year): 70
- Annual Divertible Yield (GL/year): 110

Dam/Damsite	Average Streamflow (GL/year)	Storage Capacity (GL)	Divertible Yield (GL/year)	Potential Divertible Yield (GL/year)
Glen Mervyn (D6)	3.5	1.1	1.0	2.6
Thomson Brook (DS5)	22.5	47.0	N/A	16.0
Preston River (PHS51)	88.0*	**	N/A	34.0
Joshua Creek (DS3)	8.0	31.0**	N/A	5.5
Crooked Brook (DS8)	2.4	0.1	N/A	1.8
Ferguson River (DS20)	15.6	71.0	N/A	14.0

* Reduces to 62 GL/year if Thomson River and Lyalls Mill Stream are excluded.
** Constrained due to farming development.



Bunbury-Mandurah Region Summary Report
PRESTON BASIN SURFACE CATCHMENT SOURCES

Figure.2

Collie River Basin (612)

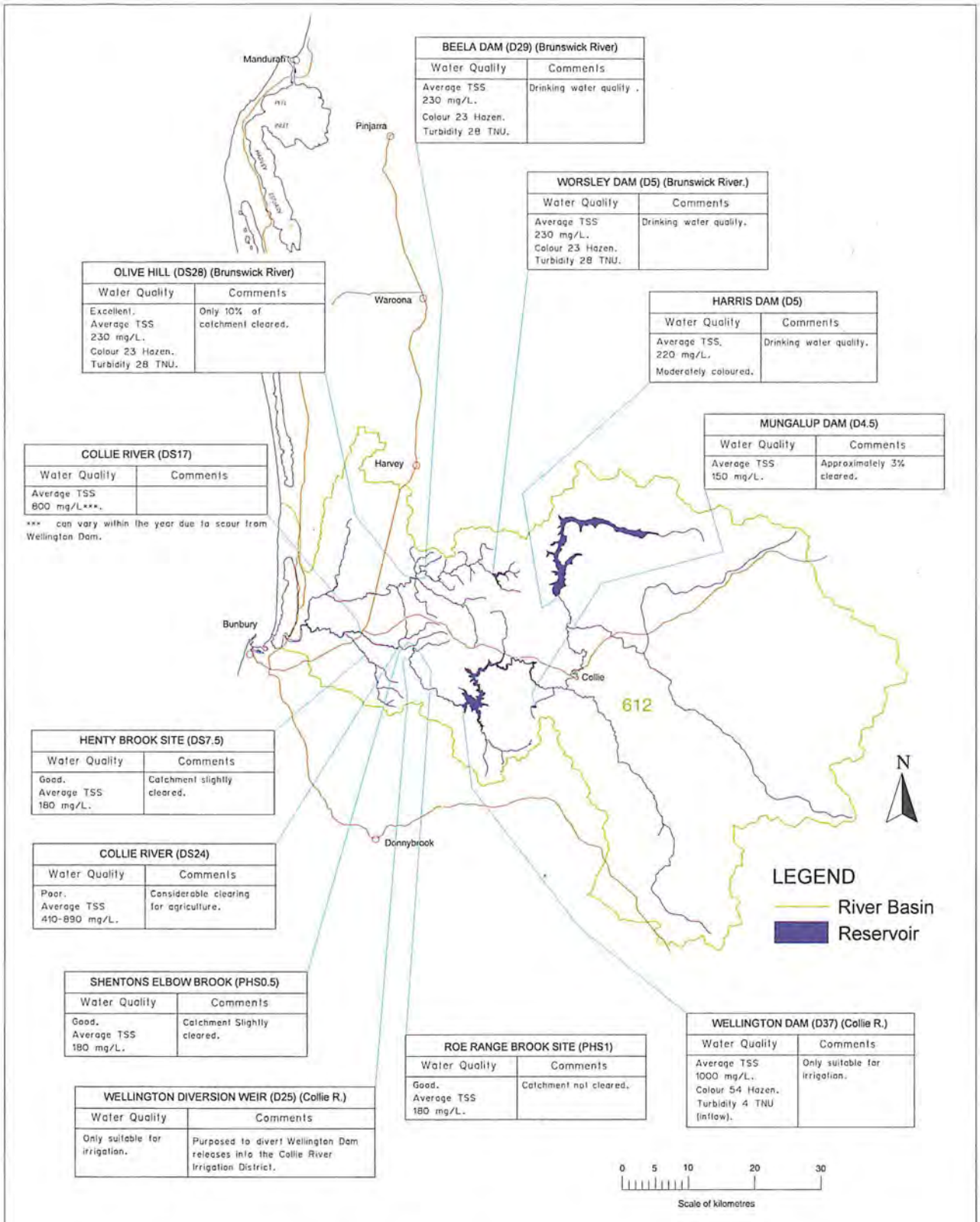
The surface water resources of the Collie River Basin are generally of good quality. Preston River and Joshua Creek have been identified as wetlands of regional ecological significance. The Basin has a divertible yield of 235 GL/year of which 45 GL/year is reserved for in-situ uses.

- Catchment Area (km²): 3640
- Mean Annual Flow (GL/year): 340
- Amount Reserved For In-situ Uses (GL/year): 45
- Amount Available For Withdrawal (GL/year): 189
- Annual Divertible Yield (GL/year): 234

Dam/Damsite	Average Streamflow (GL/year)	Storage Capacity (GL)	Divertible Yield (GL/year)	Potential Divertible Yield (GL/year)
Wellington Diversion (D25)	N/A	negligible	minimal	-
Wellington Dam (D37)	182.2*	185.0	90.0	constrained
Mungalup Dam (D4.5)	0.55	0.7	0.25	small storage
Harris Dam (D5)	27.2	72	17.5	constrained
Beela Dam (D29)	37	0.02	0.54	36.2
Worsley Dam (D5)	5.2	5.8	4.8	negligible
Collie River (DS24)	98	14.8	N/A	20
Roe Range Brook (PHS1)	1.1	N/A	N/A	0.7
Shenton's Elbow Brook (PHS0.5)	1.3	N/A	N/A	0.85
Henty Brook (DS7.5)	4.8	20.5	N/A	3.4
Collie River (DS17)	8.5	N/A	N/A	4.0
Olive Hill (DS26)	62.4	61.0	N/A	46.8

* Excluding Harris River upstream of Harris Dam.

Wellington Dam



BEELA DAM (D29) (Brunswick River)	
Water Quality	Comments
Average TSS 230 mg/L. Colour 23 Hazen. Turbidity 28 TNU.	Drinking water quality .

WORSLEY DAM (D5) (Brunswick River.)	
Water Quality	Comments
Average TSS 230 mg/L. Colour 23 Hazen. Turbidity 28 TNU.	Drinking water quality.

OLIVE HILL (DS28) (Brunswick River)	
Water Quality	Comments
Excellent. Average TSS 230 mg/L. Colour 23 Hazen. Turbidity 28 TNU.	Only 10% of catchment cleared.

HARRIS DAM (D5)	
Water Quality	Comments
Average TSS. 220 mg/L. Moderately coloured.	Drinking water quality.

MUNGALUP DAM (D4.5)	
Water Quality	Comments
Average TSS 150 mg/L.	Approximately 3% cleared.

COLLIE RIVER (DS17)	
Water Quality	Comments
Average TSS 800 mg/L***.	

*** can vary within the year due to scour from Wellington Dam.

HENTY BROOK SITE (DS7.5)	
Water Quality	Comments
Good. Average TSS 180 mg/L.	Catchment slightly cleared.

COLLIE RIVER (DS24)	
Water Quality	Comments
Poor. Average TSS 410-890 mg/L.	Considerable clearing for agriculture.

SHENTONS ELBOW BROOK (PHS0.5)	
Water Quality	Comments
Good. Average TSS 180 mg/L.	Catchment Slightly cleared.

