PERTH URBAN RAIL DEVELOPMENT PROJECT

Supplementary Master Plan

August 2002

Prepared by

THE PERTH URBAN RAIL DEVELOPMENT OFFICE

in Association with and through

THE DEPARTMENT FOR PLANNING AND INFRASTRUCTURE

for

THE GOVERNMENT OF WESTERN AUSTRALIA

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Supplementary Master Plan (August 2002)

Foreword

This Supplementary Master Plan is a supplement to the original South West Metropolitan Railway Master Plan (March 1999) and the Northern Suburbs Transit System Extension Master Plan of June 2000. It has been prepared by the Perth Urban Rail Development Office in association with the Department for Planning and Infrastructure for the Government of Western Australia, after noting by the Perth Urban Rail Development Steering Committee.

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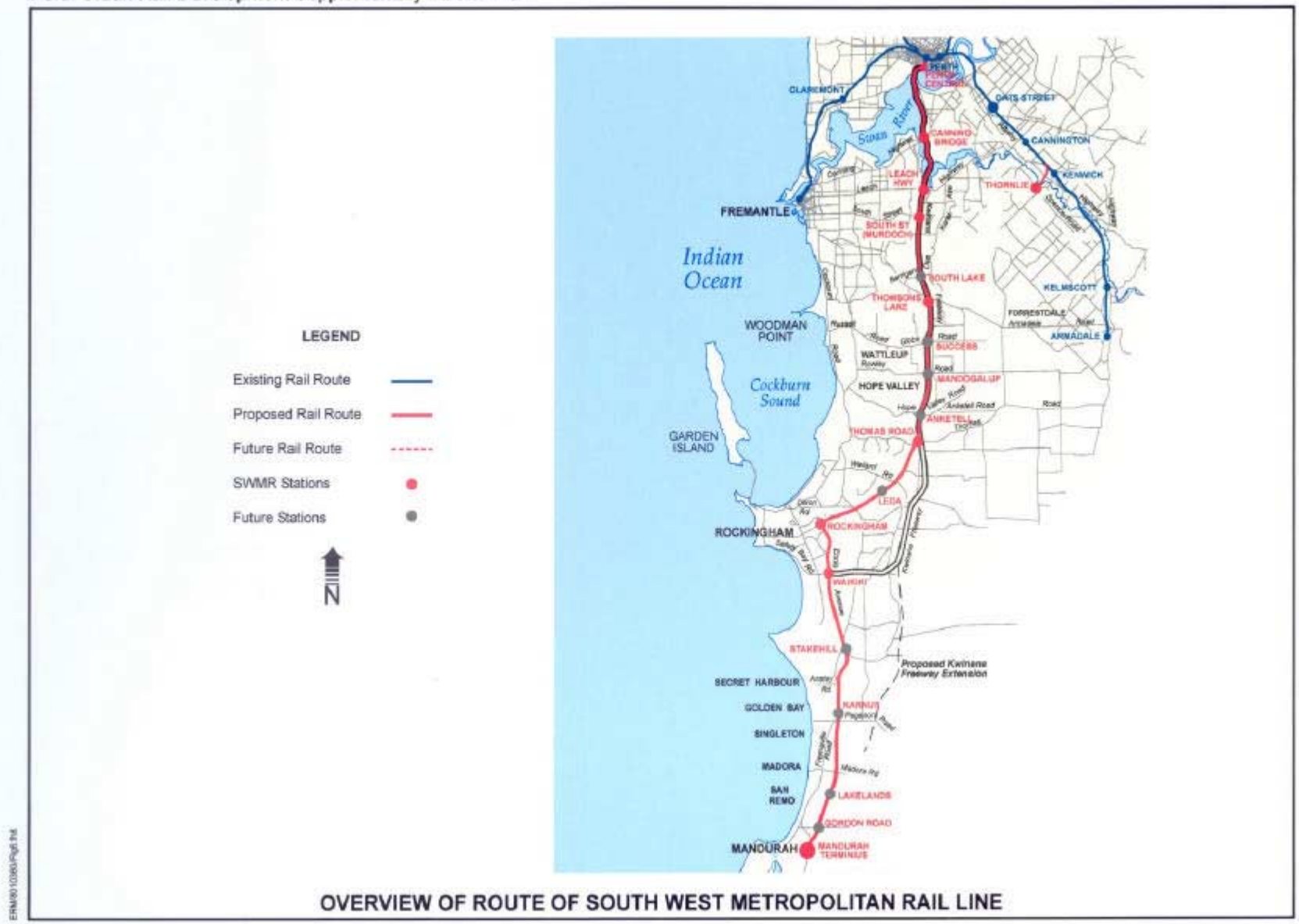

OVERVIEW OF ROUTE OF SOUTH WEST METROPOLITAN RAIL LINE

Figure 1

Executive Overview

In April 2000 a final version of the South West Metropolitan Railway (SWMR) Master Plan was considered by the government of the day and described requirements for the procurement of a new urban transit railway from Perth to Mandurah. In June 2000 an 'Interim Master Plan' was issued for the extension of the Northern Suburbs Transit System from Currambine to Clarkson / Butler.

This document is a Supplement to the SWMR Master Plan and develops the elements and proves the engineering and urban planning feasibility of the Direct Route. **Figure 1** shows the route of the railway and the location of the stations.

In July 2001, the new State Labor Government announced a major change in the route of the South West Metropolitan Railway. Instead of following the 'Kenwick' route east and north from Jandakot, the railway would now follow the alignment of the Kwinana Freeway northwards into Perth. The new route is known as the Direct Route. The 'Kenwick and 'Direct' Routes are shown on **Figure 2**.

The preparation of this Supplementary Master Plan has found major operational, infrastructure and funding implications for the rest of the Perth Urban Rail Development Project. These and other findings are as follows:

1. There have been significant changes in the land use projections for the South West Metropolitan Area, compared with that used in deriving the patronage projections for the original SWMR Master Plan. For the sectors covered by Kwinana, Rockingham, Mandurah and Murray, the latest projections show a reduction of 9% in the population projected for the year 2006, compared with data available in 1997/1998. However, compared to the 2001 Census Data, there is still expected to be a 19% growth in population for these sectors, between 2001 and 2006.

   The SWMR Master Plan showed that the all-day, weekday boardings for the Kenwick Route would be 19,100 in year 2006. Given the current land use projections, the patronage projection for the Kenwick Route would be 17,980 in year 2006.

   Modelling the Direct Route, using the current land use data and an enhanced model (*SPECTRE 2.0*), shows all-day, week-day boardings from Mandurah to Perth for year 2006 of 24,950. There will be 3,500 additional weekday boardings from the station at Spencer Road, Thornlie. Therefore the total all-day week-day boardings from the Direct Route and the Thornlie spur is 28,450.

   On the basis of a common data base of employment and population projections, the current modelling shows that for the section of the railway common to both the Kenwick and Direct routes (i.e. from Glen Iris southward) the Kenwick route would attract 11,290 boarders per weekday in year 2006, whilst the Direct Route will attract 15,890 boarders in year 2006, an increase of 40%. This patronage arises from a far more attractive service as a result of the reduced journey times and more frequent services particularly from Thomsons Lake.

   There is a 110% increase in patronage at Thomsons Lake reflecting a 42% decrease in journey time and a 50% increase in service frequency at peak times compared to the Kenwick Route.

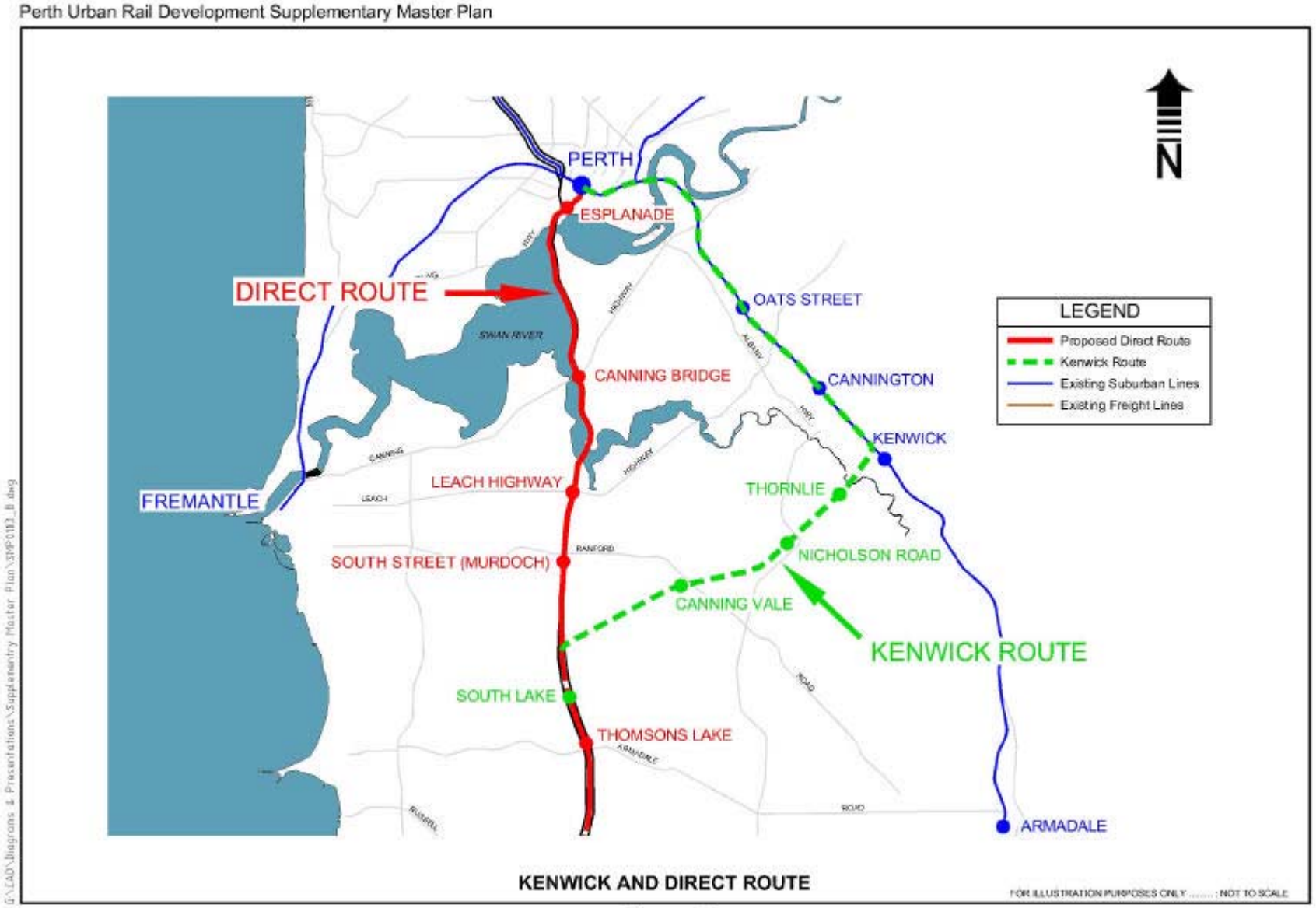
Perth Urban Rail Development Supplementary Master Plan
N
PERTH
ESPLANADE
DIRECT ROUTE
OATS STREET
SWAN RIVER
CANNING BRIDGE
CANNINGTON
KENWICK
LEACH HIGHWAY
THORNLIE
FREMANTLE
SOUTH STREET (MURDOCH)
NICHOLSON ROAD
CANNING VALE
KENWICK ROUTE
SOUTH LAKE
THOMSONS LAKE
ARMADALE
LEGEND
Proposed Direct Route
Kenwick Route
Existing Suburban Lines
Existing Freight Lines
KENWICK AND DIRECT ROUTE
FOR ILLUSTRATION PURPOSES ONLY ..... : NOT TO SCALE

Figure 2

This will be achieved using 20% less trains than for the Kenwick route.

In the morning peak hour in 2006, the railway will carry the equivalent of between two and three freeway lanes of traffic between Mount Henry and the Narrows.

2. The original SWMR Master Plan was based on a peak hour service of two trains per hour from Mandurah and eight trains per hour from Waikiki.

   The service now proposed is six trains per hour from Mandurah and an additional six trains per hour from Thomsons Lake to Perth.

   Journey times from Mandurah to Perth have been reduced by 20%, whilst journey times from Rockingham have been reduced by around 26%.

   Comparable rail and road journey times from Mandurah to Perth in year 2006 are shown in a table below.

Section	Rail All Day	Road Morning Peak	Road Off Peak
Mandurah - Perth	48 mins	68 mins	53 mins
Rockingham – Perth	33 mins	54 mins	40 mins
Thomsons Lake - Perth	16 mins	34 mins	19 mins

3. The works associated with the Direct Route and the remainder of the PURD Project were to be contained within the original budget of $1,147 Million plus $70 Million, which was earmarked for Stage Two of the Kwinana Freeway Busway in year 2005/2006. This brought the total budget to $1,217 Million. The above monies were in 1998/1999 dollar values. In May 2002, the Government approved the escalation of the budget amount to cover inflation up to the time the money is actually spent. This increased the budget, out to year 2007, to $1,403.5 Million.

   Since that time the Government has approved the addition of a further $15.5 Million to cover works associated with the route through Perth, bringing this total to $1,419 Million.

4. This Supplementary Master Plan agrees with the findings of the '*Final Report of the Perth City Rail Advisory Committee'* that recommended the Central Route through Perth.

   The PCRAC found that the total cost of the civil and track infrastructure was $195.5 Million.

   Of the above figure the track and railway infrastructure estimate will be $15.7 Million.

   Project Management and Engineering will be sourced from the overall project budget allocated for this purpose.

   Early decisions are required with respect to the following issues raised by the Final Report of the PCRAC. These are:

   - The management structure to oversee the central city work. It is recommended a Central Perth Rail Development Committee

be established which includes the State Government, the City of Perth and relevant expertise to oversee this component of the project.

- The source of funds for the recommendations not covered by the present budget, which include $12 Million to remove the William Street road bridge on the Perth foreshore and $22 Million to $39 Million to lower the Fremantle line through Northbridge. The Government will continue to work with the City of Perth and developers to examine the potential for non State Government funding of these works.

Budgetary allowance has been made for the following new stations:

- William Street (Perth City Station)
- Esplanade
- Canning Bridge
- Leach Highway
- South Street, Murdoch
- Thomsons Lake
- Thomas Road
- Leda
- Rockingham
- Waikiki
- Mandurah
- Victoria Park
- Thornlie
- Clarkson

The Carlisle station will be upgraded.

5. The construction of Leda railway station requires to be examined with regard to patronage demand in the catchment. Timing of its construction will be negotiated with the developer.

6. The railway route through Rockingham has been changed. Rockingham Station will be built at the intersection of Rae Road and Ennis Avenue. This station will be a major transit interchange for the Rockingham sub-regional centre. It will include interchange facilities for bus feeder services, extensive parking, facilities for people to be dropped off and picked up by car and also for cycling and walking.

   The provision of a Rockingham City Centre Transit Service is being examined by a separate committee and is not within the scope of this project . The report is due by December 2002.

7. The major railcar maintenance and stowage facility will now be provided at Nowergup. There will also be provision for an overnight stowage and cleaning facility at Mandurah.

8. It is proposed that services will commence to:

   - Clarkson, Greenwood and Thornlie in the latter half of 2004

- Rockingham and Waikiki at the end of 2006
- Mandurah at the end of 2007

9. With respect to infrastructure works contained in the SWMR Master Plan for the section from Perth to Kenwick, these can be significantly reduced because of a major reduction in the train services through that area, compared with that proposed in the original SWMR Master Plan. However there is still justification to undertake some works including replacement/upgrading of life-expired stations. Therefore agreement has been reached with the relevant local authorities that the following works should be undertaken:

   - Construction of a dual use pedestrian/cycle bridge in the vicinity of Howick Street, Victoria Park
   - Reconstruction of Victoria Park Station at a new site near Duncan Street
   - Closure of Bishopsgate Street level crossing
   - Closure of Lathlain Station
   - Construction of a new road crossing over a lowered railway at Miller Street/Roberts Road to replace Bishopsgate Street level crossing
   - An upgrade of Carlisle Station to extend its life by ten years
   - Construction of a road bridge over the railway at Gerard Street, Cannington

10. The Government has agreed to build a rail spur from Kenwick to a station at Spencer Road, Thornlie. A study under the auspices of a separate committee will be carried out to examine public transport connectivity options between the Armadale line and the South West Metropolitan Railway. The committee has also been asked to address connectivity between the South West Metropolitan Railway and Fremantle.

11. Because the railway is the spine of an integrated public transport system, every effort will be made to maximise the feeder services. Work is ongoing to develop a high quality service between Canning Bridge and Curtin University.

12. The total all day, weekday passenger trips on the urban rail network is expected to grow by 66%, from 101,395 in 2001 to 170,500 in 2006/2007.

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1. Background

1.1. Introduction

The original South West Metropolitan Master Plan defined the route of the railway from Jandakot to Perth to follow the existing freight railway reserve north-east to Kenwick and then use the existing Armadale tracks to Perth.

On 16 July 2001, Cabinet approved in principle changing the alignment of the South West Metropolitan Railway to a more direct route. The new 'Direct Route' will use the median of the Kwinana Freeway from Jandakot to Perth.

Planning for a railway to the South West Metropolitan Area has been a controversial issue for over ten years. Knowledge of the history and background of the scheme is important to understanding the current proposals.

1.2. Early Planning

In the early 1990s Westrail was asked to plan for an extension of the urban rail system from Fremantle to Mandurah. After completing preliminary planning, the responsibility for further planning passed to the Department of Transport.

In February 1992 the Premier announced the Government's in-principle commitment to provide rail transit from Fremantle to Mandurah via Rockingham and that a range of alternatives was to be addressed. The assessment of these rail-based alternatives was undertaken through a series of investigations commissioned by the South West Area Transit (SWAT) Steering Committee.

In early 1993 the Department of Planning and Urban Development (DPUD), approached Westrail to investigate a direct route for the railway from Perth to Mandurah. This was carried out independently of SWAT. A primary requirement was to serve the emerging regional centre at Thomsons Lake.

At that time the use of the Kwinana Freeway median south of the Narrows Bridge for the railway was not considered appropriate. It was considered that the median was too narrow compared with the generous median within the Mitchell Freeway used for the Northern Suburbs Railway. The Kwinana Freeway was earmarked as a busway.

There was not the shared interest and support among the major stakeholders to develop a railway, firstly on the surface, and specifically within the median of the Kwinana Freeway from Mount Henry to Perth.

Therefore options along the general freeway route were examined and costed. This led to a railway proposal that was underground from Perth to Mount Henry. At a cost in the order of $800 Million this was considered prohibitive.

Meanwhile, in mid-1994, the results of the SWAT group's work were (Department of Transport, June 1994). In essence SWAT recommended that buses handle the line-haul task to Perth from Rockingham and Mandurah whilst rail would be assigned to the coastal corridor to Fremantle. The report stated;

> *'A clear outcome of this work was that there will be a dominant future demand for public transport services which provide for trips within the South West Metropolitan area. However, there will be significant demand for access between the area and the Perth Central Business District and hence, the rail transit systems were all assumed to co-exist*

with a complementary express bus service operating in dedicated lanes on the Kwinana Freeway.'

However, the patronage demand analysis carried out as part of the SWMR Master Plan, public surveys and even a careful analysis of the SWAT patronage analysis, all showed that the overwhelming major demand for travel was to the Perth Central area. For example, in the SWAT work, the majority of people travelling by rail to Fremantle did not end the journey there, but continued towards Perth. This was also borne out by an informed assessment of even the current high rail patronage to and from Fremantle.

Because use of the Kwinana Freeway median for a railway was not seriously considered and alternatives along the general freeway route were prohibitively expensive, Kenwick became the preferred route even when compared to an alternative route through Fremantle. This was for a number of reasons which are covered in the SWMR Master Plan and elsewhere.

Once the Kenwick route had been adopted after appropriate planning investigation of the alternative Fremantle route, it was referred to Cabinet for inclusion in the Metropolitan Region Scheme. This was effected in December 1994.

In addition, because of the dependence of the railway on critical road works to be undertaken at Kenwick, Cabinet allocated funds in July 1995 for the construction of the rail tunnel at Kenwick as part of the Kenwick Joint Project. Cabinet, also among other things, gave an undertaking in principle to construct the railway to Jandakot within ten years.

1.3. The Master Plans

The Master Plan for the South West Metropolitan Railway was prepared in late 1997 and 1998 and endorsed by the then State Government in March 1999.

A Master Plan for the extension of the Northern Suburbs Transit System to Clarkson was prepared for the Government in June 2000.

In April 2000 an augmented version of the SWMR Plan complete with appendices was prepared for the Government.

Following this, the works described by the above Master Plans were approved and funded. It was directed that they would be undertaken under a project umbrella, namely the Perth Urban Rail Development (PURD) Project.

Following the February 2001 State election, the incoming Government decided that a more direct route along the Kwinana Freeway median, between Glen Iris and Perth and a different route through Rockingham would be adopted.

It was agreed that these significant amendments required the production of a Supplementary Master Plan.

This document describes the extent of planning, design and construction works that are necessary in order to procure the Direct Route railway and to accommodate the other changes involved throughout the Perth Urban Rail Development Project.

1.4. Objectives of the Supplementary Master Plan

The key objectives of this Plan are to:-

- identify the demand patronage
- design services to satisfy the demand
- quantify the rollingstock requirements to satisfy demand and service requirements
- identify the infrastructure required
- integrate the system with land use
- identify any secondary benefits
- ensure conformity with all regulatory requirements and other parties' services
- consult with the community and engender stakeholder ownership
- prepare cost estimates
- prepare a Master Plan report summarising the process and making appropriate recommendations

2. Strategic Objectives

2.1. Introduction

In 1997 public transport accounted for 3% of inter-suburban journeys and 35% of peak hour trips to the Perth Central Area. Of the total number of all trips undertaken in the Perth Metropolitan Area the public transport share was just over 6%.

The anticipated population growth through the entire Metropolitan Region and relevantly to the South West Metropolitan Area in particular, will result in increased pressure for travel, notably (as present trends are) by private car.

Without an appropriate public transport system there will be a reduction of mobility and access for people without private transport and unrestrained increase in private car use.

A primary objective is to encourage people travelling by car on trunk routes or to major activity centres to use public transport. There is a need to maintain high service levels for those who are dependent upon public transport.

Meeting these objectives requires an integrated public transport system of frequent, attractive rapid transit services on trunk routes complemented by local feeder and distributor services to provide a viable inter-regional, cross suburban and intra-suburban public transit system.

2.2. The Integrated Strategy Behind the SWMR Master Plan

The SWMR Master Plan concluded that an appropriate response to satisfy the demand for local, inter and intra-regional public transport would be an integrated rapid transit strategy of three complementary systems. These were to:

- **extend the Kwinana Freeway Busway to the Murdoch Park & ride;**
- **provide a dedicated Transitway (for buses) from Rockingham to Fremantle;**
- **extend the suburban rail system through Kenwick to Thomsons Lake, Kwinana, Rockingham and Mandurah.**

(Section 3.1.2: SWMR Master Plan)

2.3. A New Strategy for South West Integrated Public Transport

That strategy has now been fundamentally changed.

Instead of extending the Kwinana Freeway Busway to Murdoch:

- The railway will be located in the Kwinana Freeway from Perth to Thomsons Lake.
- A railway spur will be built from Kenwick to a station at Spencer Road in Thornlie. There will be further examination of the requirements for provision of public transport connections between Thornlie and the SWMR services operating up the Kwinana Freeway.
- Provisions will be made for bus priority along the Kwinana Freeway at Canning Bridge and immediately south of

the Narrows Bridge to accommodate those bus services which currently enter the Kwinana Freeway at Canning Bridge.

The other changes that are related to the Direct Route are:

- there is a major change in the route through Rockingham;
- a railcar stowage and cleaning facility at Mandurah;
- the major railcar depot at Nowergup.

Preliminary feasibility studies in mid-2001 of the Direct Route showed that:

- although narrow, it is technically feasible to accommodate a railway within the median of the Kwinana Freeway from the Mount Henry bridge to the Narrows bridge;
- there would be very significant journey time savings for all prospective commuters from Jandakot and further south;
- patronage would increase;
- the level of service offered by the entire metropolitan rail system would be significantly improved;
- there would be savings in rollingstock requirements and an increase in rollingstock utilisation.

The estimated travel time savings were:

- Mandurah to Perth – 20%;
- Rockingham to Perth – 26%;
- Thomsons Lake to Perth – 42%.

These travel time savings resulted in:

- a 20% reduction in railcar requirements;
- a 50% increase in railcar utilisation.

The challenge was to provide a railway from Glen Iris northward within the median of the Kwinana Freeway and through Perth, from within the forward estimates to year 2006, for a cost estimated to be $320 Million in 1998/1999 dollar values.

A review of the project showed the $320 Million could be met from the following adjustments to the scope of works:

- $70 Million from the allocation at Rockingham, by modifying the route there;
- $90 Million from the previous link from Perth to Jandakot via Kenwick;
- $10 Million from Perth Station;
- $70 Million from an allocation for Stage Two of the Kwinana Freeway Busway in years 2005/2006;
- $78 Million saving in railcars;
- $6 Million by deferring the construction of a station at Berrigan Drive, South Lake.

Following submissions to the Expenditure Review Committee and Cabinet, the Government approved the change in the route and the preparation of a Perth Urban Rail Development Supplementary Master Plan in July 2001.

2.4. What Has Not Changed

This Supplementary Master Plan builds on the work and outcomes of the previous Master Planning.

- The planned railway would be part of an integrated public transport system.
- The railway would be the spine of that system.
- The railway would maximise the rapid transit potential and high capacity qualities of a railway operating in a dedicated reserve.
- The Northern Suburbs line would be extended to Clarkson, with a further northerly extension to a railcar depot at Nowergup.
- The proposal to provide a railway from Kenwick to Spencer Road can be retained.
- The railway would enhance land use opportunities along its route.
- South West Metropolitan Rail services would integrate seamlessly with the Northern Suburbs Railway, by 'through

Section 5.3 of the SWMR Master Plan showed that the SWMR services should not be operated in isolation because of a number of interdependencies. Those that remain unchanged for the Direct Route are:

- The need to operate a reliable and robust timetable, recognising the variability of everyday operations.
- The need to integrate new and existing services at Perth Station and integration of the new services with other services beyond Perth

The original SWMR Master Plan (Section 5.3) states:

> *'It was found that the new South West Metropolitan services should be integrated with those for the Northern Suburbs. Reasons for this include:-*
>
> - *it will reduce the number of railcars required to operate the South West Metropolitan Railway (a minimum saving of eight cars);*
> - *it will avoid turning back large numbers of trains at Perth Station with associated infrastructure requirements and time delays this would incur;*
> - *it will improve timetable robustness, particularly in the event of train failure or out of course running;*
> - *it will simplify train control;*
> - *the Northern Suburbs Railway currently uses four-car consists which are filled to capacity during the peak, over the next ten years a six-car consist will be required;*
> - *forecast demand on the South West Metropolitan Railway closely matches that of the Northern Suburbs Railway and will also require a six-car consist;*
> - *transit station spacing and track alignment of both railways suit rapid transit and permit line speeds above 110 km/h. With regard to how the new railway will fit in with the existing system, the study showed that the new service cannot be operated in isolation.'*

These findings were also relevant to the specification for the rollingstock required to provide the proposed new services.

3. Land Use and Transport Integration

3.1. The Perth Region – Growth & Planning

3.1.1. Population Distribution and Growth Trends

By the year 2021 the population of the Greater Perth Metropolitan Region (i.e. Perth Metropolitan region plus Mandurah and Murray) is estimated to be about 2 million. Within existing development constraints the greater Perth Metropolitan region can accommodate a population of 2.5 million.

The 2001 population of about 1.5 million for Perth, Mandurah and Murray (Australian Bureau of Statistics preliminary estimated resident population, *National Population Growth; Cat No. 3218.0 Feb 2002*) is distributed mainly along the Perth region coastal plain over a north-south length of just over 110 kilometres and a width of up to 30 kilometres. Although not yet fully linked, the coastal corridor currently stretches from Two Rocks in the north-west to Dawesville in the City of Mandurah.

The total length of the full north/south development is expected to be about 135 kilometres and over 75% of the projected population increase of the Perth area, in the next 20 years or so, is anticipated will settle on a coastal strip no more than 15 kilometres wide.

A number of land use constraints influence the development patterns of the Perth Metropolitan Region and exacerbate the trend of development along the narrow coastal strip. **Figure 3**

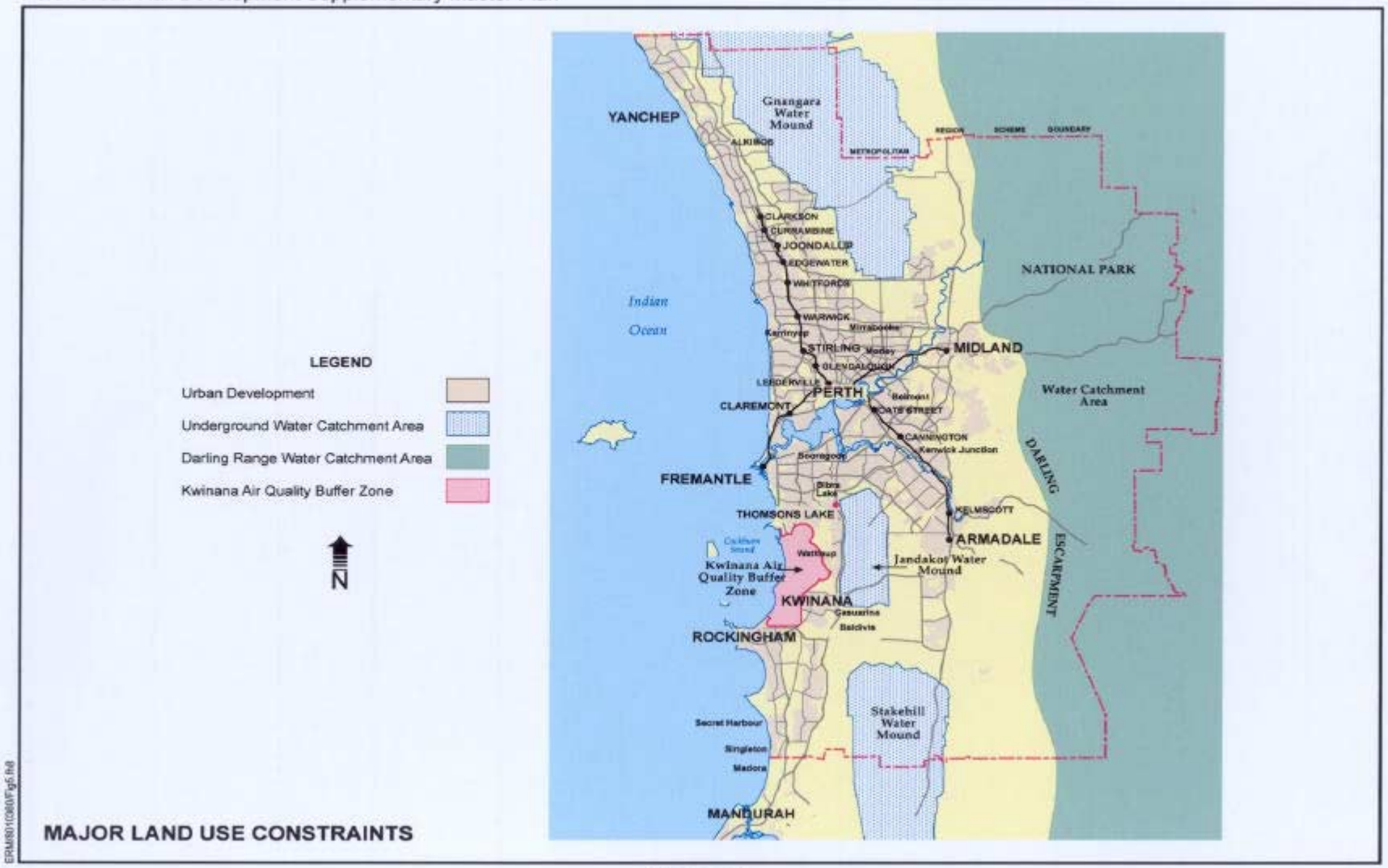
In 1996 the population and workforce was about evenly split between the inner suburbs and outer corridors. About 47% lived in the inner suburbs and 53% in the outer corridors including Mandurah and Murray. About 70% of employment was still concentrated in the core and inner suburban areas with 28% in the corridors and Mandurah. Large numbers of commuters will travel between the outer and inner suburbs.

By 2021 it is expected that only 40% of the population will live in the core and inner areas, with 60% in the outer corridors including Mandurah and Murray. However, based on the current knowledge of employment patterns and trends the core and inner metropolitan areas will still have 63% of employment. The outer corridors and Mandurah and Murray will have the balance of 37%. Put simply, the growth in the share of total employment in these corridors is falling behind population growth. Employment share is projected to increase from 30% in 1996 to 37% in 2021, whereas the share of the population is expected to grow from 52% to 61% during the same period.

Obviously the volume and length of commuter trips from the outer corridors to the core and inner areas will increase. This trend has been demonstrated in many 20th century cities around the western world.

3.2. Projections of Growth for the South West Metropolitan Area

Population in the South West corridor is projected to grow from 361,900 to 538,400 by 2021 (see Table 3.2.1). This population will require public transport for many purposes but the peak load is principally commuters travelling to employment in the central city.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LEGEND
Urban Development
Underground Water Catchment Area
Darling Range Water Catchment Area
Kwinana Air Quality Buffer Zone
N
MAJOR LAND USE CONSTRAINTS
YANCHEP
Gnangara Water Mound
NATIONAL PARK
Indian Ocean
MIDLAND
PERTH
CLAREMONT
FREMANTLE
THOMSONS LAKE
ARMADALE
Jandakot Water Mound
Kwinana Air Quality Buffer Zone
KWINANA
ROCKINGHAM
Stakehill Water Mound
MANDURAH
Water Catchment Area
DARLING ESCARPMENT

Figure 3

3.2.1. Population and Employment

Population forecasts are based on known land use arrangements in approved structure plans and regional Town Planning Schemes.

Forecasts of employment distribution are difficult. While there is some degree of confidence that types of employment will become more diverse in the future, it is difficult to predict where it will be located.

Over recent years there has been a steady trend for manufacturing employment to decline and service sector employment to rise. There is also a trend to use contracting services in place of permanent employees.

Newer residential areas have a preponderance of service industries. Industrial enterprises are using smaller workforces and increasing the use of contracting services. While the actual proportion of the population employed in the central area has declined, it remains the most significant employment area in the Metropolitan Region.

This is shown in **Figure 4**. In the past there was a substantial time lag between the creation of residential areas and employment centres. In 1966, 86% of the work force resided in the core and inner suburban areas where 88% of the jobs were located. By 1996 only 47% resided in the core and inner suburbs but 70% of jobs were still located in these areas.

Perth Urban Rail Development Supplementary Master Plan

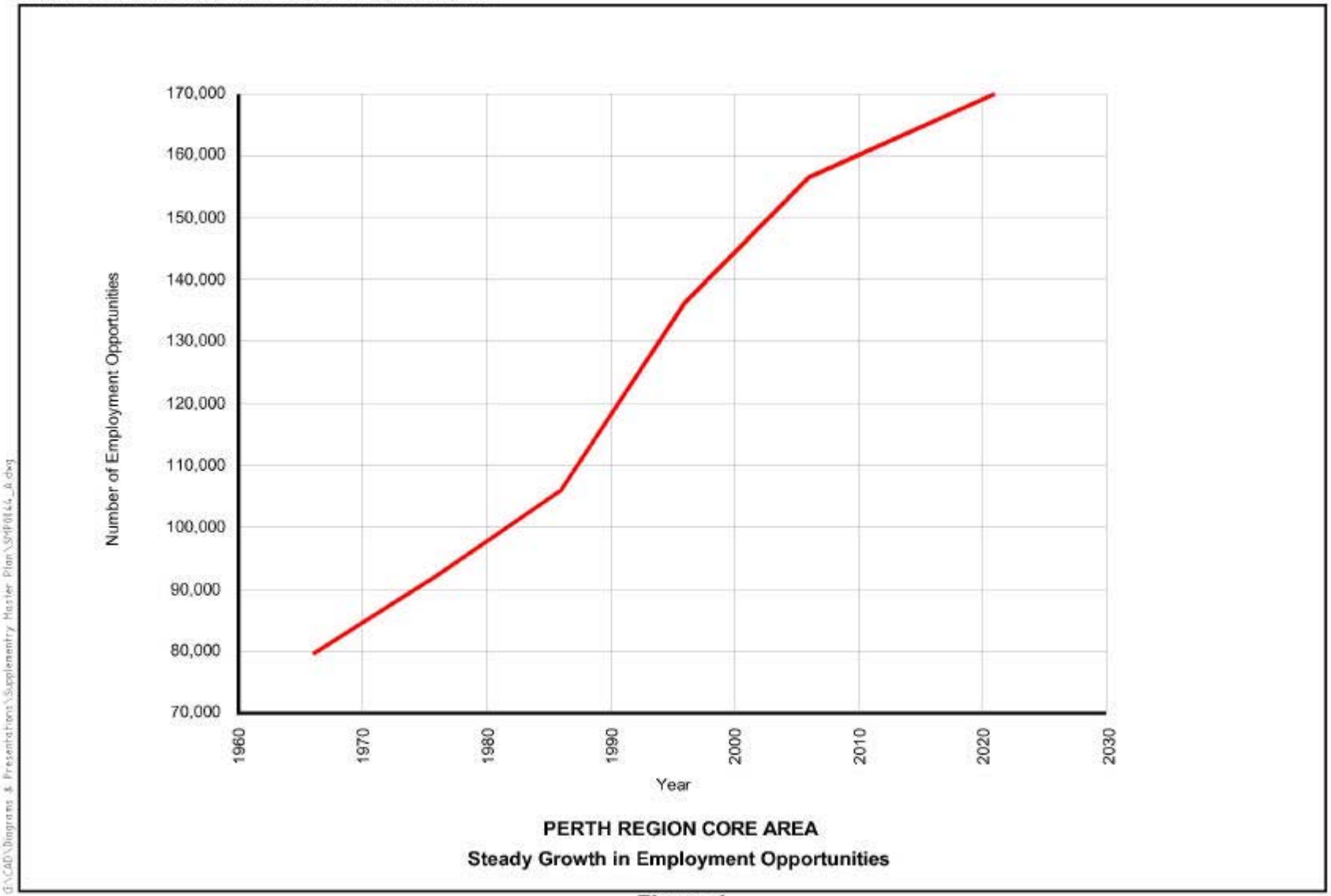

Figure 4

3.2.2. Changes in Land Use Since 1997/1998

Knowledge of how many and where people live and work is fundamental to determine what their travel needs and behaviour will be.

Population and employment projections used in the original SWMR Master Plan were taken from data produced for and adapted by Main Roads WA for their modelling purposes. That was the only data source at that time.

Current population projections, produced by the Department for Planning and Infrastructure are now fed directly into the DPI transport demand model.

The DPI have produced, for the first time, employment projections by industry group and these are also fed directly into the demand model.

Since the original SWMR Master Plan was produced, there have also been changes to land use policy developed by DPI.

Models also depend on data portraying historical trends of competition for land and space. This now indicates there is greater development of the inner metropolitan areas, than envisaged in 1997/98, at the expense of the outer regions. However when the land supply that feeds development in the inner areas dries up, development will accelerate in outer areas once again. **Table 3.2.1** shows a steady population growth in most of the local government areas along the route of the railway, out to the last forecast year of 2031. Cockburn and Kwinana are expected to grow more quickly in the period to 2016 and then grow more slowly to 2031.

Trends in population growth are also established from the Metropolitan Development Program (MDP). The original SWMR Master Plan used the MDP data of the early 1990's available at that time, whereas the current modelling has access to year 2000 MDP data.

The net effect of all information that is now available with respect to population for the year 2006 shows that there will be a slow down in the growth of population within the South West Corridor, compared to that predicted in the original SWMR Master Plan. This is shown in **Table 3.2.2**. The employment growth has also been reduced by allowing for a "worked at home" factor in the latest projections based on industry groups. This is shown in Table **3.2.3.**

Using the latest data, Table 3.2.2 shows that the population projected for Year 2006 in the original SWMR Master Plan for Kwinana, the Rockingham area, Mandurah and Murray was overstated by 9% when compared with current projections.

However, Table 3.2.2 also shows that compared to the 2001 Census Data, there is still expected to be a 19% increase in population between 2001 and 2006, for those areas.

Table 3.2.1

Population Projections for Local Government Authorities in the South West Corridor of the Perth Urban Rail Development: 2001-2031

Local Government Area	2001	2006	2011	2016	2021	2026	2031
South Perth	37,800	39,400	41,000	42,300	43,800	44,900	45,500
Melville	98,900	101,400	104,300	108,100	110,800	114,700	117,300
Cockburn	70,200	82,800	93,300	97,800	100,200	100,900	100,400
Kwinana	23,100	25,600	30,400	35,300	39,600	41,500	42,600
Rockingham	72,000	85,600	99,600	113,200	130,000	145,300	158,600
Mandurah	49,400	60,600	72,500	84,300	95,400	105,400	114,300
Murray	10,500	13,000	14,900	16,700	18,600	20,500	22,500
Total	**361,900**	**408,400**	**456,000**	**497,700**	**538,400**	**573,200**	**601,200**

Source: WAPC Medium Scenario Projections – Western Australia Tomorrow, Population Projections for the Statistical Divisions, Planning Regions and Local Government Areas of Western Australia, Population Report No. 4 October 2000.

Table 3.2.2

2001 Census Count and Population Projections for the Year 2006 for the Original SWMR Master Plan and from Current Data.

Sector	2001 Census (a)	2006 Projections Original SWMR Master Plan (b)	2006 Projections Current Land Use(c)	Difference Between SWMR Master Plan & Current Projections		Difference between 2001 Census & Current Projections for 2006	
Perth CBD	12,404	5,949	6,010	61	1.0%		
Fremantle	25,199	23,401	26,213	2,812	12.0%	1,014	4.0%
Cockburn	66,417	71,764	79,011	7,247	10.1%	12,594	19.0%
S. Riverfront Suburbs	97,768	99,322	109,306	9,984	10.1%	11,538	11.8%
Northern Suburbs	484,129	540,500	537,562	-2,938	-0.5%	53,433	11.0%
Kwinana	20,812	34,509	24,988	-9,521	-27.6%	4,176	20.1%
Rockingham Central	37,846	49,451	41,336	-8,115	-16.4%	3,490	9.2%
Rockingham South	32,460	44,380	42,916	-1,464	-3.3%	10,456	32.2%
Mandurah	45,020	58,927	55,027	-3,900	-6.6%	10,007	22.2%
Murray	10,061	12,000	16,728	4,729	39.4%	6,667	66.6%
Remainder North	175,876	217,100	201,534	-15,566	-7.2%	25,658	14.6%
Remainder South	387,082	405,000	425,049	20,049	5.0%	37,967	9.8%
Total Greater Metro.	1,395,074	1,562,303	1,565,680	3,377	0.2%		

Source:

(a) 2001 ABS Census data. Note Census count population includes visitors whereas projections are based on Estimated Resident Population (ERP) ie, they relate to persons who reside in the are for six months of the year or more. Moreover, ERP include an adjustment for people who were missed at census time.

