City of Karratha

Karratha Revitalisation Strategy

Pegs Creek, Millars Well & Bulgarra

Acknowledgements

City of Karratha

David Pentz – Director Development Services

Jerom Hurley – Manager Planning Services

John-Paul MacDonagh – Senior Strategic Planner

Consultant Team

	Date	Purpose
A	14/08/2014	Draft KRS Strategy
B	19/12/2014	Final KRS Strategy
C	03/02/2015	For consideration by Council for Public Advertising

Mayor's Forward

Councillor Peter Long
Mayor of City of Karratha

It is with great pleasure that I present the Karratha Revitalisation Strategy – an overarching framework for the revitalisation and future development of the established suburbs of Bulgarra, Pegs Creek and Millars Well. The Strategy aims to assist in the achievement of the Pilbara Cities vision for Karratha as described in the Karratha City of the North Plan, which is to be a liveable, affordable, compact Regional City of 50,000 or more people, with a diversified economy and high quality amenity and infrastructure. It is our aim to develop a healthy local community which demonstrates demographic balance and is a place of choice to work, visit, grow up, raise families and age gracefully.

The Strategy establishes a specific framework for revitalisation to occur and recognises the efficiencies and economic benefits that can be delivered by infill development and redevelopment through the utilisation of existing infrastructure. It facilitates the guidance of these opportunities in a coordinated manner.

The Strategy has been developed in consultation with the people of Karratha and emphasises the City's determination to communicate with its citizens and our commitment to on-going community development. I look forward to seeing continued engagement from the community as we work together to implement its recommendations.

Our proactive delivery of this Strategy demonstrates the City's leadership and a can-do attitude to the ongoing development of Karratha.

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Tables

1 Introduction

1.1 Revitalisation

The Karratha Revitalisation Strategy (KRS) aims to identify opportunities and key actions required to improve the liveability of the suburbs of Pegs Creek, Millars Well and Bulgarra, as Karratha grows towards its goal of becoming a liveable, affordable city with high quality amenity and infrastructure.

Revitalisation involves a variety of actions to be undertaken by a range of bodies and people including landowners, the City of Karratha, other government agencies and the community. There is no set timeframe for implementation of this strategy as it will be influenced by market forces, priorities and available resources. Its implementation will ensure, however, that future individual developments (greenfield and infill sites), redevelopments and improvements are guided by a longer term strategic vision, consistent with the intent of the Karratha City of the North Plan (KCN) and City of Karratha Local Planning Strategy (LPS). This provides a framework for implementation to occur including;

- Consistent approach with existing strategic policy and planning aspirations;
- Identification of appropriate sites, which are development ready;
- Identification of priority and focus areas;
- Implementation actions and short, medium and long term time frames;

The City and the Western Australian Planning Commission (WAPC) through decisions on planning, subdivision and development applications as well as the City's works programs governing maintenance and development of parks, pathways, roads and swales, revegetation and other amenity improvements will be major influences on the successful implementation of the strategy.

This strategy completes Stage 1 of the Karratha Revitalisation Project. Stage 2 is anticipated to deliver greater detail regarding the particular works required as well as the planning tools necessary to facilitate implementation. Planning guidance is recognised as being the key however; to developing a coordinated and cohesive outcome that enhances liveability within the study area.

1.2 Study Area

The study area of the Karratha Revitalisation Plan project comprises the suburbs of Pegs Creek, Millars Well and Bulgarra in Karratha (Figure 1.1 overleaf).

The study area is divided into two major areas which sit immediately to the east and west of the CBD. The eastern section includes Millars Well and Pegs Creek and is bound by Dampier Highway to the south, Balmoral Road to the north and west, and Bathgate Road to the east.

The western section comprises the entire suburb of Bulgarra which is bound by Millstream Road to the south, Maitland Road to the west, and Mystery Road to the north, and Searipple Road to the north and west.

The Karratha Hills are located south of the study area and the low lying tidal flats of Nickol Bay are located to the north.

1.3 Project Justification

The Karratha Revitalisation Strategy aims to assist in the achievement of the Pilbara Cities vision for Karratha as described in the Karratha City of the North Plan (KCN):

'A liveable, compact, Regional City of 50,000+ people, with a diversified economy, a healthy local community which demonstrates demographic balance, affordability, high quality amenity, and infrastructure. It is a place of choice, to work, visit, grow up, raise families and age gracefully.'

*(*KCN Vision, pg.12)

These older suburbs of the City of Karratha are:

- Not compact;
- Their liveability can be improved;
- There is a lack of connectivity within the street and path network;
- The amenity is no longer high quality with many examples of poor quality buildings and landscaping and there are many vacant sites and some vacant buildings; and
- The options to age gracefully are limited.

Whilst current pressure for development has eased, future demands, which are strongly linked to the resources industry, are not easy to predict.

Although significant improvement activities are currently occurring within the Karratha City Centre, the above mentioned slowing down of the resource industry has reduced housing market interest and increased the need for some type of intervention to encourage the redevelopment of these neighbouring suburbs.

Many lots within the subject sites are vacant or under-developed and there are issues with the connectivity of the streets and path networks.

Broadly, the KCN City Planning Principles for the built environment and public realm underpinning this strategy can be summarised as:

- Developing Diversity;
- A City of Excellence;
- A Healthy City;
- Walkable and Connected;
- An Active and Playful City;
- An Affordable City;
- Sustainable and Replenishing; and
- Integrated and Conducive.

This Strategy builds on the key principles of the KCN to establish a specific framework for revitalisation which can be implemented immediately and over the longer term. It recognises the efficiencies and economic benefits that can be delivered by infill development and redevelopment through the utilisation of existing infrastructure and aims to guide these opportunities in a coordinated manner.

Figure 1.1 - Study Area

1.4 Project Objectives

The Karratha Revitalisation Strategy builds on the KCN City Planning Principles for the Built Environment and Public Realm.

The project objectives form;

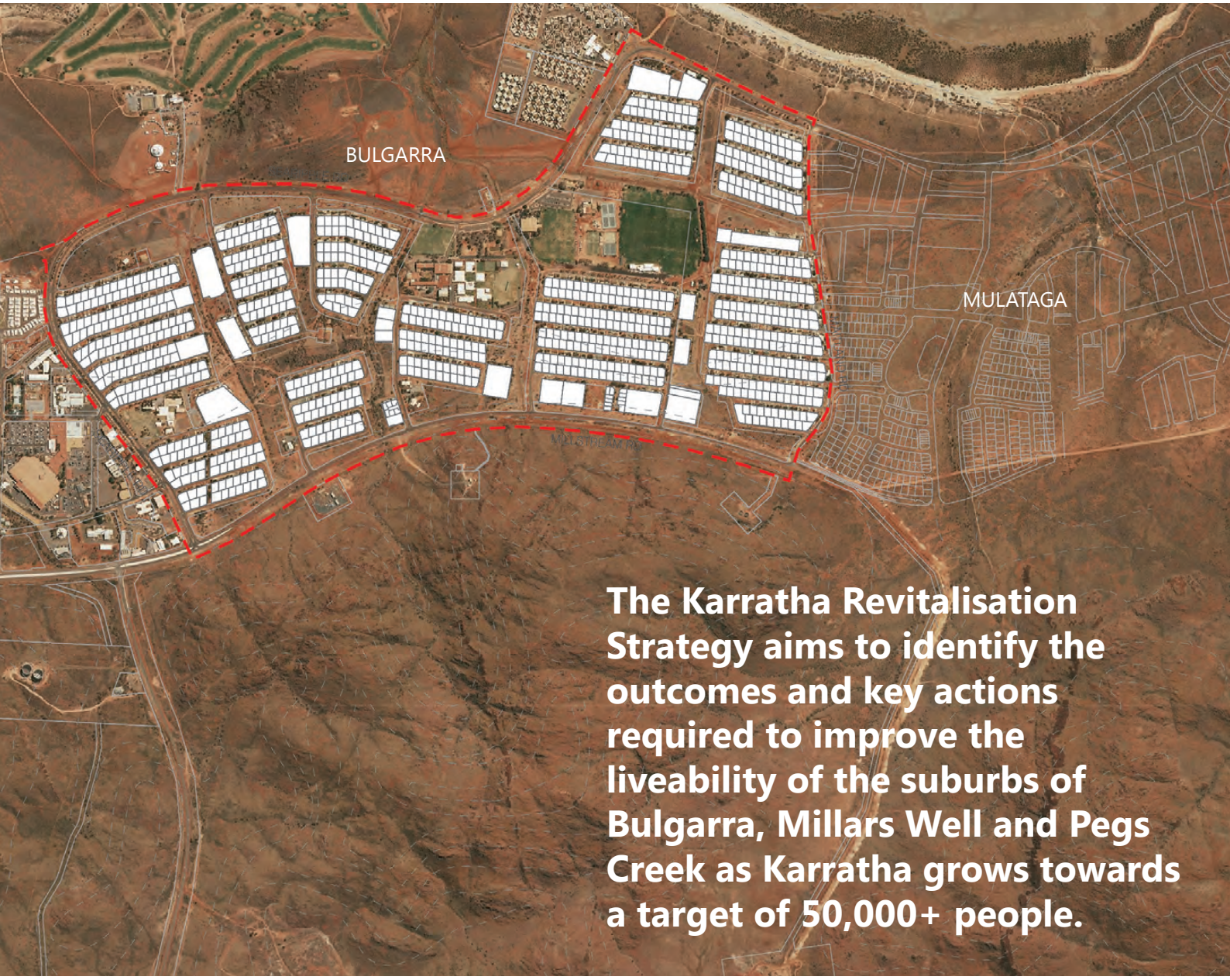
- Increase density and ensure outcomes are appropriately located, integrated and well designed;
- A place based response that reflects the climate, context and site;
- Management strategies for climate change and natural disasters;
- An integration of uses that achieves functionality, efficiency and compatibility;
- Connectivity at local, district and regional scale;
- A network and hierarchy of streets and public spaces that provides permeability and legibility;
- An integrated movement network that ensures the safe movement of pedestrians, cyclists and vehicles;
- A diverse mix of uses, buildings and housing types;
- A variety of well defined open spaces; and
- An accessible and legible City centre destination.