ROE RANGE BROOK SITE (PHS1)	
Water Quality	Comments
Good. Average TSS 180 mg/L.	Catchment not cleared.

WELLINGTON DAM (D37) (Collie R.)	
Water Quality	Comments
Average TSS 1000 mg/L. Colour 54 Hazen. Turbidity 4 TNU (inflow).	Only suitable for irrigation.

WELLINGTON DIVERSION WEIR (D25) (Collie R.)	
Water Quality	Comments
Only suitable for irrigation.	Purposed to divert Wellington Dam releases into the Collie River Irrigation District.

Bunbury-Mandurah Region Summary Report
COLLIE BASIN SURFACE CATCHMENT SOURCES

Figure 3

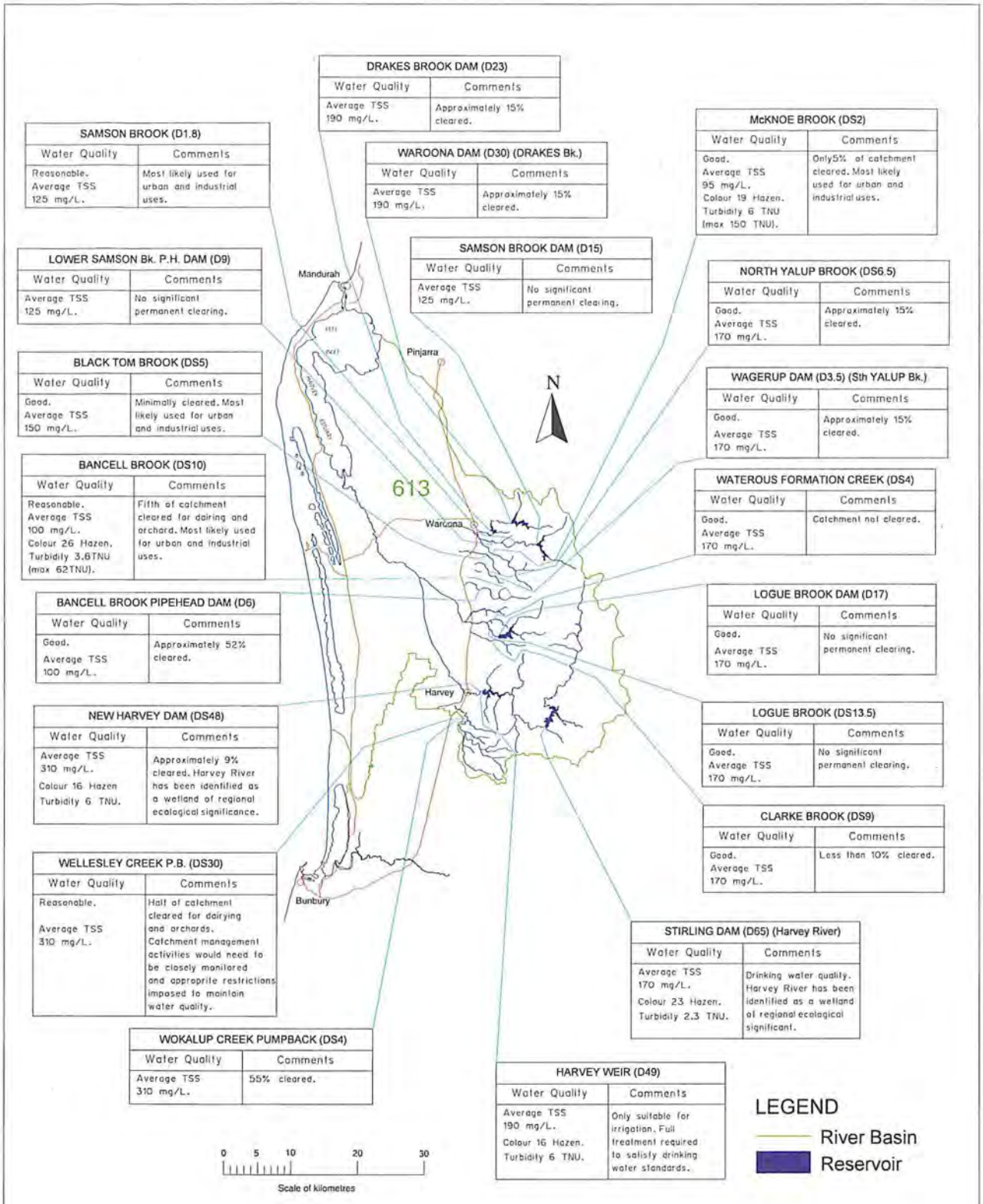
Harvey River Basin (613)

The surface water resources of the Harvey River Basin are generally good quality due to the relatively minimal clearing that has taken place in the catchments. Harvey River has been identified as a wetland of regional ecological significance. The Basin has a divertible yield of 168 GL/year of which 4 GL/year is reserved for in-situ uses.

- Catchment Area (km^2): 2200
- Mean Annual Flow (GL/year): 215
- Amount Reserved For In-situ Uses (GL/year): 4
- Amount Available For Withdrawal (GL/year): 164
- Annual Divertible Yield (GL/year): 168

Dam/Damsite	Average Streamflow (GL/year)	Storage Capacity (GL)	Divertible Yield (GL/year)	Potential Divertible Yield (GL/year)
Harvey Weir (D49)	43.5*	9.0	16.0	48.6
Stirling Dam (D65)	59.4	56.0	37.8	
Logue Brook Dam (D17)	14.0	25.0	11.0	-
Bancell Brook Pipehead (PH6)	7.7#	minimal	0.1	-
South Yalup Brook Dam (D3.5)	1.4	1.2	1.0	-
Drakes Brook Dam (D23)	3.0	2.3	1.8	-
Waroona Dam (D30)	11.6	15.0	7.9	-
Samson Brook Dam (D15)	16.6	9.0	7.6	constrained
Lower Samson Brook Pipehead (PH9)	2.6	Negligible	0.1	1.0
Wokalup Creek (DS4)	-	-	-	limited
Wellesley Creek (DS30)	17.0	1.6	N/A	11.0
New Harvey Dam (DS48)	43.6**	140	N/A	48.6#
Clarke Brook (DS9)	2.9	2.7	N/A	2.4
Logue Brook (DS13.5)	3.8	8.5	N/A	3.0
Waterous Formation Creek (DS4)	1.7	5.0	N/A	1.3
Bancell Brook (DS10)	4.9	10	N/A	4.2
North Yalup Brook (DS6.5)	2.4	1.0	N/A	1.0
Samson Brook (DS1.8)	1.8	5.0	N/A	1.6
McKnoe Brook (DS2)	10.6	2.7	N/A	8.6
Black Tom Brook (DS5)	1.0	1.0	N/A	0.75

\# Including overflow from Stirling Dam.
Would reduce to 2.8 GL/year if site DS10 upstream is developed.
* Excluding Harvey River upstream of Stirling Dam.
** Excluding overflow from Stirling Reservoir.



Bunbury-Mandurah Region Summary Report
HARVEY BASIN SURFACE WATER SOURCES

Figure 4

Groundwater Resources

The major groundwater resources in the region are contained in the sedimentary formations of the Perth and Collie Basins. The superficial, Leederville and Yarragadee Formations are shown in Figure 5.

The crystalline rocks in the Yilgarn Craton contain only localised groundwater in fractures, which is commonly brackish to saline. There is very little groundwater abstraction from the Yilgarn Craton in the region. Groundwater conditions may be inferred to be similar to the Boddington goldmine in the Murray catchment to the north, where substantial yields are obtained and where the salinity range in the bedrock is 2000 - 8000 mg/L. There may be local fresh to brackish groundwater resources in alluvial sediments within the Yilgarn Craton, such as in the valley of the Preston River, but these resources have not yet been explored or assessed.