(b) Population projections produced in 1997/1998 by MFP.
(c) Population projections based on updated land information in 2001 by DPI.

Table 3.2.3

Projected Employment for Sectors in the Greater Metropolitan Area for Year 2006

Sector	2001 Status (N/A Till Sept 2002)	2006 Projections		Difference Between SWMR Master Plan & Current Projections		Difference Between 2001 Status & Current
		Original SWMR Master Plan	Current Land Use			
Perth CBD	N/A	140,849	116,260	-24,589	-17.5%	N/A
Fremantle	N/A	24,849	24,323	-526	-2.1%	N/A
Cockburn	N/A	13,567	18,883	5,316	32.2%	N/A
S. riverfront suburbs	N/A	26,590	26,441	-149	-0.6%	N/A
Kwinana	N/A	8,315	12,562	4,247	51.1%	N/A
Rockingham Central	N/A	5,490	9,917	4,427	80.6%	N/A
Rockingham South	N/A	11,782	4,673	-7,109	-16.3%	N/A
Northern suburbs	N/A	201,512	155,949	-45,563	-22.6%	N/A
Mandurah	N/A	8,788	12,007	3,219	36.6%	N/A
Murray	N/A	4,583	5,058	475	10.4%	N/A
Remainder north	N/A	110,046	69,261	-40,785	-37.1%	N/A
Remainder south	N/A	181,936	143,656	-38,280	-21.0%	N/A
Total		**738,307**	**598,990**	**-139,317**	**-18.9%**	

Note: Employment data for 2001 not available till September 2002.

3.2.3. Workforce Participation

The workforce participation rate (the percentage of the population in the workforce) has grown since 1966 but now appears to have stabilised. For travel demand forecasting purposes the participation rate is expected to remain constant at 43% to the year 2021.

3.2.4. The Connection between Employment and Transport

The south-west corridor is over 70 kilometres long and is configured in such a way that most existing and future residential development will be within two kilometres of the proposed South West Metropolitan Railway or the Rockingham-Fremantle (Bus) Transitway.

The future population south of Jandakot through which the proposed railway route passes, is expected to be similar to that north of Warwick in the north-west corridor.

The narrowness and length of the south-west corridor is likely to result in a higher proportion of the population being closer to the rapid transit artery and the transit stations than in the north-west corridor which is already served by rail.

3.2.5. Summary of Benefits

The configuration of existing and future land use and employment areas in the south-west corridor and Mandurah will make fast line-haul public transport supported by local feeder and distributor services essential. A high standard public transport system will be vital to the well-being of the future communities who will live in the corridor if they are to have equality of access to the services and major employment areas and a viable alternative to private car use. This includes access to the central Perth area and the inner Metropolitan core.

Provision of a rapid transit railway to the south-west metropolitan area will have a positive impact on public transport patronage and reduce pressure on road capacity.

The increase in the rail modal share, with the introduction of a Rapid Transit Railway to the south-west metropolitan area will make a positive contribution to reducing private car travel on this major trunk route and to a more sustainable system overall.

3.3. Travel Demand

3.3.1. Forecasting Travel Demand

Demand forecasting uses a complex computer based Transport Demand Model. Transport modelling is part of a wider evaluation process. It is an iterative and interactive process with considerable qualitative and quantitative inputs. Modelling is essential in evaluating alternative proposals and for sizing rollingstock and infrastructure requirements. With an increasing need to accurately define project requirements, demand modelling has great importance. However, it needs to be stressed that modelling forecasts need to be tempered with proper judgement of possible outcomes.

The model used in forecasting is based on a conventional four stage modelling process that attempts to answer the four questions:

1) How many journeys will be made (trip generation)?

2) Between which centres of population and activities will the journeys be made (trip distribution)?

3) By what mode of transport will the journeys be made (mode choice)?

4) What routes will the journeys take (trip assignment)?

Demand forecasts for the original SWMR Master Plan were derived using the Department of Transport' *SPECTRE 1.3* computer model with data supplied by Main Roads WA and the Department for Planning and Urban Development which supplied the projected land use data. *SPECTRE 1.3* was limited in the following ways:

- Only motorised trips were modelled;
- Travel times for car trips were obtained from Main Roads WA data derived from their road network model; 1986 journey to work data was used.

The current demand forecasts have been carried out using a significantly enhanced computer model, *SPECTRE 2.0* which:

- Models non-motorised as well as motorised trips;
- Derives car travel times as part of the modelling process;
- Uses 1996 journey to work and 1996 population census data.

In summary, the main differences between the two models fall into three broad categories and these are:

- Input data, particularly with regard to the location and timing of population and employment in the South West Corridor;
- Model structure;
- Model calibration.

The input data (population and employment projections) are aggregated on a zonal basis for input to the model. The zone system is different for the two models. *SPECTRE 1.3* is based on 433 zones whilst *SPECTRE 2.0* is based on 472 zones. The zoning system for *SPECTRE 2.0* was completely re-drawn for compatibility with the 1996 Census Collection Districts using GIS and it is not compatible with the previous 433 zones of *SPECTRE 1.3* which used the 1996 Household Interview Survey. A more detailed explanation of the data differences is given in Section 3.2.2.

With respect to changes in model structure, SPECTRE 2.0 also features:

- Increased sensitivity to changes in residential and employment densities for trip generation and mode choices;
- An increase in the number of transport mode choices from four to seven;
- The ability to model four time periods throughout the day as well as four public transport networks.

The calibration of the *SPECTRE 2.0* model is based on:

- The numbers of households, vehicles and work trips from the 1996 Census, household characteristics and trip data from the

TravelSmart household interview surveys for the year 2000 in addition to the 1986 Household Travel Survey;

- The network characteristics of time, distance and cost of all modes of travel generated within the model from fully integrated road and public transport networks replacing data previously imported from the MRWA model.

Because of the importance of demand modelling, a full description of the process is given in a separate paper. What follows in this part are the salient points from that paper.

3.3.2. Effect on Patronage of Changes in Land Use.

3.3.2.1 Original SWMR Patronage for the Kenwick Route

The model forecasts in the original SWMR Master Plan (Scenario 38 run 244) for boardings on the Kenwick route are as shown in Table 3.3.2.1 – (see also Table 2.3.7 and Figure 7, SWMR Master Plan)

Table 3.3.2.1
Kenwick Route
Original SWMR Master Plan
2006 Forecast Passenger Boardings

Station	All-Day Boardings		a.m. Peak Boardings	
		Sub-total		Sub-total
Thornlie	1,980		1,250	
Nicholson Road	760		620	
Canning Vale	2,220		1,460	
South Lake	1,880		1,230	
Thomsons Lake	2,140	8,980	920	5,480
Thomas Road	1,600		1,170	
Leda	1,030		760	
Rockingham Transit Interchange	960		560	
Waikiki	3,980		3,280	
Mandurah	2,550	10,120	1,960	7,730
TOTAL	**19,100**		**13,210**	

Source: South West Metropolitan Railway Master Plan.
Model run 244, scenario 38.

Input: Land use projections from MRD, DPUD and DOT 1992-1998.

3.3.2.2 Current Land Use Data – Kenwick Route

Table 3.3.2.2 shows what the expected boardings on the Kenwick route would be, using the latest land use data as described in Section 3.2.2, Table 3.2.1, Table 3.2.2 and Table 3.2.3.

It shows that the all day boardings would reduced by about 6%.

More significantly it shows that the morning peak boardings would be reduced by 3,930 (21%) compared with the original data. This is because the additional information available since the original SWMR Master Plan shows a significant increase in travel between peaks, to the detriment of peak period travel.

Table 3.3.2.2
Remodelled Kenwick Route
Current Land Use Data
2006 Forecast Passenger

	All-Day		a.m. Peak	
		Sub-total		Sub-total
Thornlie	4,110		1,780	
Nicholson Road	1,340		780	
Canning Vale	1,240		240	
South Lake	590		250	
Thomsons Lake	2,590	7,280	1,160	3,050
Thomas Road	580		440	
Leda	650		300	
New Rockingham transit interchange	1,780		870	
Waikiki	1,800		1,050	
Mandurah	3,300	10,700	2,410	6,230
Total	17,980		9,280	

Source: Future Perth S.T.E. Model run 83, scenario 16.

Input: Land use projections from MfP 2001.

Note: For this model the Rockingham Transit Interchange was assumed to be in the new Direct Route location

3.3.3 Patronage Forecasts for the Direct Route

3.3.3.1 Total Patronage

Table 3.3.3.1 shows the projected 2006 passenger boardings for the Direct Route and Thornlie station, using the current land use data. The total patronage for the South West Metropolitan Railway, plus the Thornlie station is 28,450 boardings per day.

Table 3.3.3.1 shows an average of over 50% of all day boardings occur in the morning peak period at Rockingham, Waikiki and Mandurah whereas from Thomas Road north, the morning peak period boardings account for an average of just less than 40% of all day boardings. At Thornlie the morning peak boardings are 40% of all day boardings.

3.3.3.2 Patronage Comparison for the Common Part of the Kenwick and Direct Routes

Table 3.3.3.2 summarises the patronage boardings for the Kenwick route and Direct Route for the section of line that is common to both routes; that is, from Glen Iris to Mandurah.

Table 3.3.3.1
Direct Route and Thornlie Spur
2006 Passenger Boarding Boardings
Current Data

	All-Day	a.m. Peak
Mandurah Line		
Canning Bridge	970	140
Leach Hwy	3,110	1,460
Murdoch	4,980	2,070
Thomsons Lake	5,460	2,030
Thomas Road	2,560	1,070
Rockingham	2,320	1,130
Waikiki	2,060	1,220
Mandurah	3,490	2,550
Sub total	**24,950**	**11,680**
Thornlie Line		
Thornlie	3,500	1,410
Sub total	**3500**	**1,410**
Total	**28,450**	**13,090**

Table 3.3.3.2
Glen Iris to Mandurah
Comparison of Forecast 2006 All-day Passenger Boardings
Kenwick Route versus Direct Route

	Kenwick Route SWMR Master Plan Data	Kenwick Route 2002 Data SWMR Master Plan Service Frequency	Direct Route 2002 Data
South Lake	1,880	590	-
Thomsons Lake	2,140	2,590	5,460
Thomas Road	1,600	580	2,560
Leda	1,030	650	-
Rockingham	960	1,780	2,320
Waikiki	3,980	1,800	2,060
Mandurah	2,550	3,300	3,490
Total	**14,140**	**11,290**	**15,890**

Table 3.3.3.2 shows the benefits of the shorter journey time to Perth, for those stations common to the Direct and Kenwick route. Given the same land use (population and employment) base (2002 data) the Direct Route produces 40% greater boardings.

The construction of Leda railway station requires to be examined with regard to patronage demand in the catchment. Timing of its construction will be negotiated with the developer.

For this reason, patronage figures for Leda Station under the Direct Route have not been included in Tables 3.3.3.1 and 3.3.3.2.

3.3.3. Total Network Projections for 2006

Table 3.3.3.3 shows the projected all day, weekday passenger boarding for the whole network.

Table 3.3.3.3
Urban Rail Network Boardings
All Day Weekday for 2001 and 2006

Line	2001	2006
Armadale	14,246	17,000
Fremantle	16,274	13,500
Midland	14,038	12,000
Northern Suburbs	21,720	26,000
South West		25,000
Thornlie		3,500
Perth	35,117	73,500
Total	**101,395**	**170,500**

3.3.4. Conclusions

1. **Table 3.3.3.2** shows that if the Kenwick Route is modelled using the current projections of population and employment around the stations shown, the patronage would be 11,290 boardings per day from South Lake to Mandurah which is less than the 14,140 predicted in the original SWMR Master Plan.

   This is because compared with the data available for the original SWMR Master Plan, more recent data for the forecast year of 2006 has shown a 9% decrease in population projected for Kwinana, Rockingham, Mandurah and Murray.

   Therefore if any comparison is now to be made of patronage for the Kenwick route versus the Direct Route, it must be against the current land use and population projections. This means that the actual improvement in patronage for the Direct route versus the Kenwick route, for the section common to both routes and the core of the SWMR railway is 4,600 boardings per day, or 40% (15,890 versus 11,290 boardings).

   Table 3.3.3.2 shows that the new location of Rockingham station is a good attractor of patronage. The modelling shows that the new location is more attractive to a significant number of commuters who would have used the Waikiki station under the arrangements of the original SWMR Master Plan.

2. **Table 3.3.3.2** shows that there is a 110% increase in patronage for the Direct Route at Thomsons Lake reflecting a 42% decrease in journey time and a 50% increase in service frequency compared to the Kenwick route.

3. Table 3.3.3.3 shows that the total all day, weekday passenger trips on the urban rail network is expected to grow by 68%, from 101,395 in 2001 to 170,500 in 2006/2007.

4. A Route Through the City of Perth

4.1. Determining the Route

In July 2001, when the Government announced adoption of the Direct Route and endorsed the preparation of a Supplementary Master Plan, preliminary analysis of possible route options through the City of Perth indicated an alignment along William Street. This route was to follow the existing bus access road to the Esplanade Busport and thence via William Street to Wellington Street before connecting with the Northern Suburbs line. The route and its associated station drew criticism from a number of sources.

In November 2001, the Minister for Planning and Infrastructure, Hon. Alannah MacTiernan MLA, appointed the Perth City Rail Advisory Committee (PCRAC) to provide independent advice on the resolution of this matter. Details of the PCRAC and its findings are given in the *Report of the Perth City Rail Advisory Committee to the Minister for Planning and Infrastructure, Hon. Alannah MacTiernan MLA*. The report was released to the public on 14 March 2002.

The PCRAC found that although its preferred option was (2C) – the , this would more than double the budget for the city segment on the SWMR Project which could render the option 'infeasible'. Subsequently this conclusion was confirmed by the Government, which could not justify the cost.

While PCRAC found that the William Street Announced Route described above suffered sufficient shortcomings to reject the option, PCRAC found merit in a William Street option if a range of planning and construction issues could be resolved. In Finding 6, PCRAC found as follows:

> *'In the Committee's view there are many city planning benefits (especially in the longer term, when projected development proceeds) of a route that provides a rail station on the south central side of the city, in the vicinity of the Busport. While the William Street Announced route option must be rejected, a significantly enhanced central route option is feasible. For such a route to be acceptable, it would need to be demonstrated to the Government's and the community's satisfaction that the following criteria have been met:*
>
> - *It would strengthen rather than undermine the relationship of city and river;*
> - *It would integrate with the Busport;*
> - *It would positively support the Convention Centre;*
> - *It would see no reduction in pedestrian space in William Street;*
> - *Adequate traffic capacity would be maintained in William Street;*
> - *It would have no detrimental effect on buildings at the intersection of William Street and Mounts Bay Road;*
> - *It would provide no unreasonable disruption to William Street during construction;*
> - *Its main city station would connect effectively with the existing Perth City Station, in order to minimise walk times for transferring passengers and to maximise the potential to provide for all rail passengers under one roof.*

If these criteria were not met, then it is the view of the Committee that no central route option would remain feasible for the SWMR.'

Finding 7 of the report of the PCRAC stated that:

'A western route option along the Freeway, with a station at Elder Street is a satisfactory and feasible alternative route, so long as the following criteria have been met:

- *it is designed in a manner that does not compromise freeway safety;*
- *it involves no significant alteration in Freeway vehicle movements;*
- *it provides for through rail running to the northern suburbs.'*

In releasing the report of the PCRAC to the public in March, the Minister for Planning and Infrastructure announced that the Government would invite public discussion on the remaining central and western route options and conduct additional research before making a final recommendation.

The Perth Urban Rail Development office was asked to address the PCRAC findings, with respect to the William Street Route and the Freeway Route.

Although the PURD office had recommended to the PCRAC a William Street route constructed by the cut-and-cover method, there was a possibility to materially limit disruption during construction by adopting a bored tunnel method of construction for which there had been insufficient time available prior to the PCRAC March report to support this as a sound option.

The Minister reconvened the PCRAC on 19 April 2002, with the following terms of reference:

'*With a view to assisting the Government to make a final determination of a route for the South West Metropolitan Railway (SWMR) into the Central Business District of Perth, the Perth City Rail Advisory Committee is reconvened.*

The Committee is required to:

1. *Identify the best feasible option to route the SWMR along a "central" alignment and the best feasible option to route the SWMR*

2. *Assess these options against the criteria propounded in the Committee's first report and, after taking into account costs and any other matters the Committee considers to be of material relevance, recommend a preferred route.*

In forming its views, the Committee shall assess available information, as well as assessing public submissions that have been received during the recently concluded public consultation period. The activities of the Committee, including any necessary additional expert advice or information, shall be resourced by the Commissioner of Railways.

The Committee should not consider other route options.

It should report to the Minister for Planning and Infrastructure within a month. The timeframe for construction of the new railway precludes the Committee from pursuing sources of information or advice which cannot be taken usefully into account within the month.'

On 10 June 2002, the Government released the second, and final Report of the PCRAC.

The PCRAC examined the best available *'Western'* and the best available *'Central'* routes and recommended the Central Route.

The findings of the final report of the PCRAC are reproduced here in full.

> *'Finding 1: The Committee's view is that the best Western route option is that previously identified as 3PCC(I), incorporating the Freeway safety and rail operations as described in this report. The Committee is also of the view that this option should incorporate the reconnection of the bus services from the Busport to the Wellington Street bus station, and, should the Freeway option be ultimately chosen as the preferred route, that further consideration be given to the relocation of the Elder Street station and its design in order to minimise disruption to Hay Street traffic during the construction period and , in general, to provide an attractive, pedestrian-friendly station.*
>
> *Finding 2: The Committee is satisfied that the proposed Central route option 1D(I) has been sufficiently improved to satisfy the acceptance criteria specified in its first report. The detailed work since issue of the first report has not only satisfied the criteria, but has produced proposals that have the potential to integrate platforms at Perth station and contribute significantly to the connectivity, ambience and amenity of the foreshore area at the foot of William Street.*
>
> *Finding 3: Based upon the work undertaken by the Committee in its original report which included its Multi Criteria Assessment and the analysis of the key issues as elaborated within this report and including:*
>
> - *Mass transit;*
> - *Station location and travel time;*
> - *Development railways;*
> - *Integration with bus services;*
> - *Patronage;*
> - *Rail operations, efficiencies and reliability;*
> - *Disruption;*
> - *Future city rail loop;*
> - *Economic and financial considerations.*
>
> *The Committee finds that the improved Central option 1D(I) is the preferred route compared to the Western route 3PCC(I) for the City of Perth section of the SWMR and recommends that Master Planning continues on the basis of this alignment.*
>
> *Finding 4: Government should pursue the opportunity to significantly enhance the city's amenity by sinking the Fremantle lines to provide connection to Northbridge, completing the renovation of the Horseshoe Bridge and removing the William Street overpass from the foreshore.'*

The Government has accepted the Central Route. Although there are no funds allocated to undertake the proposals contained in Finding 4, the Government will

work with the City of Perth and developers to examine the potential for non State Government funding for these works.

4.2. An Outline of the Central Route

The scope of works for the Central Route is summarised as follows:

- Approximately 648 metres of double track railway in a cut and cover concrete box from just east of the Kwinana Freeway, along the Perth foreshore to Mounts Bay Road. It includes a station on the Perth Esplanade;
- From the Esplanade station, northward, under William Street and the Horseshoe Bridge to a portal in the railway reserve roughly in line with Lake Street, a lineal distance of about 1,000 metres. Within this section there are approximately 690 metres of bored tunnelling and 310 metres of twin track cut-and-cover structure. That section includes the main central station underground platforms;
- From the Lake Street portal westwards along the existing railway reserve there is a ramp structure, just under 200 metres long, grading the railway up to ground surface level and linking it with the Northern Suburbs railway.

4.3. Stations and Land Use

Stations will be located at the Esplanade and at the north end of William Street. The issue of good pedestrian access to the greatest density of employment is the key to maximising the arrivals at these stations.

The location of the greatest density of employment has been well researched and documented. This tells us that there should be concentration around the centre of the CBD.

There are three measures of centrality:

- land value
- pedestrian count
- employment density

4.3.1. Land Value

The Valuer General's office has advised that:

- the most valuable land within the Perth CBD over the past 20 and possibly 40 years has been located within the geographical area bounded by St Georges Terrace, Barrack, Murray and William Streets;
- over this time period the most valuable land has marginally been the retail location between Hay and Murray Streets around Carillon City Arcade, with the office location at the corner of St Georges Terrace and William Street assuming the position during the office boom period of the 1980s;
- the gross oversupply of office space in the 1990s however has meant that the most valuable land has now reverted again to the central Hay Street Mall retail location.

4.3.2. Pedestrian Count

The Real Estate Institute of Western Australia has advised that the point of highest pedestrian count in:

- 1999 was Murray Street at the western corner of Carillon Central;
- 2001 was Murray Street at the western corner of Piccadilly Arcade.

Since 1970 the highest pedestrian count point has fluctuated between Murray Street and Hay Street Malls and between the Plaza, City, Carillon and Piccadilly Arcades.

Based on the above, the centre of the CBD fluctuates within the area bounded by St Georges Terrace, Barrack, Murray and William Streets.

4.3.3. Employment Density

Department for Planning and Infrastructure employment data from 1991 to 2001 supports this view. **Figure 5** (1993 data) shows that the greatest concentration of employees (greater than 500 persons/ha) is between King Street and Pier Street and between the GPO and the Esplanade with the point of highest employment density being the Bank West tower at the corner of William Street and St Georges Terrace.

An important issue that needed to be resolved at this point was whether or not the city is growing and if so whether that growth is (and will continue to) enforce the existing pattern of centrality. **Figure 6** demonstrates that the City is growing and the following pictures demonstrate this quite clearly as well. **Figure 7.** The picture of the city in 1993 **Figure 8** also demonstrates the compact nature of the CBD around the Bank West Tower.

4.3.4. The Station Locations

Having determined that the CBD has a distinct centre that is growing in size the correct location of any new railway station necessitates some discussion on how far people will walk to a railway station.

The prevailing viewpoint is that street design should seek to provide a good walking environment out to 800 metres (i.e. a 10 minute walk) from the station, but that at destination stations at least twice as many commuters will walk up to 400 metres than will walk up to 800 metres. **Figure 9**

In the city environment we can therefore maximise patronage by locating new railway stations within reasonable walking distance of the greatest density of employment. That is within 400 metres of the corner of St Georges Terrace and William Street.

Many potential locations for railway stations were considered but eventually these reduced to two options depending upon whether a western route or a central route was chosen. The following “ped shed” maps (i.e. 400 metres and 800 metres actual and theoretical walking distances) illustrate the difference **Figures 10 and 11**. These figures show that the Esplanade Station serves the centre of the city better while also providing excellent interchange with buses at the Busport on Mounts Bay Road. This station gives good accessibility to Barrack Square and the foreshore and can serve as a special events

Perth Urban Rail Development Supplementary Master Plan

CENTRAL PERTH ACCESS PLAN - EMPLOYMENT LOCATION
Figure 5

IS THE CITY GROWING? CENTRAL CITY EMPLOYMENT
Figure 6

PERTH 1963
Figure 7

PERTH 1993
Figure 8

FOR ILLUSTRATION PURPOSES ONLY ..... : NOT TO SCALE

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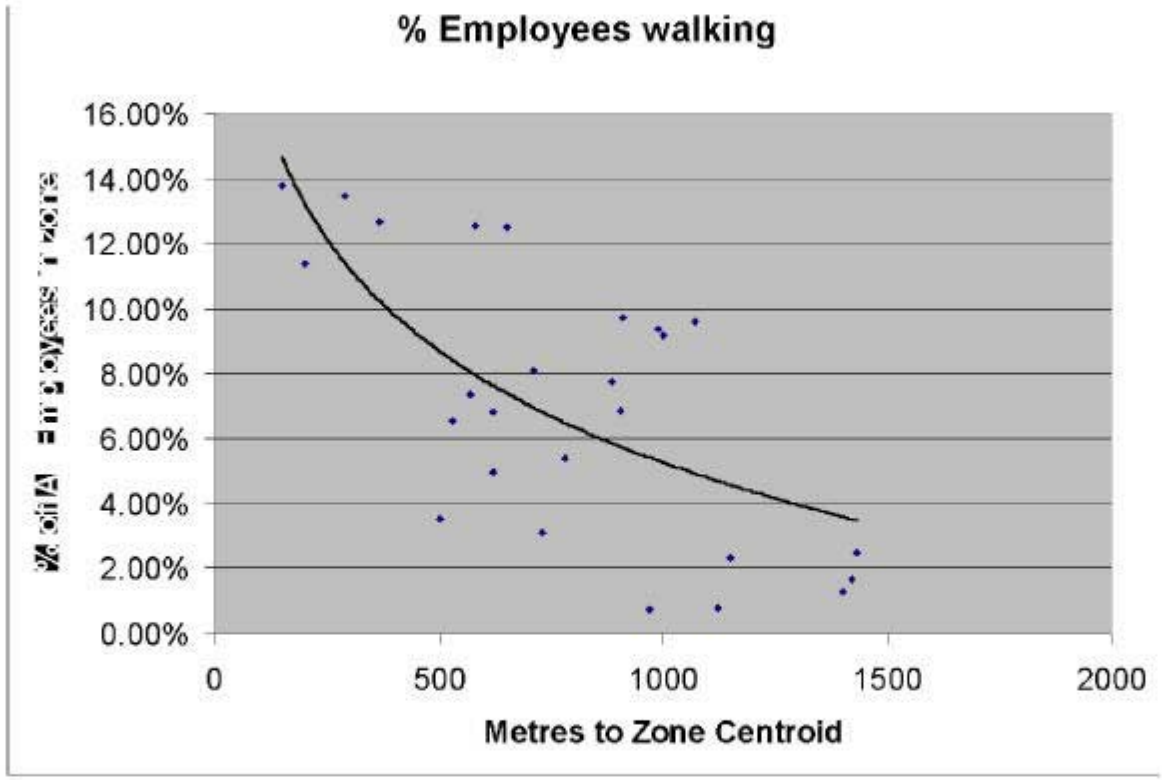
Perth Urban Rail Development Supplementary Master Plan



PERCENTAGES OF EMPLOYEES WALKING

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Figure 9

Perth Urban Rail Development Supplementary Master Plan

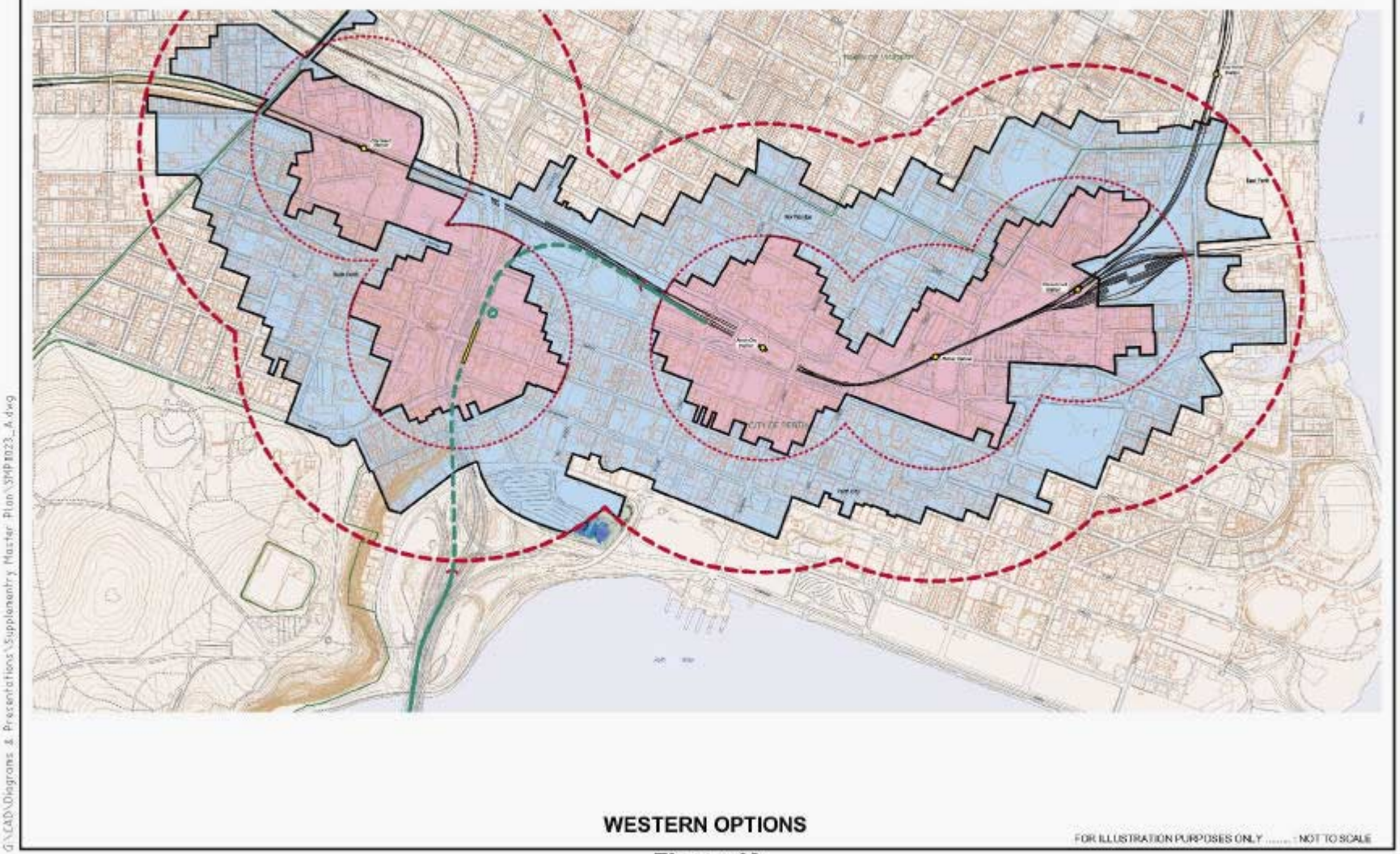

Figure 10

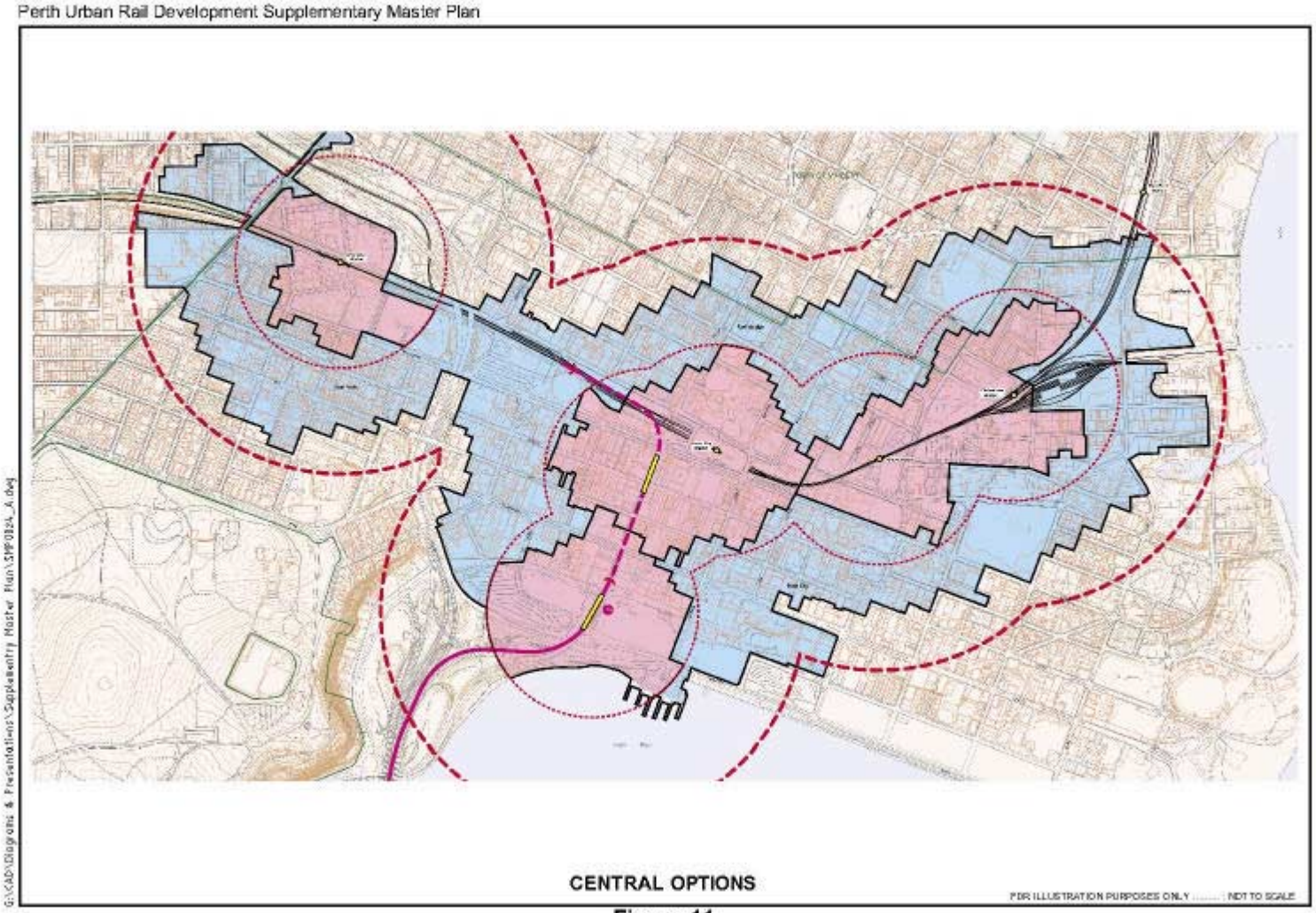
Perth Urban Rail Development Supplementary Master Plan
CENTRAL OPTIONS
FOR ILLUSTRATION PURPOSES ONLY ..... NOT TO SCALE

Figure 11

station for the Perth Exhibition and Convention Centre and for major events on the foreshore (e.g. Skyshow).

The problem of choosing between two alignments, one of which offers a simple engineering solution and another a more complex engineering problem but better access to its market has been faced many times in the history of railway planning.

Accordingly, new platforms will be constructed below ground under the commercial city block bounded by Murray Street Mall, William Street and the north side of Wellington Street to cater for predicted all-day boardings of 27,000 persons. The platforms will connect with the existing platforms of Perth Station by an underground concourse. **Figure 12** There will also be opportunity to connect with adjacent commercial developments as these are developed. Escalators, stairs and lifts will provide access to the platforms from street level and within new commercial development. **Figure 13**.

A station at the Esplanade will be located below the Mounts Bay Road/Esplanade/William Street intersection and cater for a predicted 10,000 all day boardings. Good interchange with the Busport and good pedestrian access to St Georges Terrace can be achieved. **Figure 14**.

4.4. Minimising Rolling Stock Requirements

The number of railcars required for several options were examined. To fully comprehend the requirements because of the dependency of services between different lines, it was necessary to consider the total requirement for the Northern Suburbs, the south-west and Armadale lines.

The requirements were as follows:

- Central route with through running from the SWMR to Northern Suburbs Railway – 164 railcars
- Western route: [3PCC(1)] through running from SWMR to Northern Suburbs Railway with a turnback in Perth Station – 174 railcars

One railcar costs $2.5 Million plus annual fixed and operating costs.

The Western route would have required 10 to 12 additional railcars (i.e. three to four three-car sets) at considerable additional capital and operating costs for no increase in patronage or performance.

4.5. Secondary Benefits

Any transport infrastructure project has the capacity to deliver secondary benefits. With the SWMR these were considered as follows:

4.5.1. Capacity for future traffic growth.

The objective of increasing the public transport share of peak hour trips to the Perth central area will require an increase in train frequency to greater than 16 trains per hour by 2021. The Western route required trains to dead-end and change direction at Perth Station and was thereby limited to a maximum of 16 trains per hour. The Central route gives a secondary benefit of being able to provide increases in capacity to whatever minimum headway the rail operational environment will permit. This is currently 3 minutes, but improvements to track and operating systems are likely to allow this to be reduced over time.

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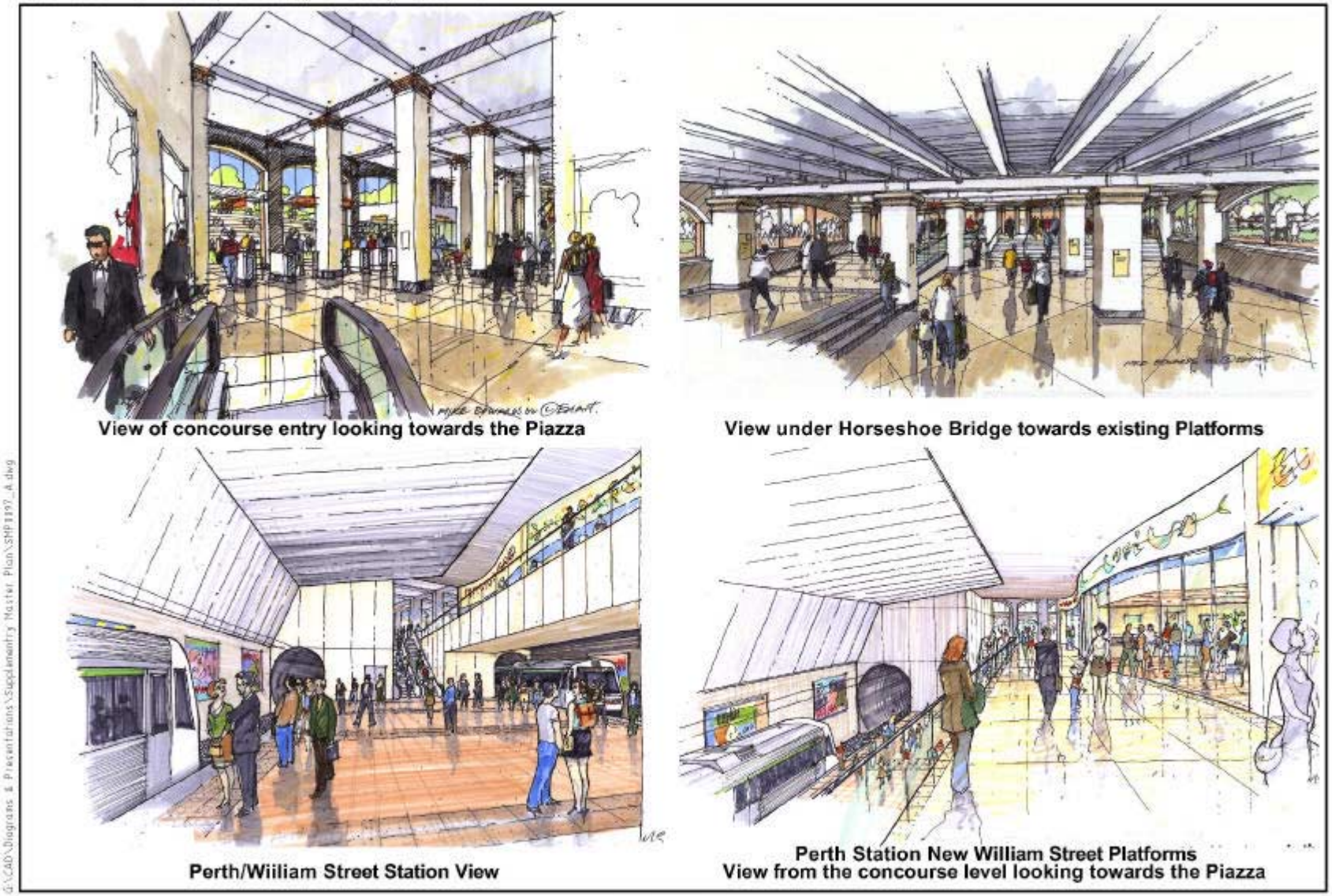

Figure 12

Perth Urban Rail Development Supplementary Master Plan

View of Piazza looking towards Forrest Place

View of William Street looking north across the proposed Piazza

Perth Station - New William Street Platform with existing Fremantle Lines

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Figure 13

Perth Urban Rail Development Supplementary Master Plan

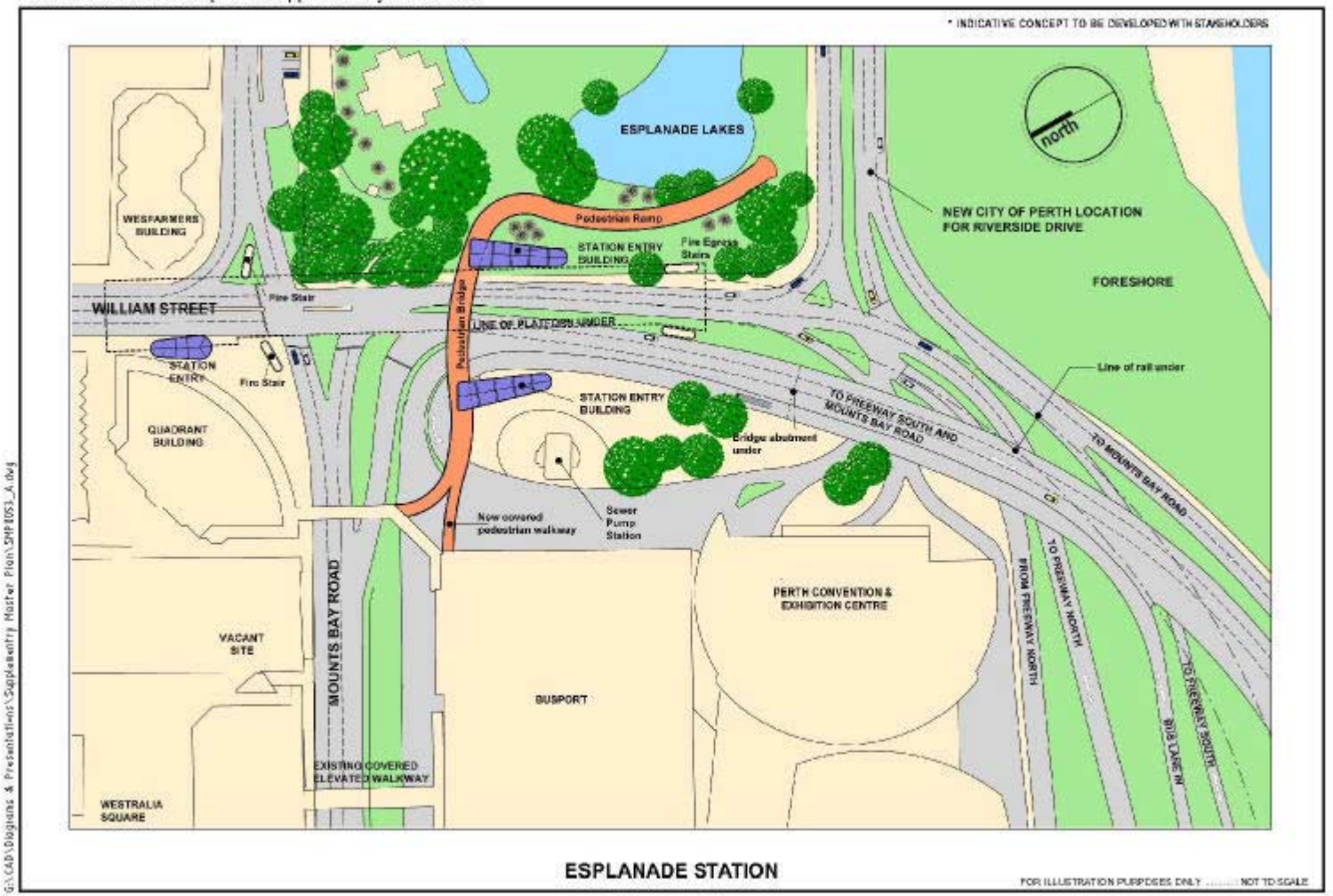


Figure 14

Under the Kenwick Route, train frequency would have been constrained because of the need to integrate SWMR services with Armadale services.