While advancing the objectives of the Pilbara Cities Vision the KRS also incorporates the latest evidential base including detailed flooding studies, updated population forecasts, and inputs from relevant reports, guides including latest developments.

1.5 Project Methodology & Approach

This Revitalisation Strategy has been undertaken according to the following methodology:

- Site visit and inception meeting with City of Karratha;
- Review of current planning policies, studies and design documents including but not limited to:
  - Pilbara Planning & Infrastructure Framework (WAPC 2012)



The Karratha Revitalisation Strategy aims to identify the outcomes and key actions required to improve the liveability of the suburbs of Bulgarra, Millars Well and Pegs Creek as Karratha grows towards a target of 50,000+ people.

  - City of Karratha Draft Local Planning Strategy 2013
  - Royalties for Regions Program
  - Karratha City Growth Plan (KCN) 2010
  - Pilbara Vernacular Handbook (LandCorp, 2012)
  - Karratha Vernacular Guideline 2011
  - Lazy Lands 2D Flood Study & Local Water Management Framework 2013
- Identify the project drivers and the key issues;
- Discussions with community and other key stakeholders to identify their key drivers, aspirations, opportunities and constraints;
- Research & analysis of opportunities and constraints from an evidential base;
- Testing & application of spatial planning, and urban design principles underpinned by the KCN principles and WAPC's Liveable Neighborhoods via an iterative and layered design approach;
- Recommendations that address:
  - **Priority Areas** in each suburb for targeted improvements;
  - **Density & Intensity:** Recommendations for opportunities to increase density in existing residential areas
  - **New Development:** Appropriate levels of new and diverse development to improve affordability and cater for population increases;
  - **Improved Connectivity:** Better connections for all forms of transport to improve amenity and provide better connections to the City Centre;
  - **Parks:** Strategically located quality parks to improve amenity, and sense of community that cater for all ages; and
  - **Streetscapes and Swales:** Improved streetscapes and enhanced swales that improve amenity and ecology.

The project methodology continues the KCN inclusive and collaborative approach by engaging stakeholders and community in the revitalisation discussion.

1.6 Structure of the Document

Section 1: Introduction including project justification, objectives and a summary of the process undertaken to develop the strategy;

Section 2: Drivers for the revitalisation include population profile and future demographics, local economy, provision of infrastructure, strategic and policy aspirations and community aspirations;

Section 3: Opportunities and Constraints including Site Analysis

Section 4: Design Process including summary of community inputs

Section 5: Revitalisation Strategy concept described in terms of development, transport, parks and amenity opportunities; and

Section 6: Implementation

1.7 Summary of Outcomes

The revitalisation interventions will result in the following improved outcomes for the study area:

- Improved amenity of suburbs through redevelopment of older uneconomic or outdated housing stock;
- Increased diversity of dwellings to cater for future population and demographic needs;
- Enhanced neighbourhood character through improved streetscapes, climate responsive building design and appropriately located medium density;
- Wider community outcomes such as the creation of vibrant town or city centres by introducing greater densities of dwellings and population within walking or cycling distance of the City centre;
- Decreased overall travel requirements of residents, particularly by cars where overall kilometres travelled for work and non-work trips can be reduced with savings on fuel, vehicle wear and tear, travel time and greenhouse emissions;
- Safer emergency access routes and guidance on the management of flood and inundation risk;
- Improved legibility of the road and footpath network between neighborhoods and to the City centre
- Improved recreation facilities and use of scarce water resources in parks within walkable distances of neighbourhoods; and,
- Enhanced amenity of public places and spaces through additional plantings of vegetation which create shade and improve the green linkages and streetscapes;

2 Project Drivers

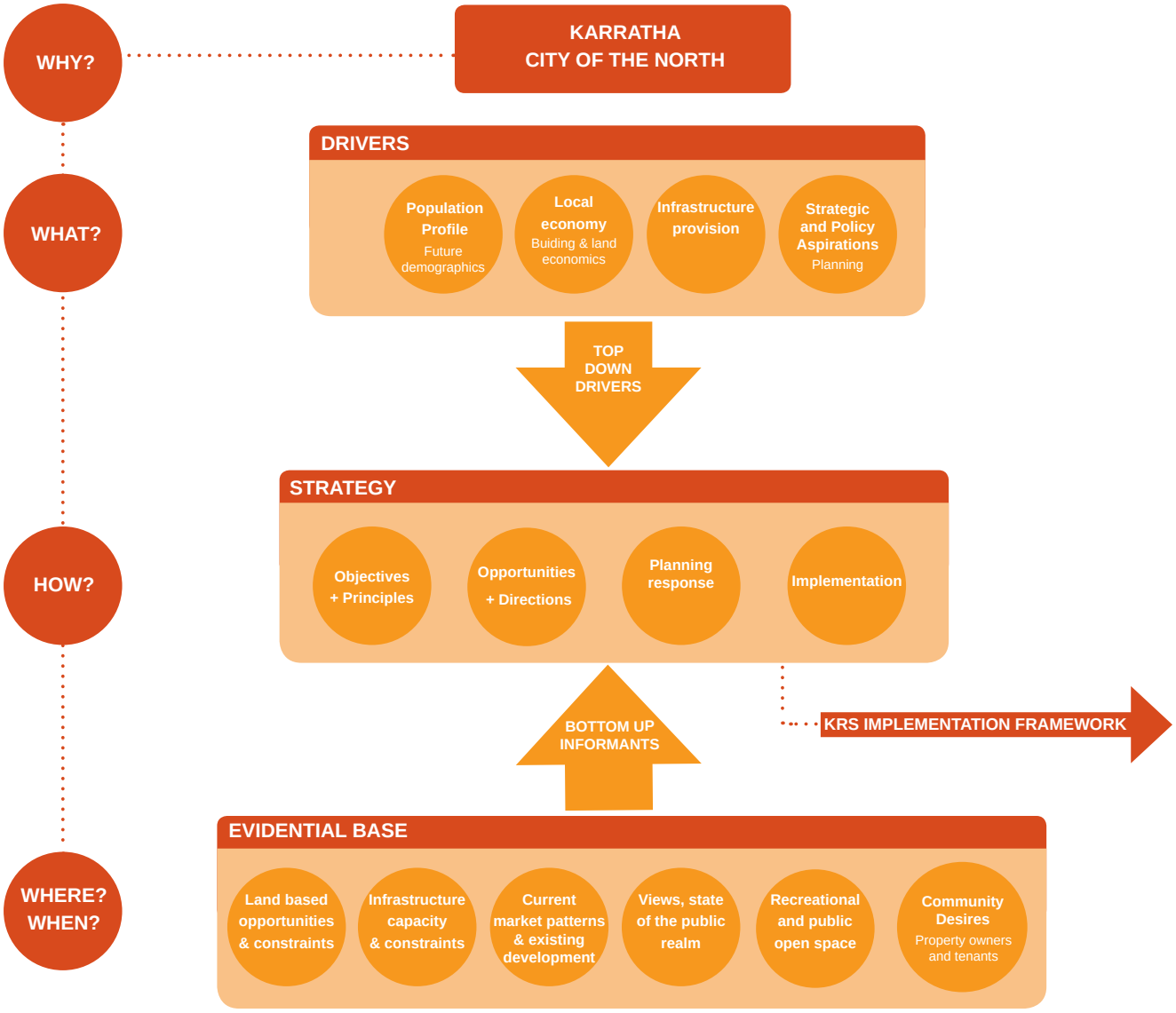


Figure 2.1 - Project Framework

Project Drivers

This section examines the stakeholder and community recognised overarching influences, the project drivers for revitalisation of the subject suburbs (See Figure 2.1 - Project Framework), which include:

- Population;
- Local Economy;
- Infrastructure Provision;
- Strategic and Policy Aspirations;

Note: For reference, the project driver commentary has been extracted from the technical documents included within section 8 Appendix:

1. Economic & Demographic Drivers
2. State Level Policies
3. Transport Technical Appendix
4. Community & Stakeholder Engagement
5. Consultation Process & Outcomes
6. Infrastructure & Servicing

Further referencing is made known immediately within this document.