In the study area, the amounts of unconfined groundwater needed to maintain the saltwater interface appear to be sufficient to maintain the wetlands. Hence, the "surplus available" volume approximates the "environmentally sustainable" volume. This will need to be further assessed and monitored as the resources are developed. Extraction from artesian groundwater is not constrained by environmental/social factors since artesian water is not associated with wetlands. Nevertheless, Water and Rivers Commission policy limits the use of artesian resources to sustainable levels over the long term.

To facilitate long term management of the groundwater resources most of the region covering these basins has been proclaimed as Groundwater Areas (GWA's) under provisions of the Rights in Water and Irrigation Act (1914) (RIWI). A substantial portion of the study area (east of the darling fault) does not overlay any sedimentary basin and consequently has not been proclaimed as a GWA. The location of existing GWA's and the estimated availability of groundwater resources within the study area are illustrated in Figure 6 and Figure 7.

South West Coastal Groundwater Area

The water resources are located in the superficial and Leederville Formations. The water is fresh in all subareas and the basis for water allocation is by Allocation Plan. Most of these resources are limited in the quantity of water they can supply at a sustainable rate.

Murray Groundwater Area

The Waroona and Coolup subareas are located within the study area. The water resources in the Murray Groundwater Area are located in the superficial and Leederville Formations. The water is fresh in all subareas and the basis for water allocation is by Allocation Plan.

Collie Groundwater Area

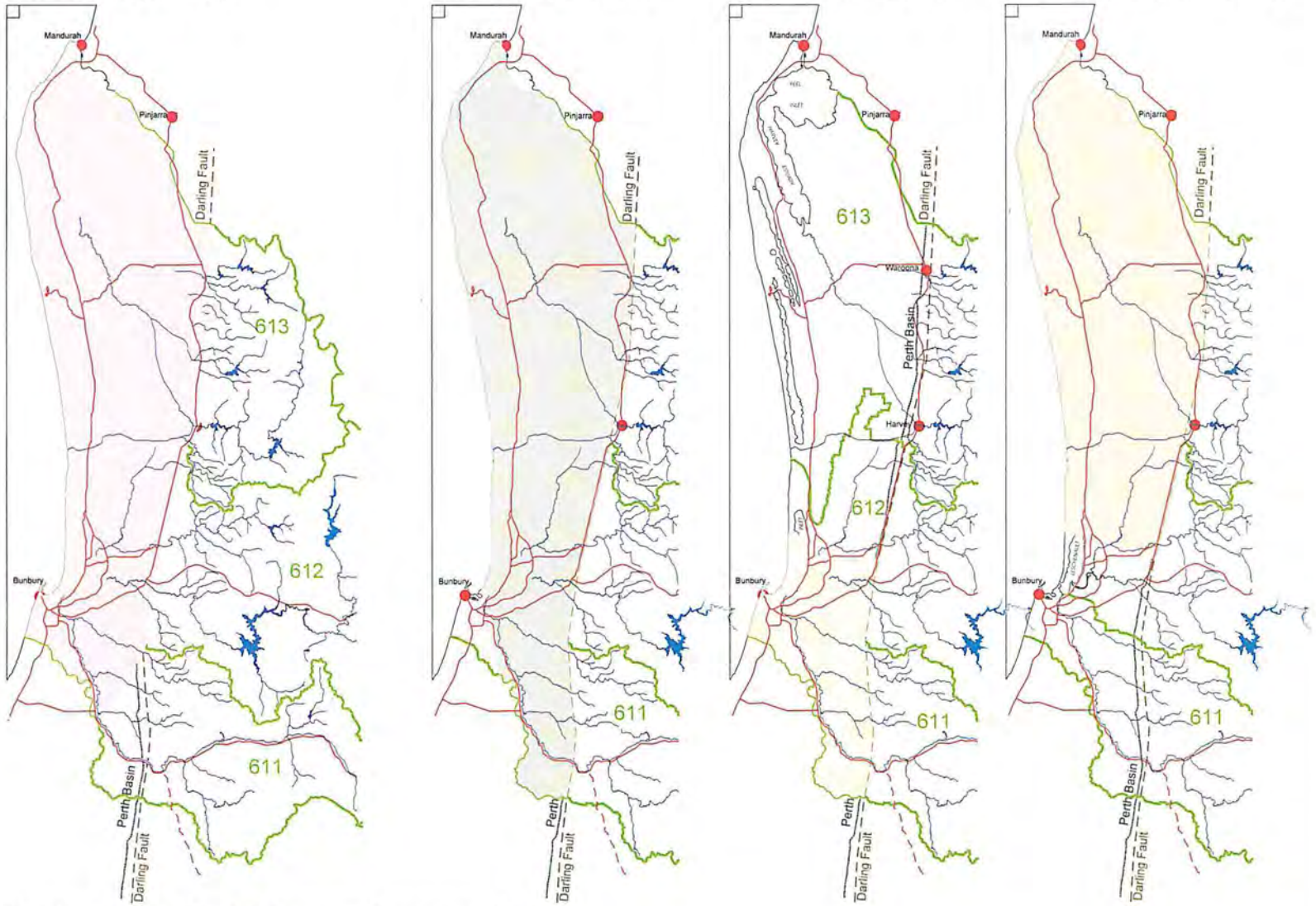
The Collie Groundwater Area is wholly contained within the study area. The water resource in the Collie Groundwater Area is located in the superficial Formation. The water resource is fresh and the basis for water allocation is by Allocation Plan.

Busselton - Capel Groundwater Area

The Donnybrook and Elgin-Capel River subareas are located within the study area. The water resources in the Busselton - Capel Groundwater Area are located in the superficial, Leederville and Yarragadee Formations. The water resources are mainly fresh and are limited in quantity in the superficial Formation of the Donnybrook subarea. The basis for water allocation is by Allocation Plan.