4.5.2. Economic Development

It has been estimated that over the 25 years to 2031 the SWMR will encourage an additional $210 Million dollars worth of development within the central business district of Perth (PCRAC, March 2002).

4.5.3. City Building

The construction of the SWMR through the Perth CBD:

- Provides and opportunity to remove the William Street Bridge over Riverside Drive and realignment of Riverside Drive to provide a significant increase in the area of foreshore parkland. **Figures 15, 16, 17 and 18**;
- makes possible connection of the City and Northbridge by providing the opportunity to lower the Fremantle railway line through Northbridge below ground level at an affordable cost; **Figures 19 and 20**
- encourages redevelopment of the William Street - Wellington Street precinct from Murray Street to the Mitchell Freeway, including creation of opportunities to return development benefits to the state from currently under-utilised Crown land and land that may have to be acquired for railway purposes.

The PURD Project Budget does not contain funds for these works, however the Government will work with the City of Perth and developers to examine the potential for non State Government funding for these works.

With respect to the removal of the William Street overpass over Riverside Drive, construction of replacement road links in conjunction with the rail tunnel will significantly reduce costs and avoid the additional disruption arising from removal of the overpass at a later time.

In deciding the issues through Northbridge it is possible to lower the Fremantle line at any time after trains begin operating through the city from the Northern Suburbs to the south-west. A crucial decision in constructing the route through Perth is whether to build the portal at Lake Street (which is funded) or to extend the undergrounding by 220 metres to a portal just west of Milligan Street.

Fixing the portal location is most crucial. If, for example, it is fixed at Lake Street, it would be extremely difficult to extend undergrounding to Milligan Street later.

Alternatively, for the expenditure of an additional $9 Million to $10 Million, the portal for the SWMR could be located at Milligan Street from the outset. This would leave a shortfall in the order of $30 Million to lower the Fremantle line, which could be done at any time after trains begin operating through the tunnel.

4.6. Funding the Scope of Works

The PCRAC found that the total cost of the civil and track infrastructure was $195.5 Million.

Of the above figure the track and railway infrastructure estimate will be $15.7 Million.

Project Management and Engineering will be sourced from the overall project budget allocated for this purpose.

4.7. Project Management

There are a wide number of issues regarding redevelopment of land associated with lowering the railway through Perth.

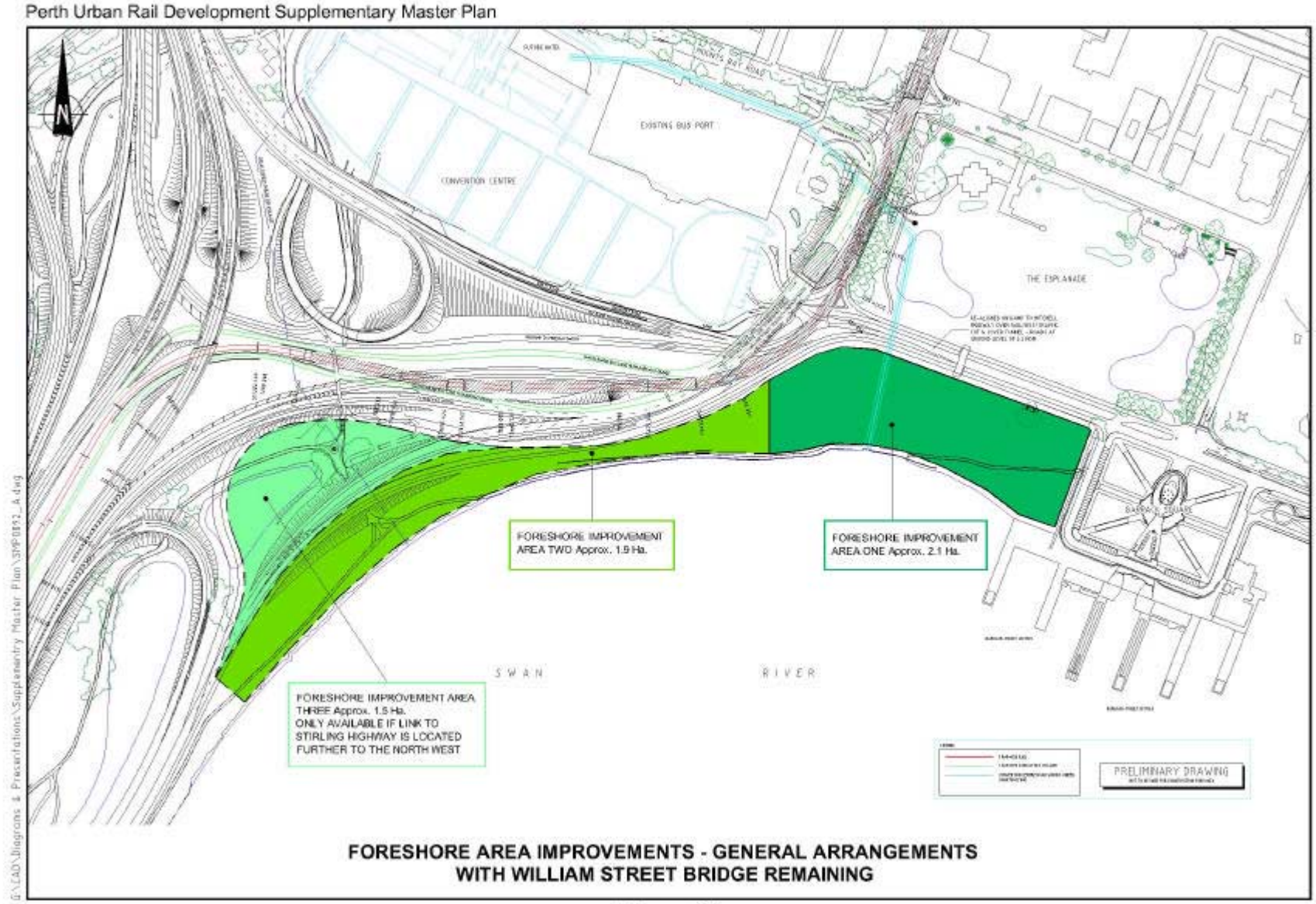
The main station location in William Street needs to be protected and development control established.

The Wellington Street/Roe Street area west of the Horseshoe Bridge requires comprehensive planning to develop the economic and civic benefits envisaged by lowering the railway.

It is therefore recommended that:

(a) Development control be effected over the Wellington and William Street land as a matter of urgency.

(b) A Committee be established to coordinate project delivery, property development, planning and design and a funding model to service the initiatives required.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PRELIMINARY DRAWING
FORESHORE AREA IMPROVEMENTS - GENERAL ARRANGEMENTS
WITH WILLIAM STREET BRIDGE REMAINING

Figure 15

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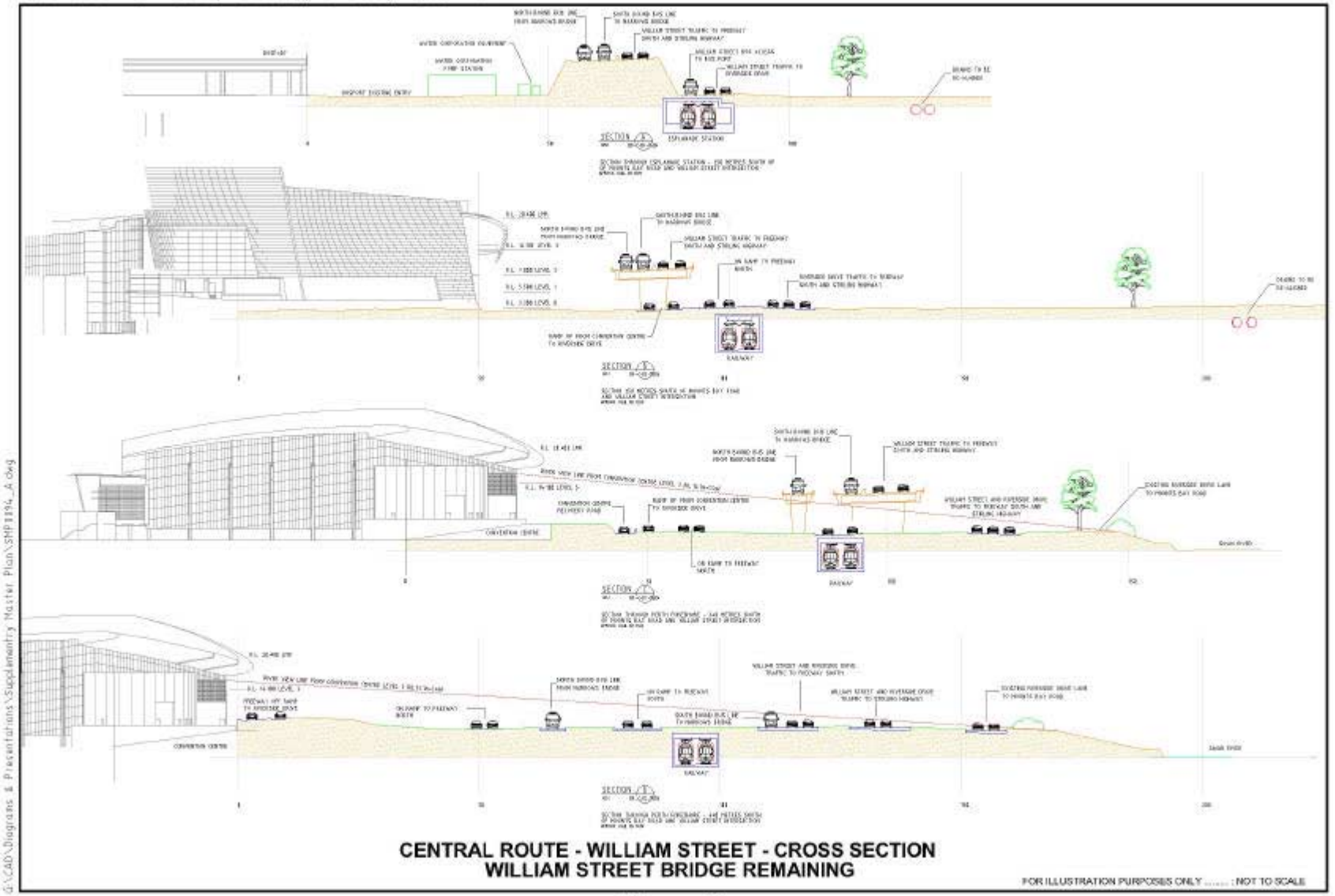
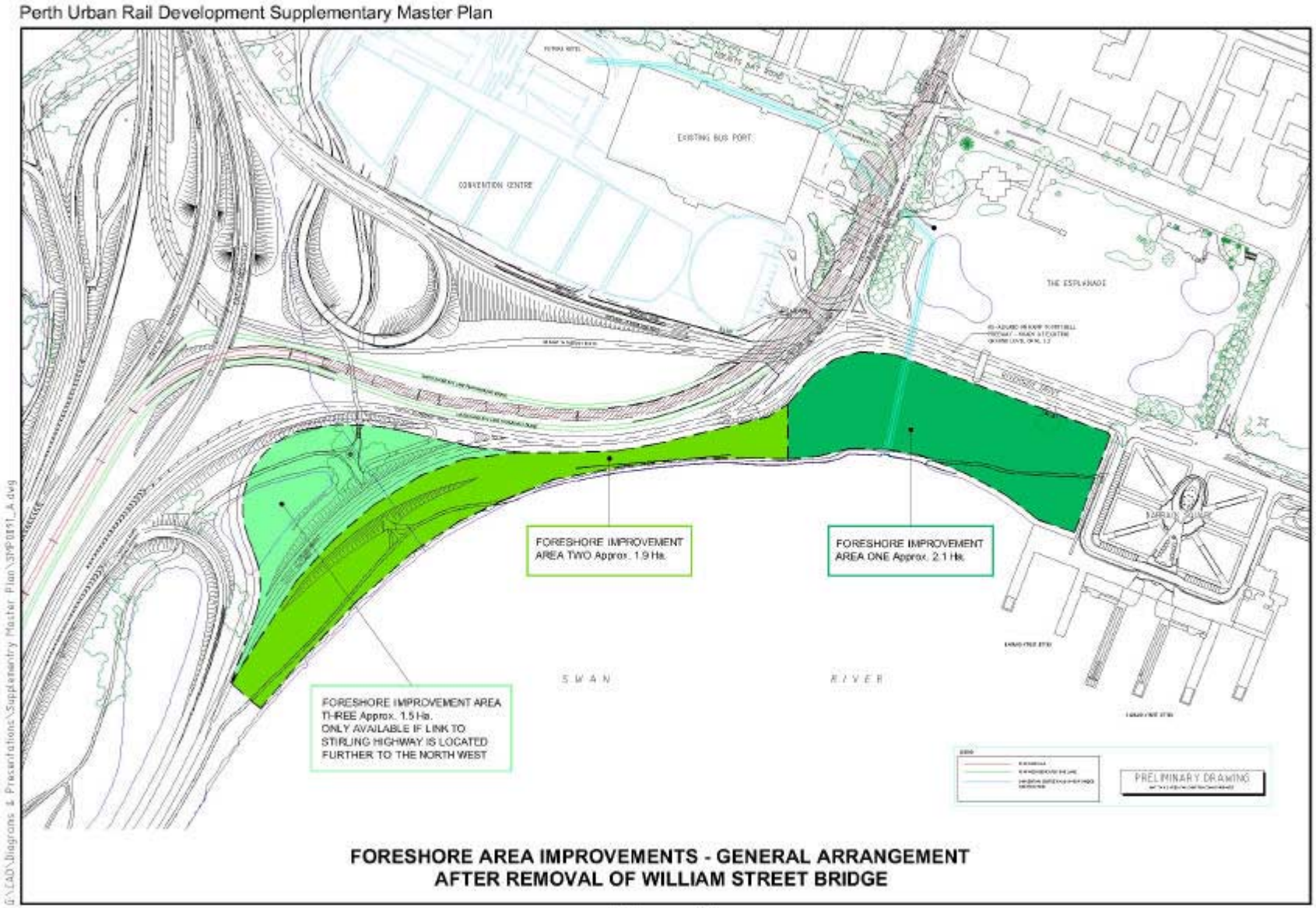


Figure 16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SWAN
RIVER
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FORESHORE AREA IMPROVEMENTS - GENERAL ARRANGEMENT
AFTER REMOVAL OF WILLIAM STREET BRIDGE

Figure 17

Perth Urban Rail Development Supplementary Master Plan

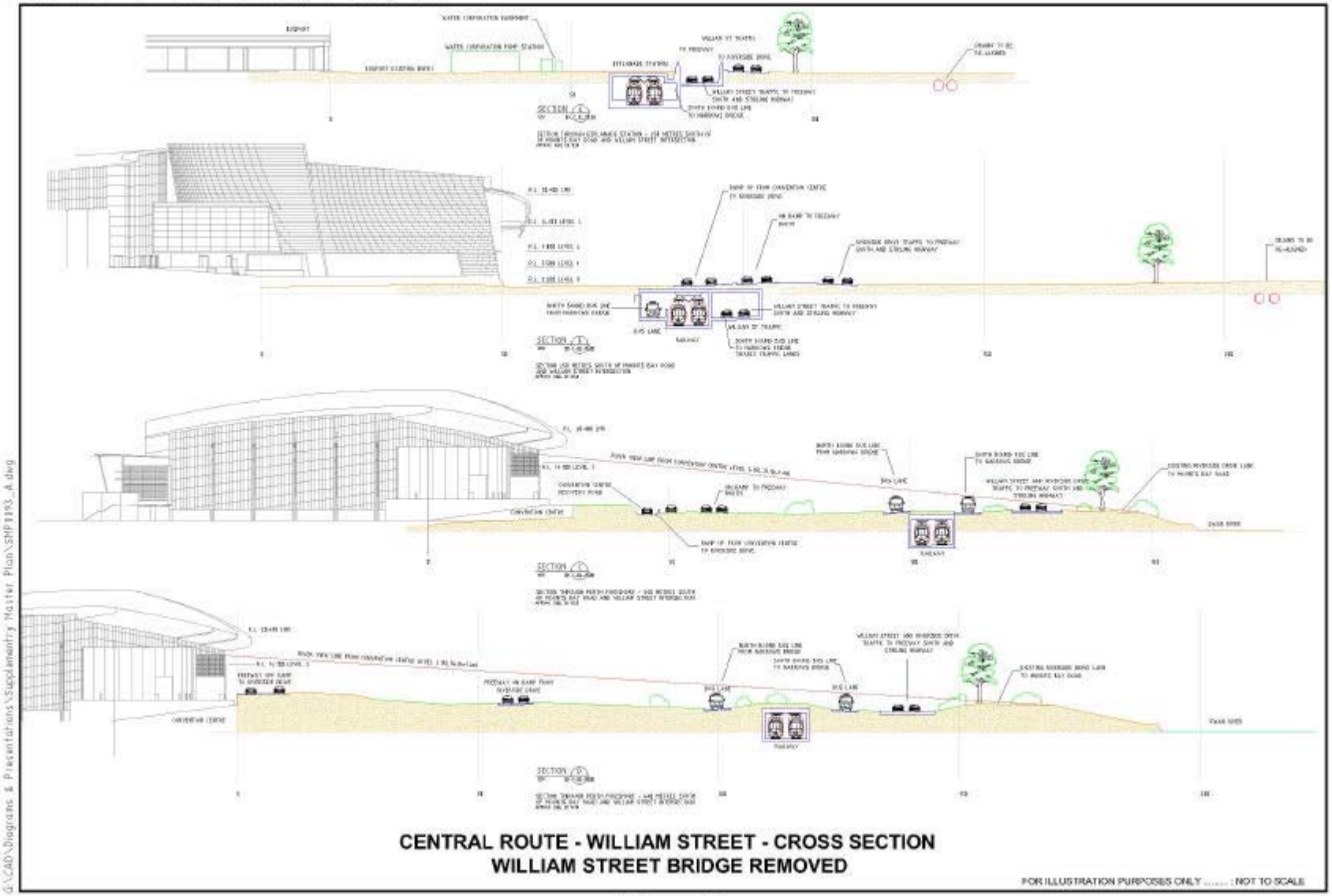

Figure 18

Perth Urban Rail Development Supplementary Master Plan

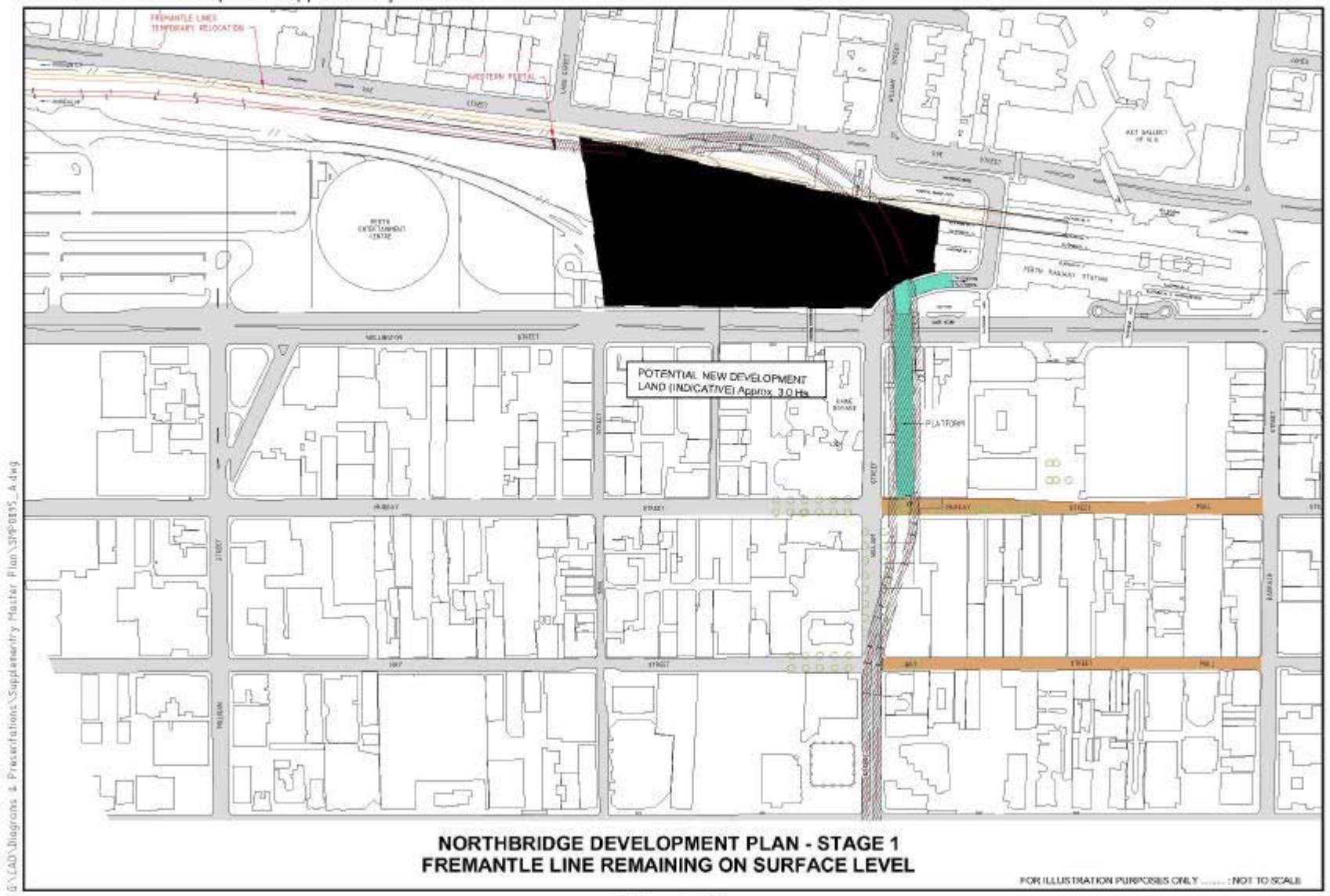

Figure 19

Perth Urban Rail Development Supplementary Master Plan

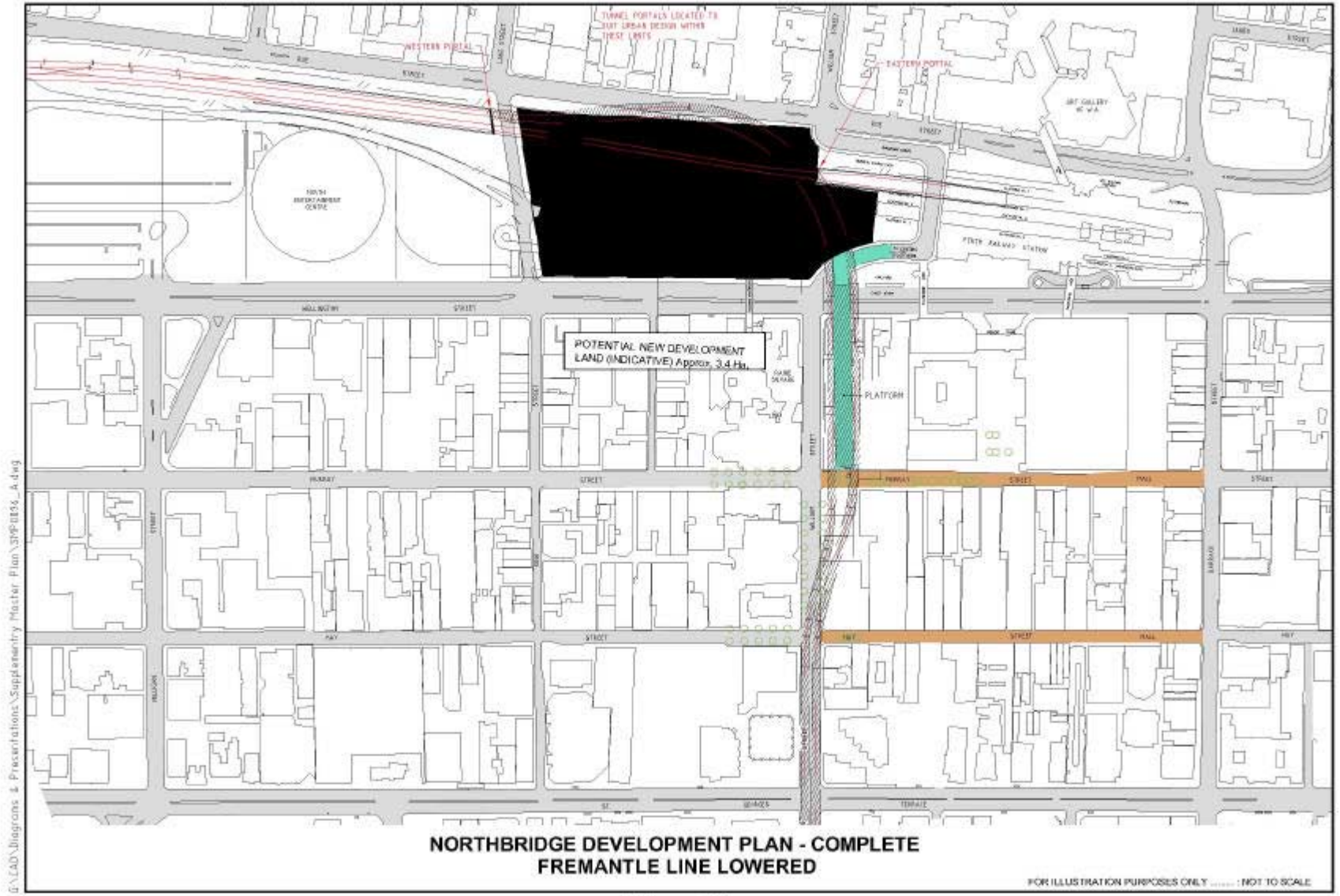

Figure 20

5. Suburban Stations

5.1. Introduction

It is anticipated that walking, cycling and bus use can be significantly increased in new suburbs designed in accordance with *Liveable Neighbourhood* principles *(WAPC, June 2000).*

However a number of stations are to be built in existing suburbs and their design must respond to the existing circumstances. South Perth, Canning Bridge, Leach Highway and South Street (Murdoch) stations were examined in detail to determine what changes were required to ensure that pedestrian access to the proposed stations was facilitated and secondary benefits maximised.

5.2. Planning and Design

Planning and concept design of transit station sites on the route considered four main objectives:

- to identify the function of the transit station;
- to quantify the function(s);
- define the precise land requirement and location;
- to identify and estimate costs to the level of accuracy required for the Master Plan.

These objectives were achieved through:

- preparation of patronage projections;
- analysis of catchment size and modes of access to the stations;
- briefing stakeholders of the requirements;
- stakeholder consensus, with local government and others;
- concept development;
- planning and design.

Stations are considered as origins or destinations depending upon their function in the morning peak period. Some stations combine both functions and some stations may develop those characteristics over time as the adjoining town centre develops and grows.

In summary, the specific details addressed at each site included:

- town planning;
- forecast patronage and extent of each modal component;
- transit station function;
- bus feeder services;
- road traffic access to the site and internal circulation;
- parking configuration including disabled, short term, taxi and motor cycle bays;
- pedestrian and bicycle facilities;
- platform configuration;
- station building requirements;
- additional special site specific requirements.

5.3. Rail Station Locations

Table 5.3 shows the location of all the stations on the Direct Route to Mandurah as well as at Thornlie.

The stations are classified under the following functions:

- Major city destination: self explanatory
- Major transit interchange: accommodation for bus feeders, park & ride, set down and pick-up, walking, cycling
- Minor-bus interchange: refers to Canning Bridge and includes pedestrian accessibility
- Future station: station will not be built as part of this project but allowance has been made in the planning for the future

The construction of Leda railway Station requires to be examined with regard to patronage demand in the catchment. Timing of its construction will be negotiated with the developer. For this reason, patronage figures for Leda Station under the Direct Route have not been included in **Table 5.3**.

Table 5.3

Rail Station Location, Function, Patronage and Parking

Transit Station	km from Perth	Function	Weekday Boardings	Car Parking
Perth (William Street)	0	Major city destination	27,000	Nil
Esplanade	0.6	Major city destination	10,000	Nil
Canning Bridge	9.4	Minor bus interchange	970	Nil
Leach Highway	13.8	Major transit interchange	3,110	700
South Street (Murdoch)	16.0	Major transit interchange	4,980	930
South Lake	21.0	Future station	-	-
Thomsons Lake (a)	22.6	Major transit interchange	5,460	400*
Success	26.1	Future station	-	-
Mandogalup	29.0	Future station	-	-
Anketell Road	32.1	Future station	-	-
Thomas Road	35.1	Major transit interchange	2,560	600
Leda (b)	39.3	Future station	-	-
Rockingham	45.4	Major transit interchange	2,320	700
Waikiki	49.7	Major transit interchange	2,060	700
Stakehill	56.2	Future station	-	-
Karnup	62.0	Future station	-	-
Lakelands	66.6	Future station	-	-
Gordon Road	71.2	Future station	-	-
Mandurah Terminus	73.1	Major transit interchange	3,490	850
Thornlie	17.0	Major transit interchange	3,500	450

(a) Thomsons Lake: The option to provide an additional 600 bays is under serious consideration and

(b) Leda: Timing of construction will be negotiated with the developer

5.4. South Perth

The idea for a station at South Perth arose from the community consultative process and as a result, the case was examined.

With respect to trips originating from the area, South Perth is well served by the existing bus services. There is better than a 10 minute service in the morning peak along Labouchere Road from Thelma Street. There is also a 15 minute service at peak times along the general route of Mill Point Road, Labouchere Road, Angelo Street, Coode Street, Hensman Street and South Terrace across Canning Highway. There is a 20 minute ferry service at peak times from Mends Street jetty to Barrack Street jetty. A considerable effort and expenditure has been put into the Travelsmart program and this has enhanced the effectiveness of the public transport system in the area.

A rail station at South Perth could create opportunities for land use intensification. A station entry located as close as possible to Lyall Street would give strong support to the Mends Street – Lyall Street axis. It would also provide access to one of the major recreational activity attractions in Perth, namely the zoo which attracts more than 500,000 visitors per annum.

However, the projected patronage for this station in 2006 is low, because the existing public transport services (bus and ferry) are attractive, providing high frequency services at peak times. The scope for car parking is very limited. Therefore on this basis and on cost, relative to other stations along the route South Perth station cannot be justified at this time.

However, it is recognised that with increasing densities and expansion of commercial precincts a station at South Perth could be justified in the future. It is possible to construct a station in the future and this option could be kept open through the protection of adequate land in the vicinity of the proposed station site. The City of South Perth should consider establishing development controls to protect the option of a future station.

5.5. Canning Bridge Station

The Canning Bridge station is located within the City of South Perth, directly under the Canning Highway Bridge over the Kwinana Freeway.

The location is highly valued as a transfer point, being at the confluence of the railway and major east-west bus routes. In this respect, it is well suited to a high quality bus connector service to Curtin University. However, the site for the rail station is highly constrained in a relatively narrow portion of the Kwinana Freeway reserve, which limits opportunities for associated urban development in close proximity to the station area.

The ‘pedshed’ and intersection analyses indicate that the traditional grid pattern and higher number of ‘four-way’ intersections in the Como area provide relatively high pedestrian access to the proposed Canning Bridge rail station.

The Canning Bridge station area should seek to serve the commercial activities to the west (Applecross commercial strip along Canning Highway) and to the east (Como). These areas should be recognised for their importance in developing the station area.

Proximity to the river and Canning Highway offers potential for redevelopment and facilitating more retail/office/commercial uses in the vicinity of the rail station precinct. Commuter rail patronage appears to be most dependent on employment density increase. There is potential to redevelop the Raffles site provided that heritage and environmental concerns can be properly addressed.

There is insufficient land available to provide any significant park & ride capacity also, the site constraints preclude a formalised facility for commuters to be set down or picked up by private cars.

The projected patronage for year 2006 is 970 boardings per day but there is the potential for greater patronage if redevelopment of the Raffles site occurs and public transport links to Curtin University are fully developed.

The platforms will be raised to suit rail and some additional vertical access provided to that already used for the buses. The station will be for walk-on and bus interchange only. No park & ride facilities are proposed at this stage. **Figure 21**.

5.6. Leach Highway

Leach Highway station will be located on the south side of the Leach Highway overpass over the Kwinana Freeway.

The majority of land within the station precinct is residential and in private ownership. There are limited redevelopment opportunities, particularly for higher residential densities and commercial uses. The redevelopment opportunities are restricted by the proximity of the Canning River, the reserve required for the provision of the transport infrastructure and the surrounding parklands (including Bush Forever site). Residential lots backing Leach Highway and Kwinana Freeway restrict the opportunities for improvement of pedestrian access to the station.

The walkable catchment could easily be extended by provision of additional pedestrian links to the station from the south-eastern quadrant (connection from Clifford Way and penetration of the Air Force Memorial Estate Aged people home); from Noalimba Accommodation/Conference Centre (south-western quadrant) and from Leach Highway further north to connect with Pulo Road. The additional pedestrian connections would result in approximately 15% extension of the actual ten minutes walkable catchment so that 33% of the total 'pedshed' would be within a ten minute walk of the station precinct.

There is considerable pedestrian flow to local schools (All Saints College and Rossmoyne High School) to the east of the station but the existing pedestrian facilities along Leach Highway would need to be upgraded particularly for children.

The station will be a major transit interchange with facilities for bus-rail interchange, parking for 700 cars private, car set down/pick up and walk on / bicycle facilities. It will have an island platform. The carpark will be located in the south-west quadrant of the interchange on the west side of the freeway between the off-ramp to Leach Highway and the northbound carriageway. Access to the platform will be by a bridge and the bus concourse elevated will be over the freeway carriageways. **Figure 22**. The projected patronage for year 2006 is 3,100 boardings per day.

5.7. South Street (Murdoch)

The site for the South Street station is surrounded by existing development of a form that minimises legibility and connectivity to the station. The conventional street pattern in Bull Creek, Leeming and Bateman has a low proportion of interconnected streets. The street pattern is dominated by 'Tee' junctions and cul-de-sac streets. The existing developments occurred on the basis that the location was a freeway interchange and as a result generally backs on to the site with very few opportunities to make local connections. The major retail/commercial activities are concentrated within the Bull Creek Shopping Centre. The area is predominantly residential and does not offer a diversity of housing options. The station, however, is located close to major activity and employment attractors: Murdoch University and St John of God Hospital.

As this will be a major transit interchange station there will be minimum opportunity for intensification and redevelopment of land within the station precinct as most of the space will be used for transport requirements.

The South Street station has the opportunity to integrate and service major activity attractors and employment generators in close proximity to its precinct: Murdoch University and St John of God Hospital. Over time there will be opportunities to consolidate commercial activity on South Street (Bull Creek Shopping Centre) and the station.

The site context analysis identified vacant and under-utilised State Government owned land immediately adjacent to the hospital site (south-eastern quadrant) that is highly desirable for the development of land uses to intensify and complement the existing educational and public purpose uses. Other land uses likely to attract activities and employment could also be considered for that site.

There is the opportunity to locate a public building (community hall, etc) within the station precinct and integrated with the car parking area. This additional activity could help to improve the attractiveness of the station area.

Murdoch University, the Shopping Centre and the surrounding colleges (both north-west and south-east) all have strong pedestrian usage. Currently, there appears to be a good level of pedestrian activity, but the existing pedestrian facilities are not ideal. Because it is a major regional road that carries high traffic volumes, provisions for safe pedestrian movements along South Street should be of primary consideration (e.g. street trees, pathways and lighting). Similar improvements should be considered for all streets within the station precinct rated as 'poor' and 'average' by the SAFE street assessment. The walkable catchment (800 metre radius) could be extended by approximately 12% through the provision of additional pedestrian links to the station from the south-eastern quadrant (Beckley Circuit), from the existing pedestrian access close to Eyre Close (north-eastern quadrant) and Goyder Place (north-western quadrant).

The Circle Bus route will continue to call at this station.

The projected patronage for 2006 is 4,980 boardings per day. This will also be a major transit interchange with bus interchange as a priority. Parking for 925 cars will be provided in the south-west quadrant of the interchange on the west side of the freeway, between the off-ramp to South Street and the northbound carriageway, to meet the forecast demand. The station will have an island platform configuration located

in the freeway median. Access to the platform will be by a bridge and a bus concourse will be elevated over the freeway carriageways. **Figure 23**

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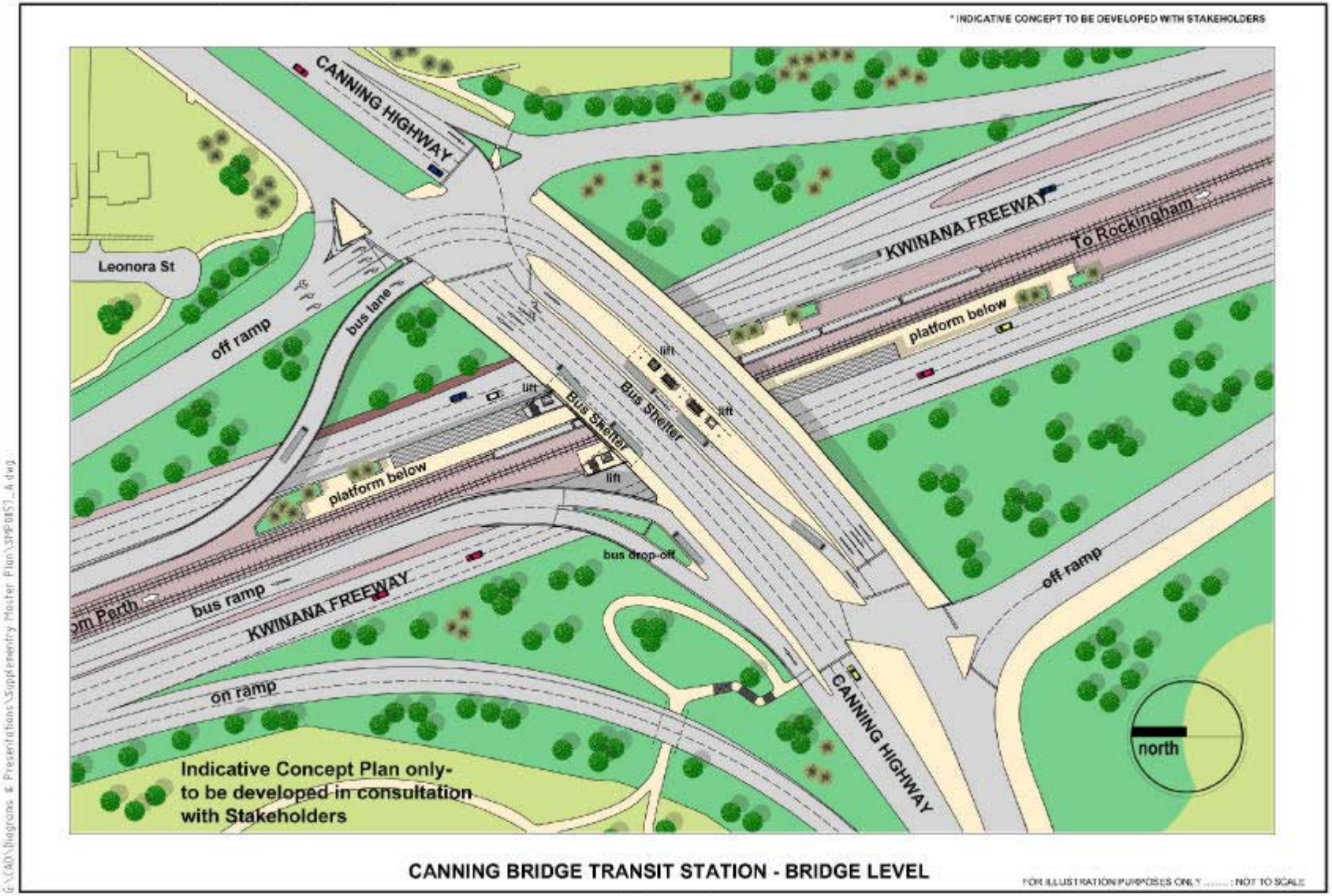

Figure 21

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Figure 22

Perth Urban Rail Development Supplementary Master Plan

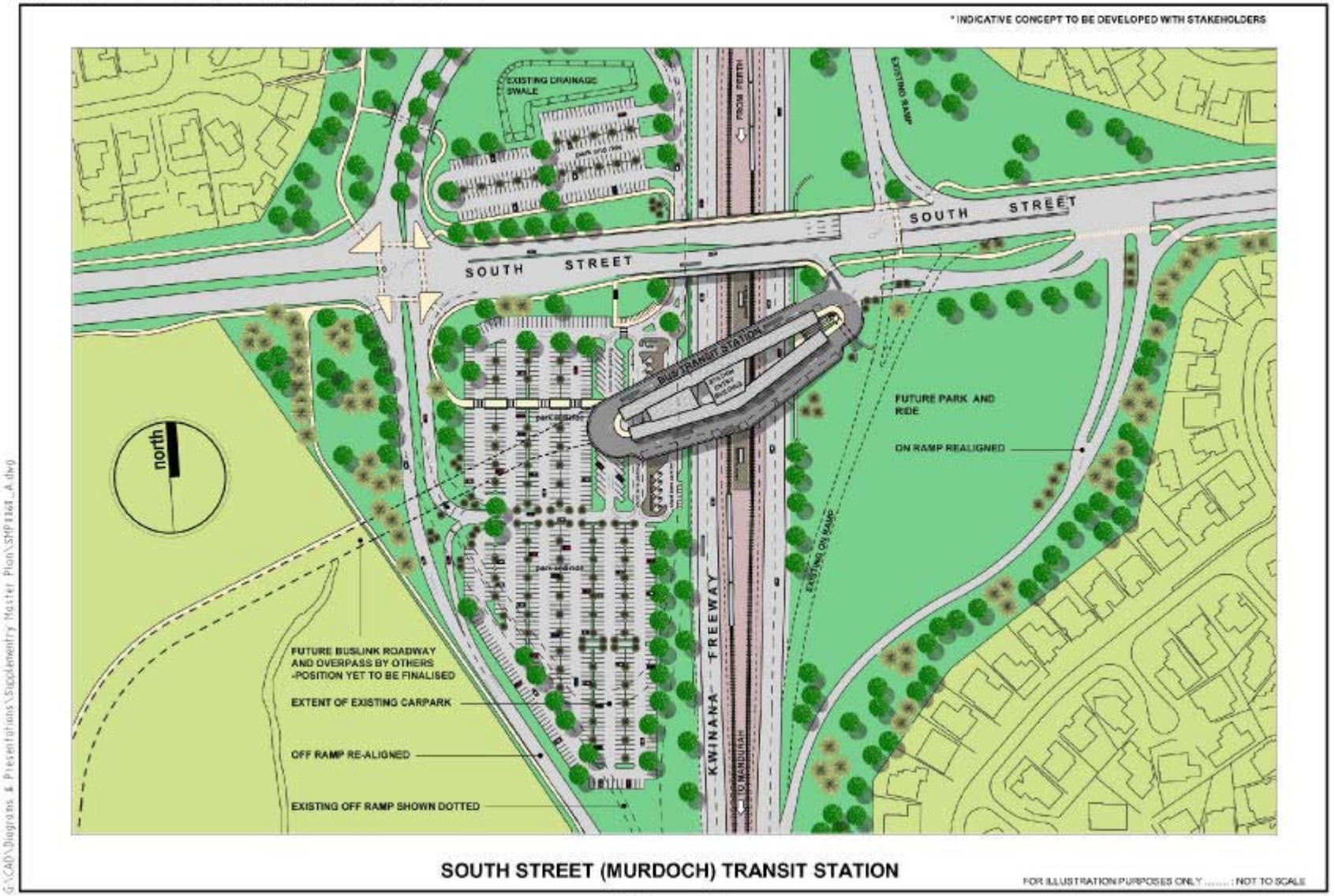

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Figure 23

5.8. South Lake

The surrounding area has been partly developed to the north and north-east of the site. Further urban development will be to the west and the south of the station site as part of the Thomsons Lake regional structure plan is implemented. Strategic planning for the area south of the site as part of the Thomsons Lake regional structure plan points to an increased longer term demand as major urban development occurs, at which time the need for the station should be reviewed.