2.1 Population

SUBU□B	Population	Private Dwellings
Bulgarra	3,603	1,287
Pegs Creek	3,207	755
Millars Well	2,183	931

Table 2.1 - Population & No. of dwellings
(Source: Forecast i.d 2014 & ABS Census 2011)

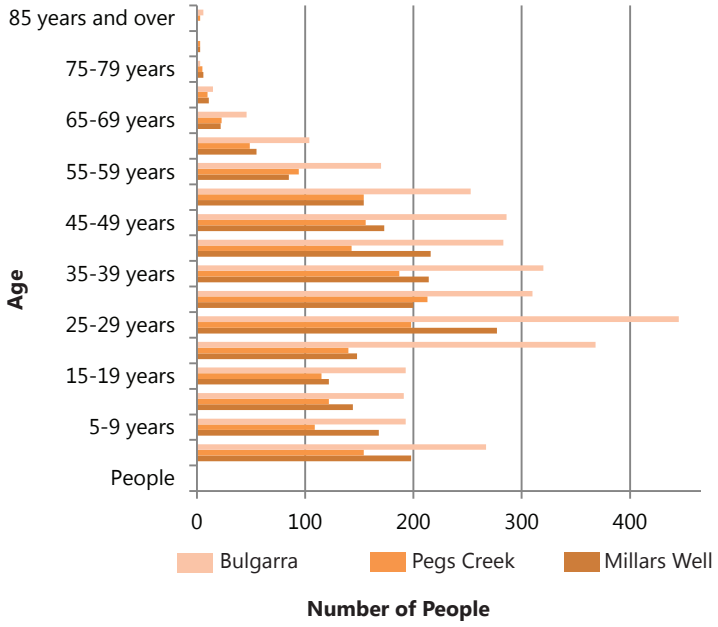


Diagram 2.1 - Age Structure of Study Suburbs 2011
(Source: ABS, 2011)

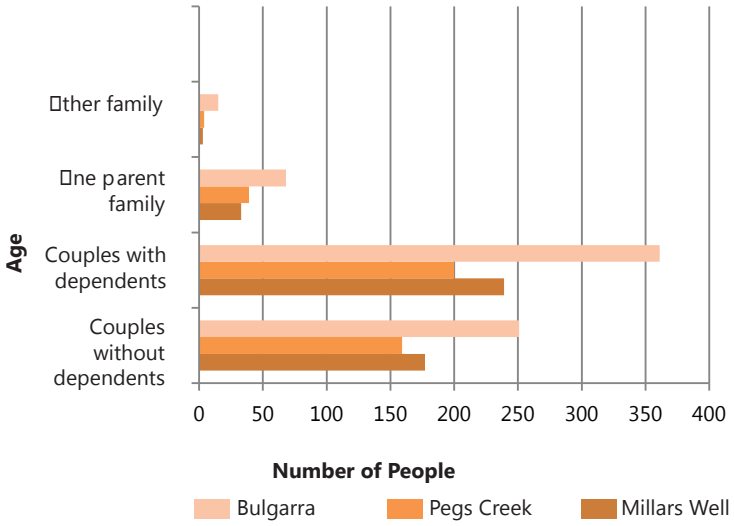


Diagram 2.2 - Household structure of study suburbs 2011
(Source: ABS, 2011)

Existing Population

The City of Karratha has an estimated residential population of 25,907 based on the 2013 ABS data. The Citys main centre of population is within the Karratha City, which has a population of 16,476 (Source: ABS Census 2011 Karratha UCL).

Within the Karratha City, falls the study area of Bulgarra 3,603, Pegs Creek 3,207 and Millars Well 2,183 with a combind population of 8.993 (Table 2.1). Therefore the study area represents approximately 34% of the City of Karratha total population.

Household Structure

In the study suburbs, the majority of the households are couples - either with or without dependents (Diagram 2.2).

The table indicates a greater percentage of families, couples with and without dependants. Lone parent households represent 9% of the total household structure which is low in national comparison being at 19% - 2011 ABS.

Age Structure

The age structure of the population of the study area, see Diagram 2.1, highlights:

- Highest number of people living in Bulgarra;
- There is a large proportion of people in the age group 25 - 29, which is not unexpected given the high level of employment in the resource sector;
- High numbers of people within the early age groups 0-4, 5-9 years suggesting a high proportion of families; and,
- Very few people (Millars Well 9, Pegs Creek 11, Bulgarra 9) aged 70 and above living in the study areas.

City of Karratha	2011		
Weekly income	**Number**	**%**	**Regional WA %**
Negative Income/Nil Income	61	1.0	1.5
$1-$199	46	0.7	1.6
$200-$299	53	0.8	2.7
$300-$399	78	1.2	5.9
$400-$599	189	2.9	9.4
$600-$799	166	2.6	8.1
$800-$999	178	2.8	7.6
$1000-$1249	226	3.5	7.0
$1250-$1499	258	4.0	6.9
$1500-$1999	506	7.9	10.6
$2000-$2499	321	5.0	6.9
$2500-$2999	1,390	21.7	8.6
$3000-$3499	653	10.2	4.6
$3500-$3999	367	5.7	1.9
$4000-$4999	418	6.5	1.5
$5000 or more	619	9.7	1.8
Not stated	880	13.7	13.5

Table 2.2 - CoK Weekly Household Income

(Source: Australian Bureau of Statistics, Census of Population and Housing 2011)

Employment

Levels of employment are the main determinant of population growth. Employment in the City has grown very fast over the period 2006 to 2011, with a 75% rise over this period due to expansion mode experienced by the extractive industries over this time.

From 2012 onwards the rate of growth in employment slowed down substantially mainly due to the extractive industries moving from expansion to an operations mode. Construction projects generate substantial short-term employment opportunities, much of which is satisfied by non-resident workers. While construction activity has slowed, there are other potential construction projects and there will be a trend of increasing operational employment for the forseeable future. A move towards residential workers, a more diversified local economy and higher home ownership will have implications for redevelopment of existing suburbs.

There is the recognised opportunity to diversify the local economy by encouraging the expansion of tourism, health and the education sectors.

Incomes

Overall, 53.8% of the households in the City of Karratha earned a high income, and 6.7% were low-income households, compared with 18.3% and 21.0% respectively for Regional WA. The major differences between the household incomes of the City of Karratha and Regional WA are highlighted in Table 2.2:

- A larger percentage of households who earned $2500-$2999 (21.7% compared to 8.6%)
- A larger percentage of households who earned $3000-$3499 (10.2% compared to 4.6%)
- A larger percentage of households who earned $3500-$3999 (5.7% compared to 1.9%)
- A smaller percentage of households who earned $400-$599 (2.9% compared to 9.4%)

Household income levels in 2011 were all high in the Study suburbs, particularly in Millars Well:

- In Bulgarra: 57% of households earned $2,500 or more per week.
- In Karratha - Pegs Creek: 48% of households earned $2,500 or more per week.
- In Millars Well: 64% of households earned $2,500 or more per week.

City of Karratha Resident Population Estimate					
2011 ERP	2016	2021	2026	2031	2035
23,634	28,102	30,390	32,738	35,268	37,433 1/

1/: Consultant Projection based on same growth rate of the model after 2021 (1.5 % pa)

Table 2.3 - City of Karratha Resident Population Estimate
Source: Imani 2014

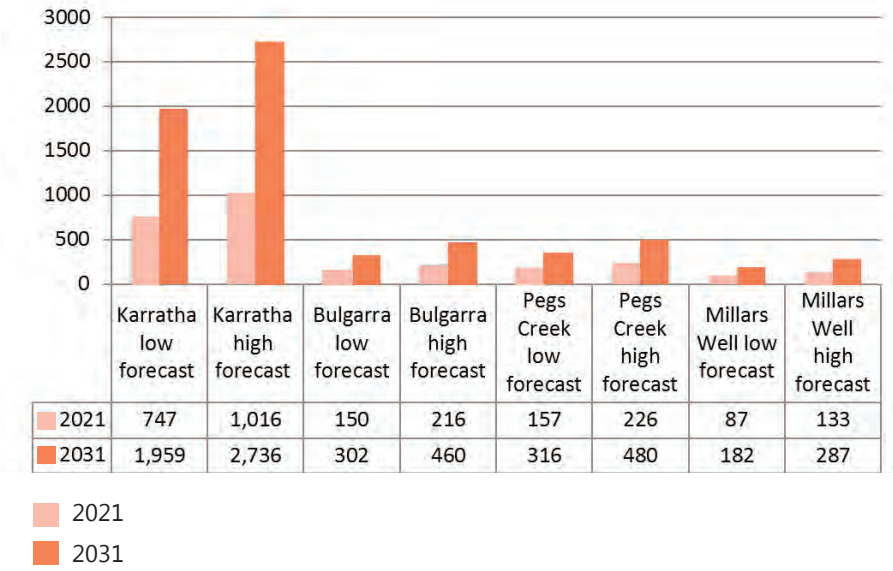


Diagram 2.3 - Dwelling Forecast
(Source: Imani, 2014)

Population Growth Estimates

A recently compiled model for the City is "City-wide" and does not estimate populations for the main centres.

It is used as one source for estimating Karratha employment and population growth. Estimates of population have been prepared for the towns of Wickham, Dampier, Roebourne and Point Samson for the period to 2035. The balance of the population estimated in the City population model has been assumed to reside in Karratha and this gives an estimate of the likely population of the town.

Based on this methodology the population of Karratha is forecast to increase to:

- From 17,096 persons in 2011 to 28,053 by 2021 - an increase of some 11,000 persons
- From 17,096 persons in 2011 to 29,764 by 2035 - an increase of 12,000 persons

  (Source: Karratha population projection derived from ABS 2011 ERP for Shire of Roebourne LGA)

These estimates based on the City model are considerably lower than any previous forecasts. Please refer to Appendix 1 for full breakdown of local economy and population data.

The annual growth rate of the population shown in the City population model is 4 % in 2012, 6 % in 2013 and 6 % in 2015. This assumption is based on the rates that were observed during the increased growth rates experienced during the expansion period.

Thereafter the growth rate varies between 1 and 2 %. Some additional 500 to 700 persons are being settled in Wickham from 2013 to 2015 and would account for a large proportion of the additional population in the City between 2013 and 2015.

The increase from 2011 to 2031 is estimated in the City model to increase by some 11,600 and from 2011 to 2035 13,800. This is very much smaller than previous estimates (some 50 % in some cases).