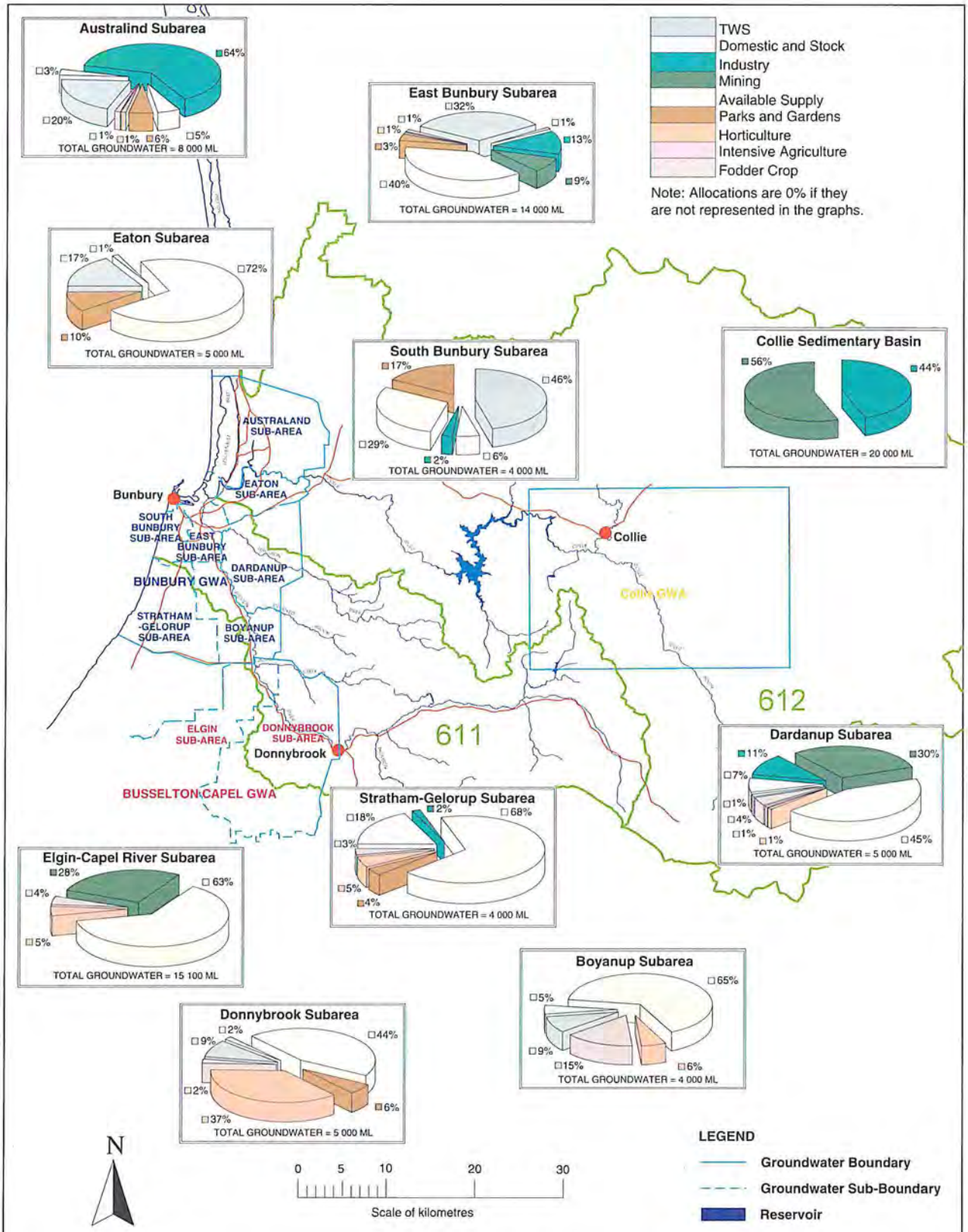
Bunbury Groundwater Area

The water resources in the Bunbury Groundwater Area are located in the superficial, Leederville and Yarragadee Formations. The water resources are mainly fresh or marginal and limited in quantity in the superficial Formation. The basis for water allocation is by Allocation Plan.



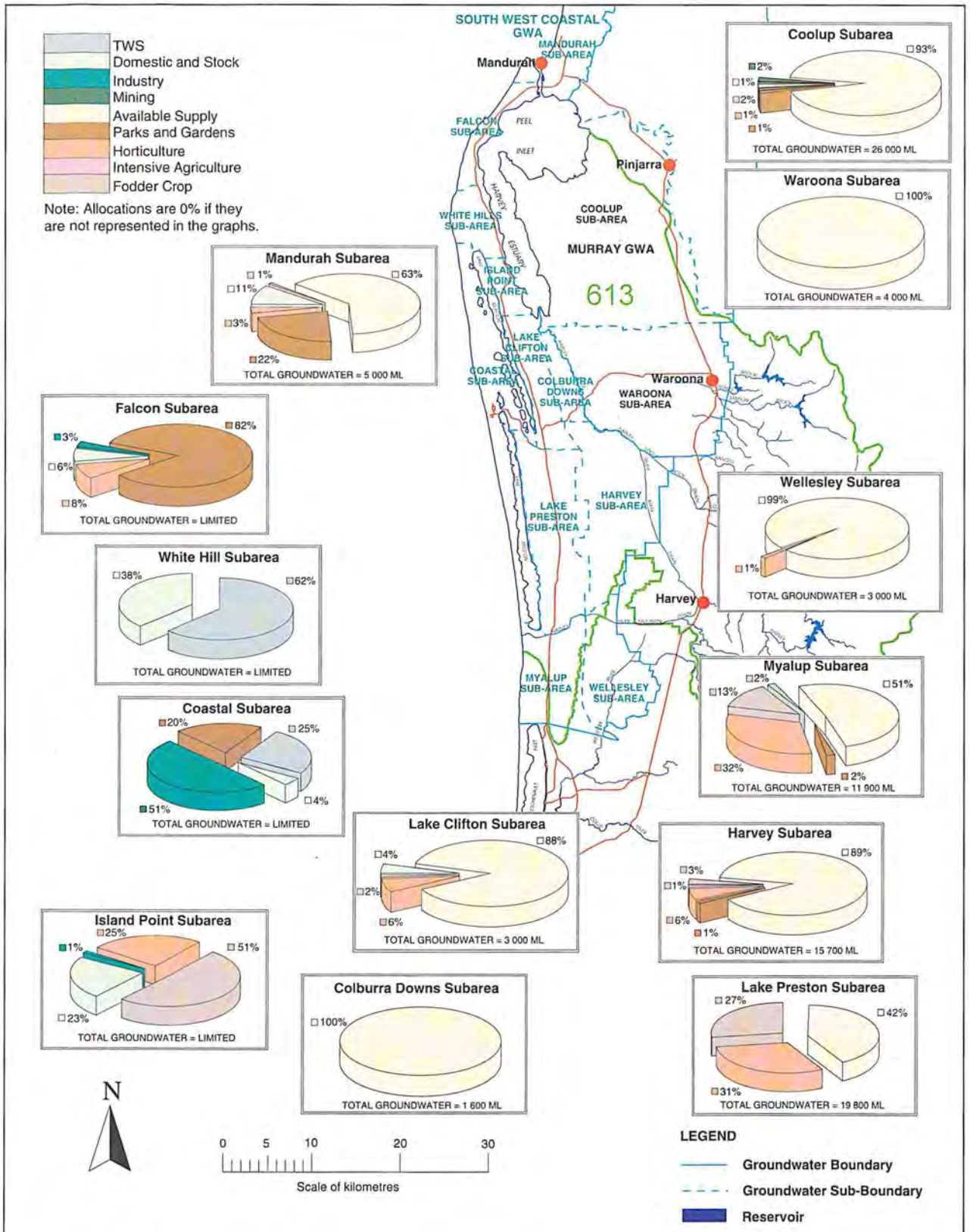
Bunbury-Mandurah Region Summary Report
GEOLOGICAL FORMATIONS

Figure 5



Bunbury-Mandurah Region Summary Report
GROUNDWATER RESOURCES ESTIMATES BASINS 611 & 612

Figure 6



Bunbury-Mandurah Region Summary Report
GROUNDWATER RESOURCE ESTIMATES BASIN 613

Figure 7

Environmental/Social Issues

This very preliminary assessment has indicated that in some cases environmental values are likely to be significantly affected by water resource development, while other potential developments may remain relatively unconstrained. The environmental and social values of each river basin are outlined below.

Preston River Basin (611)

Environmental Value	Comments	Percentage (%)
Total Basin Area	1134 km²	
Waterways	Primary catchment: Preston River Secondary catchment(s): Ferguson River, Crooked Brook, Thompson Brook, Joshua Creek	
Wetlands	-	
Water Reserves	-	
Catchment Area	-	
Conservation Park	67 km²	6
National Park or Proposed	0	0
Nature Reserve	0	0
State Forest	393 km²	35
Marine Reserve	0	0
Mining Reserve	0	0
Crown Leasehold	0	0
Aboriginal Freehold	0	0
Vacant Crown Land	0	0
Area Cleared	680 km²	60
Coastal Environment	14.3 km (100 km total)	14.3

Environmental Values

- The lower Preston River and Joshua Creek have been identified as a wetland of ecological significance.

Cultural Values

-Aboriginal sites / values

- Currently two significant wetlands for cultural purposes of Aboriginal value have been identified. These are Lake Ngartiminny and the Preston River (Picton Camp). These will not be affected by the development of any potential dam sites.

Social Values

-Recreational values

- The Glen Mervyn Dam and Lyalls Millstream provide regionally significant opportunities for water dependent and water oriented recreational activities.

-Educational values

- One significant wetland for cultural purposes of scientific/educational value has been identified. This is Big Swamp. This will not be affected by the development of any potential dam site.