The case for South Lake station is made in the original SWMR Master Plan. However construction will be deferred at present. The land for the station precinct on the south-west quadrant of the Kwinana Freeway/Berrigan Drive intersection will be protected.

The South Lake station site is less than 2 kilometres north of Thomsons Lake.

5.9. Thomsons Lake

The station with its associated bus and car infrastructure has been designed and planned in conjunction with the planning of Cockburn Central to integrate fully with the proposed town centre. The current station planning assumes that the essential infrastructure (earthworks, roads and services) will be sufficiently completed as part of the town centre development in time to facilitate station construction commencing in mid 2005.

Thomsons Lake station is sited immediately north of the Beeliar Drive/Kwinana Freeway Interchange. The projected patronage for year 2006 is 5,460 boardings per day. It will be a major transit interchange station and the bus-rail interchange will be integrated into the proposed Cockburn Central town centre on the west side of the Freeway. **Figure 24**.

Parking has been limited to 400 bays by agreement with the planners of the proposed town centre. This is to reduce the amount of town centre land required for transport parking purposes. The station will have an island platform in the freeway median with the entry building and associated forecourt facilities connecting with the platform by an elevated walkway over the freeway northbound carriageway.

A primary function of South Lake station was to provide for the park & ride arising from the limit on parking at Thomsons Lake.

Because of this, and in conjunction with the City of Cockburn, plans have been developed for parking an additional 600 cars at Thomsons Lake. This is on the eastern side of the Freeway, bounded by the Freeway, Beeliar Drive and Knock Place and connected with the station platform by a footbridge. **See Figure 25.** Ways of funding this parking from within the PURD Budget are being examined.

5.10. Thomas Road

Thomas Road station is located on the south side of Thomas Road, west of the Kwinana Freeway extension and Johnson Road. It is on the boundary of the localities of Parmelia and Casuarina. The surrounding area is undeveloped, although residential development is planned around the transit station site to join the existing residential areas of Orelia and Parmelia to the west and south-west.

Road access to the site is planned both from Thomas Road and a new local feeder road to be built as part of the residential development.

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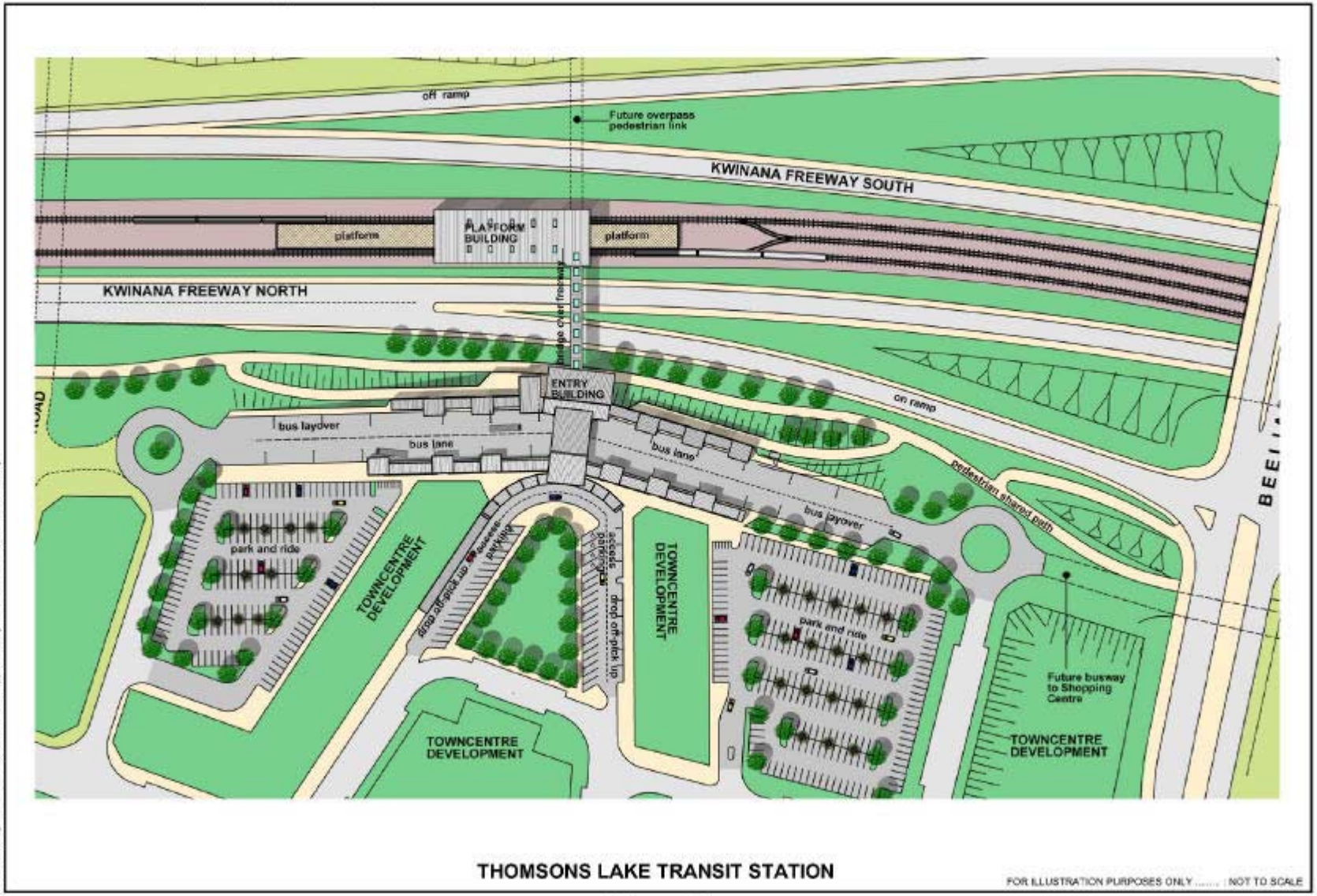

Figure 24

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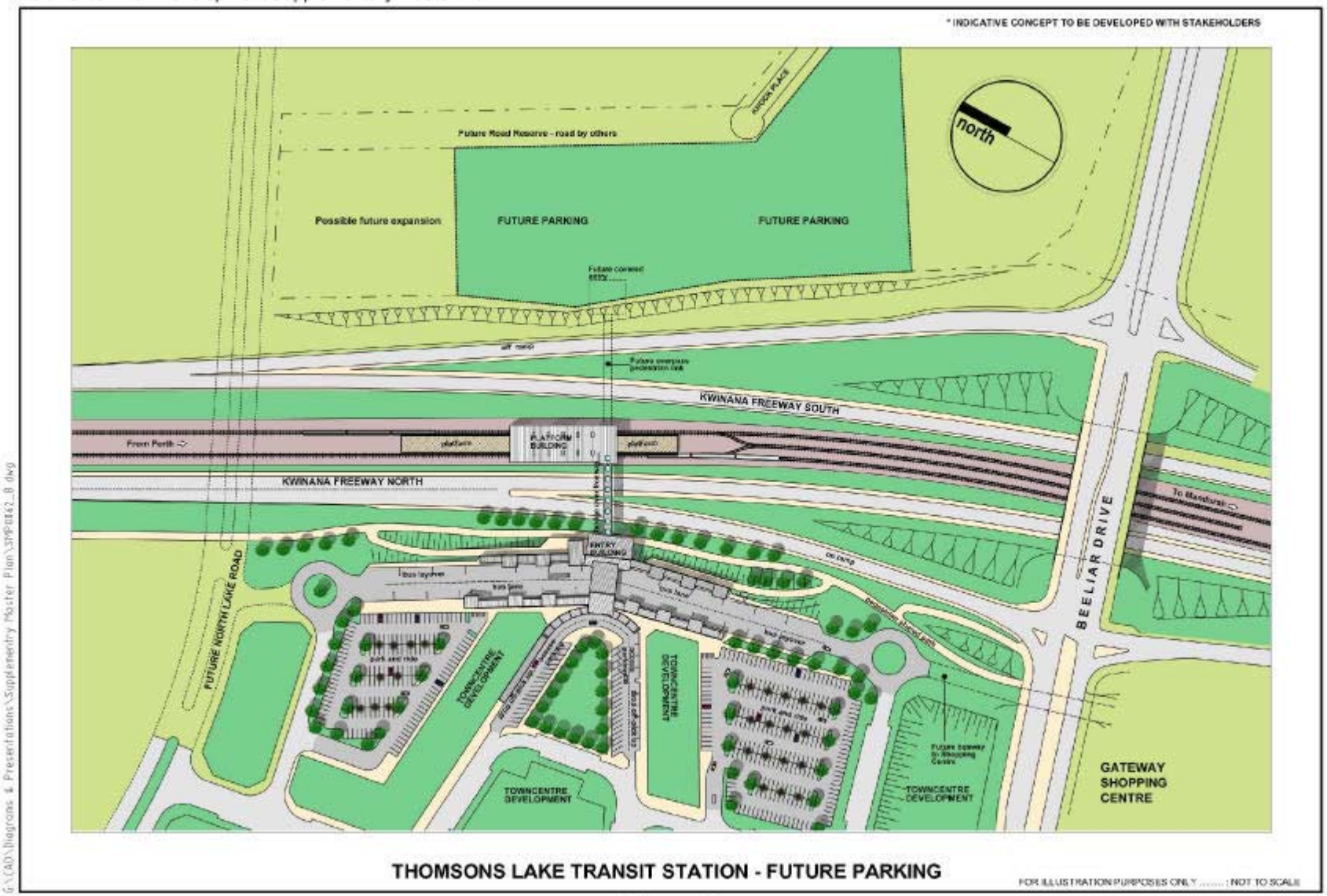

Figure 25

The projected patronage for year 2006 is 2,560 boardings per day. There will be a major transit interchange. Parking for 600 cars will be provided to meet forecast demand. **Figure 26.** The station will have side platforms in a cutting with the entrance building bridging the tracks and connecting both sides of the site.

5.11. Leda

When the original SWMR Master Plan was under preparation it was anticipated that substantial development would have occurred at Leda by 2006. In addition, as the suburb is to be designed in accordance with the *Liveable Neighbourhoods* concept, access by non-motorised modes was to be maximised. Therefore the design of the station precinct limits car parking to enable more residential development closer to the station. The surrounding urban design facilitates walking and cycling access.

Recent forecasts for the development of Leda by Landstart propose 100 lots in 2005-2006 and 150 lots in 2006-2007 giving 250 lots or about 800 people by 2007. A station with low patronage in an undeveloped area increases the risk to security of property and people.

In summary, funding for Leda Station has been allowed but timing of its construction has to be examined with regard to a viable patronage from the potential catchment and will be negotiated with the developer.

5.12. Rockingham

Concomitant with the change in the railway route between Jandakot and Perth, there has been a major change in the route through Rockingham. The former 'Rockingham Loop' and 'Eastern Bypass' have been replaced as shown in **Figure 27**.

The major transit interchange station at Rockingham will now be situated at the intersection of Ennis Avenue and Garden Island Highway/ Rae Road.

The four adjoining quadrants are completely built out to a low density urban residential form. Further development of ways to maximise walk on/cycling access from this potentially good catchment is required.

Over 85% of this patronage will arrive at the station by either car or bus and the station facilities will be designed accordingly. The final concept is shown in **Figure 28**.

The creation of a Rockingham City Centre Transit Service will enhance the opportunity for Rockingham station to integrate with the town centre, the regional educational facilities and the foreshore area. In addition the station provides for the integration of the Rockingham to Fremantle transit bus services. There is an ongoing study of a Rockingham City Centre Transit service.

The projected patronage for year 2006 is 2,320 boardings per day. Parking will be provided for 700 cars. Car set down and pick up facilities will also be provided.

5.13. Waikiki

Waikiki station location remains as previously proposed in the SWMR Master Plan. The projected boardings for year 2006 is 2,060 boardings per day. The requirement for double track the whole way to Mandurah has required changes to the site layout. The station will be

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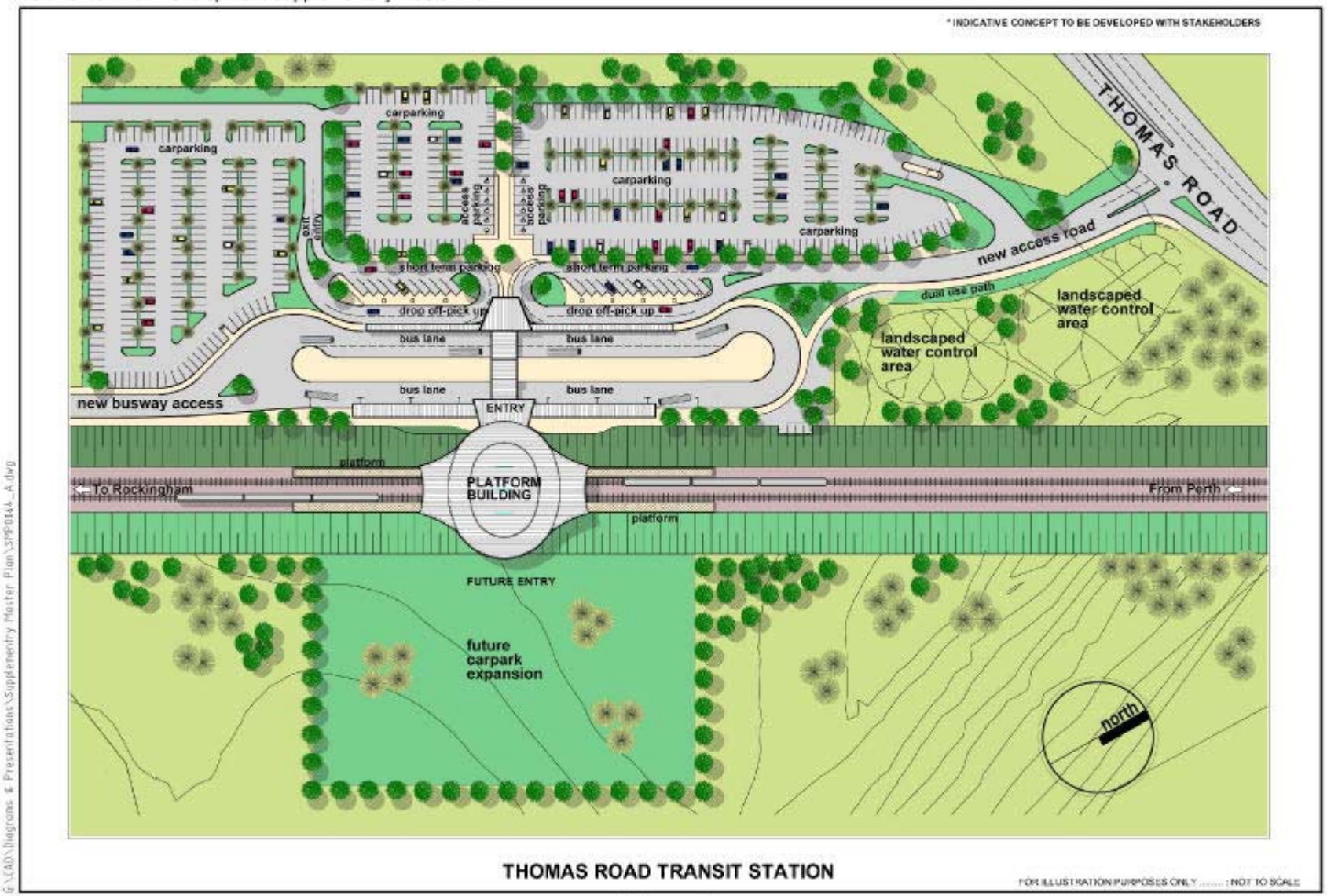

Figure 26

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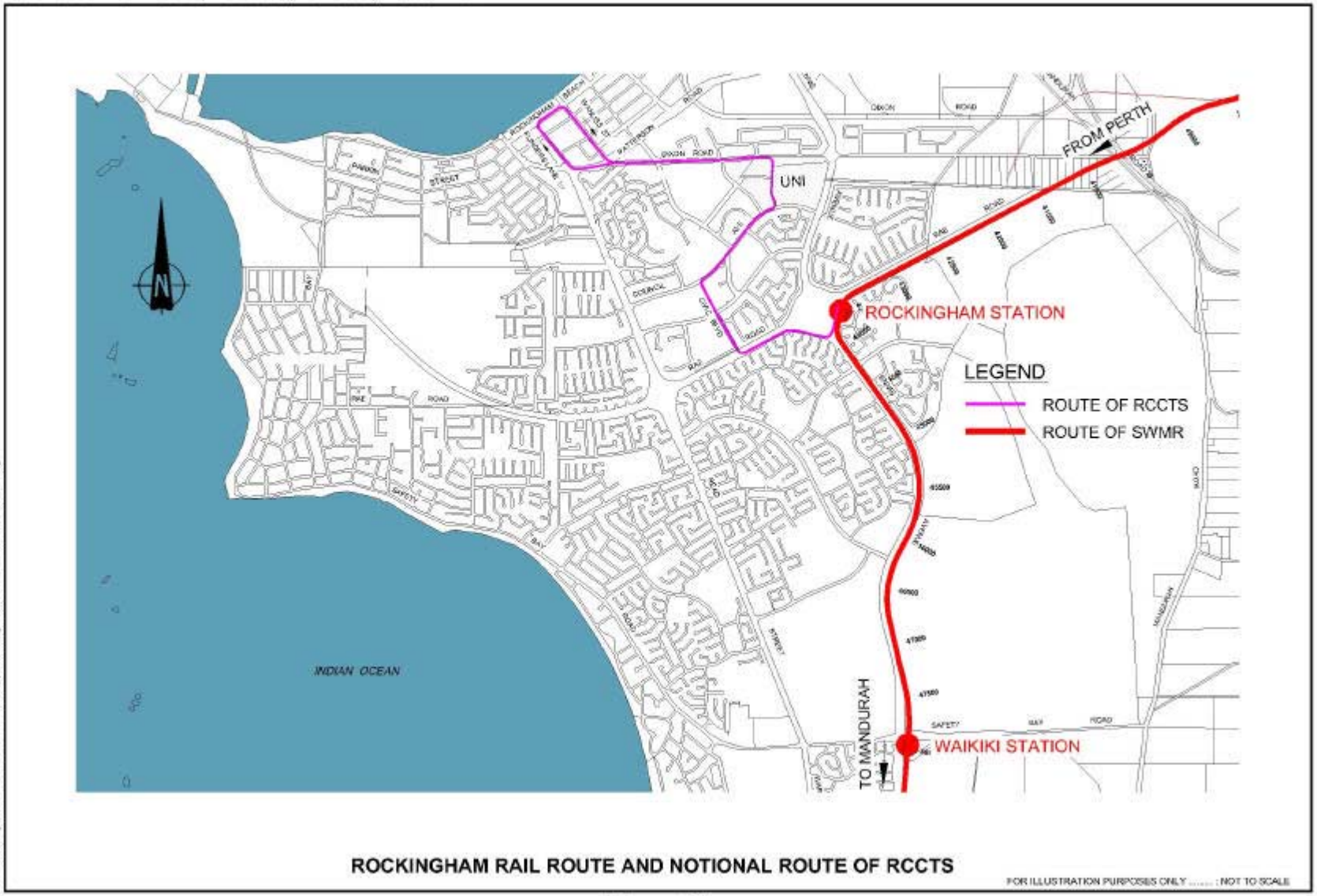

Figure 27

Perth Urban Rail Development Supplementary Master Plan

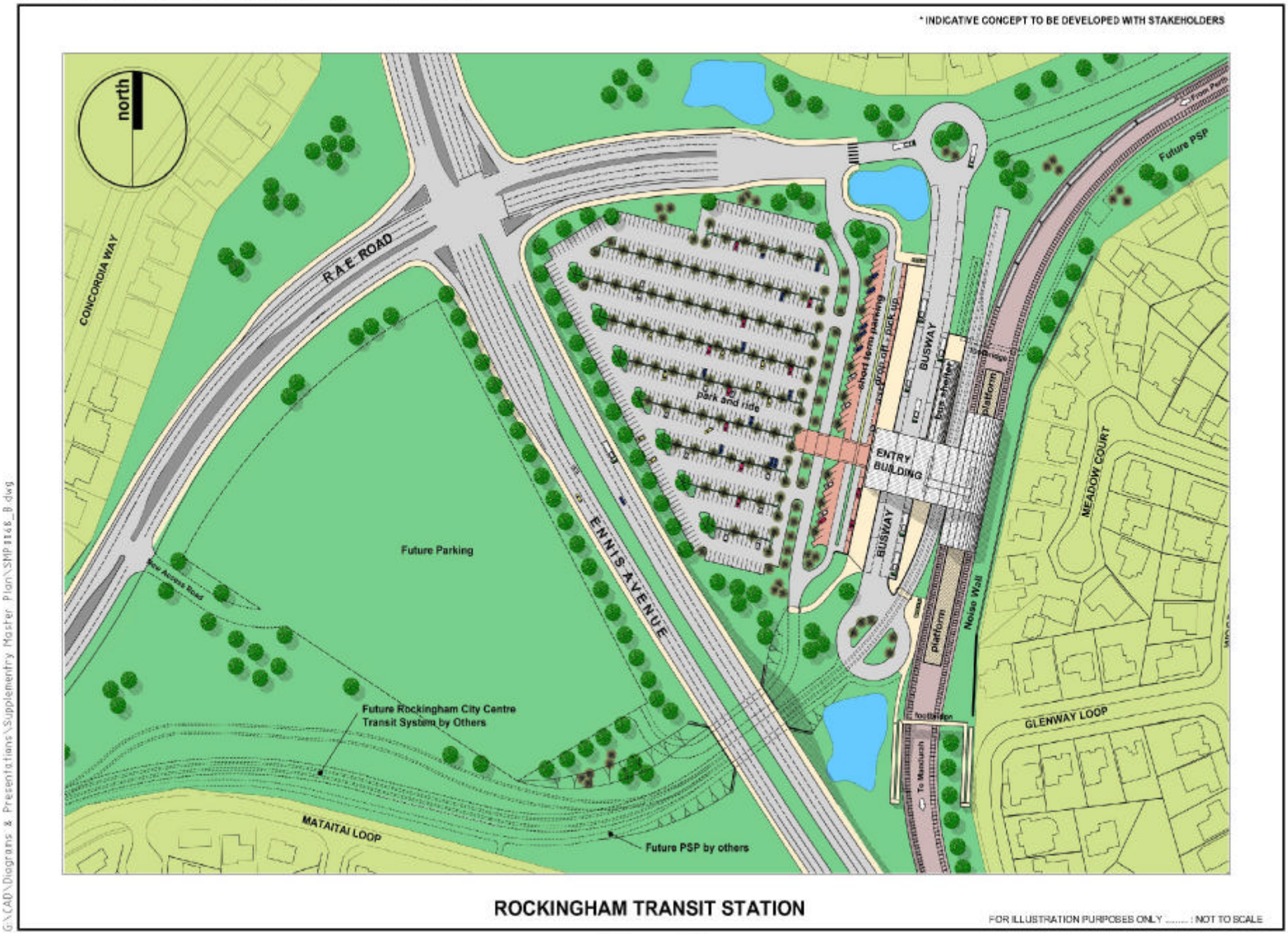

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Figure 28

a major transit interchange, include parking for 700 cars and facilities for car set down and pick up. **Figure 29.**

There has been a reduction in patronage, compared with the original SWMR Master Plan. This is because of the added attraction of the new Rockingham Station compared to previous proposals, and the increased service frequency of trains from Mandurah Station.

Perth Urban Rail Development Supplementary Master Plan

Figure 29

5.14. Mandurah

There has also been ongoing liaison with the City of Mandurah and local community to develop the best land use for the land immediately adjoining the station on the western side. This process is continuing.

Because of the size of the catchment area of the Mandurah transit interchange, a fully integrated, quality bus feeder service is a high priority. Priority should also be given to providing a good feeder bus service to the town centre, foreshore area and major attractors to encourage the use of Mandurah station as a destination.

An improved frequency of service from Mandurah is proposed at peak times – from two services per hour in the original SWMR Master Plan to six.

In addition, because there will be a significant overnight stowage and cleaning requirement for railcars, the location of the station platforms and the associated precinct have been significantly altered to meet the geometric constraints imposed by the track layout needed. **Figure 30**

The station has been re-aligned within the same site as proposed in the 1999 SWMR Master Plan, but closer to Fremantle Road. **Figure 31** It will have side platforms with the concourse as the common area joining the two platforms across the end of the tracks.

Road access to the site is from the proposed upgraded Allnutt Street that will connect with the Mandurah bypass road (Fremantle Road).

The facilities will provide bus passenger transfer, car set down/pick up, park & ride and walk on/cycle patronage. Parking for 850 cars has been provided.

The entrance buildings and major forecourt facilities will be focussed at the south (bus transfer) end of the station with immediate proximity to Allnutt Street.

The projected patronage is 3,490 boardings per day in year 2006.

5.15. Thornlie

This major transit interchange will be built on the south-west quadrant of the intersection of the existing freight railway and Spencer Road as per the original SWMR Master Plan. **Figure 32**

The projected patronage for year 2006 is 3,500 boardings per day.

Bus-rail interchange will be an important feature of this station, as will facilities for set down and pick-up by private car, walking and cycling.

The site limits car parking to around 450 cars.

The station design and access will be integrated with the grade separation of Spencer Road over the railway.

A feature of the design will be emphasis on security within the station precinct.

5.16. Nicholson Road

In announcing the Direct Route in July 2001, the State Government committed to construct a spur line to Thornlie Station at Spencer Road and to investigate the case for an extension to Nicholson Road subject to funding availability.

The patronage levels for Nicholson Road, even as shown in the original SWMR Master Plan (see Figure 6 and Table 2.3.7, SWMR Master Plan) are lower than considered sufficient to justify construction at this time.

However, patronage projections are expected to increase with growth of commercial and residential development south of the existing freight line.

From a town planning perspective, a transit station at Nicholson Road in the future would offer the following benefits:

- A relatively unconstrained Park 'n' Ride area that could accommodate demand for parking higher than can be satisfied at Thornlie which is limited to 450 bays
- Direct access from an important regional road network
- Opportunities for transit orientated development within the potential walking catchment on the southern side.
- Potential patronage from urban growth in Canning Vale and Southern River
- Serve as a destination station for workers in the adjacent Canning Vale light industry area and for major sporting events at Tom Bateman Reserve where substantial upgrades are proposed to accommodate a baseball facility for 7500 spectators

A committee has been established to examine east - west public transport connectivity between the Armadale line, the SWMR and Fremantle.

This committee will also consider the potential for a future station at Nicholson Road.

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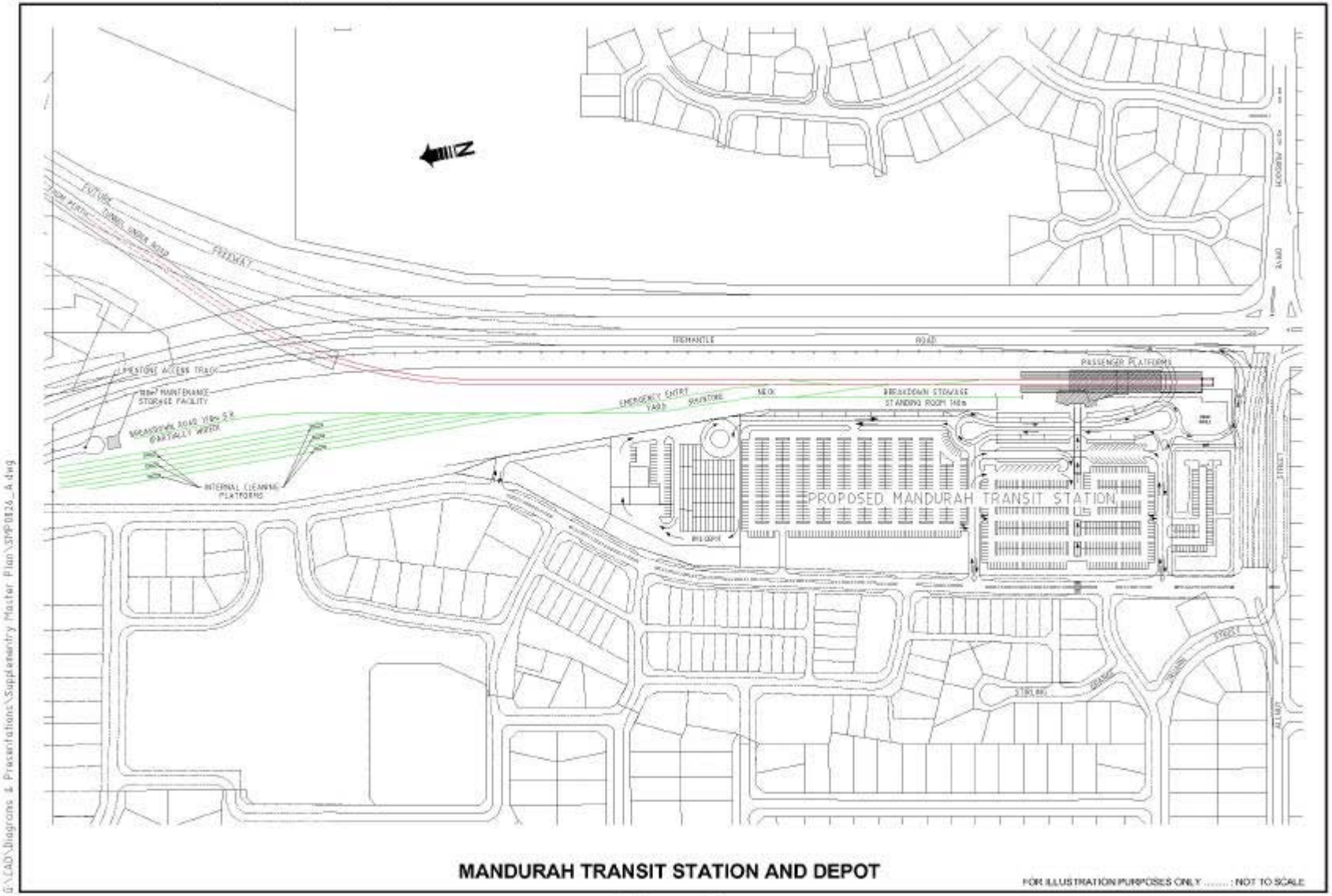

Figure 30

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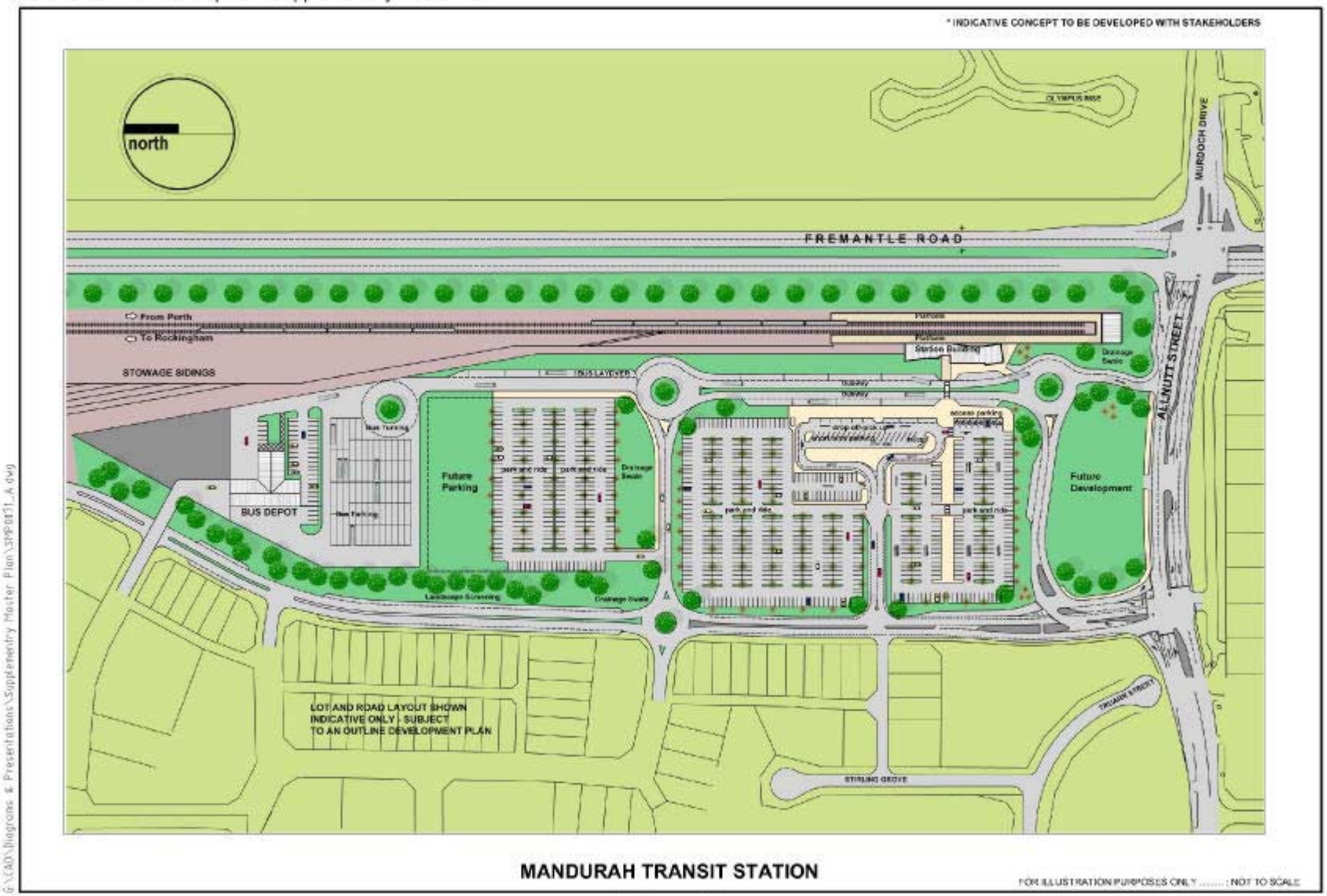

Figure 31

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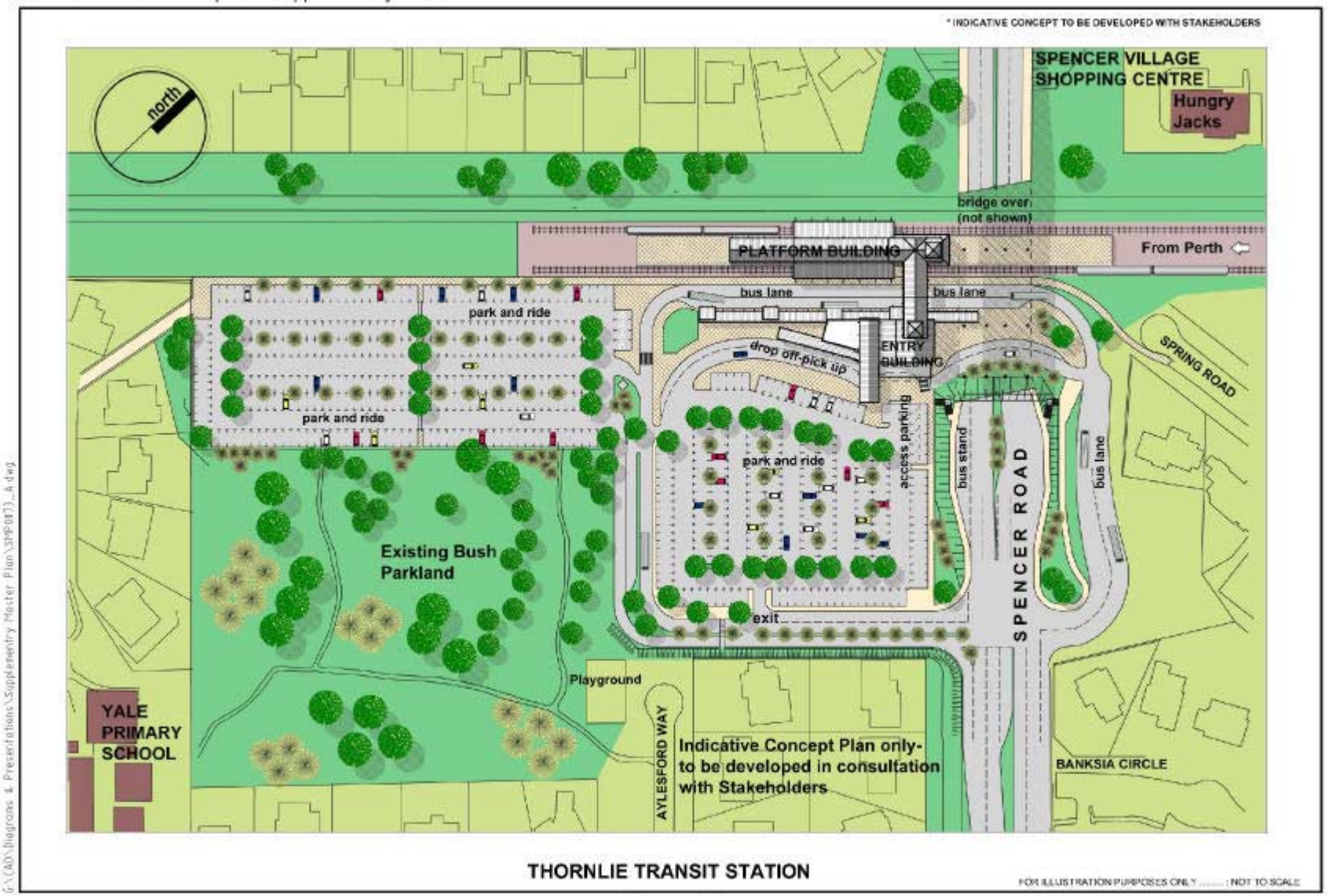

Figure 32

6. The Railway Services

6.1. Patronage, Capacity and Modes

The design of the Northern Suburbs Transit System allowed for trains at three minute intervals. Assuming each train is a basic two-car set accommodating 312 passengers, the overall capacity provided at that frequency is 6,240 passengers per hour. The size of the trains can be extended to three (two-car) sets, giving a capacity of just over 18,700 passengers per hour.

By comparison, assuming the same three minute frequency, the capacity provided by a rigid bus would be 1,200 passengers per hour. An articulated bus would provide a capacity of just over 1,800 passengers per hour.

Both rail and bus modes have the ability to provide rapid transit service on dedicated rights of way, but rail is more suited to higher patronage demands and longer inter-regional routes, where the advantages of high speed with the dedicated right of way can be maximised.

In planning for transport demand in the South West Metropolitan Area, buses are much more suited to meet the requirements for a frequent service on the relatively low demand for travel between Rockingham and Fremantle. Buses are also essential to provide local feeder services to the rail transit stations.

However a rapid transit railway as configured on the Northern Suburbs Transit System is much more suited both to the trunk route and the demand between Mandurah and Perth. To be successful, the journey time on the trunk route has to be highly competitive with private car travel. In 2006, the journey time from Mandurah to Perth will be 20 minutes faster by train than by car at peak times and 10 minutes faster in the peak. By 2015 that advantage to rail will increase.

Table 6.9.1 shows the comparative travel times between the train and car in year 2006.

6.2. Meeting Commuters' Aspirations

A typical rail commuter's (morning peak) journey to work via a major transit station is in three parts. Within each of those parts the following proportions for the different modes of travelling may be regarded as typical:

- Home to starting or origin station:

  Park & ride: up to 25%;

  Car passengers set down: up to 28%;

  By bus: 35% to 45%;

  By walking or cycle: 10%.

Time is most crucial for the morning journey to work in the afternoon peak, however, there is a marked shift in the modal split from those who were dropped off by car in the morning. A significant number of those commuters have been shown to transfer to buses, pushing up the bus modal split as high as 50% at the major transit stations. The most likely reasons for this **train to bus** transfer is the ability to plan the train trip home to suit the most convenient bus connection and confidence in the bus adherence to the departure times from the transit station.

This confidence is not shown with respect to bus arrival times at street bus stops for the inward journey to work, where the modal sequence is **bus to train**.