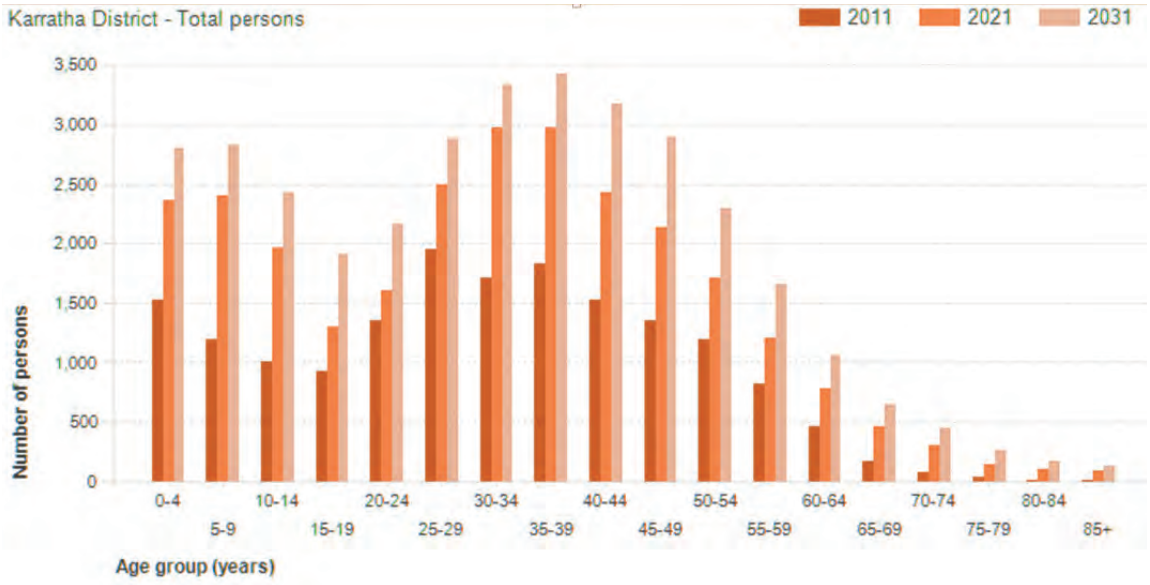


Diagram 2.4 - Forecast Age Structure, 5 year groups Karratha (ID Consulting 2014)

A report by Syme Marmion & Co estimates a long-term FIFO operations workforce of around 2,000 – 2,500 (consisting of Woodside 300; Rio 600-650; and Others 1,000 to 1,500).

Dwellings demand as a factor of demographics

Changes in the characteristics of the population of Karratha and the three study suburbs have an impact on the type and quality of dwellings demand.

The strategy also recognises that dwelling demand driven by location (fringe, City centre, regional or rural) the existing housing stock (separate dwellings, medium or high density), the amount and type of new residential development (same as existing stock, or diversifying) and where the area is in a cycle of change.

Forecast dwellings demand for Karratha

As shown in Table 2.1, based on the 2011 ABS Census data, within Bulgarra, Pegs Creek and Millars Well there are 1287, 755 and 981 private dwellings respectively, calculating a total number of 3023 private dwellings.

The dwellings forecasts based on increases in population are shown in Diagram 2.3. It should be noted that property markets do not necessarily reflect forecasts based on population however, as demand and supply in Karratha as a whole is the most important determinant of the demand and supply of dwellings in the study suburbs. Nonetheless to complete the picture, estimates have been made of possible future demand. Forecast dwelling estimates are below previous estimates made in the past by other forecasters, and take into account the greater supply of properties in 2013, 2014 and planned for 2015, and the demographic projections.

The average number of persons per household in Karratha will be approximately 2.75 over the forecast period. Forecasts do not expect this number to vary significantly to 2031.

Forecast Household Types 2011 to 2031							
	2011		2021		2031		Change 2011to 2031
Type	Number	%	Number	%	Number	%	Number
Couple families with dependents	2,295	40.5	3,718	40.4	4,746	39.9	+2,451
Couples without dependents	1,687	29.8	2,648	28.8	3,450	29.0	+1,763
Group households	282	5.0	382	4.2	434	3.7	+152
Lone person households	892	15.8	1,650	17.9	2,220	18.7	+1,328
One parent family	381	6.7	619	6.7	795	6.7	+414
Other families	124	2.2	179	1.9	235	2.0	+111

Table 2.4 - Forecast Houshold Types 2011 to 2031
(Source: ID Consulting 2014)

Future Household Structure

Analysing the future household structure provides insight into the role the area plays in the housing market.

Table 2.4 illustrated the Karratha District Forecast Household Type change from 2011 to 2031. Key points to note include;

- Couple families with dependents dominate the market with about 40% of households. This percentage is forecast to remain relatively consistent to 2031, resulting in an addition of 2451 households;
- Couples without dependents are the next dominant category at approximately 30%, with forecast consistent trends and an additional 1,763 households;
- Lone person households show the largest gain from 15.8 % in 2011 which is forecast to rise to 18.7% in 2031. Therefore the demand for smaller properties should increase slightly as a result.;
- Group households are forecast to decrease % from 5% in 2011 to 3.7% in 2031;

Inner city locations have significant numbers of lone person households and couples without dependents (ID Consulting, 2014).

The above trends are required to be reflected in the provision and range of housing stock, as well as, the urban form and public open space. In addition to accommodating the forecast growth it should be noted that successful transformation may trigger further evolution and diversity.

Age Structure (5 Year Groups)

Knowledge of how the age structure of the population is changing is essential for planning age-based facilities and services, child-care, and recreation. The forecast age groups of the City of Karratha are a function of the current age of the population (people aging each year, being born and dying) as well as the age of people migrating into and out of the area.

The forecast data indicates that there will be a slight shift to more people in the 0-14 age group and also in the 65 and above group (Diagram 2.4). This data indicates the continuing need for family type accommodation, and an increased need for retirement homes and smaller more easily managed and less expensive homes for the aged population bracket.

	Lots		Detached Dwellings		Medium / High Density Dwellings	
Suburb	**No. Sold**	**Median Price ($)**	**No. Sold**	**Median Price ($)**	**No. Sold**	**Median Price ($)**
Baynton	452	220,000	106	988,000	3	665,000
Bulgarra	2	NA	113	760,000	34	560,000
Gap Ridge	14	233,000	0	NA	0	NA
Karratha City Centre	0	NA	0	NA	5	217,000
Millars Well	2	416,250	35	740,000	28	620,000
Nickol	24	304,290	79	890,000	32	849,000

Table 2.5 - Sales Activity for respective areas in Karratha District 2011/2012
(Source: Imani consultants)

Household Type in Suburbs

Bulgarra

In 2011, the dominant household type in Bulgarra was 'Couple families with dependents', and by 2021 there are no signs of a significant shift in this demographic composition. Thus the drivers of demand will continue to be Couple families with dependents.

Pegs Creek

In 2011, the dominant household types in Pegs Creek - Stove Hill was 'Couple families with dependents', and "Couples without dependents". The proportion of Lone Person Households at 26.7 % is the highest in the town.

By 2021 the largest forecast increase is expected in 'Lone person households' and supplies will need to be adjusted in line with this development.

Millars Well

In 2011, the dominant household type in Millars Well was 'Couple families with dependents', and by 2021 there is expected to be a marginal increase in 'Lone person households'.

2.2 Local Economy

Karratha's Economic Context

The Karratha economic environment is heavily influenced by resources and construction/production cycles. The increase in mining prices was the main reason for Australia's terms of trade increasing by approximately 78 per cent from June 2004 to June 2011, which resulted in a massive boost to Australian national incomes. Karratha and the Pilbara were at the epicentre of this 'boom'. In contrast, the fall in mining since August 2011 has been a smaller 11 per cent fall in Australia's terms of trade. Sources: ABS Cat. No. 5206.0, Australian National Accounts, ABS Cat. No. 5249.0, Australian National Accounts, Tourism Satellite Accounts 2010–11

Intrinsically linked to the mining cycle Karratha has now switched from a city coping with mining expansion to a city 'normalising' to mining production. Simply translated as follows:

- A large increase of operational labour requirements associated with industry expansion (more people in Karratha)
- Contrasted by less labour and alternate specialties required for ongoing production which is influenced by world market prices linked with commodity supply targets (less people in Karratha).

LNG

LNG competition worldwide is increasing including demand from key Asian markets. Western Australia is one of the world leaders in LNG offshore technology and production and LNG will remain a strong stimulus for the City's economy. Robust LNG commodity sales are likely to lead to consistent LNG production from the North West Shelf and support increased production in the fields offshore of the neighbouring City of Ashburton, which in turn has more limited town facilities. This may increase the need for people amenity and facilities within Karratha.

Iron Ore

Relatively strong demand for iron ore will also continue from China with annual increases of between three to five per cent; however, these rates of increase are less than in the immediate past and there is a risk that alternative suppliers will increase competitive pressures on Pilbara producers. The Western Australian Government intends to develop a new deep water port and strategic industrial area at Anketell for increased iron-ore exports and industry in the Pilbara. This will have a positive impact on Karratha's economic diversification.

Karratha Investment

Recent investment in social/community facilities through the R4R Program and other funding sources has been substantial. Various government agencies, the City, and private enterprise have contributed to upgrading and expanding services such as roads, water, energy and telecommunications, including major property developments.

The appeal of the town as a place to live and do business has been considerably increased. Health and education facilities are under considerable improvement.

Much of the major infrastructure government led development to improve the level of service provision has already been completed or is coming to an end. There are possible construction projects in the pipeline such as a new hotel, new Community and Arts Precinct and the planned renovation of the Karratha airport has commenced and is to be completed some 12 to 18 months later. These developments will assist in improving facilities still further and provide a limited amount of additional construction work over the medium term.

The City's economy requires ongoing stimulus to promote alternative diversification of goods and services attracting government and private sector to upgrade housing stock, infill the City Centre with commercial and retail outlets, etc.

Demand for Housing

Vacant Residential Land

Demand for lots in the Pilbara has increased significantly in recent times and Karratha has played a major role in meeting the housing demand in the City, averaging 179 lot sales per year since 2000. This accounts for 97.1% of all lot sales in the City.