=> Environmental/Cultural/Social Water Requirement = 40 GL/yr.

Collie River Basin (612)

Environmental Value	Comments	Percentage (%)
Total Basin Area	3697 km²	
Waterways	Primary catchments: Collie River, Brunswick River Secondary catchment(s): Roe Range Brook, Shenton's Elbow Brook, Henty Brook	
Wetlands	Leschenault Inlet	
Water Reserves	-	
Catchment Area	Wellington Dam, Brunswick Water Supply, Harris River Dam	
Conservation Park	331 km²	9
National Park or Proposed	289 km²	8
Nature Reserve	8 km²	0.2
State Forest	1476 km²	40
Marine Reserve	0	0
Mining Reserve	0	0
Crown Leasehold	0	0
Aboriginal Freehold	0	0
Vacant Crown Land	0	0
Area Cleared	1294	35
Coastal Evironment	19 km (100 km total)	19

Environmental Values

- The Burekup dam site on the Collie River has been excluded as a potential dam site due to the resulting inundation of the entire valley to Wellington Dam (significant wetland for cultural and recreational purposes) and a substantial area of the Mount Lennard Reserve.
- The Collie River, Bennelaking Conservation Park, Muja Conservation Park, Augustus River, Ernest River Complex, Harris River Complex, Nalyerin Lake and Leschenault Estuary have been identified as wetlands of ecological significance.
- Dam sites on the Brunswick River, DS30 and DS38, would significantly alter the river flow regime and would impact on the Leschenault Inlet and lower Collie River with reduced input of fresh water.

Cultural Values

-Aboriginal sites / values

- A number of significant wetlands for cultural purposes of Aboriginal value have been identified. These are the Collie Reservoir, Boronia Gully, Telfer's Pool, Collie River (East Camp), Harris River (Wuridjong Pool), Bingham River (Bolton's Pool) and Lake Yourdamung.
- A significant wetland for cultural purposes of historical value has been identified. This is the Collie River between the Burekup Weir and Wellington Dam.

Social Values

-Recreational values

- A number of wetlands have been identified as significant for recreational purposes. These are Leschenault Inlet, the Collie River between the Burekup Weir and Wellington Dam and Wellington Dam and Reservoir.

-Educational values

- Three significant wetlands for cultural purposes of scientific/educational value have been identified. These are the Collie River between Burekup Weir and Wellington Dam, the upper section of the Harris River and the Bingham River.

=> Environmental/Cultural/Social Water Requirement = 45 GL/yr.

Harvey River Basin (613)

Environmental Value	Comments	Percentage (%)
Total Basin Area	2055 km²	
Waterways	Primary catchment: Harvey River Secondary catchment(s): Logue Brook, Bancell Brook, South Yalup Brook, Drakes Brook, Samson Brook	
Wetlands	Peel - Harvey Estuary, Lake Clifton, Lake Preston	
Water Reserves	-	
Catchment Area	Bancell Brook, Harvey Dam (Logue Brook), Waroona (Samson Dam)	
Conservation Park	24 km²	1
National Park or Proposed	154 km²	8
Nature Reserve	42 km²	2
State Forest	605 km²	29
Marine Reserve	0	0
Mining Reserve	0	0
Crown Leasehold	0	0
Aboriginal Freehold	0	0
Vacant Crown Land	0	0
Area Cleared	925 km²	45
Coastal Environment	66.7 km (100 km total)	66.7

Environmental Values

- A number of wetlands of ecological significance have been identified. These are Myalup Swamp, Mialla Lagoon, Benger Swamp, Harvey Flats Nature Reserve, Wellard Road Nature Reserve, Harvey River, Hamden Wetland, Riverdale Wetland, Coolup Reserves Wetland, Lake Mealup, Lake McLarty, Lake Clifton, Duck Pond, Boundary Lake, Linda's Lagoon, Lake Pollard, Martin Tank, Lake Yalgorup, Lake Hayward, Lake Newnham, Lake Preston and the Peel-Harvey Estuary.
- The proposed new Harvey Dam may inundate small areas of Crown Reserve and State Forest.

Cultural Values

-Aboriginal sites / values

- Three significant wetlands for cultural purposes of Aboriginal value have been identified. These are the Peel-Harvey Inlet, Mills Road Site and Nine Mile Lake.

-Historical sites

- One wetlands of significance for cultural purposes of historical values has been identified. This is the Harvey River between the Stirling and Harvey Dams.

Social Values

-Recreational values

- A number of significant wetlands of recreational value have been identified. These are the Peel-Harvey Inlet, Waroona Reservoir, Logue Brook Reservoir and Harvey River between the Stirling and Harvey Dams.

-Educational values

- A number of significant wetlands for cultural purposes of scientific/educational value have been identified. These are Harvey River (Riverdale), Waroona Reservoir, Lake Clifton, Lake Yalgorup, Martins Tank, Lake Hayward, Newhams Lake and Lake Preston.

=> **Environmental/Cultural/Social Water Requirement = 4 GL/yr.**

Town Water Supply Projections and Water Source Development Options

The Bunbury - Mandurah Region is currently experiencing significant population growth. The town of Australind, with an annual growth rate of almost 4%, is one of the fastest growing towns in Western Australia. To cater for future water demand, population increases have been projected to the year 2025, along with the corresponding increases in water consumption. Future increases in water demand from town water supplies will place further pressure on the existing water sources. Based on the expected water demand in the year 2025, as well as the current availability of water from the sources, water source development options have been offered.

These development options range from extension of the existing borefields (groundwater) to the development of new surface water sources.

Two population growth scenarios have been developed; 'medium' and 'high'. The 'medium' scenario is referred to as 'projected population'. The 'high' scenario is referred to as the 'feasible population' and is used to demonstrate the likely maximum needs in the respective areas. Growth scenario projections of water demand to the year 2025 and development options for each town water supply scheme are summarised in the figures and table below.