The behaviour pattern of commuters reflects the very low urban densities in Perth. This restricts the number of potential public transport users who can live within walking distance of rail stations.

Given the high dependence that low urban densities have placed on private car ownership and use, together with a generous road infrastructure to facilitate car use, the rail system must be designed to minimise journey times and maximise convenience in order to attract people from cars. From this has come the station spacing interval selected, high train frequency, fast trains and transit stations which facilitate convenient modal interchange.

On the inbound rail journey to destinations in the Perth City area, approximately 10% of commuters transfer to other trains at Perth, McIver or Claisebrook.

At the completion of the inbound rail journey to Perth (morning peak), typically 90% of commuters walk to their destination, whilst 10% transfer to a bus, such as the CAT system.

(N.B. The terms origin and destination relate to the morning peak that is, typically the home to workplace journey.)

6.3. Type of Service Proposed

The SWMR will maximise the investment and advantages of rapid urban passenger rail. The key requirements are:

- dedicated right of way;
- high frequency;
- reliability;
- fast trains;
- well designed and located transit stations facilitation good modal interchange;
- good connection with feeder services;
- high standards of comfort and safety; and
- integration with surrounding land use to maximise catchment.

Journey times are reduced by the proper combination of high frequency services, fast trains and judicious station spacing. Passenger appeal is enhanced by providing safe, comfortable trains and well located transit stations which provide the most convenient access and modal transfer facilities.

Figure 33 shows that in order to minimise journey time, maximise the speed potential of the rollingstock and optimise rollingstock utilisation, the average spacing of transit stations should be no less than about 3.2 kilometres on average. The effect of compromising this will be to reduce patronage and increase both capital and operating costs.

The rapid transit system proposed will have the following;

- fast 130 km/h trains;
- an exclusive right of way;
- an appropriately designed track alignment, track structure traction power and signalling control system;

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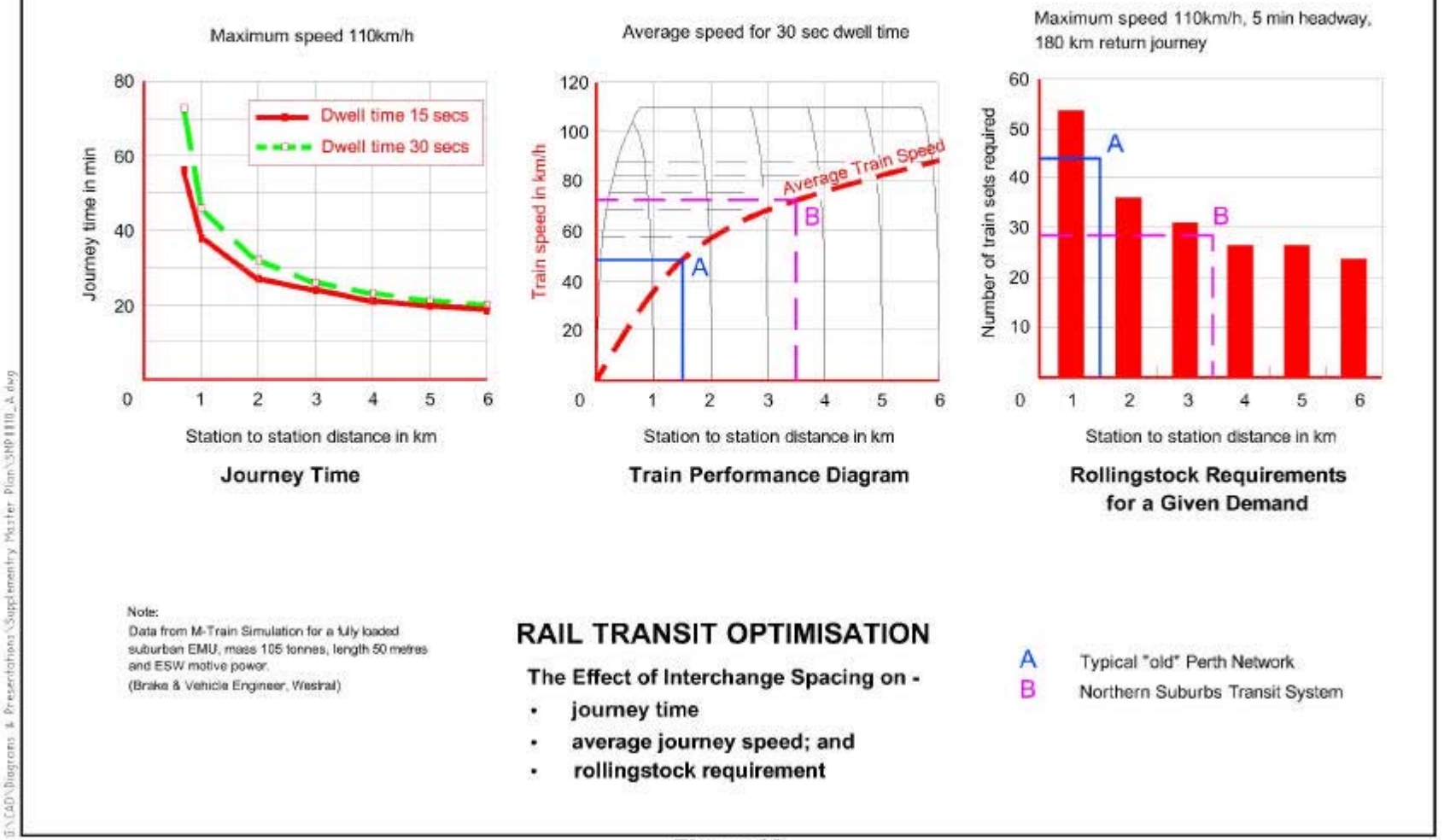

Figure 33

- strategically located transit stations to maximise the potential of the rollingstock and the route whilst maximising the patronage potential;
- well designed transit stations to minimise time lost and any inconvenience in transferring from bus or car to train; good feeder bus connections.

The natural advantages which a railway will bring to the long corridor of the South West Metropolitan Area include:-

- superior capacity to meet the projected demand;
- short journey time in comparison with car travel particularly at peak times;
- flexibility in train size to provide frequency commensurate with the demand load;
- the highest levels of safety and comfort;
- reduced traffic congestion on the roads.

An important factor in defining the type of railway to be built is the low density development of the Perth Metropolitan Region. The reality of this type of development is that at most transit stations the majority of commuters will access the service by a motorised mode. Experience has shown that the maximum walk on patronage at most suburban stations is limited to around 500.

Construction of the South West Metropolitan Railway along this new route will be a major contribution towards completing the Regional Integrated Public Transport system for the Perth Metropolitan Region.

6.4. Railway Operational Imperatives

Meeting the travel demand requires that the operational system needs the following:

- appropriate infrastructure;
- suitable rollingstock;
- a service that satisfies community aspirations.

The considerable investment in capital expense and research effort in rail systems means that the operating plan must maximise the capabilities and attributes of the system.

A poor operating plan can seriously undermine and detract from the return on the investment in infrastructure and rollingstock and hence the efficiency and effectiveness of the service in meeting its demand objectives, which is its primary aim.

6.5. The Task

The patronage forecast shows the peak period for demand is from 7:00 a.m. to 9:00 a.m. It is the nature of railway operations that if the resources are consistent with carrying the peak flow, then demand over the rest of the day will also be accommodated. The forecast demand and operational requirements of the railway indicate that 93 new railcars will be needed for year 2006.

6.6. Fleet and Service Integration

The new railway cannot be operated in isolation from the rest of the urban rail network as described in section 2.4.

The Fremantle – Midland service will continue approximately in demand balance and the Armadale – Perth Service will be operated as a single operation.

6.7. Train Service Requirements and Operational Issues

6.7.1. SWMR Integration with Northern Suburbs Railway

The forecast patronage for the NSR and the SWMR confirms the need for a high frequency service over both lines. In the peak periods, trains from Mandurah will stop at all stations to South Street (Murdoch), then run express to Perth and then stop at all stations to Whitfords where they will turn back and form a return service to Perth and onward to Mandurah. A journey time as low as 45 minutes may be possible between Mandurah and Perth and just over 30 minutes between Rockingham and Perth.

At peak times, in addition to the above services, trains from Clarkson will stop at all stations to Warwick, then run express to Perth and then all-stations to Thomsons Lake. From Thomsons Lake they will operate a return service to Clarkson. Some of these services will require the capacity of 6-car trains.

Trains will operate at fifteen minute intervals off-peak.

For special events direct services will operate to West Leederville for the football and to Showgrounds for the Royal Show.

The additional demand arising from Mandurah confirms the need for double track from Waikiki to Mandurah. The original SWMR Master Plan proposed a single line over this section.

An improved frequency of service from Mandurah is proposed at peak times – from two services per hour in the original SWMR Master Plan to six.

The frequency of trains from Mandurah is linked to both patronage and operational factors as Mandurah being the terminus with the stowage and cleaning facilities.

An operations plan is to be produced and this will optimise the train frequency of the service in the south-west area.

6.7.2. Armadale Line

The SWMR Master Plan highlighted a number of issues associated with operating the proposed high frequency services between Perth and Kenwick, on top of the existing services from Perth to Armadale. (*Chapter 5 SWMR Master Plan*)

Because of the above, significant infrastructure works were proposed between Perth and Kenwick.

The adoption of the Direct Route and the integration of South West Metropolitan and Northern Suburbs Transit services means that the Armadale line services will become self-contained (i.e. only operate as far as Perth Station).

The currently integrated Northern Suburbs/Armadale services imposes operating constraints on the Armadale line as the Armadale timetable is subservient to that of the Northern Suburbs. When the Northern Suburbs services cease operating to Armadale and begin operating directly to the Mandurah line, this will provide the opportunity to re-examine improvements to the Armadale services.

6.7.3. Services to Thornlie

It is proposed to provide a service frequency of four trains per hour from Thornlie to Perth during peak and interpeak periods, on a single track from Kenwick to Thornlie station. A second track can be provided as required in the future.

Previous consultation with the local community has raised safety issues (particularly with respect to school children) that strongly indicate the need to grade separate Spencer Road from the rail services. Provision for this is made in the budget.

6.7.4. Perth Station Changes

The effect of the central route through Perth upon the rail infrastructure at Perth Station is primarily about the major modifications required at the western end to terminate the Armadale line services and to provide good pedestrian access to the new underground. Termination of Armadale services will also mean removal of the Armadale to Joondalup link through Northbridge. In addition to these works the only other alteration required at Perth Station is the provision of an additional crossover at the east end of the station to accommodate the turn-back of Armadale line trains.

6.8. Rollingstock Speed

The alignment of the South West Metropolitan Railway has been designed for speeds up to 140/150 km/h. However, there are other factors that will limit the operational speed to 130 km/hr.

6.9. Rail Service Summary

Figure 34 shows the indicative train service proposed at peak periods.

Peak period travel times to Perth and the comparative times for the Kenwick route (shown in brackets) are:

Mandurah	48 min	(60 mins)
Rockingham	33 min	(45 mins)
Thomsons Lake	16 min	(28 mins)
South Street (Murdoch)	13 min	

From Mandurah to Joondalup the peak period travel time will be 71 minutes, while Joondalup to Rockingham will be 56 minutes.

On the Armadale line there would be an additional four trains per hour with the extension of a spur from Kenwick to stations at Spencer Road and/or Nicholson Road.

Table 6.9.1 shows comparative travel times in year 2006 for the Direct route rail services and road from Mandurah to Perth.

Table 6.9.1
Perth to Mandurah
Year 2006 Rail versus Car Journey Times

Section	Rail All Day	Road Morning Peak	Road Off Peak
Mandurah - Perth	48 mins	68 mins	53 mins
Rockingham – Perth	33 mins	54 mins	40 mins
Thomsons Lake - Perth	16 mins	34 mins	19 mins

Note: Road travel times sourced from road travel data collected by MRWA.

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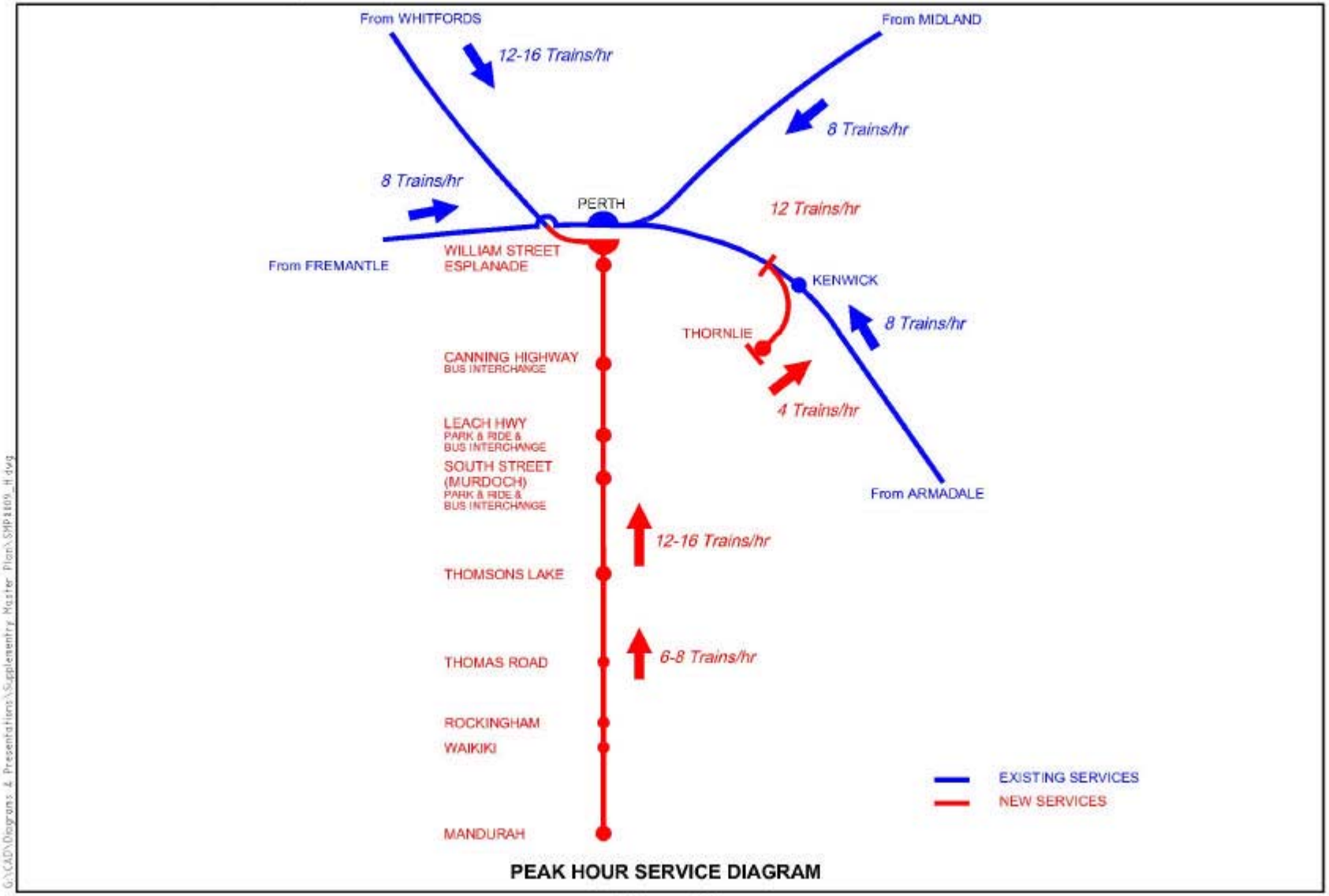

Figure 34

7. Environmental Considerations

7.1. Introduction and EPA Requirements

The significant changes in the route **Figures 35 and 36** involve three main sections of the alignment:

- the connection from the Northern Suburbs Railway through central Perth to the Narrows Bridge;
- Narrows Bridge to Glen Iris;
- South Leda to Rockingham along the Garden Island Highway Reserve and along Ennis Avenue.

These changes have been referred to the Environmental Protection Authority (EPA).

In September 2001, the level of assessment was set at Public Environmental Review (PER). PURD is currently in the process of preparing the PER document.

The guidelines for the document consider:

- vegetation
- fauna
- wetlands and water courses
- groundwater
- noise and vibration (operational)
- noise and vibration (construction)
- other construction impacts
- soil and groundwater contamination
- visual amenity
- public risk and safety
- aboriginal culture and heritage
- pedestrian and traffic management during and after construction
- a discussion on environmentally sustainable development
- all other potential environmental factors

The PER document will list commitments to be implemented by the proponent, to manage the above.

There will be an eight week public review period after the document is released. During this time submissions can be made to the EPA. The EPA will then summarise the submissions in a report to the Minister for the Environment, that will be the basis for ministerial environmental conditions placed on the project.

The PER process is the primary means by which environmental approval for the project will be achieved and is expected to be finished early in 2003.

An Environmental Management Plan (EMP) has been prepared for the section south of Mandogalup in accordance with ministerial conditions set in Statement 368 on the original assessment of the MRS amendments to the South West transport corridor in 1994. The final draft for this document has been completed and is now under review by the various stakeholders.

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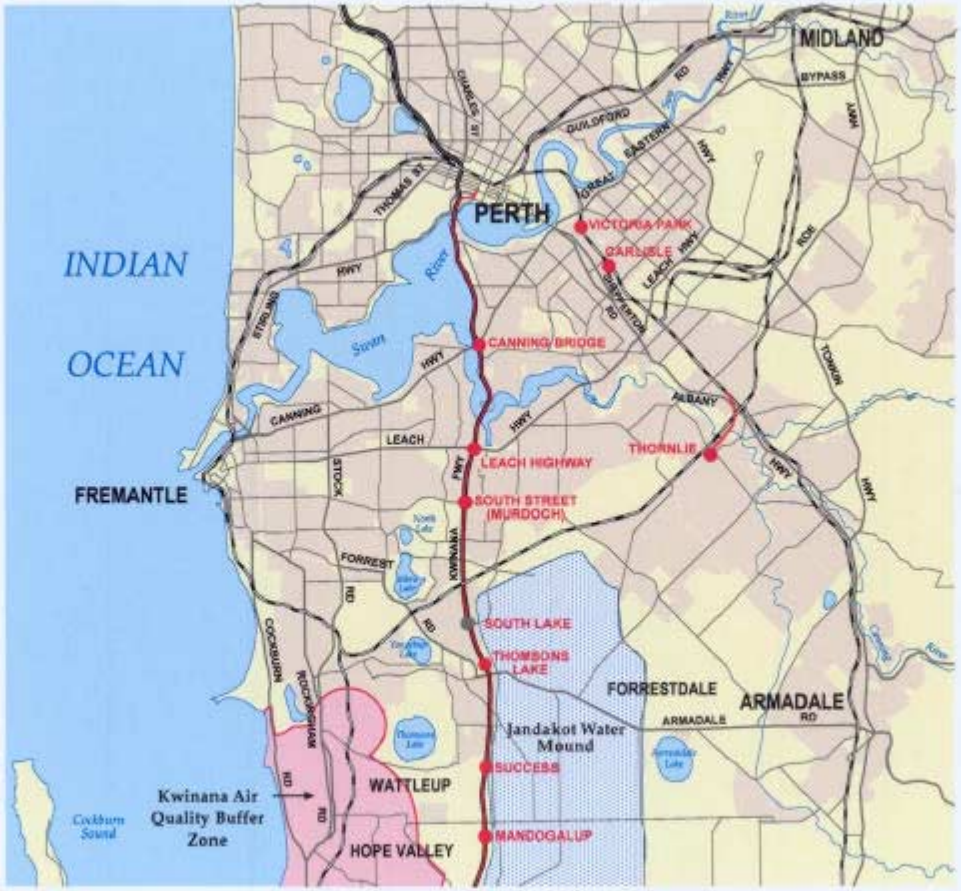
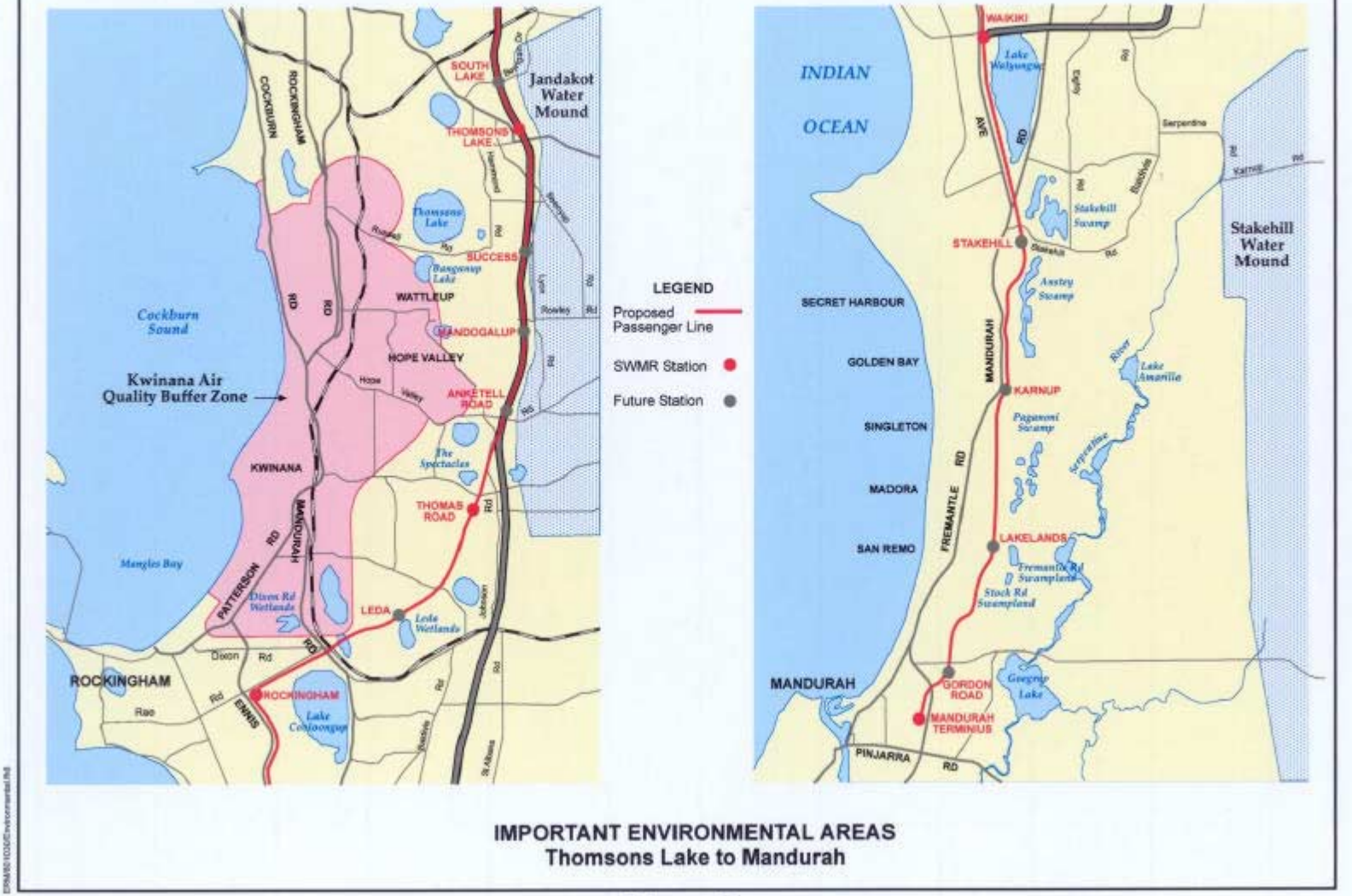


IMPORTANT ENVIRONMENTAL AREAS
Perth to Thomsons Lake

Figure 35

Perth Urban Rail Development Supplementary Master Plan



IMPORTANT ENVIRONMENTAL AREAS
Thomsons Lake to Mandurah

Figure 36

7.2. Heritage and Archaeological Issues

7.2.1. Aboriginal Heritage

There are several registered Aboriginal sites in the central Perth area, including the Swan River. They were considered in the risk assessment of the various route options, with expert advice provided by suitably qualified heritage consultants. Early consultation with the relevant Aboriginal community members is essential and is now being undertaken.

The consultation process is expected to be finished by mid-October 2002.

A Section 18 application under the Aboriginal Heritage Act 1972 will then be prepared for the Narrows Bridge and central Perth section of the project.

This must be submitted to the Department of Indigenous Affairs by 29 October 2002 which is the close of agenda date for the Aboriginal Cultural Material Committee (ACMC) meeting of 3 December 2002.

The ACMC will consider the application and make a recommendation to the Minister for Indigenous Affairs on whether the project should proceed and under what conditions the project should proceed.

Upon receiving the recommendation of the ACMC it is usual for the Minister's decision to take approximately four weeks. Aboriginal Heritage clearance for this section of the project is expected to be achieved by February 2003.

The widening of Mount Henry Bridge will involve disturbance of the Canning River, which is a registered Aboriginal site. This requires an application under Section 18 of the *Aboriginal Heritage Act 1972* which requires formal consultation with the Aboriginal Community, lodgement of a Section 18 application to the Aboriginal Cultural Material Committee.

Prior to the Direct Route being announced, consultation had been undertaken by Main Roads with the relevant Aboriginal groups regarding the augmentation of the Mount Henry Bridge for the proposed dedicated busway.

The structural changes proposed for the Mount Henry Bridge for the Kwinana Freeway Busway and now for the railway are essentially the same with regard to Aboriginal Heritage issues.

The relevant Aboriginal groups will be consulted regarding the change in the project from a busway to rail. A Section 18 application under the Aboriginal Heritage Act 1972 will be lodged with the Department of Indigenous Affairs using the previous consultation for the busway as supporting documentation.

Aboriginal Heritage clearance for the modifications to Mount Henry Bridge is expected by November 2002, following a similar process to that described above.

Previous consultation with Aboriginal groups found no strong objections to the project but recommended the Section 18 process be followed.

Similarly any modifications to the Narrows Bridge that will disturb the Swan River bed or banks will require compliance with the provisions of the *Aboriginal Heritage Act 1972*.

7.2.2. European Heritage

The route into and through central Perth will consider further the impact on heritage listed buildings. Places included on the Register are given legal protection under the *Heritage of Western Australia Act 1990*. Should the project impact on a registered place, it will be referred to the Heritage Council for approval and advice.

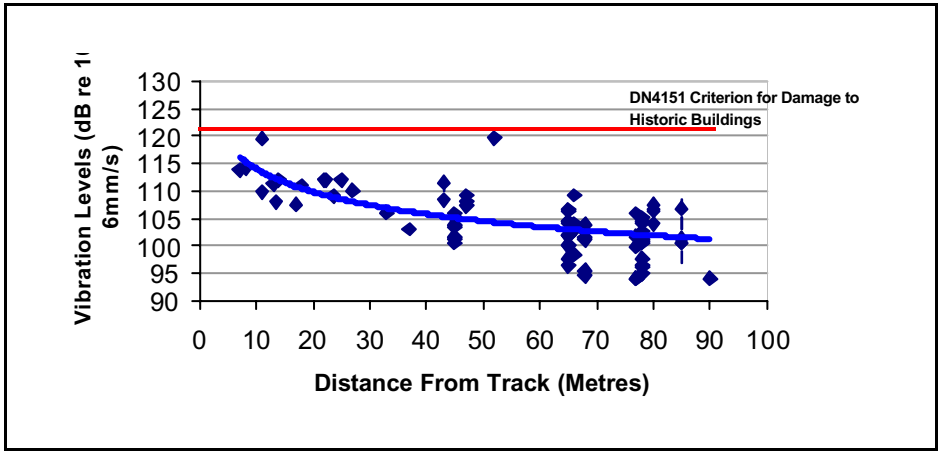
Preliminary considerations indicate that there will be no adverse impact on Shenton's Mill at the Narrows. Shenton's Mill (The Old Mill) was built in 1837 and is listed on the following heritage lists: Heritage Council of WA register, Statutory data base, Register of the National Estate, Heritage Agreement, Municipal inventory for the City of South Perth and Classified by the National Trust.

During the past 165 years major events that could have caused damage to the Old Mill include the construction of the Narrows Bridge and Kwinana Freeway in 1959, the duplication of the Narrows Bridge in 2000 and the recent construction of the bus way. There was also the Meckering earthquake in 1968, in which earth tremors were experienced in the central Metropolitan area for between 24 seconds and 3 minutes.

The new railway will be constructed on a concrete slab adjacent to the Old Mill. This consists of a concrete base on which the rails are located and isolated by resilient fasteners. This method of construction significantly reduces the level of vibration transmitted through the ground.

The new rolling stock that will service the SWMR will produce less vibration than the current fleet of rail cars as the traction motors will be mounted as part of the sprung mass of the train. This dampens the vibration that is transmitted to the wheel / rail interface and consequently reduces the vibration that radiates through the ground.

Vibration modelling that has been carried out for train operations indicates that the expected vibration levels in the vicinity of the Old Mill are well below the internationally accepted German Standard DN4151 criteria for damage to historic buildings.



The railway will be at least 35 metres from the Old Mill. The above chart shows vibration measurements for corresponding distances as measured in Perth over the last nine years. It indicates that vibration levels produced by the trains passing the Old Mill will be well below that which produces structural damage to historic buildings.

Precautionary measures will be undertaken to ensure no significant damage occurs to the Old Mill as a result of construction and operation of the railway include:

- A baseline structural survey of the Old Mill to determine the structural soundness of the building to enable the measurement and assessment of any impacts.
- Measurement of vibration levels during construction and during operations to ensure levels are within the limits expected.
- Monitoring of the Old Mill for vibration impacts during construction and operation to pick up any damage early in the unexpected event that significant vibration occurs.
- Immediate remedial action should the monitoring detect damage occurring due to vibration from the railway.

All indications are that there will be no significant adverse effect to the Old Mill from ground borne vibration.

7.3. Environmental Issues

7.3.1. Noise

Noise assessments for the new route, excluding central Perth, are nearing completion. Preliminary results are that noise impacts will be manageable. Where required, noise attenuation measures such as noise walls, earthen bunds and dampening reflected noise through the use of noise absorbing material will be implemented.

The impact and amelioration of noise in the central Perth area will be addressed during the detailed design phase of the work. In this section there are unlikely to be any significant noise issues which cannot be resolved, due to the lower speed of the trains and the application of current engineering technology to the track. Where the trains are underground, world's best practice noise and vibration attenuation measures will be applied.

The new fleet of railcars that will operate on the SWMR are expected to produce lower noise and vibration levels than the current fleet. This is due to differences in their traction, braking and suspension systems.

Noise resulting from construction will be managed as for any major infrastructure project. Contractors undertaking the work will be contractually obliged to comply with all relevant environmental legislation including noise regulations and will be periodically audited to ensure compliance.

7.3.2. Vibration

Predictive vibration modelling has indicated that vibration levels associated with railway operations will be generally acceptable. Further assessments will be undertaken during the design phase and after introduction of the actual rail service.

The introduction of the new railcars will reduce the probability of adverse vibration. Technical innovations over the current fleet of railcars are expected to produce less vibration.

7.3.3. Visual Intrusion

This is predominantly an issue along the South Perth foreshore and into Perth where there is a perception that the overhead wiring for the

system will degrade the view across the freeway to the Swan River. **Figure 37.**

The alternative of a third rail power supply to the rolling stock has been investigated. While technically feasible it was found to be an unattractive option from a cost, safety, operational and, ironically, aesthetic point of view. The visual gains made from removing the overhead wires would be offset by a requirement for a 2.5 metre high fence topped with barbed wire. The fence would also act as a trap for wind blown rubbish further impairing visual amenity.

Investigations were undertaken as to the type of catenary and support system that would be the least intrusive along the South Perth foreshore and over the Narrows Bridge. It was decided that the most unobtrusive mast was concrete, similar to those presently installed on the existing network, built to the latest Australian Standards but of slimmer dimensions and, where possible, for the mast spacings to be increased to reduce the overall number.

Further studies were undertaken in an effort to reduce the number of overhead electrical conductors supported by the traction overhead masts, as compared to the existing network. It has been established that the two return conductors and the earth wire could be run underground adjacent to the track reducing the number of wires from seven to four, with little effect on the electrical system requirements. This will require the return conductors to be insulated to 3.3kV and the earth wire to be protected by a PVC insulator. These wires can be run in formed concrete ducts at ground level adjacent to the track.

There will be additional cost for this arrangement as well as additional cost for signalling, power and communications equipment located at ground level near the conductors.

Work is continuing to determine the best options for reducing the impact on visual amenity within the budget constraints of the project.

7.3.4. Atmospheric Pollution

Greenhouse Gas Effect

Whilst generation of electricity produces pollutants at the generating source, the benefit to the Metropolitan area of the proposed rail line is that emissions throughout the length of the electric railway are negligible.

The production of one megawatt hour of electricity (including distribution losses) incurs an atmospheric pollution factor of 1.032 tonnes of greenhouse carbon equivalent gases.

The environmental impact of rail operations between Perth and Rockingham would be the production of 23,530 tonnes of greenhouse gases (carbon dioxide equivalents) per year.

The number of road passenger cars required to transport an equivalent number of passengers, would generate 49,335 tonnes or an additional 25,805 tonnes of greenhouse gases.

Perth Metropolitan Area Air Quality

The power to drive the electric passenger trains will be generated primarily in the south-west of the state at the Collie power station. This will provide a significant environmental benefit to the air quality of the

Metropolitan region and the emissions generated may be better managed from a static generating source.

The railway will generate negligible atmospheric emissions in the Metropolitan area. Other forms of transport with an equivalent carrying capacity will emit significant quantities of carbon monoxide, nitrous oxides, hydrocarbons, particulate matter and sulphur dioxide.

To put this into some perspective the following pollution loadings have been estimated over the distance from South Street (Murdoch) to the Narrows Bridge (12 km), if the estimated annual rail patronage was to travel by train, or bus, or car:

Combined exhaust atmospheric pollutants of the train	Negligible
Combined exhaust atmospheric pollutants of buses	40.13 tonnes/year
Combined exhaust atmospheric pollutants of cars	96.24 tonnes/year

The above simply means if the projected annual rail patronage in year 2006 was to transfer to car, the emissions along the section from Murdoch to the Narrows Bridge would increase by 8 tonnes per kilometre per year.

This is in addition to the tonnes of atmospheric emissions caused by the daily freeway car traffic. In the 300 metre segment of the freeway between the Judd Street Freeway ramps and the Mill Point Road off ramp, 157,750 vehicles per day generate the equivalent of approximately 39 tonnes per kilometre per year in the Judd Street vicinity, South Perth.

It can be shown using normally accepted data that through the Lake Monger area, the Northern Suburbs Railway carries the equivalent of over 2.5 freeway lanes of traffic towards Perth in the morning peak hour period.

The proposed SWMR train service will yield similar benefits through the South Perth area.

Notwithstanding the environmental benefits, given the lack of room for expanding the freeway system adjacent to Lake Monger and through the South Perth foreshore, the important role of the railway in providing a viable alternative to private car use is amply demonstrated.

Perth Urban Rail Development Supplementary Master Plan

ARTISTS IMPRESSION OF NARROWS BRIDGE TO CANNING HIGHWAY
SLAB TRACK 900mm and 1200mm Barrier Heights

FOR ILLUSTRATION PURPOSES ONLY ..... : NOT TO SCALE

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Figure 37

8. The Railway Infrastructure

8.1. The Railway Alignment, Layout and Standards

8.1.1. The Railway

The South West Metropolitan Railway will be 1067 mm gauge, as an extension of the existing Perth Urban Rail system and will comprehend the following design standards.

The minimum radius of horizontal curvature is generally 700 metres although where there are geometric constraints, such as through the city, the radius is as low as 135 metres. This can be accommodated and managed with the appropriate speed restrictions, a lubrication regime, minor gauge widening and attention to rail and wheel profiles.

The maximum value of applied superelevation will be 100 mm. Passenger comfort will be met by limiting the unbalanced lateral acceleration to 0.052 metres per second^2. The maximum permissible unbalanced lateral acceleration shall not exceed 0.65/sec^2.

Transition curve lengths will be generous to enhance comfort. In this regard, the rate of change in the development of applied superelevation will generally be limited to 26 mm/sec. The transition ideally should also be long enough to limit the development of unbalanced lateral acceleration to the order of 0.20 m/sec^3.

The vertical curvature along the railway will be designed to appropriate standards for the line speed and will be limited to a minimum of 5000 metre radius except in the central Perth area where down to 2500 metres will be used. The desirable vertical acceleration over vertical curves should be less than 0.01g. The vertical curves will also be designed to accommodate the overhead catenary requirements. Maximum grade will be 3% compensated except in the central Perth area where it may be necessary to design for steeper grades.

The railway will be designed to standards which allow a maximum train speed of 140 km/h to be achieved with an initial operation to 130 km/hr. There will be restrictions where this speed cannot be achieved due to current standards, curvature or other reasons.

The new railway will have two tracks from its connection with the Northern Suburbs line in Perth yard all the way to the Mandurah Terminus. Facilities for overnight stabling of railcars will be constructed at Mandurah adjacent to the terminal station.

The track will be constructed for a 16 tonne axle load, generally with new 50 kg/m standard carbon steel rail fastened with resilient fastenings on concrete sleepers and crushed rock ballast. However, for the section from the Northbridge end of the city tunnel to the north abutment of Mount Henry Bridge a continuous concrete slab track structure with 60 kg/m rail will be used.

Long rail strings will be field welded into continuous lengths to ensure a quiet stable ride with minimum maintenance.

8.1.2. Structures and Clearances

The bridges and tunnels on the new route will conform with WAGRC and Main Roads WA practice and standard clearances.

Where rail tracks pass closely either side of bridge piers, crash walls will be required to protect the piers from impact by rail vehicles.

8.1.3. Utility Service Alterations

There are a number of locations where major utility services impinge upon the proposed railway works. In addition to these major services there are numerous individual small services and connections which will have to be dealt with in the normal progress of the works to avoid or minimise disruption to their individual users.

Some major utility services are affected at several locations and they require diversion or protection works and include telephone, communications and electric power cables and water, gas and fuel pipelines. These required changes are covered in detail in associated reports.

8.1.4. Fencing & Guard Rails / Road Vehicle Safety

These will be provided in accordance with standard WAGRC and MRWA practice. The section in the freeway median from the Narrows Interchange to Glen Iris will have concrete barriers. These are already in place for the busway from the Narrows Bridge to just past the Canning Bridge Busway Station.

Crash barriers will be required along the Kwinana Freeway and at other locations where there is likely to be a conflict between the railway and parallel road traffic.

Allowance has been made for link mesh fencing 1.8 m high to be erected along the rest of the line. However, within station precincts, appropriate aesthetically pleasing fences of lower height will be used.

8.1.5. Screening

Wherever there are bridges and structures over the track, screens will be provided to standard WAGRC practice to prevent persons on the structure from touching live conductors and to discourage vandalism.

8.1.6. Earthing & Bonding

This will be provided in accordance with WAGRC codes.

8.1.7. Level Crossings

There will be no level crossings on the SWMR Railway between Perth and Waikiki.

Side roads south of Waikiki intersected by the line at Stakehill Road, Paganoni Road and near the future Lakelands Station will have level crossings protected with automatic boom barriers and lights. However the safety risk at these crossings will be examined further.

On the Armadale Line, level crossings at Bishopsgate Street and Crawford Street will be closed and they will be replaced by bridges over the railway at Miller Street/Roberts Road and Gerard Street respectively as part of the works for the Thornlie spur. Also as part of

the works associated with building the spur to Thornlie, a bridge will be built over the railway at Spencer Road to eliminate the existing level crossing.

8.2. The Railway Right of Way – The Direct Route

8.2.1. West Perth to Narrows Bridge

At Perth the line will start from a connection with the Northern Suburbs line at the entry to the Roe Street tunnel. **Figure 38**.

The tracks commence to decline within the rail yard near Fitzgerald Street and will be fully underground adjacent to Lake Street. The decline structure will be constructed by cut-and-cover methods and contain two tracks. The Fremantle tracks will be moved to the north side of the rail reserve. Below ground the tunnel will be constructed using the bored tunnel method towards the new platforms to the eastern side of William Street just north of the Murray Street Mall. These platforms, which will be located at basement level below the old Myer Department store site, will extend as far as Murray Street Mall. The tunnel will be bored under the buildings on the east side of William Street between Murray and Hay Streets and curve to shift westwards to pass under the street reserve. The bored tunnel will continue southward to an underground station at the Esplanade. This station will be constructed by cut-and-cover methods. A shallow cut-and-cover tunnel, containing two tracks, will extend from the south end of the Esplanade station to a point 80 metres from the Kwinana Freeway. The tracks emerge from the tunnel to pass under the southbound carriageway of the freeway before curving south to run over the Narrows Bridge.

8.2.2. Narrows Crossing

Early analysis of options for the Narrows Crossing concluded that:

- the ‘old’ bridge carrying southbound traffic could not be modified to carry rail traffic;
- there was sufficient room between the old and new bridges for an additional single track (rail) bridge;
- the new bridge carrying northbound traffic could be modified to take either one or two rail tracks.

After a comprehensive analysis of engineering feasibility and traffic engineering, as well as the public transport requirements, it was concluded that:

- a new rail bridge can be built between the two existing bridges in a way that minimises the environmental and visual impacts;
- the existing (west) bridge can be strengthened so that northbound trains will run in the existing northbound busway;
- the southbound busway lane on the old bridge will be retained;
- The northbound road lanes on the new bridge will be rearranged to suit. **Figure 39**.

8.2.3. Narrows Bridge to Canning Bridge

Figure 40 shows the route through this section. The SWMR will be constructed in the present busway between the existing concrete barriers. The distance between these barriers varies with a minimum width of 10.2 metres apart .