Median lot sizes in Karratha have decreased over the past 12 years, from approximately 702sqm in 2000 to 560sqm in 2012. The median price for lots sold in Karratha was $264,000 as at December 2012. This represents a rate of $470/sq m based on a median lot size of 560sq m.

New and Used Detatched Dwellings

New subdivisions on the fringe of Karratha Township such as Baynton have added significant new lots and housing supply to the market. Over the last two years there were approximately 452 lots sold in Baynton, which accounted for 84.5% of all lot transactions over this time period.

Baynton has the highest median price for dwellings in Karratha. There was very limited response to the need for commercial or retail space in the study suburbs over and above what has already been developed or is zoned for this use.

New and Used Apartments

The dynamics of the market have changed with higher quality and more diversity of properties available in recent years. The market has responded positively to these changes in the new suburbs. There appears to be some resistance to the offer of smaller product; however, as residents prefer properties where items such as boats can be stored and corporates and the public sector have been the major buyers of the available apartments. (Refer to Appendix 1)

House and Rental Prices and Demand

Table 2.5 (see previous page) illustrates the Karratha District Sales Activity by Property Type for 2011/2012. This data indicates:

- House prices for detached dwellings in the three study suburbs are fairly uniform and are below that of the other suburbs;
- Prices for medium/ high density properties are lower than the highest price suburb of Nickol, but higher than Karratha centre itself;
- New subdivisions on the fringe of Karratha Township such as Baynton have added both new lots and housing supply to the market;
- Over the last two years there were approximately 452 lots sold in Baynton, which accounted for 84.5% of all lot transactions over this time period;
- In addition, 106 detached dwellings were sold with a median price of $988,000 per dwelling. Baynton has the highest median price for dwellings in Karratha, demonstrating that a premium has been paid for newly developed housing product in the area.

Market Comparison

To provide a present day comparison against Karratha District Sales Activity 2011/2012 Table 2.6, discussion with a sales lender at First National Real Estate in Karratha were undertaken to understand general property trends and present market conditions. Key points include;

- Typically newer houses (built within the last 10 years) in comparison to older properties (30 years) will attract an increased value of $200,000+.
- If renovations have been undertaken with older stock this assists the property to hold its value;
- Discussion with the sales lender indicated that there has been a tendency for some landlords to do limited maintenance / renovations whilst taking advantages of the high prices over the boom period (2004-12);
- The median property price for a single detached dwelling 3 bedrooms and 1 bathroom in Bulgarra is $450,000. As a generalisation the price increases across Karratha when moving west, towards Nickol, by $50,000;
- A reduction in median property price has occurred from the present day market compared with the boom 2 – 5 years ago. The sales lenders estimated this decrease in median property price is approximately a 30% decrease;
- The average lifespan of properties built 50 – 60 years ago was approximately 50-55 years, whereas new properties only have an estimated lifespan of 30-35 years due to changes in building styles and materials; and,
- Newer properties typically have an increased value in comparison with older house stock due to better suit contemporary lifestyle living and better condition as they are early within their lifespan.

Weekly rental prices

- Karratha's average advertised weekly rental has dropped for the ninth consecutive quarter (December 2013), down from $1,784 in the September 2011 quarter to $1,081 in the latest quarter, which is the lowest since figures have been collected by the Pilbara Development Commission – the weekly rental has fallen by some 35 % during this period, which is significant from an affordability point of view. It
- For full breakdown of rental analysis refer to Appendix 1.

Housing Affordability

The study suburbs have existing services: water, power, wastewater, roads and public open space that can be supplemented or modified at lower cost compared to development of new suburbs. Whilst the cost of water may rise only slightly, the cost of electricity may well continue to rise quite significantly. New construction can take advantage of changing demographics and consumer preferences for modern, environmentally friendly, more diversified properties at a lower cost of construction than in the immediate past.

Discussions with stakeholders confirm that cost pressures in the City are subsiding due to less demand for services from the construction sector. Employment costs will be lower over the period 2014 to 2017 - but will remain comparatively high to those in Perth. As a result, the rapid increases of the past few years are unlikely to be repeated without major new investments, and so prices are not likely to increase at the same pace as in recent years unless there is further port development and/or exploitation of additional LNG or iron ore reserves.

The cost of construction of housing is a significant factor that drives housing affordability. The specific characteristics which impact on the cost of housing in Karratha are;

- The remote regional location of Karratha to source and transport materials and building supplies;
- Environmental considerations relating to building standards including flood risk, cyclone proofing and fire risk etc;
- Limited experience and successional training of the local building industry and associated skills.
- High mobilisation and demobilisation costs associated with out of town skill hire.
- High labour costs due to the inflated local resource industry market;

Overall it is believed that property development costs in Karratha have fallen by 10% to 20% since end of 2011.

However, Western Australia's State land developer, LandCorp has a considered central role to deliver land and support infill where private development becomes not viable.

Market Dynamics

With regard to market dynamics the data indicates:

- Higher quality, more choice and diversification of properties are now available at lower cost especially within the newer suburbs of Madigan Road, Nickol and Baynton;
- The market has been released from housing shortage pressures and become more normalised and affordable;
- Older stock is becoming less attractive due to contemporary functionality and limited lifespan.

The older established subject suburbs need to respond to the present day market dynamics to be become more economically attractive and provide a point of difference in the cooling market.

In summary the pecularities of this market is as listed;

- Central role of LandCorp in developing land;
- High cost of developing land;
- Remote nature of this market e.g. low opportunity for diversity within the housing product however there has been a marked improvement over recent years;

These are all the factors constraining or delaying normalisation and without intervention some may be insurmountable.

Note: Revitalisation is a market intervention where the outcome is a reinvigorated property market and an improved urban environment. The process and strategies are detailed later.

2.3 Infrastructure Provision

Drinking water

Water for Karratha townsite is sourced from the Water Corporation's West Pilbara Water Supply Scheme (WSS). The West Pilbara WSS also supplies water to the Burrup Peninsula, Dampier and its port, Roebourne, Wickham, Point Samson and surrounding areas.

Water for the West Pilbara WSS is sourced from the Harding Dam (approximately 40 km inland) and the Millstream Wellfield (approximately 100 km inland). These two sources operate together throughout the year, while water from Harding Dam is used as the preferential source when availability and quality allow. The water source has been recently augmented through a $330million investment by Rio Tinto which extracts water from the Bungaroo Valley borefield, transferring it into the existing water supply scheme.

Water from these sources is treated and then transferred by large trunk mains to the storage tanks at the various townsites.

Karratha's water is currently stored in one 25 ML storage tank at the town's western tank site, two 9 ML tanks at the eastern tank site close to the town centre, and two small 225 kL tanks near the Karratha Light Industrial Area (see Figure 6 - Appendix 6). The 9 ML tanks have recently been refurbished. Please refer to Figure 6, Appendix 1 for the water supply network for Karratha.

In 2011 and 2012, the Water Corporation reviewed its long-term water planning for the West Pilbara WSS and for the Karratha scheme, based on a planning horizon of 2040. The long term plan for Karratha identifies the need and approximate timing of various upgrades and expansions to the town's water storages and distribution network to meet anticipated demands. The water scheme plan provides for staging of capital works and includes options to vary the planning based on the rate and spatial distribution of demand over time.

For a proposed population of 50,000 (based on the Pilbara Cities vision (DRDL, 2012)), it is estimated that the town's water storage tanks will need to be expanded to achieve a total storage volume of around 100 ML, which is likely to be distributed equally between the eastern (50 ML) and western (50 ML) tank sites, subject to need and available space at each site.

The long-term water scheme plan also schedules approximate dates for capital expenditure on various upgrades and extensions to the town's water distribution pipes (generally major water mains greater than 300 mm in diameter).

The Water Corporation's planning also considers concepts for further system expansion (storage expansion and distribution improvements) for a longer-term population of approximately 78,000 people, based upon the August 2010 Karratha Regional HotSpots Land Supply Update which predicts 36,000 dwellings.

Planning for water service provision will be reviewed by the Water Corporation in future years as growth and demand conditions change.

Wastewater

To meet the demands arising from the proposed high development growth in Karratha over the next 25 years, several parts of the town's wastewater system, including the treatment plants, major gravity sewers, wastewater pressure mains and wastewater pumping stations will need to be upgraded and/or replaced to deal with the additional wastewater flows.

In 2010 and 2011, the Water Corporation undertook a substantial review of its long-term wastewater infrastructure planning and capital expenditure program for the town. The main driver for this planning review was the rapid increase in development in the town on the back of the resources boom in the Pilbara, as well as projected future increases in townsite population and in particular the shift towards higher density and mixed use development in the town centre.

The Water Corporation's planning review was based on a number of land use planning studies and inputs including:

- State Government's Pilbara Cities initiative;
- WAPC's 2010 Karratha Regional Hotspots Land Supply Update;
- City of Karratha TPS No.8 and known scheme rezoning amendments;
- City of Karratha's Karratha City Centre development plan, LandCorp plans for various development sites notably Mulataga and City centre development sites; and
- Various site-specific land development and feasibility queries received by the Water Corporation.

This planning review took a 50 year horizon to approximately 2060. The planning considers various options into the future and provides a guide for the Water Corporation's capital investment decisions on upgrading of existing infrastructure and establishment of new infrastructure. The Corporation's planning is based on a wide range of sustainability principles including: minimising potential environmental impacts, minimising the impacts on the community, determining the best long-term option, minimising whole-of-life asset costs, maximising the life of existing assets, and staging the cost of new assets and upgrades over time.