Bunbury Town

Figure 8: Water Demand Projections Basin 611

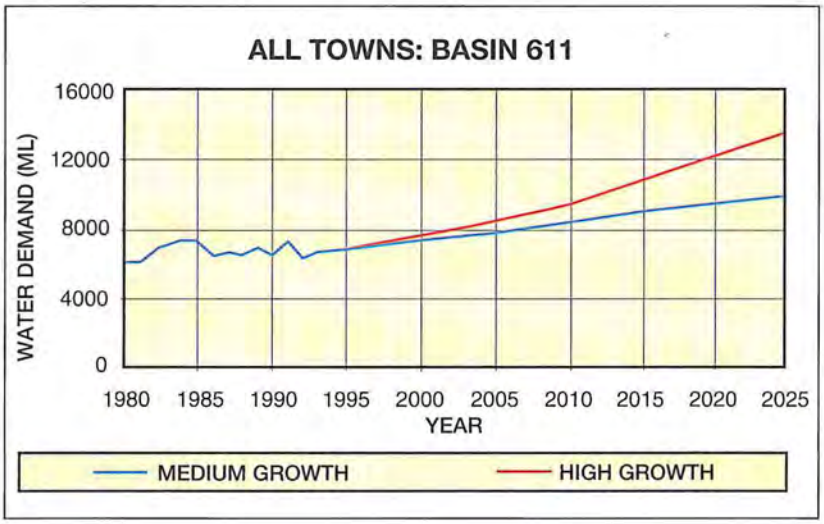


Figure 9: Water Demand Projections Basin 612

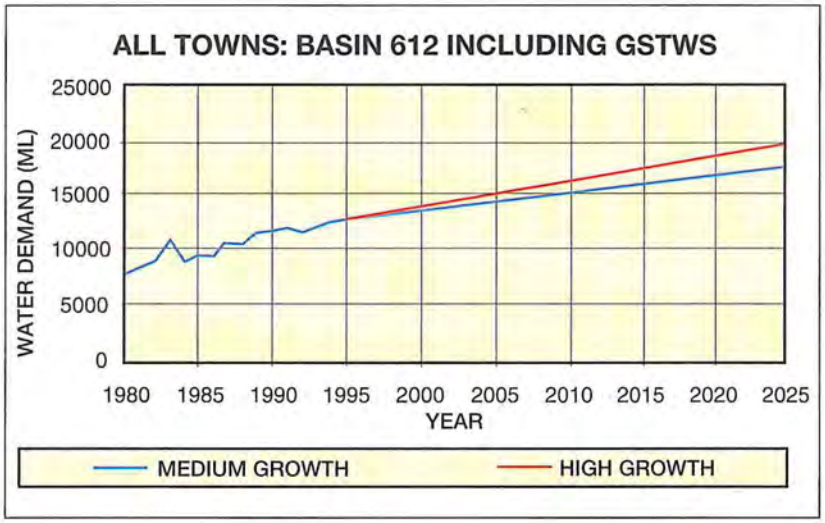
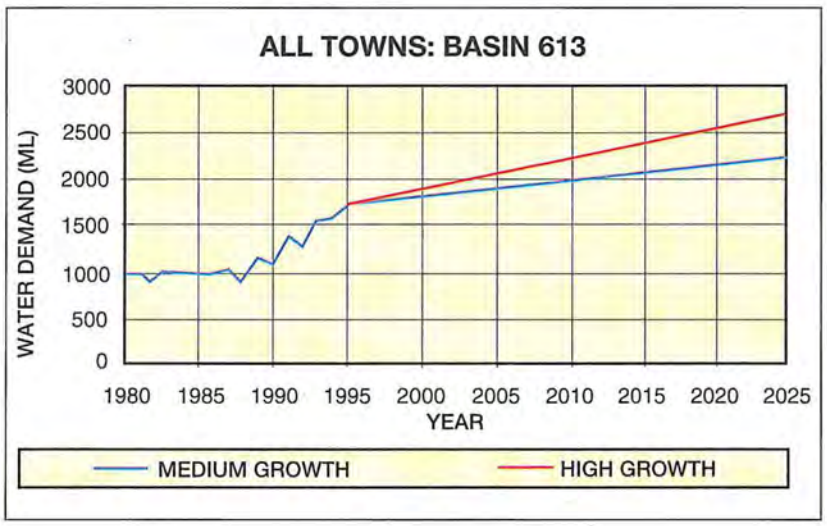


Figure 10: Water Demand Projections Basin 613



Town Water Supply Scheme	Source	Current Licence (ML)	Demand 2025 (medium) (ML)	Demand 2025 (high) (ML)	Estimated Availability (ML)	Development Options
Boyanup	Yarragadee Formation	3.25	523	643	1694	- expansion of existing borefield - Joshua Creek (DS3)
Bunbury	Yarragadee Formation	9200	9641	12216	5198	- expansion of existing borefield
Dardanup	Leederville Formation	75	88	99	533	- expansion of existing borefield - Crooked Brook (DS8) - Ferguson River (DS20)
Donnybrook	Leederville Formation	450	518	656	1020	- expansion of existing borefield - Yarragadee Formation - Coolingutup Brook - Waterfall Gully
Australind	Leederville & Yarragadee Formations	1700	2488	3825	237	- Yarragadee Formation - Olive Hill (DS26) - Collie River (DS17)
Binningup	Leederville Formation	150	356	474	limited	- superficial formation
Brunswick Junction Regional	Beela & Wellington Dams (supplemented by Worsley Dam)	560	698	926	560	- Olive Hill (DS26)
Great Southern	Harris Dam (Collie supplemented by Mungalup Dam)	-	-	13153	17750	- Olive Hill (DS26)
Eaton	Yarragadee Formation	1100	1327	1371	4000	- expansion of existing borefield
Harvey	Harvey Dam	-	772	1010	16000	- New Harvey Dam (DS8)
Myalup	Leederville Formation	55	50	91	limited	- superficial formation
Preston Beach	Leederville Formation	55	93	98	limited	- limited availability kept for public purposes - connection to another town scheme - development of a new source
Park Ridge	Leederville Formation	110	123	143	100	- augmentation from Mandurah Regional Water Supply Scheme
Waroona & Hamel	Samson Brook Pipehead	540	856	990	7800	- Samson Brook (DS1.8)
Yarloop/Wagerup	Bancell Brook Dam	320	401	407	1700	- Bancell Brook (DS10)

Industrial Development and Growth Potential

All recent studies, including the South West Strategy (SWDC, 1994) and the Bunbury - Wellington Plan (WAPC, 1995), acknowledge that the future industrial development of the region is of prime importance. Much of the regions industry is focused upon the extraction and processing of primary resources, particularly minerals, timber and agricultural produce. These industries also contribute directly to activity in the construction sector and both directly and indirectly to various light and service industries.

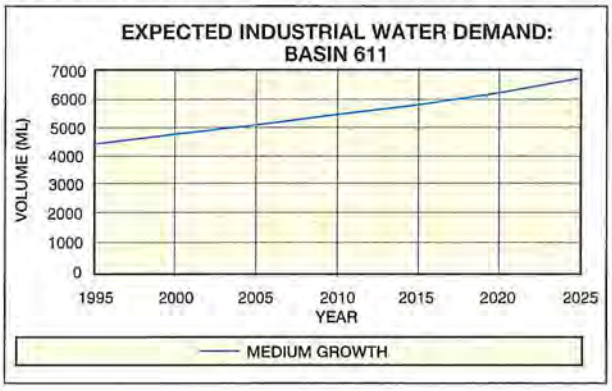
The need for greater downstream processing of raw materials to add value to Australian exports and to help replace imports is now widely accepted. In addition, it is State Government policy to foster major industrial development in regional areas rather than creating further major industries close to Perth.

Major industries located in the study area illustrated in Figure 1. Current water demands and future water demand projections of medium to large industries are present graphically in the figures below.

Industries in the Preston River Basin (611)

The current industrial water demand in Basin 611 is 4439 ML. During the 1994/5 financial year the industrial consumption from town water schemes, private bores and surface water impoundments were 220 ML, 4220 ML and 0 ML, respectively. These are expected to grow to 334 ML, 6272 ML and 0 ML by the year 2025, respectively. This relates to a constant growth in demand of 1.3 % per year. There is sufficient groundwater resources to meet this future demand.

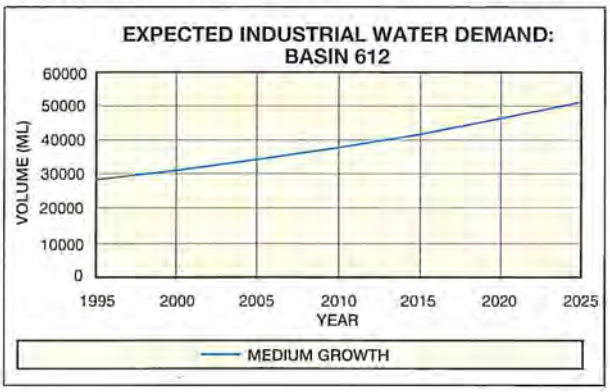
Figure 11: Expected Industrial Water Demand in the Preston River Basin.



Industries in the Collie River Basin (612)

The current industrial water demand in Basin 612 is 27 977 ML. During the 1994/5 financial year the industrial consumption from town water schemes, private bores and surface water impoundments were 174 ML, 25 303 ML and 2500 ML, respectively. These are expected to grow to 179 ML, 28 625 ML and 22 235 ML by the year 2025, respectively. This relates to a constant growth in demand of 2.0 % per year. Water resources are sufficient to meet the projected demand in most areas. A new source will need to be developed to meet future water demand from Kemerton Industrial Park. The potential source is the Collie River at DS17.