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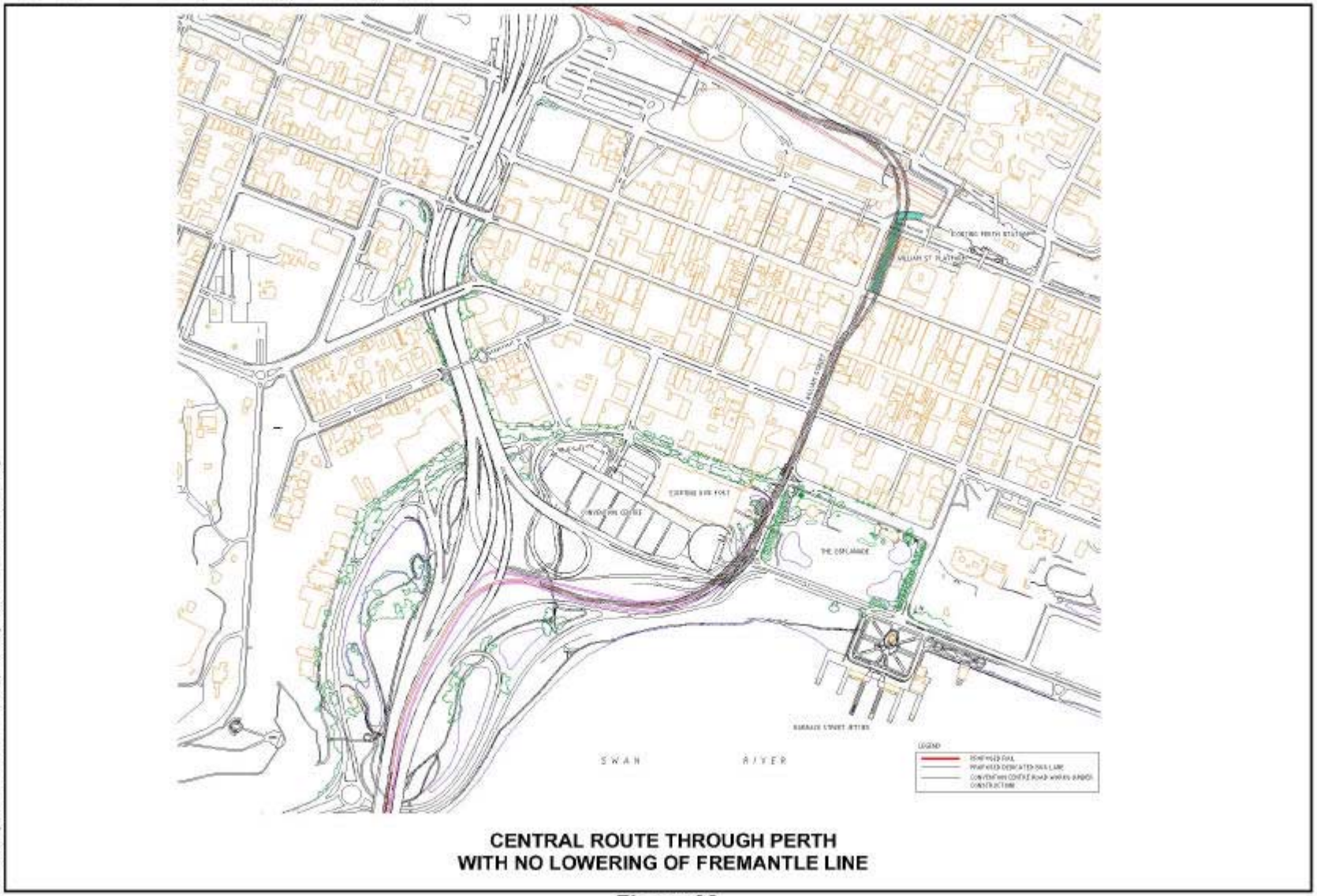
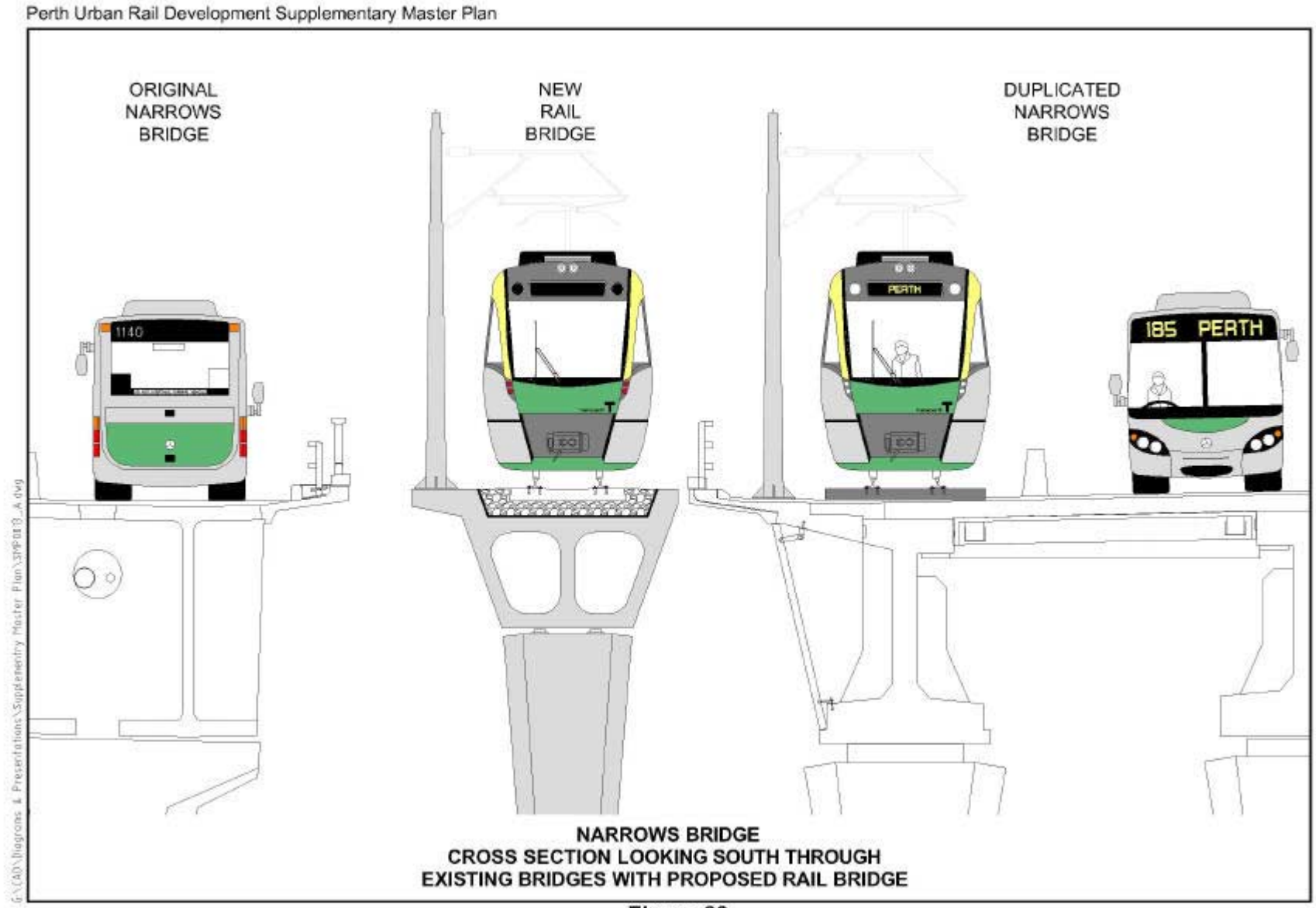


CENTRAL ROUTE THROUGH PERTH
WITH NO LOWERING OF FREMANTLE LINE

Figure 38


Perth Urban Rail Development Supplementary Master Plan
ORIGINAL
NARROWS
BRIDGE
NEW
RAIL
BRIDGE
DUPLICATED
NARROWS
BRIDGE
1140
PERTH
185 PERTH
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NARROWS BRIDGE
CROSS SECTION LOOKING SOUTH THROUGH
EXISTING BRIDGES WITH PROPOSED RAIL BRIDGE

Figure 39

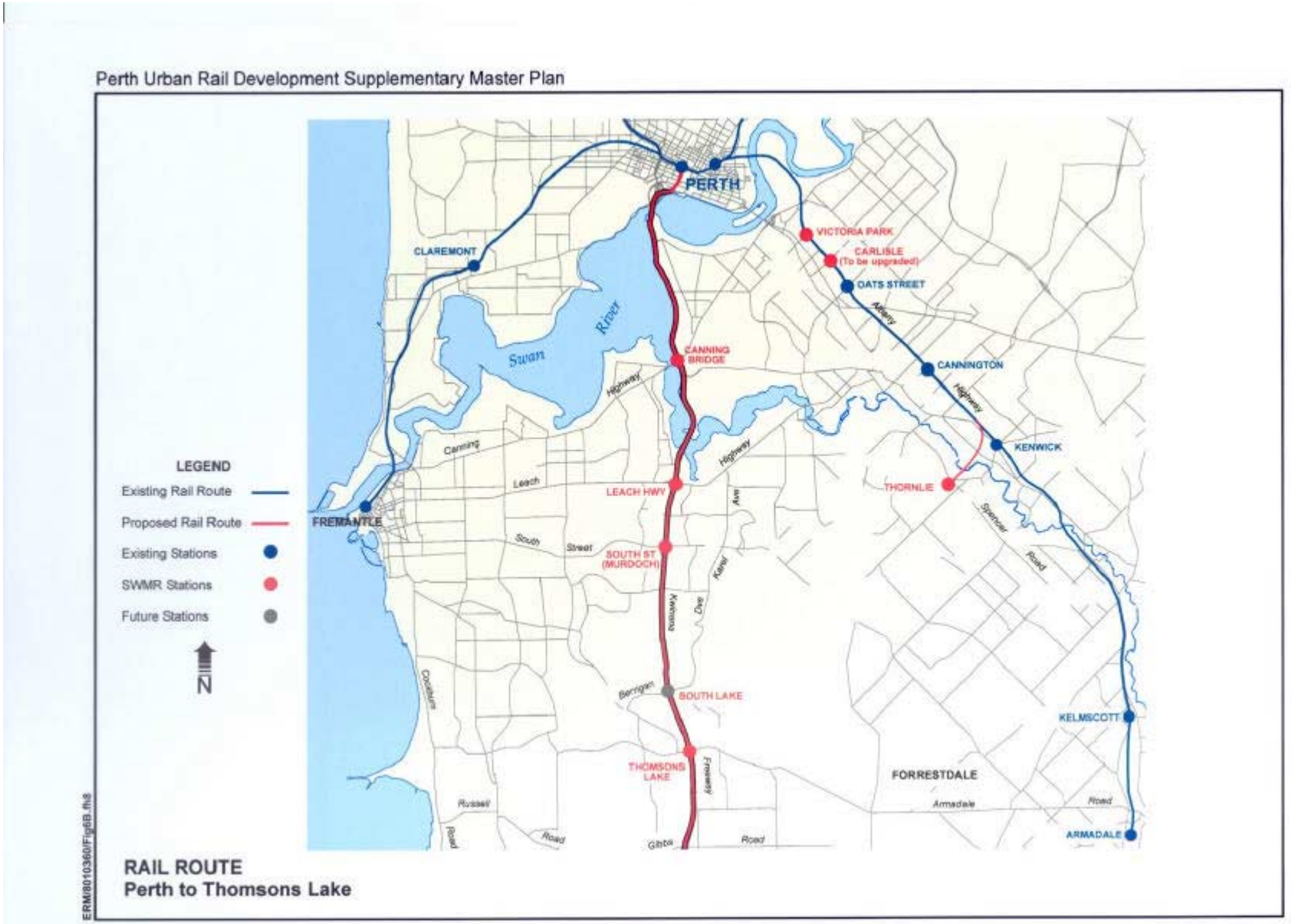
Perth Urban Rail Development Supplementary Master Plan
PERTH
CLAREMONT
VICTORIA PARK
CARLISLE
(To be upgraded)
OATS STREET
CANNINGTON
KENWICK
THORNLIE
CANNING BRIDGE
LEACH HWY
FREMANTLE
SOUTH ST
(MURDOCH)
SOUTH LAKE
THOMSONS LAKE
KELMSCOTT
FORRESTDALE
ARMADALE
Swan River
Canning Highway
Leach Highway
South Street
Kwinana Freeway
Spencer Road
Armadale Road
Russell Road
Gibbs Road
Berrigan Drive
Coolbellup Avenue
LEGEND
Existing Rail Route
Proposed Rail Route
Existing Stations
SWMR Stations
Future Stations
N
RAIL ROUTE
Perth to Thomsons Lake
ERM/8010360/FigEIB.fh8

Figure 40

To maximise safety and reliability, minimise maintenance and to minimise environmental impacts, a slab track structure will be used over the full length from the Narrows to Mount Henry Bridge. **Figure 41.**

The alignment of rail tracks will follow closely the horizontal and vertical geometry of the existing freeway and busway works. It may be necessary to adjust some railway levels to obtain required clearances under existing bridges or structures.

From the Narrows Bridge to Judd Street the existing busway median barrier will require adjustment over a short distance to meet the new rail track alignment from the Narrows Bridge. Also a section of present barriers just to the north of Canning Bridge will need adjustment to suit the requirements of the changed busway.

To make provision for a station at South Perth realignment works would be required on the freeway southbound carriageway over a distance of 900 metres. These works include utility services and replacement of the existing freeway footbridge between Melville Parade and the foreshore. For the reasons outlined in section 5.4, the construction of a station at South Perth cannot be justified at this time.

The present busway station at Canning Bridge will be modified to become a new Canning Bridge rail station with side platforms. The bus platforms on the highway bridge deck and their associated traffic arrangements will remain. It will incorporate most of the existing station infrastructure and facilities including those for cyclists and transferring passengers.

To meet the requirement to maintain adequate levels of service on the bus routes remaining in this section of the freeway, there will be short lengths of exclusive bus lanes. These will be at Judd Street and include the bus ramps at Canning Bridge. They will require some local widening and realignment of the freeway traffic lanes and minor reductions in shoulder width to keep within the existing freeway reserve.

The existing drainage system is generally adequate, with adjustment of gullies etc to suit changes of barrier positions, pavement contours and the like. Due to levels of existing pipes, utility services and outfalls, there is very little scope for reducing track levels below existing surface levels.

The existing railway traction power supply arrangement through the whole network is based on an overhead 25,000 V a.c. system. It has been suggested that over this section this power system should be replaced by a ‘third rail’ power supply at track level. However this form of power supply does not suit the open nature of the Perth Rail network with level crossings and pedestrian crossings.

Adopting a “third rail” system would require a 750 V d.c. power supply, with a conductor located at rail level under the train. Therefore the rollingstock would have to be modified to draw 750 V d.c. from ground level as well as the 25,000 V a.c. from the overhead system. Performance of the railcars would be degraded. Modifications of the new rollingstock alone would cost in excess of $20 Million.

Traction supply substations would be required alongside the freeway at no more than three kilometre intervals. Existing utilities would have

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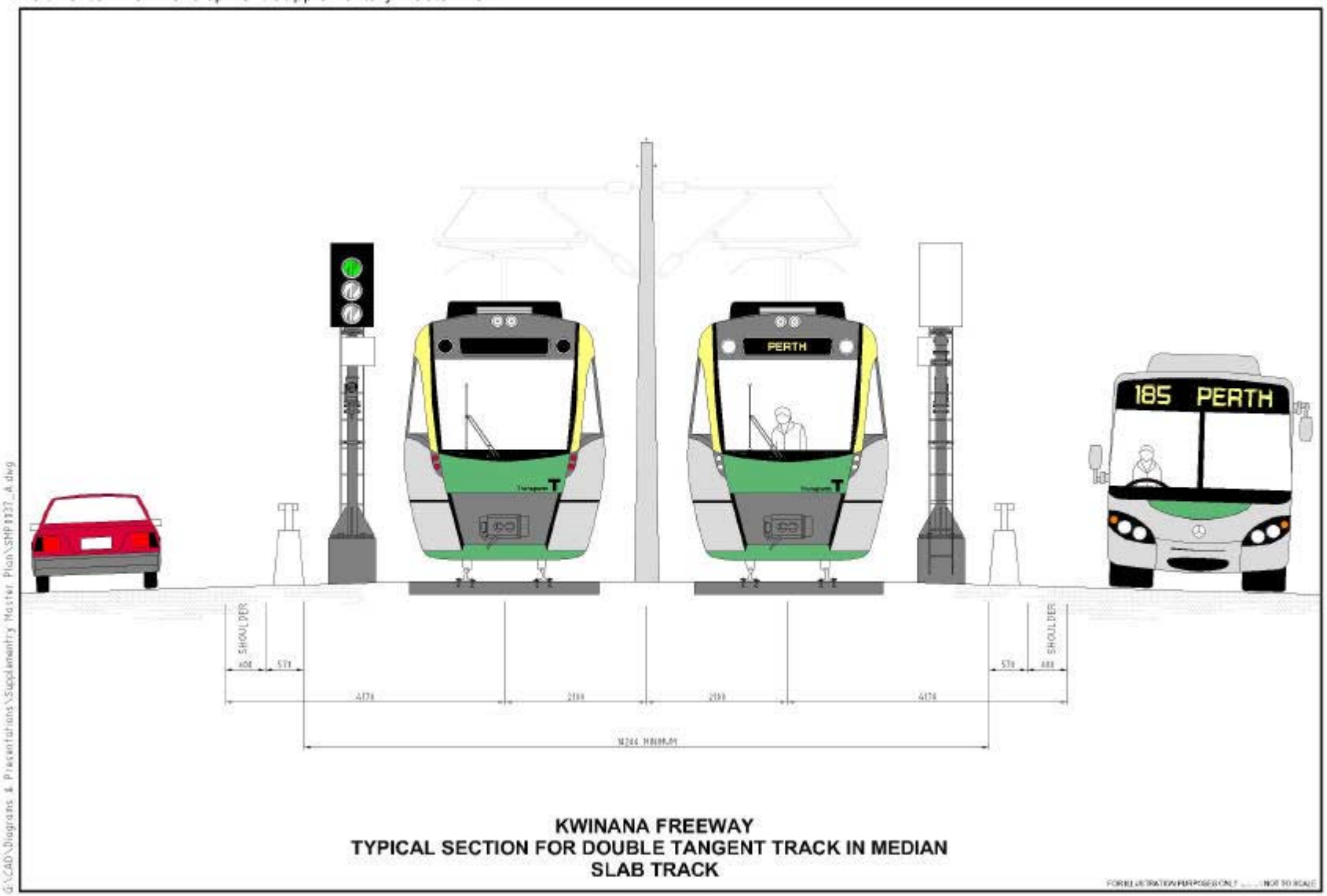

Figure 41

to be protected against electrolytic corrosion. Special requirements would be imposed on the signalling system.

In addition, the Office of Energy has indicated a need for protective fencing on either side of track up to a height of 2.5 metres. This would be located on top of the concrete barriers each side of the railway track.

The total cost of all the above measures would exceed $40 Million for the Narrows to Mount Henry section. This cost cannot be justified.

Because it was concluded that a 'third rail' ground level electrical power supply is not justified, the ability to minimise the number of overhead wires between masts has been investigated. Normally with two tracks, there are two overhead power conductors, a catenary wire supporting each conductor, one overhead earth wire and two overhead return current conductors.

It is possible to relocate the overhead earth wire and the two return conductors at ground level between the masts. However, there is a premium to be paid. In addition there are some minor technical issues with respect to lightning protection and safety in the case of line breakage, but these are not insurmountable.

At this stage, it appears that the most practical mast design is of concrete materials, albeit of slimmer dimensions to that used on the existing network. There is also the possibility of increasing the distance between masts on straight sections of track.

8.2.4. Canning Bridge to Mount Henry Bridge

South of Canning Bridge station the SWMR railway alignment will continue to follow the busway corridor between the existing barriers which now end immediately south of Manning Road bridge. The barriers are relatively widely spaced at this location and the railway will fit within the existing median resulting in minimal disruption of the existing freeway.

The track centres need to be in the order of six metres to clear the bridge piers at Manning and Cloisters Avenue. The concrete barrier will be required in this section as the freeway median is still relatively narrow. South of Cloisters Avenue bridge the freeway alignment has sharper reverse curves before Mount Henry Bridge. On these curves the barriers are of a height that would reduce the freeway sight distance for drivers. The freeway design speed is 110 km/h and the sight distance criterion at this design speed is 205 metres. In order to provide for this sight distance, widening of both the northbound and southbound carriageways will be required over this section. This will require work on existing drainage, lighting and signing etc.

The additional width required on both sides of the carriageways on the northern approach to the Mount Henry Bridge will require retaining walls to be used to contain the freeway within the reserve.

This is also the case at some other locations within this section where the freeway requires widening to maintain it within the present reserve.

8.2.5. Mount Henry Bridge (Canning River)

The railway will cross the Mount Henry Bridge in the centre of the deck within a 10.2 metre wide median which will have a continuous concrete barrier on either side. **Figure 42**.

The freeway will have three traffic lanes in each direction with shoulders 2.5 metres wide on each side of the railway and 0.8 metres adjacent to the outer edge of the carriageways. New bridge structures will be added each side of the existing bridge to replace the roadway area taken up by the railway. These will appear to be continuous with the existing bridge deck and will be supported on new piers and piled foundations.

The additional side structures will be similar to those that would have been required for the widening of the Mount Henry Bridge for the Kwinana Freeway Bus Transitway.

Shared paths will be provided on each side of the bridge similar to those existing and will connect with the present pathway network along the river. Preliminary environmental assessment of the impact on the river and environs has been carried out with no adverse findings.

8.2.6. Mount Henry Bridge to South Street

From the Cranford Avenue Bridge the northbound carriageway curves left toward the Mount Henry Bridge. The railway concrete barrier in the median impairs the freeway stopping sight distance. To overcome this and provide stopping sight distance of 205 metres for 110 km/h design speed it is necessary to reduce the curve radius of the northbound carriageway to 780 metres. Which in turn requires the realignment of the Cranford Avenue on-ramp.

Some widening is required within the Freeway reserve along the western side of the freeway to meet sight distance requirements. The Cranford Avenue off-ramp will be relocated.

Between Mount Henry Bridge and Cranford Avenue the freeway is constructed between noise bunds. Widening this section will mean that these bunds need to be replaced by new bunds or noise barrier walls where there is insufficient space within the existing reserve.

The Cranford Avenue interchange is a half-diamond with single lane exit and entry ramps commencing and terminating at the southern abutment of Mount Henry Bridge. Cranford Avenue Bridge has four spans: Two central spans are 29.5 metres with two central columns one metre wide.

Placing the railway in the freeway median requires some minor widening of the freeway with adjustment of lane markings for new median shoulders against the railway barrier. **Figure 43**

There will be no encroachment of the Freeway on either the Swan River foreshore or Melville Parade.

The ultimate freeway design and railway can be accommodated through the Cranford Avenue Bridge with no further alteration.

The interchange at Leach Highway is a part clover leaf layout. The southbound exit ramp is two lanes wide while the other ramps are single lane ramps. The Leach Highway Bridge has two spans supported on four central columns. The western span is 36.6 metres

wide and the eastern span is 39.5 metres wide. The central columns are 1.5 metres wide.

The width between the Leach Highway bridges is sufficient for the railway, including a 9.5 metre wide station island platform, and the ultimate freeway, however there is little room to spare.

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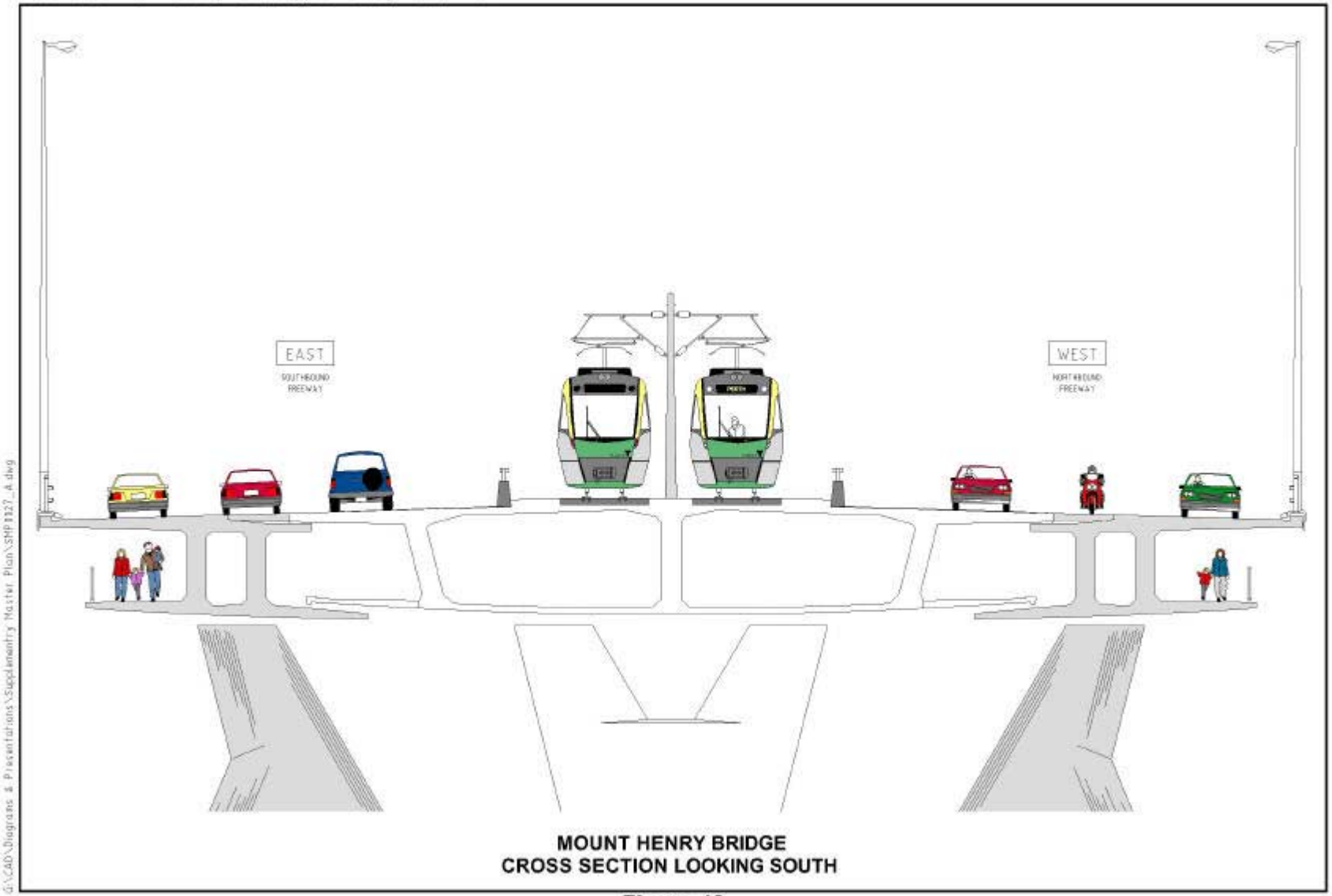

MOUNT HENRY BRIDGE
CROSS SECTION LOOKING SOUTH

Figure 42

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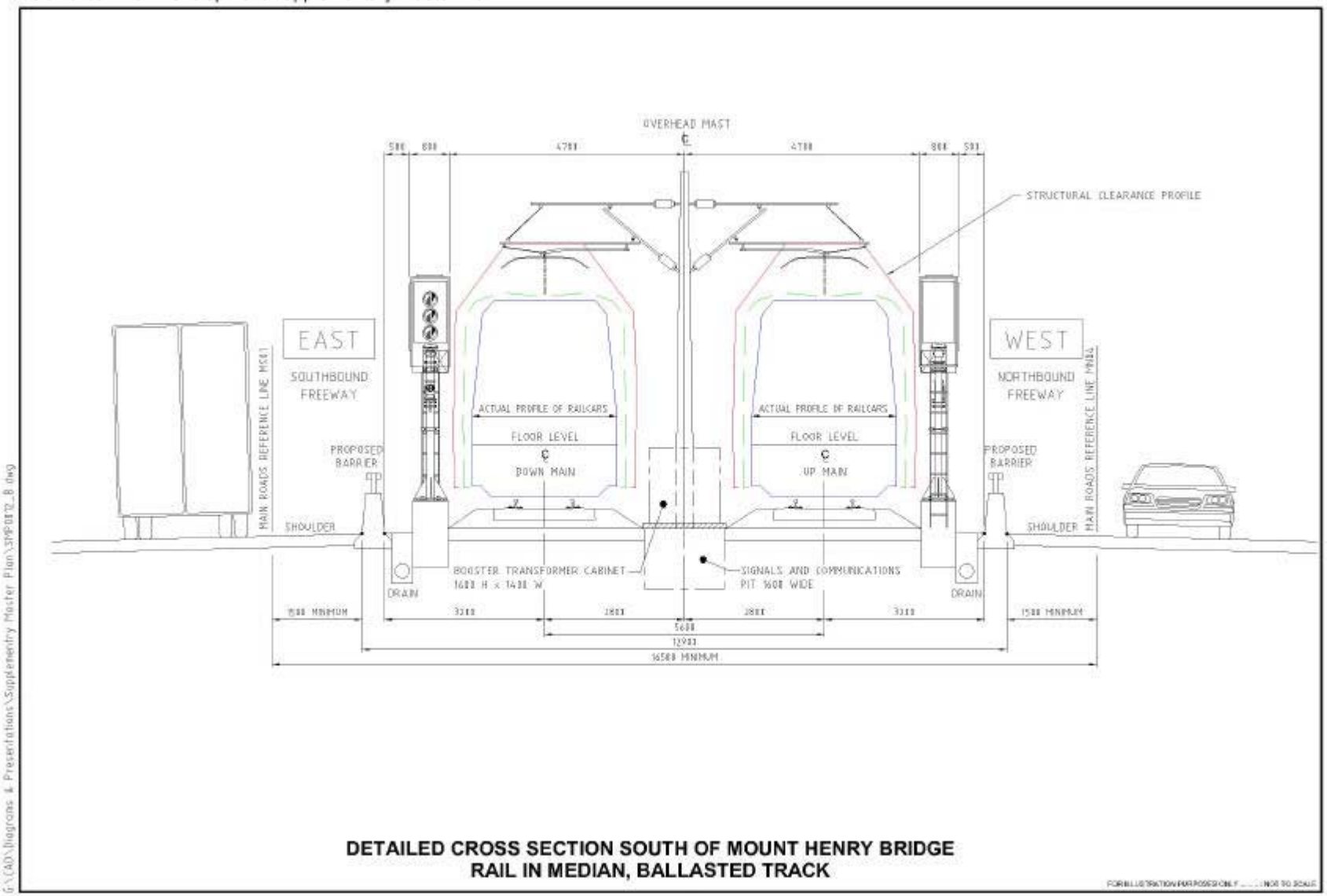

DETAILED CROSS SECTION SOUTH OF MOUNT HENRY BRIDGE
RAIL IN MEDIAN, BALLASTED TRACK

Figure 43

The Parry Avenue bridge is about half-way between Leach Highway and South Street. In common with the other bridges on the freeway, it has two spans supported on two central columns. Both spans are 31 metres wide. The columns are one metre wide. This bridge has part spill-through abutments and being built square to Parry Avenue is therefore skew to the freeway. This effectively increases the column width and the railway track will be separated further for clearance of these columns. This will require localised widening of the freeway.

South Street freeway interchange is a full diamond layout. The southbound exit ramp is two lanes wide. The western span of the South Street Bridge is 39.9 metres wide and the eastern span is 27.25 metres. The central piers are 1.35 metres wide.

A station will be built at South Street (Murdoch) with an island platform 9.8 metres wide. The station will have turnback facilities with a track south of the station between the Up and Down tracks. This requires railway signals to be located in the vicinity of South Street and increases the overall width required for the railway by 1.6 metres. For the ultimate freeway design this effectively places the shoulder of the southbound carriageway against the eastern bridge abutment with only room for a protective concrete barrier. In this case the width of the median shoulder is reduced through the station area and the platform located so that the bridge piers are slightly off centre.

8.2.7. South Street to Glen Iris

Provision for a turnback and railcar stowage immediately to the south of South Street Station, between the Up and Down tracks requires the freeway median to be 21.4 metres wide for a distance of 600 metres from the station and the freeway will be widened there to accommodate these works. The distance between freeway interchanges at South Street and Farrington Road is relatively short by freeway standards and an auxiliary weaving lane will be provided on both carriageways. The ultimate freeway configuration at this location requires four lanes in each direction and median shoulders and breakdown lanes. Retaining walls will be provided as required for on-and off-ramp connections with the freeway.

The station car park area in the south-east quadrant of South Street interchange affects the length of the auxiliary lane on the southbound carriageway.

Farrington Road interchange is a half diamond with single lane exit and entry ramps. The road bridge has two spans, the western span is 37.5 metres wide and the eastern span is 32.5 metres wide there are two central columns 1.35 metres wide in the median. The railway track centres will be increased for clearance from the bridge piers.

South of Farrington Road the railway corridor will fit within the existing median. The tracks will be at 5.6 metre centres within a 13 metre overall width including the continuous concrete barrier. From this point southwards to Glen Iris the railway has no effect in the first phase on the freeway configuration which will be two 3.5 metres lanes dual carriageway with 1.5 metres median shoulders and 3.0 metres breakdown lanes. The ultimate freeway configuration of three lanes in both directions and the railway can be accommodated within the existing reserve.

Where the SWMR crosses the Fremantle-Woodbridge freight railway line immediately north of Glen Iris, it will be carried on a new structure constructed in the space between the existing freeway carriageway

bridges. Continuous concrete barriers will be constructed on the existing bridges to replace the present steel parapets. This is shown in **Figure 44.** No additional work for widening the existing structures is required to accommodate the railway. In the ultimate configuration both carriageway bridges will require widening to accommodate the three lanes and shoulders of the freeway.

Immediately to the south of the freight railway bridge the SWMR railway lines will be spaced further apart to pass around the existing Glen Iris tunnel portal and ramp retaining walls and then converge back into the original SWMR alignment in the freeway. From this point onward the continuous concrete railway barrier is not needed as the median is wider and other types of barrier will be used.

The barriers required alongside the tunnel portal will encroach into the 1.5 metre median shoulders. This requires a minor widening of the freeway with an adjustment in its horizontal alignment which will need new surfacing and realignment of short sections of lane markings on both carriageways.

8.2.8. Glen Iris (Jandakot) to the new Rockingham Station

From Glen Iris to just south of Anketell, works have been completed on the freeway to allow the railway to continue in the median.

These works were executed in the Kwinana Freeway Interchange and Extension Project and included:

- a tunnel at Glen Iris (Jandakot);
- widening some 15 kilometres of the freeway northbound carriageways from Glen Iris to Mandogalup to create a median of sufficient width to accommodate the railway;
- increasing the span of the road overbridges over the freeway from Glen Iris to Kwinana for the wider median;
- a railway tunnel 1.2 kilometres south of Anketell Road to take the railway out of the freeway median, under the northbound carriageways to form the railway alignment through the Spectacles towards Kwinana.

There will be a station at Thomsons Lake (Beeliar Drive). Sites for future transit stations will be protected at South Lake (Berrigan Drive), Success, near Gibbs Road / Russell Road, Mandogalup (Rowley Road) and Anketell (Anketell Road). The rail route from Glen Iris to Rockingham is shown in **Figure 45**.

South of Thomas Road, which crosses over the railway with a bridge, the railway line skirts Wellard Road and an extension of Gilmore Avenue, through Leda.

There is a site for an intermediate station just south of Thomas Road. The sites for future stations at Leda and South Parmelia at Challenger Avenue will be protected.

The route passes through the Leda nature reserve in a cutting, maximum depth ten metres, until it passes through the limestone ridge where it immediately passes on to an embankment.

The route through Rockingham has been extensively revised compared with the options given in the original SWMR Master Plan.

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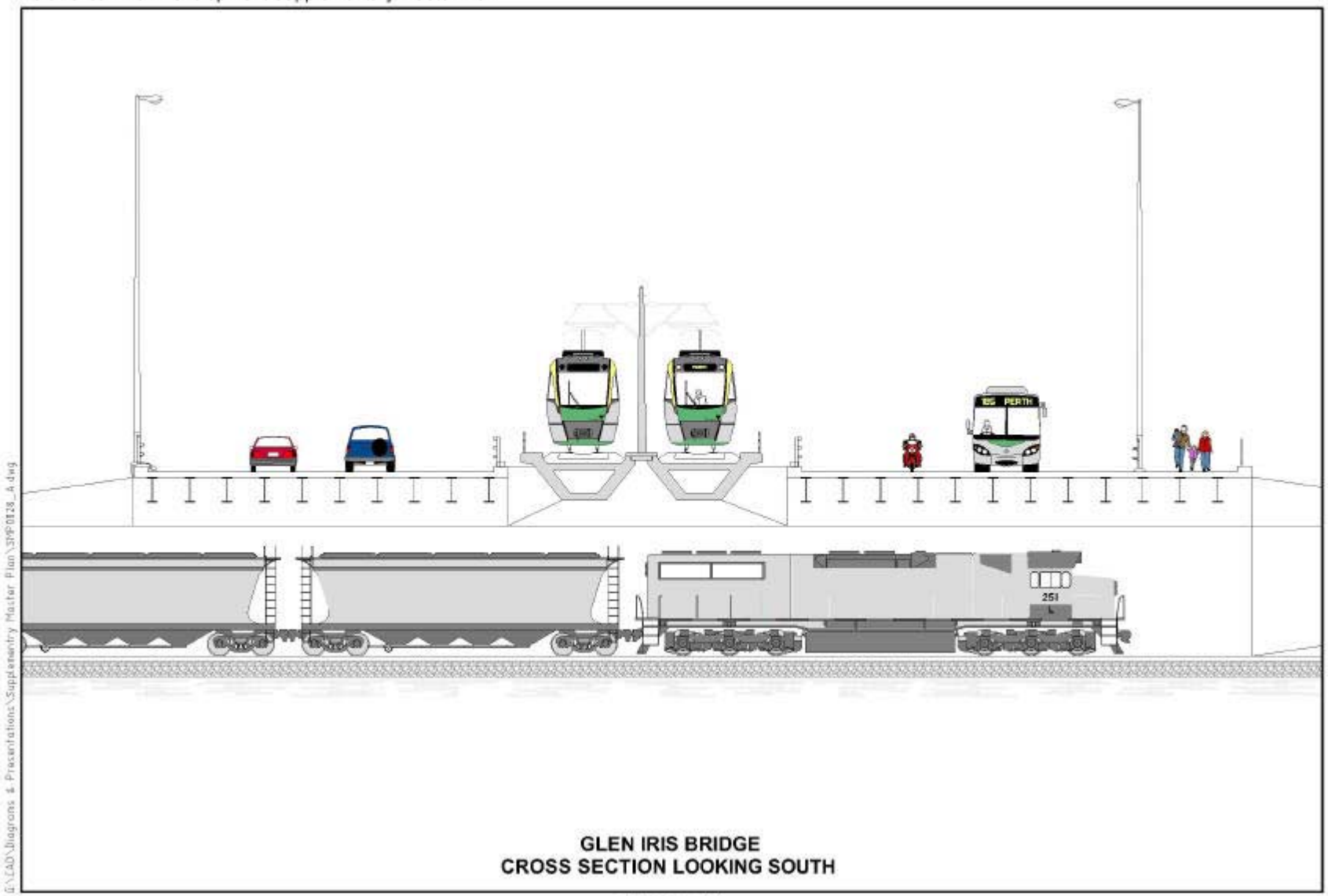

GLEN IRIS BRIDGE
CROSS SECTION LOOKING SOUTH

Figure 44

Perth Urban Rail Development Supplementary Master Plan

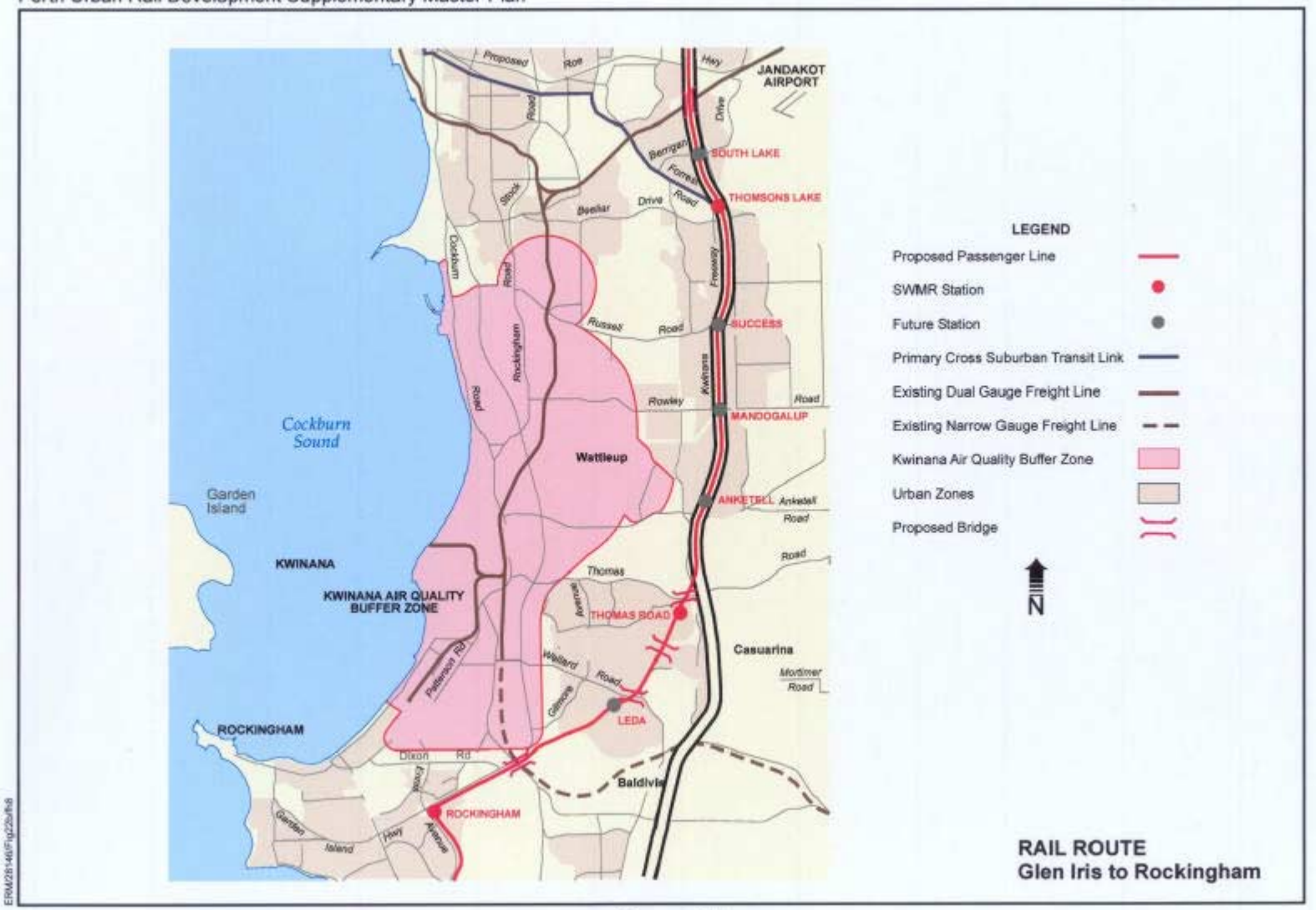

Figure 45

The railway alignment deviates from the original alignment one kilometre west of Leda Station and runs south-west, passing south of the existing Gilmore Avenue and crossing over the existing freight rail line and Old Mandurah Road approximately 70 metres to the south of the Dixon Road/Gilmore Avenue and Old Mandurah Road intersection. From this point the SWMR proceeds westward, following the Garden Island Highway reserve to the intersection with Ennis Avenue where the new Rockingham station will be sited. This is adjacent to Meadow Close and Greenway Loop and within the large reserve provided for the Fremantle-Rockingham Highway/ Ennis Avenue interchange with Rae Road. The SWMR then proceeds southward along the Ennis Avenue reserve to rejoin the original SWMR alignment 100 metres to the north of Willmott Drive.