Wastewater treatment plants (WWTP)

Karratha currently has three wastewater treatments plants:

- K1 is situated to the south-east of Karratha and accepts and treats wastewater flows from the eastern half of the town. K1 has a licensed capacity of 2.3 ML/day.
- K2 is situated to the south-west of the town and treats flows from the western half of the town. K1 has a licensed capacity of 3 ML/day.
- K3 is small light industrial area treatment plant located to the south of K1 abutting the Karratha Light Industrial Area (LIA). This WWTP treats wastewater flows from a limited catchment comprising mainly workers accommodation located in the LIA as well as effluent from a number of septic tanks in the LIA. K3 has a very limited capacity and is registered to accept 70 KL/day.

K1 and K2 WWTPs are operating close to their maximum capacity and the Water Corporation has undertaken separate planning and committed substantial capital towards upgrading to improve treatment capacity and treatment wastewater management capacity at K1. The upgrading and expansion of K1 WWTP to a maximum capacity of 10 ML/day, is currently underway. The long-term planning for the system also has an option to consolidate the WWTPs at one location and to possibly decommission K2.

The City of Karratha currently uses some treated waste water to irrigate public open spaces throughout the city, some of which are within Bulgarra, Pegs Creek and Millars Well. Disposal of the remainder is into evaporation ponds.

Based on the high development growth estimated for Karratha over the next 25 years there is no drinking water or wastewater upgrade requirements beyond that which would be normally delivered by the Water Corporation through collection of headworks charges. Future infrastructure requirements are limited to local scale provision of reticulation systems and individual lot connections which are to be funded, designed and constructed by developers in accordance with the Water Corporation's design standards.

Power

Horizon Power is the State-government owned corporation that supplies and distributes power in regional and remote Western Australia, including Karratha, through its North-West Interconnected System (NWIS). This NWIS grid is partially interconnected by high voltage power transmission lines owned by both Horizon Power and mining companies (City of Karratha, 2010).

The Karratha townsite power high voltage supply scheme is a network of a combination of 11 kV overhead power cables and underground feeder cables fed from zone substations located on Millstream Road in Bulgarra and Dampier Highway in Millars Well. These zone substations are known as the Bulgarra Substation and Pegs Creek Substation, respectively (City of Karratha, 2010). Existing high voltage overhead power transmissions lines are located along Dampier Highway linking the Bulgarra and Pegs Creek zone substations to the existing Stovehill Road switchyard. The existing transmission and distribution networks in Karratha are shown in Figure 8.

A large proportion of Bulgarra, Pegs Creek, Millars Well are currently serviced by overhead power lines. The majority of 11 kV high voltage overhead and underground feeder cables within the townsite are currently at capacity (City of Karratha, 2010). To address this issue, accommodate expected population growth and deliver the Pilbara Cities vision of approximately 50,000 in the townsite, Horizon Power has completed a number of planning reviews of the power supply in Karratha.

To meet the growing demand, two major upgrade projects are currently underway in the region, the Pilbara Underground Power Project and the Hedland Precinct Power Project, described below.

Pilbara Underground Power Project

The Pilbara Underground Power Project (http://www.horizonpower.com.au/pupp.html) is a partnership between the Royalties for Regions, Pilbara Cities initiative and Local Government to better ensure a reliable power supply in cyclone affected areas, by replacing ageing overhead electricity infrastructure with underground networks. This project is being undertaken in Karratha, as well as South Hedland, Onslow and for the remaining overhead network in Roebourne. The distribution voltage and therefore capacity of the electrical distribution network will be upgraded from 11 kV (above ground power lines) to 22 kV (underground power lines). These upgrades will increase the capacity of the system from 5 MVA to 8.5 MVA, approximately a 40% increase in capacity.

Horizon Power allows for a usage of 10 kVA per household and 7 kVA per unit in Karratha (pers comm. Horizon Power, 10th January 2014). Based on this allowance a maximum of 3,000 additional houses, approximately 1000 houses per suburb, could be serviced by Karratha's distribution network once underground power line upgrades are completed.

The current capacity of the existing and temporary power stations and substations is considered sufficient to meet this increase in demand. However, 3,000 houses is considered the capacity limit of the system (pers comm. Horizon Power, 5th March 2014).

The replacement of the existing overhead power network has been partially completed in Bulgarra and the full program is scheduled for completion in Bulgarra, Pegs Creek and Millars Well in 2017.

Based on the high development growth estimated for Karratha over the next 25 years, there are no upgrade requirements for power infrastructure beyond that which would be normally delivered by Horizon Power and funded by direct charges to developers.

Horizon Power has indicated that they will be installing underground power in Pegs Creek as part of the Pilbara Underground Power Project in 2015 with the program across the study area scheduled to be completed in 2017.

Refer to Appendix 6 - Infrastructure and Servicing for full overview of Infrastructure Technical Information.

Non-drinking water

There is an existing non-drinking water (treated effluent) distribution network operating within Karratha delivering water for irrigation of public open spaces. The public open spaces within the study area of the Karratha Revitalisation Plan that are currently irrigated with treated effluent are:

- Bulgarra Oval
- Old KEC oval, west and central horse paddocks
- Pegs Creek Oval
- Cattrall Park
- Kevin Richards Memorial Oval (Millars Well)
- Golf Course
- Leisureplex

Upgrades to the level of treatment provided at the wastewater treatment plant as well as an increase in capacity will increase the availability of this resource. However, there is substantial competition for this resource and as a result only limited expansion of the treated effluent irrigation system is likely and currently no additional sites within the study area of the Karratha Revitalisation Plan are proposed for irrigation with treated effluent.

A separate Karratha Effluent Reuse Scheme investigation is currently underway which will prioritise public open spaces for irrigation with treated effluent and develop designs for expanded and more efficient distribution and irrigation systems.

Relevance: The Karratha Effluent Reuse Scheme provides opportunities for delivery of improvements to priority public open spaces and streetscapes through access to high quality recycled wastewater for irrigation.

2.4 Strategic & Policy Aspirations

Planning & Infrastructure Framework

The *Pilbara Planning and Infrastructure Framework* (WAPC, 2012) provides a twenty year plus vision for the growth in population, jobs, development and infrastructure in the Pilbara Region. It anticipated the region's population to grow from 50,000 to 140,000 by 2035. The Pilbara region is envisaged to have a settlement structure at 2035 of:

- Two Cities with aspirational populations of 50,000 -Karratha (including Dampier) and Port Hedland;
- One Sub-regional Centre with a population of 15,000 – Newman;
- Major Towns -Tom Price, Onslow, Wickham;
- Three Towns - Paraburdoo, Roebourne, Pannawonica;
- Five Villages - Point Samson, Marble Bar, Nullagine, Cossack, Shellborough; and
- Aboriginal Communities.

The Planning and Infrastructure Framework does not provide for any significant new settlements in the region. It promotes a greater proportion of the workforce to reside permanently in the Pilbara with a lesser role for a Fly-In, Fly-Out (FIFO) workforce, and provides for settlements to develop into more liveable and attractive places with improved facilities and services. The implementation of the Planning and Infrastructure Framework within the region is to be by the City, the Pilbara Development Commission, Landcorp, the Department of Housing, the WAPC and other government agencies as well as the private sector. The Planning and Infrastructure Framework flagged the need for various more detailed further studies to aid implementation.

Royalties for Regions Program (R4R)

Since 2008, the State's long-term focus on regional development has been supported by state-wide investments using 'Royalties for Regions' funding. This state government policy involves the reinvestment of 25% of mining and onshore petroleum royalties each year into projects in regional WA. The aim is to achieve strong and vibrant regional communities that are desirable places to live, thus supporting the Pilbara Cities vision in the *Planning and Infrastructure Framework*. Through R4R, additional investiment is channeled into projects that help build regional communities and all decisions are underpinned by six principles (as stated on the DRD website, 2014, as):

- Building capacity in regional communities;
- Retaining benefits in regional communities;
- Improving services to regional communities;
- Attaining sustainability;
- Expanding opportunity; and
- Growing prosperity.

Guided by these principles, by 2015 the Department of Regional Development estimates that there will be 2,500 Royalties for Regions funded projects across the regions supporting and developing new healthcare and educational facilities, community programs, housing, infrastructure, water and agriculture initiatives and community assets such as town centres, parks and sports facilities. In Karratha, investments have included funding for the;

- Health Campus;
- Senior High School, Karratha Leisureplex;
- City Centre Revitalization;
- Various infrastructure works;
- Northern Planning Programme; and,
- Housing for workers.

There has been some restraint on expenditure on projects recently since the State's credit rating was down-graded although it is understood that funds have not been diverted from the program.

Relevance: The R4R program is relevant to the KRS as investments have included significant funding for key infrastructure within the City. This assists in the goal of building strong and vibrant regional communities that are desirable places to live.

Karratha City of the North Plan (KCN)

This study was prepared in 2010 for the City of Karratha and LandCorp with funding from R4R. It is intended to provide guidance for Karratha's growth from a population of 18,000 to an aspirational target of 50,000 people. The KCN Plan's vision for Karratha is:

'A liveable, compact, Regional City of 50,000+ people, with a diversified economy, a healthy local community which demonstrates demographic balance, affordability, high quality amenity, and infrastructure. It is a place of choice, to work, visit, grow up, raise families and age gracefully.'

A more focussed aspiration of the KCN Plan is to create a City centre for Karratha and to develop diversity:

'A variety of living and lifestyle opportunities will underpin the diversification of Karratha. At its heart, a vibrant mixed-use City centre will celebrate a rich cultural heritage and landscape. Cool shady streets, a City Square, and a vibrant street culture contrast the existing tarmac dominated town centre, providing a new communal 'backyard' for residents, the community and visitors ...'