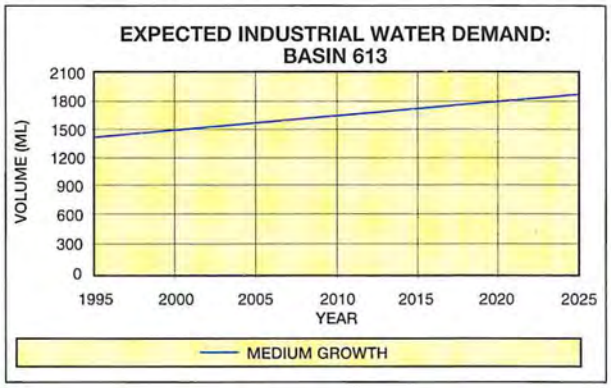
Figure 12: Future Water Demand of the Industries in the Collie River Basin



Industries in the Harvey River Basin (613)

The current industrial water demand in Basin 613 is 1404 ML. During the 1994/5 financial year the industrial consumption from town water schemes, private bores and surface water impoundments were 28 ML, 410 ML and 966 ML, respectively. These are expected to grow to 33 ML, 814 ML and 1026 ML by the year 2025, respectively. This relates to a constant growth in demand of 1.0 % per year. There are sufficient water resources available to meet this future demand.

Figure 13: Future Demand of the Industries in the Harvey River Basin



SCM Chemicals, Kemerton

Agricultural Development and Growth Potential

The rural (primary) industries have historically been the mainstay of the regional economy and agriculture has significance to the future of the region. The region contributes significantly to the State's agricultural production. The relationship between agriculture, the natural environment and other land uses in the region are changing and values placed on agriculture and its location are being redefined.

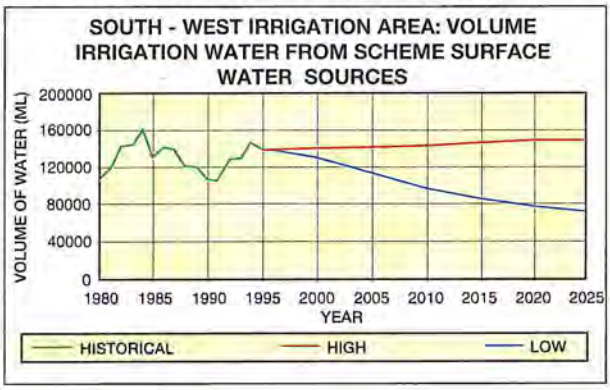
The processing of agricultural products within the region has particular development potential. Effluent disposal from these industries is a vital issue. In particular dairying and horticulture/hydroponics are industries which already contribute significantly to the region but also have potential for further development. Demand for water supplies will increase with the growth of agricultural activities in the region.

Past and current water demands and future water demand projections relating to various agricultural areas are presented graphically in the figures below.

South West Irrigation Area

The total area of the South West Irrigation Area is divided into the three basins in the following proportions: Preston River Basin (611) - 5%; Collie River Basin (612) - 53% and the Harvey River Basin (613) - 42%. Water demand projections have been undertaken for each district and then combined for the whole scheme. The Harvey and Waroona Districts abstract their water from the Harvey River Basin (613) and the Collie District abstracts water from the Collie River Basin (612) (refer to The Irrigation Strategy Study South-West Western Australia, 1990).

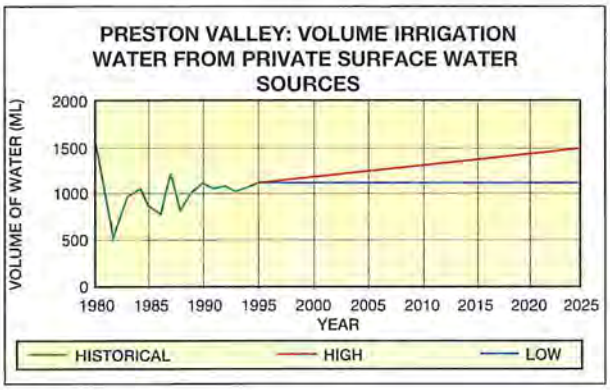
Figure 14: Future Water Demand in the South West Irrigation Area



Preston Valley Irrigation Area

The Preston Valley Irrigation Area is located within Basin 611 (see Figure 1). Since it is managed as a single system, the water demand projection has been undertaken for the whole scheme.

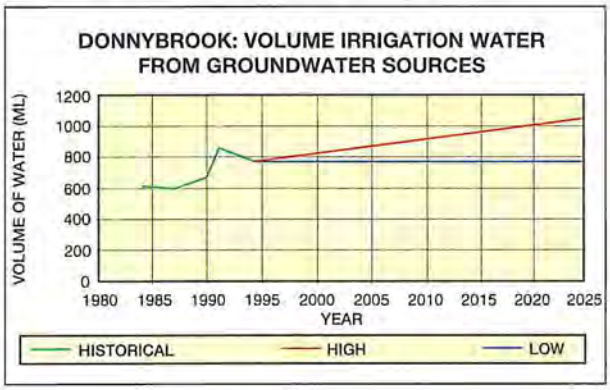
Figure 15: Future Water Demand in the Preston Valley Irrigation Area



Donnybrook

In the Donnybrook area, there is local competition for groundwater resources between the Donnybrook Town Water Supply Scheme and the local horticultural district. For this reason, the groundwater used for agriculture within the Shire of Donnybrook - Balingup has been included in the water demand projections. Approximately 45% of the Shire of Donnybrook - Balingup falls within the study area and the projected water demands have been adjusted accordingly.

Figure 16: Future Water Demand in the Donnybrook Area



Conclusion

Figure 17a: Potential Surface Water Supply and Likely Demand Within the Study Region 1995

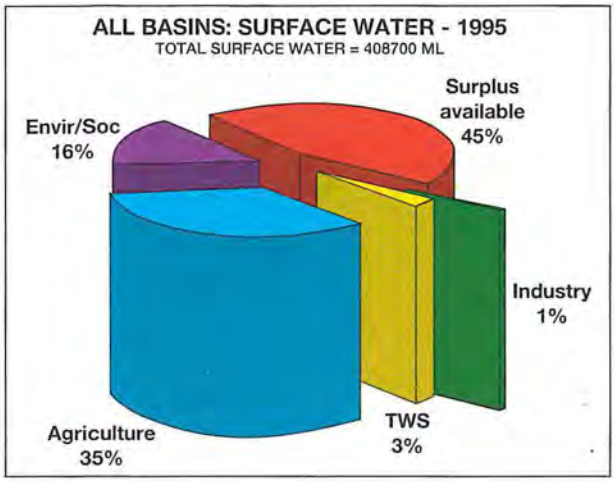
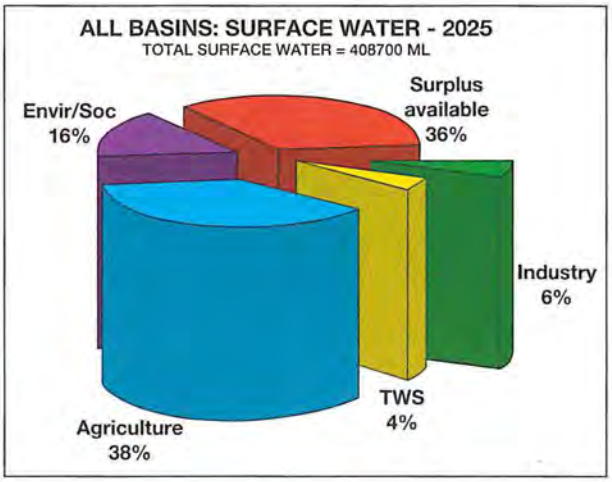


Figure 17b: Potential Surface Water Supply and Likely Demand Within the Study Region 2025



Currently, surface water resources are largely used by the agricultural sector in the Bunbury - Mandurah Region. Demands for surface water resources are relatively small from the town water supplies and industrial sector. Surface water is allocated to sustain the environmental value of the Region. Currently, the surplus surface water available is almost half of the total surface water resources of the Bunbury - Mandurah Region.