The railway will be 1.5 to 2 metres below existing ground level as it passes between the Hillman and Woodbridge estates. Rail level at Ennis Avenue Station will be 5.5 metres AHD and the station platform will be approximately at existing ground level.

There will be SWMR rail bridges over the Kwinana-Mundijong freight rail line and the Old Mandurah Road in Leda.

A footbridge over the SWMR will replace the existing footpath at the end of Milina Street between Woodbridge and Hillman estates. This footpath will maintain access to the primary school in the Hillman estate.

8.2.9. New Rockingham Station to Waikiki

The SWMR will be placed on the eastern side of the Ennis Avenue reserve as it runs south from the station. Ennis Avenue is part of the Perth-Bunbury Highway and is a designated high load vehicle route requiring a 10 metre clearance envelope. The centre of the Down track is 15 metres from the eastern reserve boundary.

The Ennis Avenue alignment provides grade separation under Ennis Avenue for the Rockingham City Centre Transit System (RCCTS) together with pedestrian and cyclist access routes to the station and access between the car parking areas. The RCCTS will pass beneath Ennis Avenue at the lowest practicable level to limit the extent to which raising of Ennis Avenue will be necessary.

The railway will grade down at maximum permitted rate to pass under the Elanora Drive/Grange Drive cross roads. The track will be at a level of 1.8 metres AHD. Elanora Drive and Grange Drive will be raised approximately 1.5 metres above existing road level over the width of the intersection. Some minor level adjustment of the approaches of these roads to the intersection will also be necessary.

Beyond Elanora Drive the track will rise above design water table (4.0 metres AHD) and will remain at this level, approximately two metres below existing ground level as far as the southern end of Woodbridge estate opposite Link Way. The track will then rise to existing ground level southwards to meet the original Master Plan alignment 100 metres to the north of Willmott Drive.

The structures required in this section will be:

- A grade separation under Ennis Avenue, for access between the station and car park areas, which will also accommodate the public transport route together with pedestrian and cyclist access;

- A tunnel (or underpass) and associated retaining walls and approach ramps under Elanora Drive.

The rail route from Rockingham to Mandurah is shown in Figure 46.

8.2.10. Waikiki to Mandurah

From Waikiki the railway will follow the alignment as shown in the original SWMR Master Plan. Whereas the original plan provided a single track, a double track to Mandurah will now be provided.

South of Stakehill Road the route runs close between Mandurah Road.

Provision will be made for future transit stations at Stakehill on the south side of Stakehill Road, at Karnup (the north side of Paganoni Road), Lakelands (opposite Madora Beach Road) and at Gordon Road.

There will be level crossings at Stakehill Road, Paganoni Road and near the future Lakelands Station. These crossings will be protected with automatic boom barriers and lights.

8.3. Perth to Thornlie

8.3.1. Perth to Kenwick

Sections 5.4.2 and 8.1.14 of the SWMR Master Plan (1999) highlight significant infrastructure changes between Kenwick and Perth. The rail route from Perth to Thornlie is shown in **Figure 47**.

It is now proposed that the infrastructure works from Perth to Kenwick will be limited to the following:

- A new pedestrian bridge will be built in the vicinity of Howick Street at Victoria Park as per SWMR Master Plan. **Figure 48**
- The construction of a new station at Victoria Park on a new site should proceed as planned. This will replace the existing station and Lathlain station will be closed. The contract for the architectural design and preparation of the tender document is about to be let. Construction will start around October 2003 and be completed by July 2004. **Figure 49**.
- Bishopsgate Street level crossing will be closed in conjunction with the works for the new Victoria Park Station. This is in consideration of its proximity to the new platforms and for safety issues for pedestrian access to the platform.
- Grade separation by construction of a two lane road bridge over the railway will be constructed at Roberts Road/Miller Street and will replace the Bishopsgate Street crossing. **Figure 50**. The railway will be lowered through this area to limit the height of the road bridge and to facilitate connections to the existing road network.
- There will be an upgrade of Carlisle Station which will remain in its present location.
- Level crossings will be retained at Oats Street and Welshpool Road and no work is proposed at these locations.
- Gerard Street road bridge will be constructed as committed to the City of Canning.

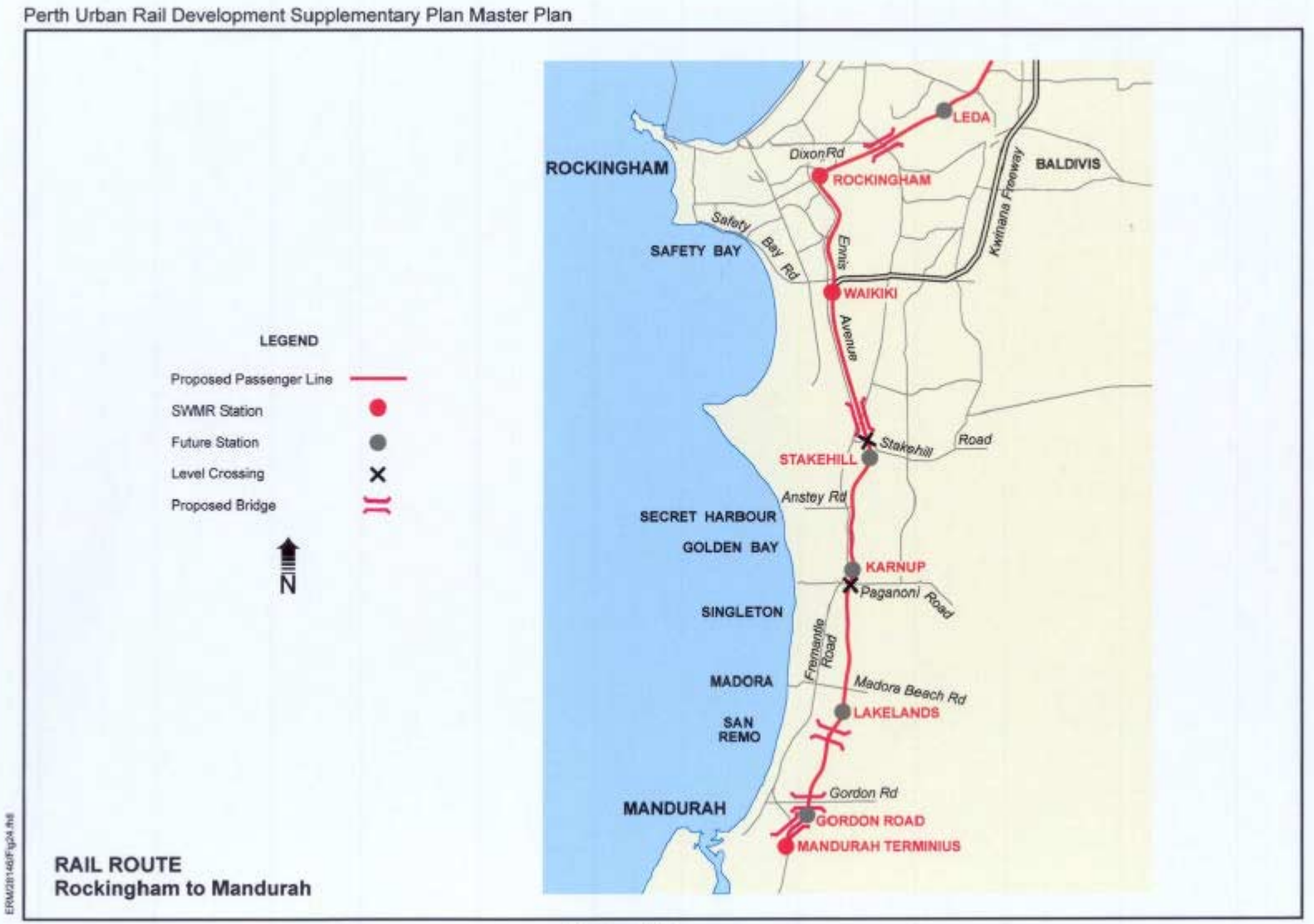
Perth Urban Rail Development Supplementary Plan Master Plan
LEGEND
Proposed Passenger Line
SWMR Station
Future Station
Level Crossing
Proposed Bridge
N
RAIL ROUTE
Rockingham to Mandurah
ROCKINGHAM
SAFETY BAY
SECRET HARBOUR
GOLDEN BAY
SINGLETON
MADORA
SAN REMO
MANDURAH
BALDIVIS
LEDA
Dixon Rd
ROCKINGHAM
Safety Bay Rd
Ennis Avenue
Kwinana Freeway
WAIKIKI
Stakehill Road
STAKEHILL
Anstey Rd
KARNUP
Paganoni Road
Fremantle Road
Madora Beach Rd
LAKELANDS
Gordon Rd
GORDON ROAD
MANDURAH TERMINUS

Figure 46

Perth Urban Rail Development Supplementary Master Plan

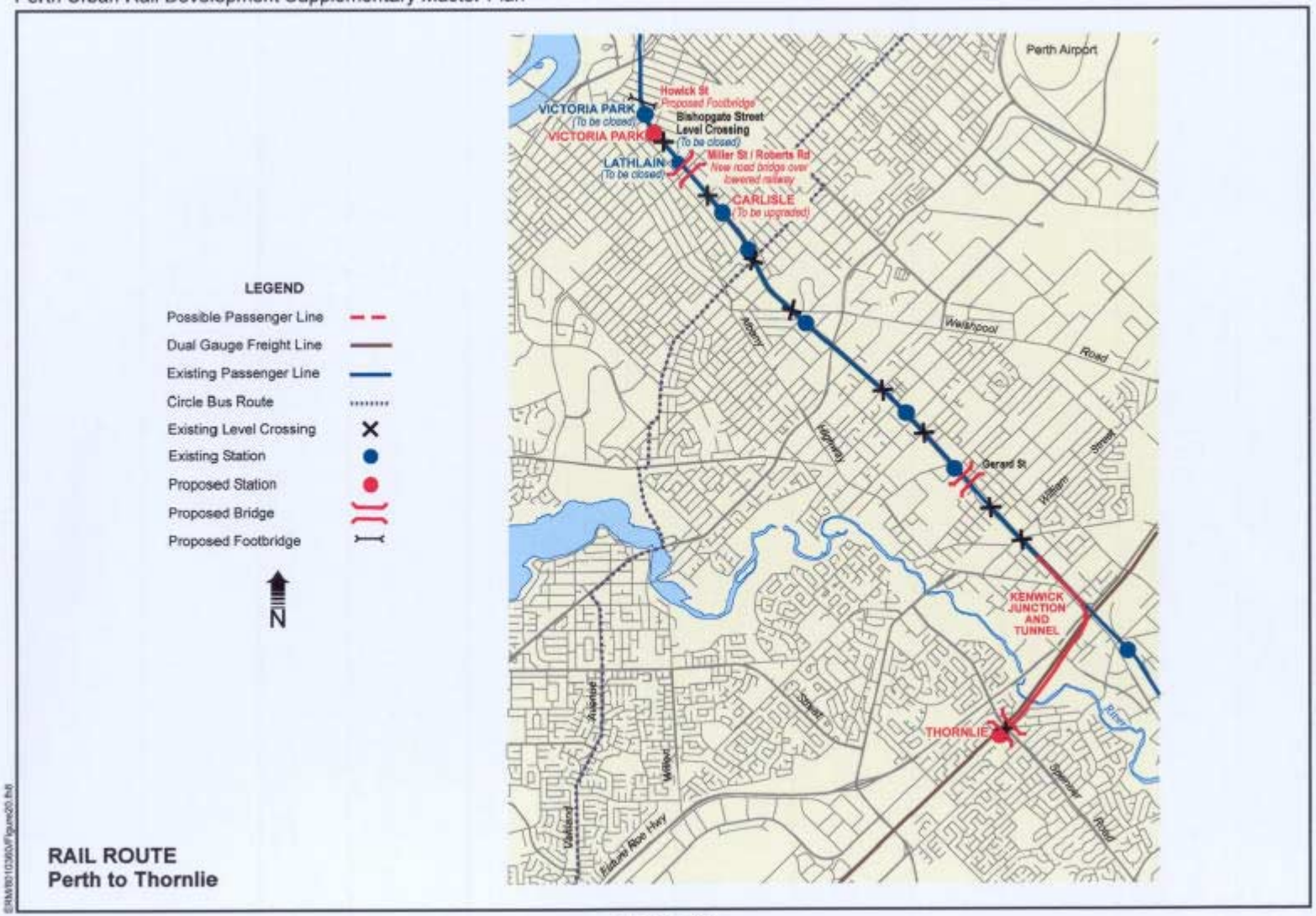

Figure 47

Perth Urban Rail Development Supplementary Master Plan

HOWICK STREET BRIDGE LOOKING SOUTH

FOR ILLUSTRATION PURPOSES ONLY ..... : NOT TO SCALE

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Figure 48

Perth Urban Rail Development Supplementary Master Plan

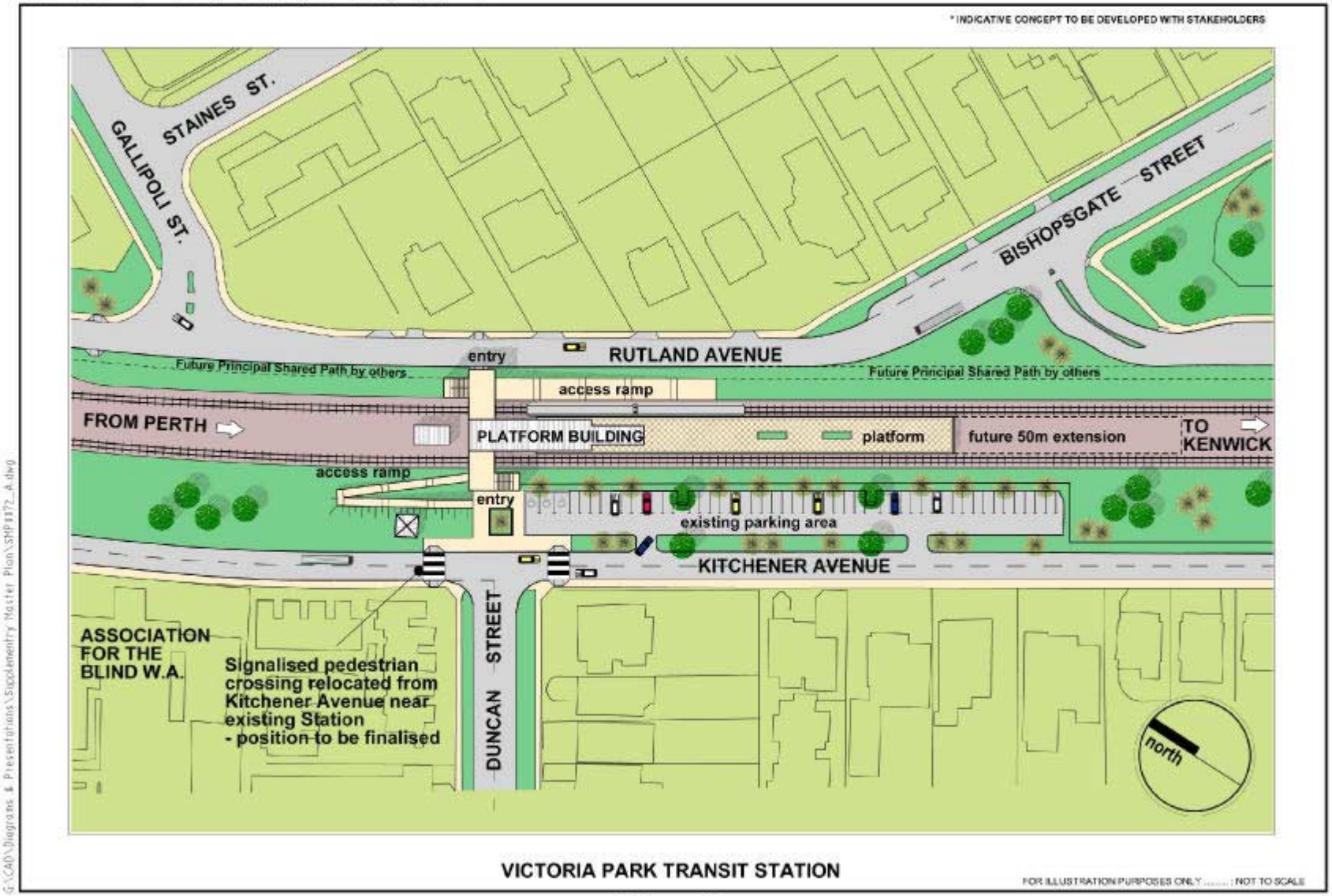
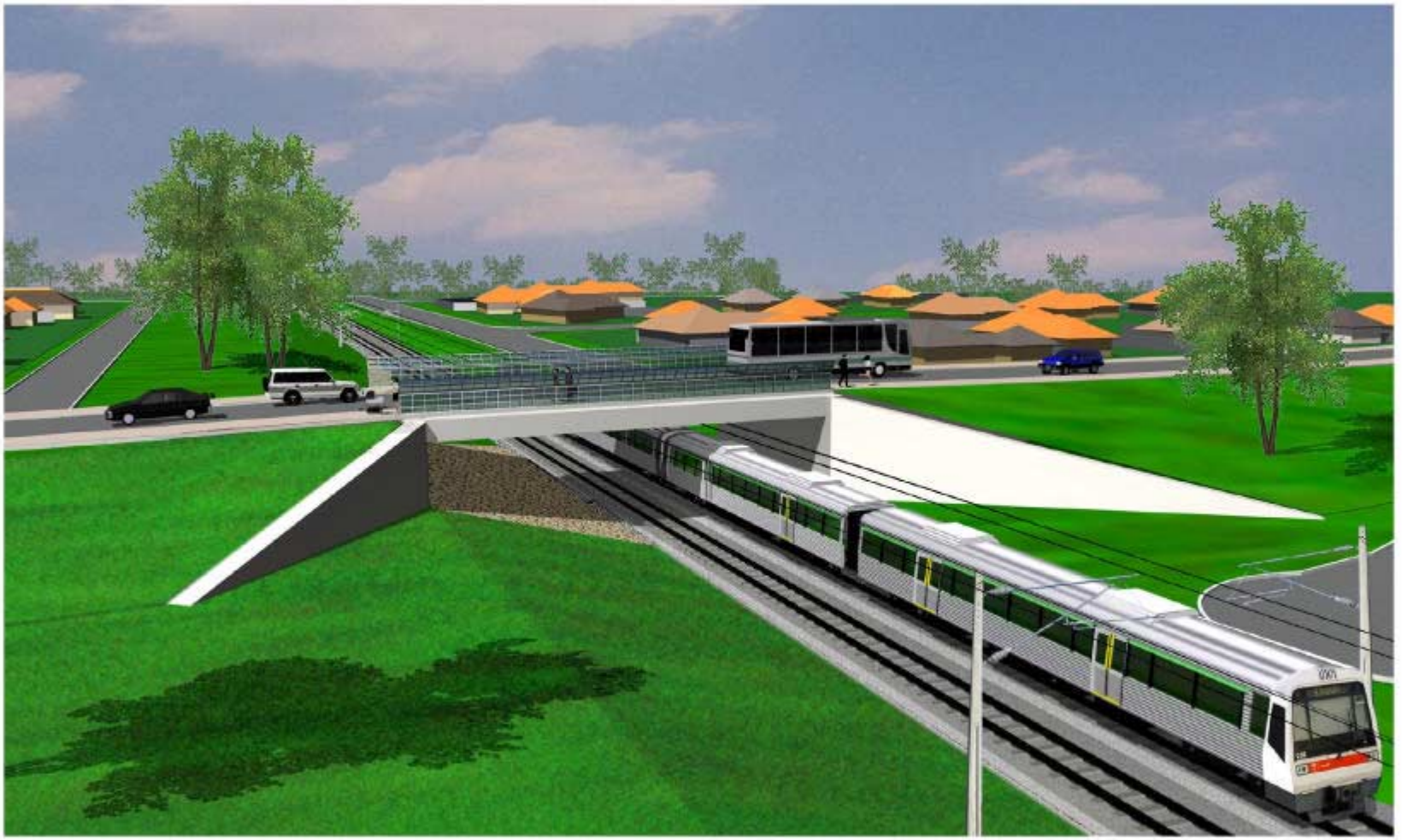


Figure 49

Perth Urban Rail Development Supplementary Master Plan



MILLER STREET/ROBERTS ROAD BRIDGE LOOKING NORTH

FOR ILLUSTRATION PURPOSES ONLY ..... : NOT TO SCALE

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Figure 50

8.3.2. Kenwick to Thornlie

Extension of the railway requires:

- A single-track railway will be built from Beckenham to Thornlie.
- Stage 2 of the Kenwick tunnel and associated works.
- A railway bridge over the Canning River.
- A road bridge over the railway at Spencer Road eliminating the existing level crossing.
- A station at Spencer Road, Thornlie.
- A new traction power feeder station at Kenwick.

8.4. Signalling and Communications Systems

The signalling system will be in accordance with WAGRC practice. It will incorporate computer based interlockings linked with fibre-optic cables and will use existing type three-aspect, multi-unit colour-light signals as on the Perth Urban Rail System.

It will enable services to operate at full line speed at three minute intervals.

Automatic Train Protection (ATP) equipment will be provided to enforce conformity of trains with signal indications.

There will be provision for emergency single-line working.

All signal control functions will be exercised from a Control Centre which will be an extension of the existing WAGRC Control Centre.

Train approach operated automatic boom barriers will be provided at road level crossings on the track south of Waikiki Station.

A fibre optic communications bearer system will be provided which will interconnect equipment at the new stations, the traction power supervisory control (SCADA) system and signals control and indications sites.

Mobile radio communications for the new line will use conventional mobile radio technologies to provide WAGRC train control and security radio systems. There will be extensions and enhancements to the existing WAGRC radio network including extra channels and facilities to improve service with additional highly reliable facilities through the city centre tunnels.

This will provide all the facilities needed for train operations, security and maintenance.

Standby power will be installed to maintain communications in the event of a grid system power failure.

Stations will be provided with the Driver Assistance Video System. Emergency telephones will be located within view of video surveillance cameras. The Video Surveillance System will be real-time in full colour and will be monitored and recorded on a 24-hour basis to ensure best response times.

The Passenger Information Network system will be extended to cover all new transit stations with visual and aural announcements.

For the public communications system necessary immunisation measures against electrical interference have been incorporated in the Master Plan.

8.5. The Traction Power and Supply System

The South West Metropolitan Railway will be an integral part of the Perth Urban Railway network. Power supply to the new lines must be integrated with the existing system. The power demand of the new railway will be of a similar order to the whole of the existing electric rail system.

From the Narrows south to Mandurah, all traction overhead support masts will be, wherever possible, single and centrally mounted between the tracks (central masts). On the section from the Narrows Bridge along the South Perth Foreshore and over the Mount Henry Bridge, there will be central masts. The arrangement on this section is shown in **Figures 41, 42 and 43**.

Exceptions to this will be in station areas where central platforms have been utilised, for example Leach Highway Station and Murdoch Station. Marginal masts will be required in these areas where the tracks widen out to accommodate the platform.

New feeder stations will be provided at Kenwick, Jandakot and Karnup, taking 132kV supply from Western Power facilities. There will be midpoint 25kV switching stations at Esplanade and Leda. Intermediate switching stations will be located at Anketell and Waikiki.

The 25kV traction overhead catenary wiring system will be similar to that already in use for the Perth Urban Rail system. The existing Traction Power Supervisory Control and Data Acquisition system for the Perth Urban Rail system will be extended to cover the South West Metropolitan Railway.

Investigations were undertaken as to the type of catenary and support system that would be the least intrusive along the South Perth foreshore and over the Narrows Bridge. It was decided that the most unobtrusive mast was concrete, similar to those presently installed on the existing network, built to the latest Australian Standards but of slimmer dimensions and, where possible, for the mast spacings to be increased to reduce the overall number.

Further studies were undertaken in an effort to reduce the number of overhead electrical conductors supported by the traction overhead masts, as compared to the existing network. It has been established that the two return conductors and the earth wire could be run underground adjacent to the track reducing the number of wires from seven to four, with little effect on the electrical system requirements. This will require the return conductors to be insulated to 3.3kV and the earth wire to be protected by a PVC insulator. These wires can be run in formed concrete ducts at ground level adjacent to the track.

There will be additional cost for this arrangement as well as additional cost for signalling, power and communications equipment located at ground level near the conductors.

9. The Rollingstock (EMU) Vehicles

9.1. The Electric Multiple Units

9.1.1. Train Configuration

A contract for the design, supply and maintenance of new rail cars was awarded to EDI Rail-Bombardier Transportation Pty Ltd on 10 May 2002. The contract is for 31 three-car units (comprising 93 cars). The first (3-car) unit will be ready for delivery in August 2004. Ten (3-car) units will be available by the end of 2004 and a total of 75 railcars (equal to 25 three-car units) by the end of 2005. The total order for the new railcars will be completed in May 2006. When completed these new railcars will almost double the size of the urban rail passenger car fleet.

The new trains will be operated on the SWMR and NSR. They will be electric multiple unit vehicles which obtain their energy from the single phase a.c. 25 kV 50 Hz overhead contact wire.

The railcars supplied will be semi-permanently coupled to form a three-car unit, unlike the current Perth railcar fleet which is a two-car unit. **Figure 51**.

The selection of a three-car unit results from operational studies. This configuration means a lower capital cost for the vehicles as less driving cabs are required by comparison with a two-car unit.

The operational studies have demonstrated that there is a passenger demand for a combination of both three-car and six-car trains in the peak period.

Unlike the existing railcars which have d.c. traction motors on the bogies, the new cars will have a.c. motors which are more efficient and need less maintenance.

The new cars will not be entirely compatible with the present railcar fleet. They will be capable of coupling mechanically and will have a braking system that will allow the old and new railcars to assist one another in the clearance of a line section should the need arise.

9.1.2. Car Interior Finishes and Passenger Comfort

Car interior finishes and passengers facilities will be to a comparable standard with the existing stock and they will have air-conditioning. Recent improvements to the existing fleet for passenger safety and amenity will be included. Passenger information displays will be incorporated in the new railcar fleet. These information displays will show visually the digitised recorded messages concerning route information such as "*The Next Station Stop is……*".

9.1.3. Performance

The vehicles will have a maximum normal service speed of 130 km/hr and be capable of transit times of approximately 33 minutes between Rockingham and Perth and 48 minutes between Mandurah and Perth with a limited stopping pattern. The vehicles will be capable of working the Joondalup line to the existing timetable.

The current planning for the operation of the new railcars is primarily on the north-south route between Clarkson and Mandurah and does not include for operation on the existing lines other than in an emergency.

Perth Urban Rail Development Supplementary Master Plan

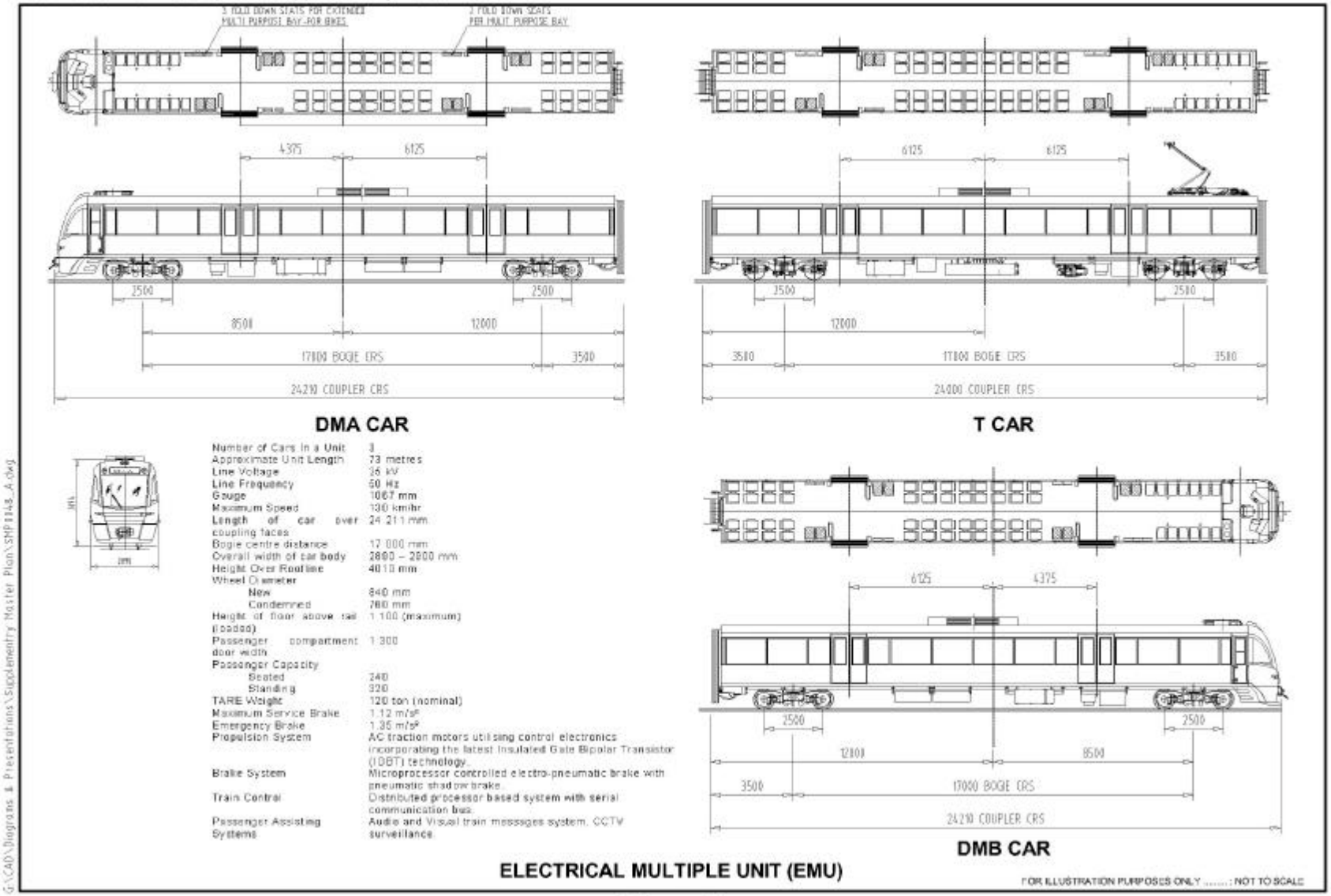

Figure 51

The design of the new railcars will be optimised for running between Clarkson and Mandurah in order to take full advantage of the higher speed of the new railcars and the greater station spacing, by comparison with the Fremantle, Midland and Armadale lines.

Because of the optimisation of the design for the Northern Suburbs and South West Metropolitan Railway they will not be suitable for the all station stops services on the Armadale, Midland and Fremantle lines. Running the new railcars on these older lines with all station stopping patterns means more frequent acceleration and deceleration than the railcars have been designed for. This is likely to lead to overheating problems with both the propulsion and braking systems.

Whilst EDI Rail-Bombardier are yet to complete final design of the railcars. **Figure 52** shows an artist's impression of the railcars.

Automatic Train Protection equipment to monitor the position and speed of the train relative to trackside signal positions in areas so equipped will be installed in each unit. The equipment will automatically override the driver's control of the train and make an emergency brake application if the allowable speed profile at these places is exceeded. A vigilance system which will monitor the actions of the driver will also be installed.

9.2. Depot & Stowage Facilities

9.2.1. Depots

A number of options for the optimum location for maintenance and cleaning the existing and new railcars were considered against the forecast demand for depot facilities slots, given the various scenarios for railcar consist and predicted growth on the Perth Urban Railway system.

The conclusion was that a maintenance depot will be built at Nowergup on the Northern Suburbs Transit System and that a railcar stowage facility should be built at Mandurah on the South West Metropolitan Railway. This stowage facility is needed because of the distance to Mandurah and the need to start trains in the morning from Mandurah terminus.

Nowergup has been selected as the main depot facility for a number of reasons. Firstly the South West Metropolitan Railway will not be in service until December 2006 and a facility is needed before that time to maintain the railcars for the Northern Suburbs Transit System extension. Also as the Nowergup depot will be in the median of the proposed Mitchell Freeway extension the impact of the depot on the public will be minimal.

Consideration was given to using the Claisebrook Depot for the maintenance and servicing of the existing and new fleet. This idea was rejected as the new cars would need to be two-car units as are the existing, otherwise Claisebrook would need to be modified to maintain both two and three-car units.

Perth Urban Rail Development Supplementary Master Plan

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ARTIST'S IMPRESSION OF RAILCAR

Figure 52

Also Claisebrook is now at its maximum safe stowage limit and as such it was determined that new maintenance, stowage and cleaning facilities were required.

Consideration was given to providing an underfloor wheel lathe at Nowergup to machine railcar wheels and discs.

However the cost of a wheel lathe of $3 Million to $4 Million could not be justified given the availability of a wheel lathe at Forrestfield.

9.2.2. Stowage Requirements

Stowage on the current network is concentrated at Claisebrook Depot. This accommodates most of the 48 two-car units (equal to 96 railcars) now in service. There is also a small facility for eight, two-car units (16 railcars) at Currambine. There are no existing facilities which are able to accommodate the new SWMR railcars.

The 93 new railcars, an additional 31 three-car units, will require the following overnight stowage facilities:

- 15 three-car units together with 8 two-car (existing) units to be stowed at Nowergup (61 railcars)
- 16 three-car units to be stowed at Mandurah (48 railcars).

Nowergup and Mandurah will be designed to cater for future growth on the Perth Urban Railway system by allowing for the construction of further stowage facilities at each of the sites.

Nowergup will be designed to cater for the fact that the railcars will be delivered before completion of stowage facilities at Mandurah.

9.2.3. Railcar Acquisition and Maintenance

Consistent with recent acquisition practice elsewhere, tenders were sought for the design, manufacture, commissioning and maintenance for a period of 15 years for the new fleet of railcars in accordance with a performance specification. This approach is now widely used and is intended:

- to ensure that ‘whole of life’ costs are taken into consideration in tender evaluation;
- that the responsibility for design and subsequent user maintenance resides with the manufacturer;
- that the maintenance costs are controlled under contractual arrangements.

The option for the supplier to finance the supply of the railcars under an operating or finance lease was seriously examined. However in the ultimate analysis it was shown that the cost to the Government and hence the taxpayer would be significantly higher than if Government funded the purchase. This was after allowing the trade-offs such as the transfer of financial, construction and other risks.

Therefore the railcars will be procured using Government funding.

The contract signed with EDI Rail-Bombardier includes the design and construction of the new railcar depot and servicing facility at Nowergup from where EDI Rail-Bombardier will carry out the railcar maintenance.

The railcar supplier is responsible for the design and construction of the depot to ensure it meets its own requirements and because it will be responsible for maintaining the railcars for 15 years.

The depot site at Nowergup and possibly the stowage facility at Mandurah will be made available to EDI Rail-Bombardier for the duration of the period of the maintenance contract.
EDI Rail-Bombardier will be granted a lease or licence to occupy the sites.

10. System Management

10.1. Infrastructure Maintenance

10.1.1. General

Track maintenance on the current urban rail system is executed under contractual arrangements. The overhead power system and the signalling equipment (including level crossing protection) are maintained by a direct labour force. The maintenance of the existing urban rail system is currently centralised, with the civil (power and overhead) and signalling resources being located at Claisebrook and telecommunications at Westrail Centre in East Perth.

The extended urban rail system including the extension to Clarkson and the new railway to Mandurah will continue to be managed by WAGRC for the foreseeable future. Provision is to be made for an infrastructure facility from which the railway may be maintained. It is intended that this maintenance depot will be an integral part of a co-ordinated WAGRC maintenance strategy.

Where possible convenient access points to the railway reserve will be provided by access from public roads or from access tracks established for fire management purposes. In a number of sections of the railway, particularly in the central Perth and Kwinana Freeway sections, special maintenance access provisions will be necessary.

10.1.2. Narrows and Perth City Area

Special provisions and practices will be required for maintenance of the rail infrastructure between the northern end of the Narrows Bridge and Northbridge.

Because the tracks are in tunnel over this length, planned maintenance will be carried out at times when no train services are operating.

The design will provide for access to the track and tunnel for planned or emergency maintenance vehicles at the northern and southern portals of the underground section.

The design of the railway infrastructure will be of the highest standard, recognising the very tight tolerances and limited accessibility for both normal operators and maintenance and in emergencies. The track structure will be of concrete ‘slab track’ type.

The design will provide for access to the track and tunnel for planned or emergency maintenance vehicles at the northern and southern portals of the underground section.

10.1.3. Kwinana Freeway

Narrows Bridge to Mount Henry Bridge

Between the Narrows Bridge and Manning Road the track is contained within the concrete barriers that define the existing busway. Between Manning Road and Mount Henry Bridge, concrete barriers will be installed to define the railway reserve. The minimum internal clearance between the faces of barriers is 10.2 metres over the whole section.

Access to the railway infrastructure over this section will be constrained by the continuous concrete barriers at each side of the railway reserve and in normal circumstances it will be impossible to gain access from the freeway carriageways. For this section of the railway a planned maintenance strategy will be developed. This will recognise the

constraints of minimum clearances and the continuous barriers imposed by the freeway.

Recognising these constraints a concrete 'slab track' structure will be provided. This will also have the effect of minimising the rail height above the existing pavement level from about 650 mm to less than 200 mm shown in **Figures 43 and 41**.

To provide for planned or emergency maintenance of the railway infrastructure in this section, access to the track may be obtained by the provision of access ways to the railway reserve at locations immediately north of the bus on and off-ramps at Canning Bridge. The development and agreement of the detail for this access is to be negotiated with MRWA.

Mount Henry Bridge to Glen Iris

Over this section, the width of median available is generally 13.5 metres and therefore is wider than that north of Mount Henry. Between the Mount Henry Bridge and the freight railway line bridge at Glen Iris the barriers will be continuous solid concrete. Because of the additional width and because there is no existing road pavement structure in place which limits the vertical flexibility of the track height, a conventional ballasted track will be provided.

Where possible provision for the temporary stowage of rail mounted maintenance vehicles will be provided in conjunction with the stowage tracks at South Street (Murdoch) station and Thomsons Lake station.

10.2. Emergency Response

WAGRC has well established procedures for the management of emergencies. Emergency response plans are developed and tested annually for the existing urban passenger railway and these plans will be further developed for the management of emergencies that may arise on the sections of the railway where there is restricted access and in the tunnel section through the City.

10.3. Rail Operational Safety Management

Railway safety management aims to ensure that appropriate action is taken to limit the risk of harm to persons or damage to property, to acceptable levels. This approach recognises that whilst there is an ideal level of safety the practical costs of achieving this ideal might far out weigh the benefits and limit the viability of railway operations.

To meet the requirements of the Western Australian Rail Safety Legislation, PURD will operate under the relevant requirements of the Western Australian Government Railway Commission Accredited Rail Safety Management System that includes systems, standards and procedures that satisfy the Rail Safety Act of 1998 and Australian Standard AS 4292 – Railway Safety Management.

Under the accreditation process the Western Australian Government Railway Commission is responsible for determining the standards that are suitable to their proposed operations and for demonstrating to the Accreditation Authority the appropriateness of those standards.

Contractors engaged by PURD whose work may have an impact upon rail safety will be contractually required to prepare and implement

Safety Plans that not only address railway safety matters but also the relevant aspects of the Western Australian work place legislation.

As part of the Safety Plans, the coordination of interface activities with the existing railway is of paramount importance. In this regard in the execution of all Project Works on or near an existing railway network, the safe passage of the public and rail traffic will take precedence over all works.

11. Buses & Other Rapid Transit

11.1. Bus Operations Strategy

The South West Metropolitan Railway will form the major spine of a totally integrated public transport network. The bus route network has been designed to complement the train service and connect transit stations with surrounding suburbs and major activity centres. The proposed bus services in the network can be broadly categorised in the following types of services. Supporting these services will be the following secondary bus network which will connect with transit stations and major centres:

- *Cross suburban services* - will provide frequent services connecting other district or regional centres with transit stations.
- *Feeder services* - relatively short distance trips which provide frequent, direct connections to transit stations from nearby suburbs. Wherever possible feeder services will also connect with local suburban centres.
- *Minilinks* - community-based services which will run along a fixed route on the outward trip but determine the route for the return journey according to demand. In many cases the relatively low demand may allow small or mid-size vehicles to be used, with easier access to residential areas.
- *Major line haul services* - frequent long haul services connecting major centres via alternative routes.
- *Series 900* - frequent high-quality services serving other corridors but connecting with trains.

Buses serving the SWMR will operate in a similar manner to those serving the Northern Suburbs Railway in the Mitchell Freeway corridor. Transperth has redesigned their route network to feed previously Perth CBD-bound services into SWMR stations. There will be no CBD-bound services from south of Mount Henry Bridge. Buses will continue to operate between the Perth CBD and Melville districts via Canning Highway and South Perth via Labouchere Road with an appropriate level of bus priority.

Most stations will have exclusive bus off-street facilities. The goal is to have services timed to meet arriving and departing trains. Some stations will have regular basic network services pass the station with existing bus routes on adjacent streets.

Bus route frequency to rail stations will be 10-15 minutes in peaks and 20-30 minutes in off-peak periods. The frequency will be finalised as the train timetable is confirmed. Currently the bus feeder service level in the northern suburbs is 15 minutes in the peak and 30 – 60 minutes off-peak with peak train services at four to eight minutes in the peak and 5 to 15 minutes off-peak.

The introduction of the SWMR will significantly change the bus network. The service changes will be limited to five of the ten Transperth contract service areas.

The northern suburbs contract service area affected by the Clarkson extension will see relatively minor service changes, given that buses in this area currently deliver patrons to Joondalup station and there are no CBD-bound bus services from this area.

11.2. Kwinana Freeway Bus Services

Buses serving the SWMR will operate in a similar manner to those serving the Northern Suburbs Railway in the Mitchell Freeway corridor. Transperth has redesigned their route network so that services which currently link directly with Perth CBD, instead will connect into SWMR stations. There will be no direct CBD-bound bus services from south of Mount Henry Bridge.

Buses will continue to operate between the Perth CBD and Melville districts via Canning Highway and the Kwinana Freeway and South Perth via Labouchere Road. In both cases there will be a requisite level of bus priority. Approximately 73 buses (54 and 19 buses respectively) will serve the CBD from these two origins in the two 120 minute peak periods.