The KCN Plan consists of a summary document and three detailed volumes:

- Implementation Plan (vol. 1);
- City Growth Plan (vol. 2); and
- City Centre Master Plan (vol.3).

The KCN Plan has formed the basis of more detailed investigations including area structure plans. Some of its proposals have evolved and are being implemented. This includes improvements to the City centre being undertaken by LandCorp on behalf of the City using R4R funding. Recognition is included in the KCN Plan that planning and implementation of Karratha's growth needs to take a holistic view and it includes a conceptualised City Growth Plan.

Relevance: The Karratha Revitalisation Strategy builds on the broader vision, principles and strategies espoused by the KCN plan and couples this with the latest evidential base - such as detailed flood and surge mapping and other supporting programmes such at the *Footpaths Future Works Report*.

Pilbara Vernacular Handbook

In order to assist with the implementation of the Pilbara Cities vision, LandCorp developed two documents which aimed to guide and inform future built-form in the Pilbara. In 2011 LandCorp completed the Karratha Vernacular Guideline which aimed to inform Mulataga and Karratha City Centre. Since this time new research and experiences have allowed LandCorp to refine and expand this work to other parts of the Pilbara region.

This knowledge has been captured in the 2012 *Pilbara Vernacular Handbook*. The principles and guidelines specific to Karratha are compiled in the 'Pilbara Region Part 1' of this document. Although the information provided in this handbook is similar to the previous guideline, the latest iteration will better assist the implementation of the Karratha Vernacular by incorporating the valuable advice of the previous Karratha Vernacular as well as new considerations tailored to each part of the Pilbara region.

Relevance: There is the opportunity for housing, public realm and open space upgrades within the revitalisation study area to take advantage of the principles espoused by the Handbook.

Lazy Lands

The Department of Regional Development and Lands, in association with the City of Karratha, identified 61 parcels of undeveloped Crown land reserved for parks, recreation and drainage in the City's *Town Planning Scheme No.(TPS) No. 8*, that subject to further investigation, might have the potential for residential development. These were named 'Lazy Lands'. The intention was that the development of these parcels could assist with meeting Karratha's current and future housing requirements.

The Lazy Lands project is being co-ordinated by the Pilbara Development Commission (PDC). The parcels have been variously allocated for further investigation, planning and implementation via a Cabinet decision to the City of Karratha, LandCorp, the Department of Housing and the PDC.

The 61 Lazy Lands parcels are situated in the suburbs of Nickol, Millars Well, Pegs Creek and Bulgarra. Seven parcels, representing stage one of the project were rezoned in the City of Karratha *TPS No. 8* in 2013 by Amendments 29, 30 and 31 (three in each of Bulgarra and Millars Well, and one in Pegs Creek). This was subsequent to detailed planning assessment of each parcel, including flood risk.

Since the original development of Karratha, understanding of flood risk has evolved considerably. Two flood studies have been undertaken to examine the issue. The *Karratha Coastal Vulnerability Study* (JDA, GEMS, Damara WA Pty Ltd, Coastal Zone Management and DHI Water and Environment, 2011,) considered the impacts of future climate change, the hydrology around Karratha, shoreline stability, flooding from storm surge and riverine flooding. The *Lazy Lands 2D Flood Study and Local Water Management Framework* (LWMF) (JDA, 2013) assessed the current impact of flooding from rainfall runoff on Karratha, with the 61 Lazy Lands sites being assessed against the 100 year 'ARI' flood and classified as being either hydrologically constrained or not. This study did not consider storm surge implications, which were addressed in the V*ulnerability Study and the City's Draft Local Storm Surge Risk Planning Policy (*DP19).

The study concluded that the majority of the 61 sites are not required for drainage purposes, although some sites may require additional engineering works to mitigate the impact of development on drainage flood levels. Further flood investigations are being undertaken. Storm surge and flooding issues are more fully explored in Section 3.

Relevance: An important task of the Karratha Revitalisation Strategy is to assess in more detail the suitability for development of the remaining Lazy Lands parcels within Bulgarra, Millars Well and Pegs Creek taking into account the full range of planning issues.

Other Development Projects

The revitalisation of the three suburbs within the study area will occur in the context of significant greenfield and redevelopment projects and opportunities in other parts of Karratha. The staging and rate of residential development elsewhere in Karratha will impact on overall demand, timing of development, and to some extent, viability and competitiveness of new development and redevelopment within Bulgarra, Millars Well and Pegs Creek. Key projects include Mulataga, Baynton West and the City Centre.

Relevance: Mulataga and the City Centre redevelopment projects are the most directly relevant to this study due to their immediate adjacency and connections to the study area.

Town Planning Scheme (TPS) No. 8

The *City of Karratha TPS No. 8* controls and guides the use, development and subdivision of land within the City. It was originally approved in 2000 and is currently in a review phase with the preparation of a Local Planning Strategy underway. Local Planning Strategies are a requirement under the planning legislation to provide the planning rationale and basis for the zonings and provisions of a new planning scheme.

The strategy will provide a 20 year planning direction for the City and guidance for infrastructure providers, the community, investors and developers on where and how growth is likely to occur. It will consider expected population and economic growth, and the associated demand for a range of housing options, the various transport modes, employment opportunities, recreational, leisure, entertainment, retail and community facilities.

A number of technical papers and evidential analysis reports have been prepared and three scenario development workshops were held in September 2013 with community and stakeholder representation. The *Local Planning Strategy Workshop Outcomes Report* (October 2013) indicates a number of main messages of particular relevance to the revitalisation strategy for Bulgarra, Pegs Creek and Millars Well. These include:

- Strong demand from the community for housing that accommodates the demographic sector of the growing family with a boat and caravan. Private open space for recreation and entertaining is also highly valued;
- A recognised need for housing diversity to accommodate other populations such as young singles/couples and the retired/aging population. It is consistently agreed that higher densities would be most appropriately located in and around Karratha town centre and in Dampier, while for aged care and accommodation, accessibility is the critical consideration;
- Support for common boat storage areas as an alternative to the large lots that can accommodate boat storage, provided the storage areas are conveniently located and secure;
- Support for innovation in housing design, such as elevated homes, to provide diversity to the streetscape and make better use of smaller lots. Proactive planning and design guidelines that are realistic, affordable and reflective of the demands of the community are needed to drive this;
- Public transport, in the form of buses, is identified as realistic for the future in Karratha, and there is demonstrated desire for greater cycling infrastructure and walking trails, which should incorporate shade, as this has been noted as a valuable community asset;
- Aged care and services for older peoples' needs are required, but aged care does not necessarily have to mean purpose built facilities. Aging in place should be an important consideration for future planning; and
- Uptake on environment and climate responsive design is relatively low, but there is demonstrated interest within the community for climate adaptive design, including passive solar design, and incorporation of renewable energy sources and water recycling. These features for sustainable built form need to be encouraged through mechanisms of government leadership, academic research, design competitions and land allocated to provide for relatively risk free innovation.

A draft Local Planning Strategy is expected to be adopted for the purposes of public advertising in 2014. The Strategy and planning scheme will be important implementation mechanisms for the Karratha Revitalisation Strategy recommendations.

Residential development is generally controlled in *Town Planning Scheme No. 8* by the application of the WAPC's Residential Design Codes, (SPP No. 3.1). Clause 6.3.1 of the scheme enables the council to adopt design guidelines whilst Appendix 7 enables the inclusion of special conditions to be applied to Urban Development zoned land.

Relevance: The opportunity exists to use these and similar approaches to achieve a high degree of certainty of planning outcomes for the community and developers where changes in residential densities and dwelling diversity are proposed. The potential for developer contributions will also need to be considered. Development contributions are usually by way of land, works or payments towards the provision of infrastructure.

Development contributions can be sought for:

- A new item of infrastructure;
- Land for infrastructure;
- An upgrade in the standard of provision of an existing item of infrastructure;
- An extension of existing infrastructure;
- The total replacement of infrastructure once it has reached the end of its economic life;
- Other costs reasonably associated with the preparation, implementation and administration of a development contribution plan.

The contribution are for the initial capital requirement only and not for the ongoing maintenance and / or operating costs of the infrastructure. (WAPC, State Planning Policy 3.6)

Zoning

The combination of rugged hills, open drainage swales, verges filled with Pilbara toys, and robust simple housing creates a unique environment that reflects and enables the lifestyles of the community.

The following City of Karratha Town Planning Scheme No 8 zones and reserves are contained within the study area;

- Residential zone
- Urban Development zone
- City Centre zone
- Parks, Recreation and Drainage reserve
- Public Purposes reserve
- District Roads reserve
- Regional Roads reserve
- Local Roads reserve

The land use zoning is summarised in Table 2.6.

Local Land Use Zoning				
SUBURB	Bulgarra	Pegs Creek	Millars Well	TOTAL
Local Roads (ha)	42.7	22.9	27.1	92.6
Residential (ha)x	84.6	49.5	56.8	190.9
Commercial (ha)	0	6.0	0.23	6.2
Education (ha)v	11.6	2.1	2.4	16.0
Recreation (ha)#	11.6	2.6	5.3	19.4
Other Crown Reserves (ha)^	56.2	22.3	45.7	124.2
Other Community (Churches, halls)	3.6	1.8	1.4	6.9
Utilities (ha)	0	0	0.06	0.06
TOTAL*	210.4	107.15	138.8	456.4
Gross subdivisible area (ha) = (Residential, Local Roads & Recreation)	138.9	74.9	89.1	303

x Includes a park (Ashton Way) and a drainage area in Urban Development zone (DA1 and DA3) in Millars Well.

*Does not include major distributor road reserves surrounding the suburbs (Dampier Hwy, Millstream Rd, Balmoral, Searipple, Mystery, Bathgate Rds)

^Reserves include existing land used as parks that are not defined by cadastral boundaries. Please note that:

- all the calculations are based on the areas calculated by MapInfo using cadastral information.