Demands for surface water from the town water supplies and the agricultural and industrial sectors are expected to increase marginally by the year 2025. Surface water will continue to be allocated to sustain the environmental value of the Region. It is expected that there will be a large surplus of surface water available in the Bunbury - Mandurah Region in the year 2025.

Potential surface water developments include a pipehead dam on the Collie River (DS17) for the diversion of water from Wellington Dam for use by industries at Kemerton and the New Harvey Dam (DS48), which has been proposed by the Water Corporation and is currently being investigated.

Brunswick River

Figure 18a: Potential Groundwater Supply and Likely Demand Within the Study Region 1995

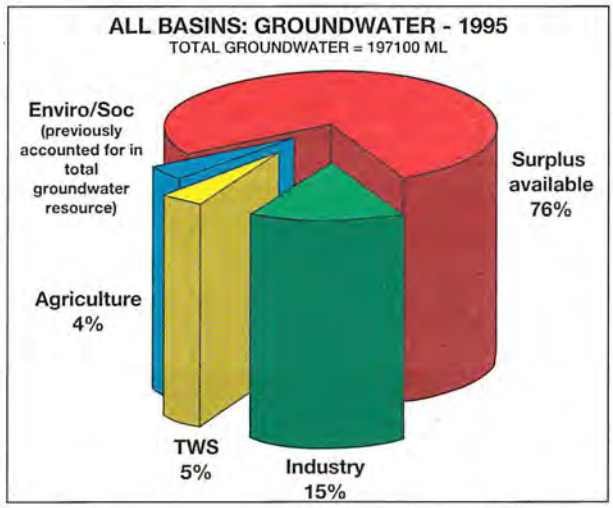
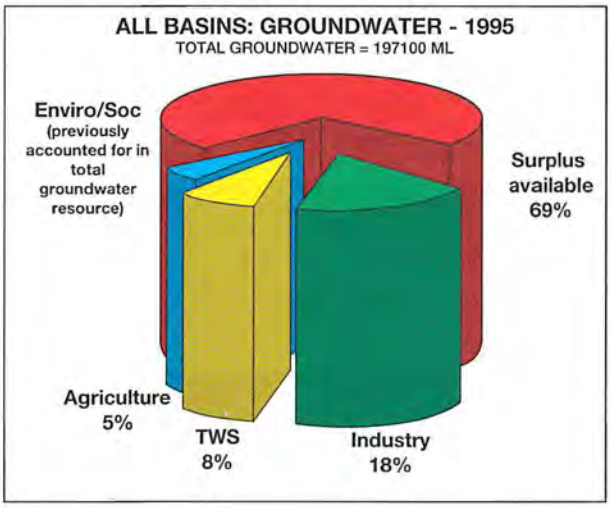


Figure 18b: Potential Groundwater Supply and Likely Demand Within the Study Region 2025



Currently, groundwater resources are largely used by the industrial sector of the Bunbury - Mandurah Region. Demands for groundwater resources are relatively small from the town water supplies and agricultural sector. Groundwater allocations are based on sustainable yield. This means that environmental constraints are accommodated before estimating groundwater yields. Currently, the surplus groundwater available is three quarters of the total groundwater resources of the Bunbury - Mandurah Region.

Demands for groundwater from the town water supplies and the agricultural and industrial sectors are expected to increase marginally by the year 2025. Groundwater allocations will continue to be based on sustainability, which will allow for environmental requirements. It is expected that there will be a large supply of groundwater available in the Bunbury - Mandurah Region in the year 2025.

Future developments of the water resources in the Bunbury - Mandurah Region will meet regional demands.

Possible developments of both surface water and groundwater beyond the planning period will be to integrate Bunbury - Mandurah water resources with those of Perth. In this way, the needs of the Region will be met, with surpluses being available to meet water requirements in Perth.

Parkridge Groundwater Supply

Glossary

Aquifer	A geological formation or group of formations capable of receiving, storing and transmitting significant quantities of water.
Brackish water	Water of salinity 1000 - 3000 mg/L TSS.
Cockleshell Gully	Deep artesian aquifer at depth 200 - 1000 m
Dam	A structure constructed across a river valley to store stream flow and allow it to be diverted for water supply use and for release in a controlled manner for downstream use.
Demand	The amount of water required from the water supply system.
Divertible water	The average annual volume of water which could be removed from developed or potential sources on a sustainable basis.
Diversion	Development of a water resource to harvest some or all of its divertible water.
Fresh water	Water of salinity less than 500 mg/L TSS.
Gigalitre	1000 Megalitres.
Groundwater	Water which occupies the pores and crevices or rock or soil.
Groundwater area	An area proclaimed under the Rights in water and Irrigation Act 1911 in which private groundwater abstraction is licensed.
Kilolitre	1000 litres.
Leederville Formation	A shallow artesian aquifer at depth 50 - 200 m.
Marginal water	Water of salinity 500 - 1000 mg/L TSS.
Megalitre	1000 Kilolitres.
Pipehead	A small dam allowing some of the water flowing in a stream to be diverted into a pipe for water supply use.
River basin	The catchment of river(s) as defined by the Australian Water Resources Council for presenting hydrological data.
Saline water	Water resources of salinity greater than 3000 mg/L TSS.
Salinity	The measure of the total soluble (or dissolved) salt, ie. mineral constituents in water. Water resources are classified on the basis of that salinity in terms of milligrams per litre Total Soluble Salts (mg/L TSS).
Scheme supply	Water diverted from a source (or sources) by a water authority or private company and supplied via a distribution network to customers for urban, industrial or irrigation use.
Self supply	Water diverted from a source by a private individual, company or public body for their own individual requirements.
Strategy	A set of policies or means aimed at a set of objectives designed to bring various actions under unified direction in order that the organisation's or community's objectives may be effectively served. It may consist of one or more source options, water efficiency policies, as well as a commitment to research and develop "environmentally friendly" options.
Superficial Formation	An unconfined aquifer at depth 0 - 50 m.
Surface water	Water flowing or held in streams, rivers and other wetlands in the landscape.

Sustainable yield	The rate of water extraction from a source that can be sustained on a long-term basis without exceeding the rate of replenishment. Sustainable groundwater use limits extraction to no more than the recharge rate and requires sufficient throughflow to prevent significant ocean water intrusion into aquifers.
System yield	The maximum demand that the water supply system can sustain under specified expectation of restrictions (currently restrictions are expected in 10% of years).
Treatment	Application of techniques such as settlement, filtration, chlorination, to render water suitable for drinking purposes.
Turbidity	Clouding of water due to suspended material in the water causing a reduction in the transmission of light.
Water Reserve	An area proclaimed under the metropolitan water Supply Sewerage and Drainage Act or Country Areas water Supply Act to allow the use of water on or under land for public water supplies.
Water Resources	Water in the landscape (above and below ground) with current or potential value to the community and the environment.
Watertable	The surface of the unconfined groundwater, which may be above ground as swamps or lakes in low-lying areas. Measured as the level to which water rises in a well tapping an unconfined aquifer.
Well	A hole dug or drilled (bore) from the ground surface into a groundwater aquifer to monitor or to withdraw water. Household wells are commonly termed bores.
Wellfield	A grouping of wells to extract large volumes of groundwater, generally for scheme supply.
Wetland	Area of seasonally, intermittently or permanently waterlogged soils or inundated land, whether natural or otherwise, fresh or saline.
Yarragadee Formation	Deep artesian aquifer at depth 200 - 1000 m
Yield benefit	The increase in system yield which occurs when source is added to the water supply system.