Rail stations will have dedicated off-street bus facilities. The goal is to have services timed to meet trains travelling in the peak flow direction. Canning Bridge station will have bus services passing the station on existing bus routes. Bus stops on Canning Bridge will allow passengers to transfer to the train at this station.

Bus route frequency to rail stations will be 10-15 minutes in peaks and 20-30 minutes in off-peak periods. The frequency will be finalised as the train timetable is confirmed.

11.3. Busway Works & Bus Services

Priority will be provided for buses joining the Kwinana Freeway northbound at Canning Highway Bridge and in the vicinity of Judd Street overpass and into the Busport from the Narrows Bridge. **Figure 53**. These services could otherwise incur losses of patronage if patrons were required to change to rail at Canning Bridge. In the outbound or southerly direction bus priority will be provided between the Busport and Judd Street and for buses leaving the Freeway at Canning Highway.

The areas for bus priority infrastructure are:

- Kwinana Freeway North: Canning Highway off-ramp.
- Kwinana Freeway South: Canning Highway on-ramp.
- Kwinana Freeway North: Judd Street to Narrows Bridge.
- Kwinana Freeway South: Narrows to Judd Street.
- Narrows Bridge to Busport in both directions.

The work at Canning Bridge will give buses entering the freeway from Canning Highway priority access on to and off the freeway and enables saving of approximately 30% of the time difference between a bus operating in the busway compared with a bus operating in general traffic.

Buses will travel south on the freeway in the centre (median side) lane and leave the freeway at a bus-only deceleration lane on to Canning Bridge over the newly constructed bus bridge. The

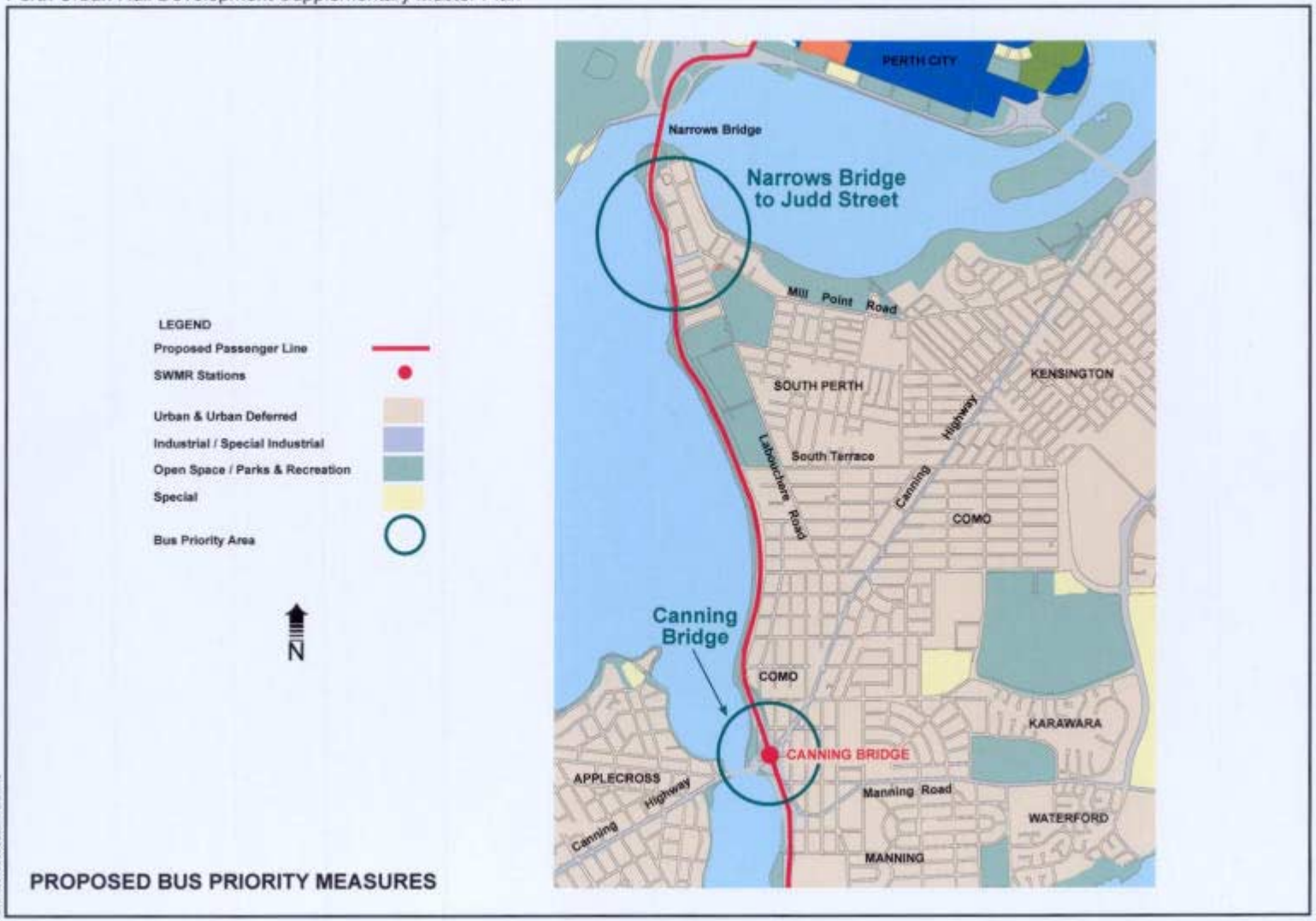

Perth Urban Rail Development Supplementary Master Plan
LEGEND
Proposed Passenger Line
SWMR Stations
Urban & Urban Deferred
Industrial / Special Industrial
Open Space / Parks & Recreation
Special
Bus Priority Area
N
PERTH CITY
Narrows Bridge
Narrows Bridge to Judd Street
Mill Point Road
SOUTH PERTH
KENSINGTON
Labouchere Road
South Terrace
Canning Highway
COMO
Canning Bridge
COMO
KARAWARA
CANNING BRIDGE
APPLECROSS
Canning Highway
Manning Road
WATERFORD
MANNING
PROPOSED BUS PRIORITY MEASURES

Figure 53

deceleration lane can be accommodated within the existing freeway reserve. No modifications are required to the bus bridge or to Canning Bridge and interchange upper level.

Buses travelling north to Perth on the freeway will travel on to Canning Bridge to the interchange. A turning lane and bus stop will be constructed at the interchange station upper level. A new ramp will be constructed from this turning lane to a bus lane in the freeway. This bus lane will merge with the centre lane of general traffic. The design merge speed is 100 km/h. The existing bus bridge will be demolished to accommodate the proposed rail alignment.

Bus priority works are proposed between the Judd Street freeway north on-ramp and the Narrows Bridge. Bus services travelling north and south on the Kwinana Freeway are to have exclusive lane access through the zone of traffic congestion which enables saving of approximately 50% of the time difference between a bus operating in the busway compared with a bus operating in general traffic.

Buses travelling north to Perth using the freeway will join the freeway general traffic centre lane using the dedicated on-ramp described above at Canning Bridge and traverse the freeway in the general traffic centre lane. 500 metres south of the Judd Street on-ramp buses will merge to the right into a bus-only lane to the southern end of the Narrows Bridge where buses again enter general traffic lanes. Entry to the city Busport is by a dedicated bus lane of similar configuration to that currently in place but modified to accommodate the SWMR alignment. An additional lane in this vicinity can be accommodated within the existing reserve by modification of road shoulders, reduction in emergency breakdown lane width and there is no requirement for an additional concrete barrier.

Buses travelling south on the Kwinana Freeway from the Busport will join the freeway and cross the Narrows Bridge in the exclusive bus lane currently in place. From the south end of the Narrows Bridge a new bus-only lane will be constructed. This additional lane will continue to approximately 500 m South of the Judd Street freeway north on-ramp.

11.4. Rockingham Area Public Transport Service

With the July 2001 decision to locate Rockingham Transit Station at the intersection of Rae Road and Ennis Avenue, it was identified that Rockingham would benefit from a high frequency fast public transport service between the Transit Station and major Rockingham activity centres.

This service has been titled the *'Rockingham City Centre Transit System'* (RCCTS). It will operate between the rail station and the foreshore via the Rockingham CBD and Murdoch University a distance of approximately five and a half kilometres at a frequency of four times per hour.

The integration of this bus transit service with the train service is directed at enhancing the City of Rockingham as a destination rather than an origin for trips elsewhere. In this way, the combined integrated system of feeder buses, train service, RCCTS and Rockingham to Fremantle Transit bus service will provide and complete the highest level of public transport service to the Rockingham area.

11.4.1. Rockingham City Centre Transit System (RCCTS)

Following the new SWMR alignment announcement in July 2001 the Minister for Planning and Infrastructure established a Rockingham City Centre Transit System Taskforce chaired jointly by Mark McGowan

MLA and Norm Marlborough MLA to investigate alternative transit modes and route concepts for this service proposal. Planning has also been done on funding strategies and land use opportunities presented by such a proposal. The Taskforce hosted an open house in February 2002 for the community to publicise preliminary ideas for the proposal. The Taskforce is scheduled to complete its planning in the next few months.

Technologies under consideration for the RCCTS range from advanced bus systems to rubber tyred optically guided buses and extend to a steel wheel light rail system.

Planning to date suggests a preference for operating along the following route:

- Initial stop immediately adjacent to the Rockingham rail station platform (this would be the same stop as other bus operations).
- Rae Road (Ennis Avenue to Kitson Street, with access between Kitson and Rae Road limited to public transport vehicles)
- Kitson Street (Rae Road to Council Avenue)
- New north-south City Centre Transit Mall (Council Avenue to Chalgrove Avenue)
- Chalgrove Avenue (Whitfield Street to the Murdoch University campus)
- A new north-south road through the campus to Dixon Road
- Dixon Road to Patterson Road.

There are a number of route options in the foreshore area using combinations of Patterson Road, Flinders Lane, Wanliss Street, Kent Street and Rockingham Beach Road.

Details of the RCCTS project can be found on the project web site at http://www.transport.wa.gov.au/metro/policies/rockinghamtransit/index.html.

11.5. Bus services at Rail Stations

Wellington / William Street Station

This rail station is an extension of the existing Perth City railway station and provided direct access to the Wellington Street Bus Station connecting with bus services to the Fitzgerald Street and Wanneroo Road corridors. In addition, bus services from William Street (Beaufort Street and Guildford Road services) operate southbound over the Horseshoe Bridge and along William Street adjacent to the bus and rail stations. Northbound these services operate from the Busport along Barrack Street with the nearest bus stop 200 metres east of Perth (Wellington Street) rail station.

Currently 15% of rail patrons arriving at the Perth (Wellington Street) rail station between 7:00 a.m. and 9:00 a.m. transfer to buses or CAT services.

Modifications to the CBD bus system including CAT routes, are under consideration in an effort to improve system legibility, improve operational efficiency and decrease travel time for public transport patrons.

Busport / Convention Centre / Esplanade Station

The Busport is the more southerly of the two CBD bus stations. Both of the bus stations will provide direct interchange with the rail system. Buses from the Busport serve the Kwinana Freeway, Stirling Highway, the Causeway, William Street and Guildford Road corridors as well as the Wellington Street Bus Station. The Blue CAT also serves the Busport. Currently approximately 28% of bus patrons arriving at the Busport between 7:00 a.m. and 12:00 noon weekdays transfer to another bus or a CAT service.

Canning Bridge Station

Six bus services, three of them high frequency *900 Series* routes from Melville districts via Canning Highway will continue to serve the Perth CBD directly, without requiring transfer to the railway. However, bus stops located at Canning Bridge Station will be retained to facilitate transfer to the rail system both southbound and northbound. Bus priority facilities are proposed for the Kwinana Freeway between Canning Highway and the Perth CBD Busport, as section 11.2 above. In addition there are proposals being developed for bus priority along Canning Highway west of the Kwinana Freeway. Work is ongoing to develop a high quality service between Canning Bridge and Curtin University.

Leach Highway Station

A total of twelve bus routes will converge at this station from both east and west including a direct link with the Garden City Shopping Centre.

South Street (Murdoch) Station

This station will have the largest volume of passenger interchange (bus and park and ride) along the entire SWMR outside the Perth CBD. 17 feeder bus routes plus the Circle route will deliver patrons from surrounding suburbs mainly to the west, south and east.

One route will provide a direct link with the Garden City Shopping Centre.

Planning is underway for a bus-only roadway south of and parallel to South Street from Murdoch University, directly accessing a bus deck above the rail station platform. This will provide a better service to the growing Murdoch super block area and improve bus operating efficiency by avoiding a number of traffic signals and traffic congestion on South Street.

Thomsons Lake Station

Destined to become the transport focal point for the planned Cockburn Central project, a total of 12 bus routes will converge at this station. There will be a frequent cross suburban services directly linking Cockburn Central with Fremantle.

Thomas Road (Kwinana) Station

Four feeder bus routes will serve this station initially, with provision for expansion as the surrounding area further develops. All four routes will also link to the Kwinana Hub bus station on Gilmore Avenue.

Rockingham Station

The primary Rockingham bus interchange will now be at the new SWMR station and will replace the current Rockingham Bus Station located adjacent to the Rockingham City Shopping Centre. The rail station will be the meeting point for all local and regional bus services which will be timed to coincide with specific train arrivals and departures.

The Rockingham-Fremantle *900 Series* bus route number 920 from the north and local feeders from the south will serve the rail station directly. Other feeder services from the west and north-west will travel via Rockingham City centre most of them using the planned Transit Mall. In addition the concept is being developed of a transit technology providing a service between the SWMR station, Rockingham City centre, Murdoch University and the Rockingham Foreshore Park. This RCCTS concept is discussed in Section 11.4 above.

Waikiki Station

This station will be a focal point for feeder bus services from suburbs to the east and west of the rail line including Secret Harbour, Port Kennedy, Waikiki and Baldivis.

Mandurah Station

The southern terminus of the rail line will incorporate a major bus interchange facility which as well as enabling good co-ordination between bus and train services will function as the primary transfer point between buses serving the Mandurah area.

Canning Vale Area

This area will be served primarily by buses feeding the rail system via South Street and the South Street (Murdoch) stations. Investigations are underway to identify bus priority opportunities in the South Street corridor. Roe Highway staging is being considered in planning for this area.

11.6. Summary of Effects on Bus Feeder Services

The introduction of the SWMR will change the bus route network significantly.

About 80 existing bus routes will be replaced by completely revised services, with another 15 to be altered. Recurrent and capital financial budgets will be affected by the consequent changes in operating kilometres and the number of buses needed. The service changes will affect five of the ten Transperth bus service contract areas and indirectly affect other contracts, including the Circle route.

The northern suburbs contract service area affected by the Clarkson extension will see relatively minor service changes, given that buses in this area currently deliver patrons to Joondalup station and there are no CBD-bound bus services from this area.

12. Budget, Costs & Delivery Options

12.1. Summary of Comparative Estimates of Cost

Table 12.1 shows all estimated costs for the Project including escalation and construction contingency . For comparison purposes the Total Estimated Project Costs are shown in:

- Base Values, July 1998 and July 1999 $'s as expressed in the South West Metropolitan Railway Master Plan and the Northern Suburbs Transit System Master Plan (column 1);
- Current Values, April 2002 $'s including escalation between 1998/1999 and 2002 (column 2);
- Current and Future Values, i.e. when progressive payment for the works is anticipated up to the end of 2007 (column 3).

Table 12.1

Estimated Costs

	1998 & 1999 $ Million Base	**2002** $ Million Current	**2006 – 2007** $ Million Future
General Items, Project Management and Engineering	141.5	158.0	158.0
Rollingstock and Depots	300.0	300.0	300.0
Northern Suburbs Extension	48.3	48.9	48.9
Perth to Thornlie	115.7	87.8	87.8
Perth to Mandurah	611.5	696.8	696.8
Escalation to 2006/2007	-	-	127.5
Total Estimated Project Cost	**$1,217.0**	**$1,291.5**	**$1,419.0**

The cost estimates compiled for the South West Metropolitan Railway and works between Perth and Kenwick and the new line to Thornlie were based on costs current at 1 July 1998. For the Northern Suburbs Transit System, the costs were current at 1 July 1999.

12.2. Scope of Estimates

The above estimates include :

- General Items, Project Management and Engineering;
- Rollingstock allocation for 93 rail cars and depot facilities at Nowergup and Mandurah;
- The main SWMR project works from Perth to Mandurah including the necessary changes to the Kwinana Freeway **Figures 54 and 55**;
- Extension of the NSTS to Clarkson **Figure 56**;
- Infrastructure improvements between Perth and Kenwick and the new line to Thornlie; **Figure 57**;
- Escalation based on the adjusted Perth Consumer Price Index (CPI) from 1998/99 to 2002 and 2002 to 2006/07.

The costs in **Figures 54, 55, 56 and 57** show the estimated construction costs inclusive of the appropriate contingencies but exclude costs for Rollingstock, Engineering, Project Management and some General Items. The totals show costs for discrete items of work as well as sections of line and have been rounded.

The costs are in April 2002 $ values and have a Project Cost Index (PCI) of 107.00 compared to July 1998 (PCI = 98.00) and July 1999 (PCI = 100.00).

The costs estimates assume work will proceed without industrial disruption or natural causes outside the normal and are based on the assumptions that contracts will be let in large packages covering work scopes of a similar nature and that contract conditions will be those common in the construction field and that no unusual conditions likely to affect costs will be included. The cost estimates are net of GST.

The estimates are based on provision of facilities to meet current forecast levels of demand. No additional provision has been made for increased patronage demand arising from subsequent development of supporting urban areas and feeder systems.

The breakdown of the net construction costs (April 2002 $'s) for the major component of the Project, the works between Perth and Mandurah by major section of the line is shown in **Table 12.2**.

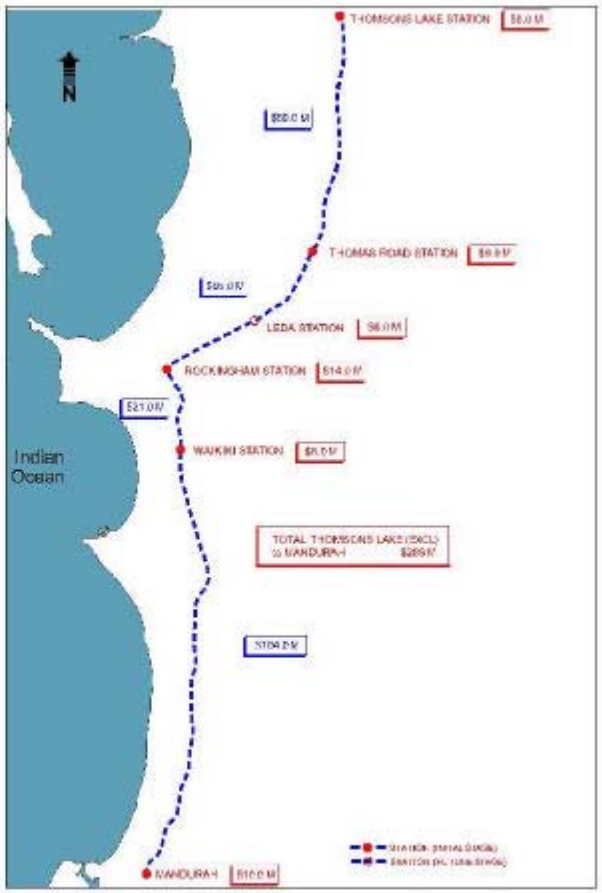
Table 12.2

Perth to Mandurah Estimated Costs

Section	**2002 $ Million Current**
• Perth yard to Narrows Bridge (excl)	195.5
• Narrows Bridge (incl) to Glen Iris tunnel (incl)	194.7
• Glen Iris tunnel (excl) to Thomsons Lake (incl)	20.8
• Thomsons Lake (excl) to Mandurah Road (excl)	98.9
• Mandurah Road (incl) to Waikiki (incl)	72.5
• Waikiki (excl) to Mandurah	114.4
Total (including contingency but excluding General Items, Project Management and Engineering)	**$ 696.8**

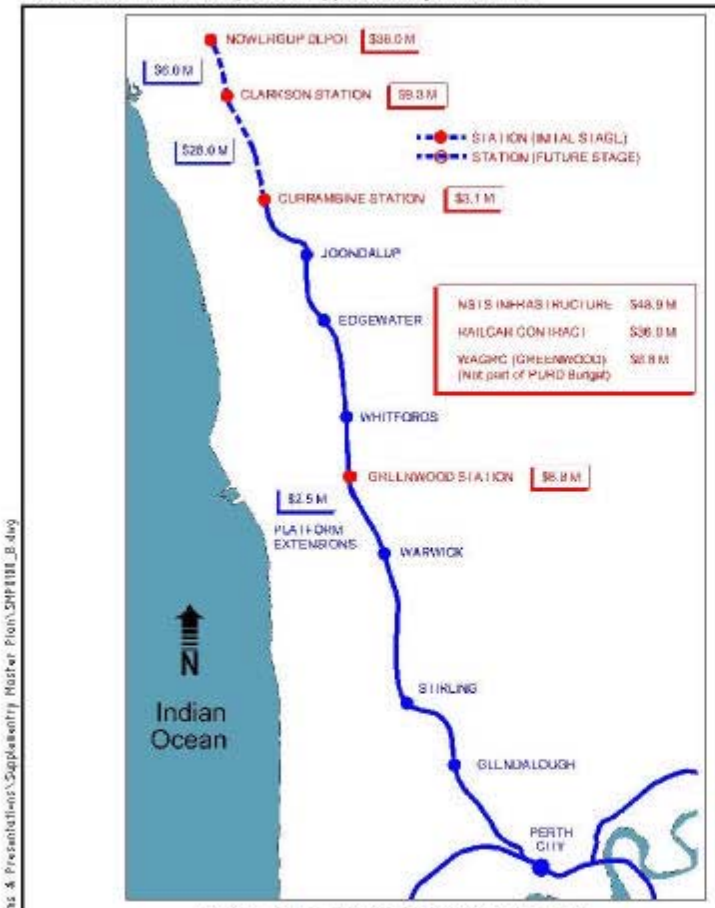
Perth Urban Rail Development Supplementary Master Plan

PERTH to THOMSONS LAKE
BUDGET for PROJECT WORKS
Figure 54



THOMSONS LAKE to MANDURAH
BUDGET for PROJECT WORKS
Figure 55

Perth Urban Rail Development Supplementary Master Plan



PERTH to NOWERGUP DEPOT
BUDGET for PROJECT WORKS
Figure 56

PERTH to THORNLIE
BUDGET for PROJECT WORKS
Figure 57

12.3. Funds Required

12.3.1. Summary

The funding for the Perth Urban Rail Development Project outlined in the 2002/03 Budget is $1,403.5 Million comprising :

- $300 Million from proceeds of the Alinta Gas sale, via a capital appropriation;
- $1,103.5 Million from public borrowings.

Since that time the Government has approved the addition of a further $15.5 Million to cover works associated with the route through Perth, bringing this total to $1,419 Million.

12.4. Background

In October 2000 Cabinet approved the Perth Urban Rail Development Project with an estimated project cost of $1,147 Million.

The cost of $1,147 Million was made up of as follows:

- $941 Million SWMR Master Plan (Costs current at 1 July 1998);
- $81 Million NSTS Master Plan (Costs current at 1 July 1999);
- $18 Million additional railcars (6 additional cars for Greenwood station and growth on the existing network at year 2003);
- $107 Million Rockingham Loop (Costs current at 1 July 1998).

The funding strategy endorsed at that time was:

- $300 Million from the proceeds of Alinta Gas sale;
- $398 Million funded by way of an operating lease with the private sector for the supply of railcars, including the necessary infrastructure;
- remaining $449 Million funded through public borrowings.

This was to be expended on:

- $749 Million infrastructure;
- $398 Million railcars.

In July 2001 Cabinet approved in principle, a variation to the SWMR Master Plan to construct the Direct Route between Perth and Mandurah. A $70 Million borrowing transfer from the Kwinana Freeway Busway Program was identified as the funding source for the additional works. The cost of the project was revised from $1,147 Million to $1,217 Million. This was made up of:

- $898 Million Direct Route option and Northern Suburbs extension;
- $319 Million railcars including maintenance depots.

In October 2001 Cabinet agreed not to accept the proposal to lease railcars through private funding and to approve the procurement of the railcars using traditional government finance.

In April 2002 Cabinet, as part of the year 2002/2003 State Budget process, approved a variation to the project service delivery dates for the SWMR. Services to Waikiki would then commence in December 2006 and services to Mandurah are to commence in December 2007. The estimated escalation and associated costs for the project of $186.5 Million were approved. The revised project cost

approved in the 2002/2003 Budget is $1,403.5 Million. This is made up as follows:

- $1,217 Million approved Budget July 2001;
- $168 Million escalation (calculated using actual and forecast Perth CPI figures)
- $18.5 Million for extended construction time associated with the Waikiki to Mandurah works.

The final breakup of costs is therefore:

- $1,103.5 Million Infrastructure includes Northern Suburbs extension, Perth to Thornlie works and Perth to Mandurah works;
- $300 Million Railcars includes maintenance depots.

On June 10, 2002 the Government announced the adoption of the Central Route as recommended by the PCRAC Report of May 2002. Based on the PCRAC costings, the Central Route added $15.5 Million to the $1,403.5 Million after identified savings elsewhere in the PURD budget were taken into account, making a total of $1,419 Million inclusive of escalation.

12.5. Delivery Options

12.5.1. General

The scale of the SWMR project dictates that tender packages, whether for design or construction, will be substantial in size.

Previous Government of Western Australian procurement experience with the Graham Farmer Freeway and Kwinana Freeway extension contracts demonstrate the delivery of works packages of this scale, scope and complexity.

To be successful, contracts of this magnitude require the following key attributes:

- appropriate allocation of risk;
- tailored and robust documentation;
- opportunity for innovation and cost saving;
- excellence in personnel / management teams;
- integrity and cultural maturity of organisations involved;
- excellence in documentation / administration / quality safety and environmental management;
- a partnering and team building approach, with opportunities for continuous improvement;
- local availability of management teams, personnel and resources;
- excellence in leadership.

12.6. The Route Through Perth

The decision to commence services from Waikiki to the end of 2006 and the additional complex works at the Perth end requires an early commencement on the civil and railway works in the Perth area. It is critical that civil, structures and earthworks in the foreshore area near the Convention Centre are commenced early with forward works for Package F underway early in 2003 to enable the bulk of the work near the Convention Centre to be substantially complete by June 2004.

Delivery of the route through Perth will be a complex issue. There is a multiplicity of stakeholders, a diverse range of construction and commercial risks and a prime need to minimise disruption to daily city life. These circumstances lead to a form of delivery that allocates each risk to the body that is most capable of managing it and in which all stakeholders are consulted by a single authority that is closely associated with the contractor and principal. The 'Design and Construct' and 'Alliance' are the contract models that best provide that facility. Further investigations will be carried out into these options and recommendations made in a procurement plan.

12.7. Staging the Work

The scope of design and construction work associated with the SWMR includes :

- stations;
- civil and structural works;
- railway infrastructure.

A detailed procurement plan has been prepared for delivery of the works, which have a estimated construction of approximately $700 Million. The procurement plan divides the SWMR work into seven primary packages based on location, scope and delivery method. The staging plan proposed also allows for the route into central Perth to be approved while the design of the stations, civil and rail infrastructure for the rail line south of the Narrows is commenced.

The seven major contract works packages will be of substantial size. These packages, designated A to G, will be aligned such that the scope of each design package aligns with the scope of the construction package. Each design consultant will be responsible for design, documentation, technical support, design verification and design product validation for each individual package.

The seven packages are as follows:

Package A	Civil, structural and drainage works from Glen Iris to Mandurah and for rail infrastructure work from Perth yard to Mandurah
Package B	Stations at Thomsons Lake and Thomas Road
Package C	Stations at Rockingham, Waikiki and Mandurah
Package D	Stations at South Street, Leach Highway and Canning Bridge
Package E	Bridge works on the Mount Henry Bridge and Narrows Bridge, including civil, structural and drainage works from the Narrows Bridge to Glen Iris
Package F	Civil, structural and drainage works from Perth yard to the Narrows Bridge, including tunnelling (excludes track infrastructure which is Package A)
Package G	Train control systems upgrade

The packages developed for the stations will be traditional in nature (Packages B, C and D), with all stations being fully designed by PURD and its appointed consultant and constructed by the selected contractor to the PURD design.

Packages A, E and G will be a mix of traditional design and then construction and contractors' design for structural works such as bridges and tunnels, along with signalling, communications and train control. It is anticipated that by allowing construction expertise to be adopted in the design process by contractors for packages A, E and G cost and time savings will be realised by the project together with improved constructability. The construction delivery of these packages will therefore be based on a mix of PURD and contractors' design.

Package F will also require advanced enabling works to be undertaken prior to the award of the main packages, such that the delivery program can be optimised and disruption of the City section of the route minimised with a key target of June 2004 to be achieved for works near the Convention Centre.

Improvements on the Perth to Kenwick section and the spur line to Thornlie will be undertaken progressively from early 2003 to late 2004.

12.8. Introduction of the Service

The infrastructure delivery program is planned to enable the commencement of train services from:

- Clarkson by September 2004
- Thornlie by December 2004
- Waikiki by December 2006
- Mandurah by December 2007

12.9. Construction Staging

The staging of the work packages A to G is to be arranged so that there is minimal construction interface between the packages. Construction is planned to commence with preparatory works for Package F by way of geotechnical improvements, services relocation and access roads and the widening of Mount Henry Bridge. Package A works and development of the rail route, from the Narrows to Mandurah, including civil, structures and rail infrastructure. The preliminary implementation schedule is shown in **Figure 58**.

Package A will follow packages E and F. These require a substantial period of contractors' design, prior to commencement on site. Package F is significantly complex as it involves the structural and civil elements from the Narrows Bridge into central Perth.

Station packages B, C and D will be the last to commence, being heavily dependent upon the rail infrastructure packages. Stations will be completed and commissioned together with the rail infrastructure prior to operation.

Continuity of construction of track and its associated infrastructure will be a key element in project success, with the construction program staged so that civil, structural and station elements are completed in time for continuous track and rail infrastructure construction.

Construction work on the railway will commence in the third quarter of 2003 and be completed in 2007.

12.10. Rollingstock

The contract for the new railcars has already been awarded so the delivery schedule of the railcars is now known and the delivery of the infrastructure for the NSR extension will be completed to ensure that it matches the delivery program of the railcars.

It is important that the Nowergup Depot is accessible by rail ready for the arrival of the first railcar in Perth. This is so that the commissioning and final fitting-out of the railcars can be completed at Nowergup. The first railcar will be delivered to Perth late in the first quarter of 2004. It will then complete a commissioning program before it is ready for service in around August 2004.

All works associated with the NSR extension to Clarkson and the new station at Greenwood will be completed prior to the delivery of the five three-car sets that are required to operate services for them. These five three-car sets are expected to be available for commencement of the service by September 2004.

Railcars will be delivered progressively after the NSR works are completed. This allows for services to commence on the SWMR when infrastructure is completed. All railcars will be delivered by the middle of 2006.

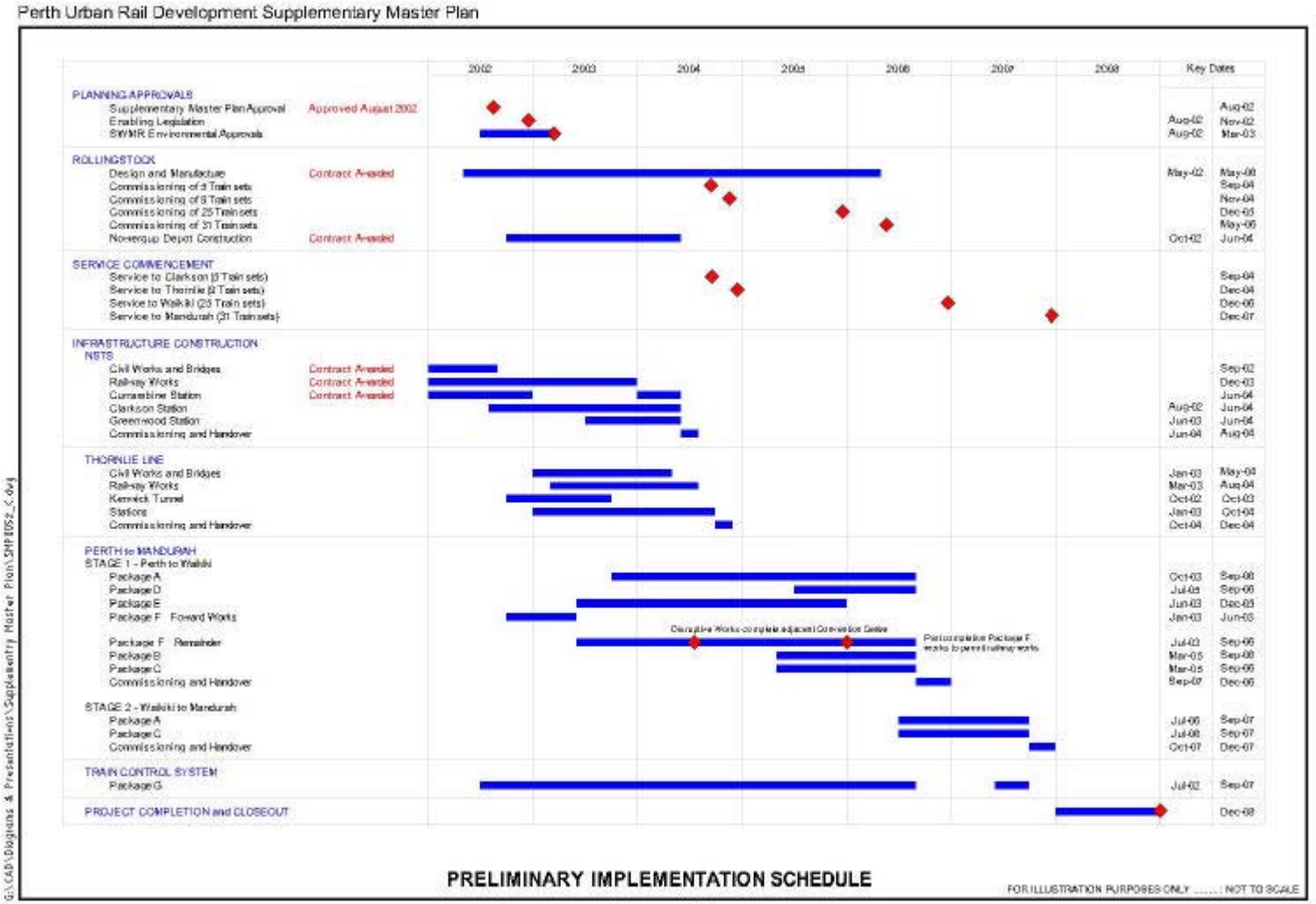

Perth Urban Rail Development Supplementary Master Plan
2002
2003
2004
2005
2006
2007
2008
Key Dates
PLANNING APPROVALS
Supplementary Master Plan Approval
Approved August 2002
Aug-02
Enabling Legislation
Aug-02
Nov-02
SWMR Environmental Approvals
Aug-02
Mar-03
ROLLINGSTOCK
Design and Manufacture
Contract Awarded
May-02
May-06
Commissioning of 8 Train sets
Sep-04
Commissioning of 8 Train sets
Nov-04
Commissioning of 25 Train sets
Dec-05
Commissioning of 31 Train sets
May-06
Nowergup Depot Construction
Contract Awarded
Oct-02
Jun-04
SERVICE COMMENCEMENT
Service to Clarkson (8 Train sets)
Sep-04
Service to Thornlie (8 Train sets)
Dec-04
Service to Waikiki (25 Train sets)
Dec-06
Service to Mandurah (31 Train sets)
Dec-07
INFRASTRUCTURE CONSTRUCTION
NSTS
Civil Works and Bridges
Contract Awarded
Sep-02
Railway Works
Contract Awarded
Dec-03
Currambine Station
Contract Awarded
Jun-04
Clarkson Station
Aug-02
Jun-04
Greenwood Station
Jun-03
Jun-04
Commissioning and Handover
Jun-04
Aug-04
THORNLIE LINE
Civil Works and Bridges
Jan-03
May-04
Railway Works
Mar-03
Aug-04
Kenwick Tunnel
Oct-02
Oct-03
Stations
Jan-03
Oct-04
Commissioning and Handover
Oct-04
Dec-04
PERTH to MANDURAH
STAGE 1 - Perth to Waikiki
Package A
Oct-03
Sep-06
Package D
Jul-03
Sep-05
Package E
Jun-03
Dec-03
Package F Forward Works
Jan-03
Jun-03
Disruptive Works complete adjacent Convention Centre
Package F Remainder
Part completion Package F works to permit trolley works
Jul-03
Sep-05
Package B
Mar-05
Sep-06
Package C
Mar-05
Sep-06
Commissioning and Handover
Sep-07
Dec-06
STAGE 2 - Waikiki to Mandurah
Package A
Jul-06
Sep-07
Package C
Jul-06
Sep-07
Commissioning and Handover
Oct-07
Dec-07
TRAIN CONTROL SYSTEM
Package G
Jul-02
Sep-07
PROJECT COMPLETION and CLOSEOUT
Dec-08
PRELIMINARY IMPLEMENTATION SCHEDULE
FOR ILLUSTRATION PURPOSES ONLY ..... NOT TO SCALE
G:\CAD\Diagrams & Presentations\Supplementry Master Plan\SMPE052_C.dwg

Figure 58

13. Community Consultation

13.1. Community Consultation Program

Community consultation has been an integral component of the master planning process since planning for the South West Metropolitan Railway began in earnest in 1997. Community input led to a number of modifications to the original SWMR Master Plan and has also contributed positively to the preliminary designs in this Supplementary Master Plan.

Immediately following the Government's announcement of the Direct Route on 16 July, 2001, community consultation commenced.

In the main phase from July 2001 to the end of February 2002, the PURD Office initiated and participated in 47 briefings and meetings including :

- 10 briefings for Local Government
- 21 stakeholder meetings
- 16 public meetings

13.2. Details of Community Consultation

These are summarised in Tables 13.2.1, 13.2.2 and 13.2.3.

13.2.1. Briefings for Local Councils

City of Cockburn	31 July 2001
City of Rockingham	31 July 2001
City of Mandurah	3 August, 12 November, 12 December 2001
City of South Perth	7 August 2001, 22 January 2002
City of Melville	8 August 2001
Town of Victoria Park	13 September 2001
Perth City Council	4 September 2001

13.2.2. Meetings with Stakeholders

Thomsons Lake Steering Committee	26 July 2001
City of Mandurah	16 August, 8 November 2001
Melville Stakeholders	5, 20 September, 22, 28 November 2001
Murdoch Precinct Group	22 November, 10 December 2001
William Street Stakeholders	14 September 2001
Rockingham Stakeholders	30 November 2001
Rockingham Lakes Regions Park Community Advisory Committee	22 September 2001
Town of Victoria Park	23 October, 13 November 2001
Association for the Blind	14 November 2001
City of Cockburn	13, 27 November 2001
City of Gosnells	13 February 2002

13.2.3. Public Meetings

City of South Perth	4 September 2001, 5 February 2002
City of Cockburn in the form of two Cockburn Central Open Days	13, 20 October 2001
Canning Value	5 September 2001
City of Melville	15 October, 3 December 2001
Special meetings at City of Melville – Bateman residents – 3 meetings	29 November 2001, 30 January, 14 February 2002
RAAF Retirement Village	20 February 2002
Bull Creek / Leeming Ward public meeting	9 August 2001
Environmental Workshop in Rockingham	22 September 2001
City of Rockingham	21 January 2002
City of Mandurah	27 February 2002

13.2.4. Website

An interim website was established site in September 2001 to enable the community to access current information on the project. The fully developed PURD site went live on 14 December, 2001. This is a comprehensive site designed specifically to gather community feedback on plans related to the key areas of the route. Online Feedback Forms were designed to encourage public involvement and the feedback has been constant since the site was launched. Responses were directed to the appropriate Discipline Manager for addressing within seven days. Questions and responses that are

commonly asked were also incorporated into a Frequently Asked Questions section on the website.

13.2.5. E-mail inquiries

General e-mail inquiries were received and recorded.

13.2.6. Feedback Forms

Hard copy feedback forms were distributed at public meetings. Community members could post, fax or hand the forms to a PURD or Council representative. All inquiries were answered usually within a fortnight.

13.2.7. Newsletter

An eight-page newsletter was produced in August 2001 for distribution to all the local Councils along the route. It contained basic information on the new Direct Route, much of which has been superseded by research studies and new developments.

13.2.8. Display

Display materials were used to support each public meeting. These materials were regularly upgraded to reflect design changes arose from stakeholder or community input or from designs altered as a result of further investigations. Each local Council was given a set of the most recent designs and maps for display use in local Council offices.

13.2.9. Video Animation

Early in the consultation stage it became apparent that the community was having difficulty visualising the railway in the centre of the Kwinana Freeway. There was also a general concern expressed about the 'visual blight' that the railway would impose on the section of the route between Canning Bridge and Perth. A computer-generated model of the railway between Mount Henry Bridge and the Perth CBD was produced as an education tool to stimulate discussion with stakeholders and the community.

13.2.10. Letterbox Drops

Letterbox drops advertising public meetings were undertaken in all communities where public meetings were held. In some localities, the drops were restricted to those residents who were most likely to be affected by the railway.

13.2.11. Personal letters

Members of the community who attended a public meeting were placed on a mailing list and were personally invited to attend subsequent meetings. Members of the public who wrote letters to PURD making inquiries or comments were sent personal replies.

13.2.12. Telephone calls

A considerable amount of community feedback was received from telephone inquiries. A register of calls was maintained as a reference.

13.2.13. Media

The community and to a lesser degree mainstream media, played an important role in the community consultation process. Briefings and interviews with selected journalists helped promote public meetings and to publicise the outcome of those meetings.

13.3. How Issues Were Addressed

There were a number of difficult issues that were addressed in preparing the Supplementary Master Plan.

The approach in dealing with these issues was as follows:

- Understanding community perceptions;
- Educating, informing, improving, and facilitating collective problem solving;
- Leading local communities to define desirable outcomes, in the best interests of the wider community;
- Aligning the Governments program with the community's expectations;

The consultation strategy involved:

- Identifying key stakeholders and those directly affected;
- Identifying and addressing key issues;
- Ensuring a high awareness of the project;
- Reinforcing that it is part of an integrated solution to transport problems;
- Focussing on the fact that it is a project for the benefit of the wider community.

13.4. Summary

Every effort was made to resolve key issues through negotiation with the community and stakeholders.

n cases where residents were genuinely likely to suffer serious adverse effects from rail or station infrastructure amendments were made to designs, where possible that addressed the concerns but did not compromise the basic functional and operational outcomes required.

Special attention was paid to community concerns regarding noise and vibration.

Negotiations and public meetings were carried out in a frank but empathetic manner without hidden agenda.