- areas defined 'Recreation' are the lots on which the three major ovals and some of the parks are located (not necessarily their areas as defined by the City), and as shown in Figure 2 Land Use map

- areas defined "Reserve" also include some of the land used for parks.

This is an under-estimation of the Crown reserve land actually used for formal park purposes. The areas of parks as defined in Attachment 1 to the City's Report to Council 12.2 Review of Public Open Space in Karratha, 16 May 2011 total 26.3347 ha (Bulgarra 12.3159 ha; Pegs Creek 5.8584 ha; Millars Well 8.1604 ha)

V This includes 5.2 ha of the former Karratha High School site which is likely to be available for future residential use and St Paul's Catholic school in Bulgarra

Table 2.6 - Local Land Use Zoning

2.5 Identified Community Aspirations

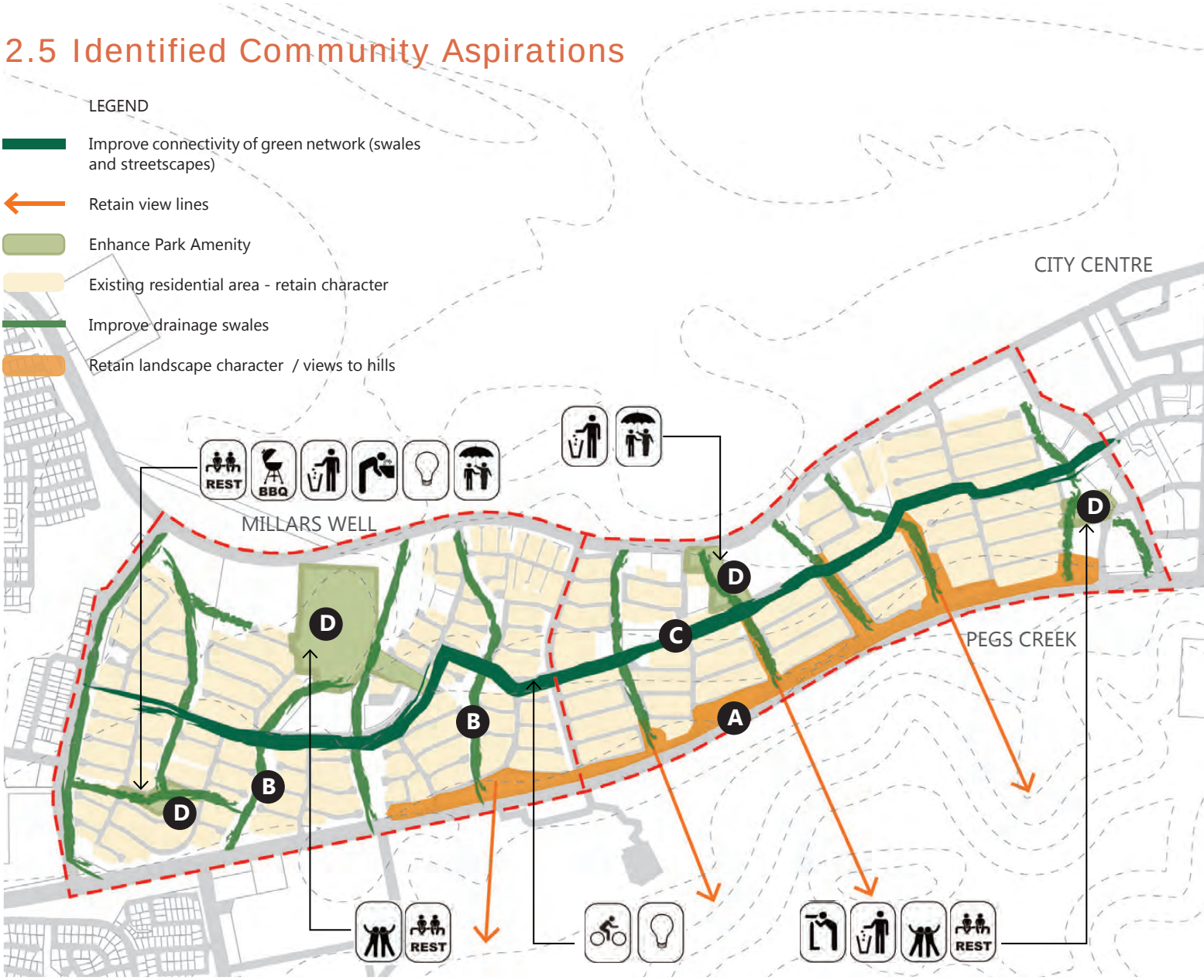


Figure 2.2 - Community Mapping

Building on KCN Principles

The KCN discusses the aspirational goal of:

'...Communities that are safe, healthy, and enjoyable places to live and work; offer cultural, educational, recreational opportunities; provide appropriate housing, services and amenities; foster active local citizenship...'

This goal is underpinned by key project objectives of:

- *Community cohesion, vitality and involvement*
- *Strong cross cultural relationships*
- *Community participation in goal setting and decision-making processes*

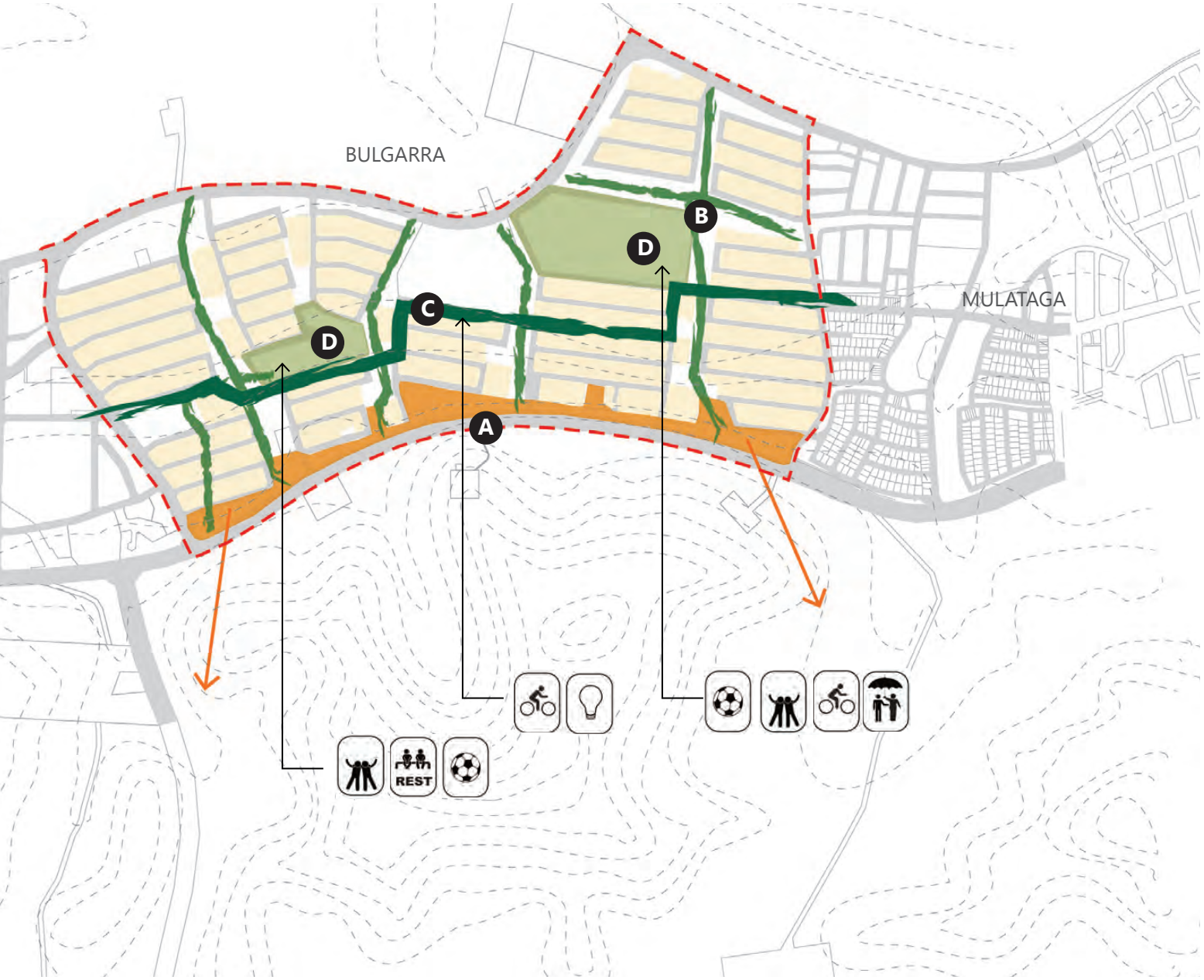
KCN, Principles for Achieving the Vision, p14

The KRS builds upon the KCN implementation strategy by the inclusion of multiple engagement sessions with the local community and stakeholders to gain key inputs and generate support for the KRS. This opportunity was facilitated via two community workshops and an online web tool 'Collaborative Map'. Refer to Appendix 4 for Collaborative Map Feedback Report.

Figure 2.2 spatially maps the most prominent community inputs received during the two community workshops. Key opportunities and constraints that were raised during the engagement workshops include;

Opportunities

- **(A)** Retain and enhance landscape character; including open space feel, views and connection to Karratha Hills and natural vegetation;
- **(B)** Opportunity to improve or transform drainage areas, which are currently an under utilised asset;
- **(C)** Improve connectivity between drainage reserves, parks and open space through shared path network;
- Improve connectivity for all modes of transport;



- Improve streetscapes by street trees, verge treatment and maintenance;
- **(D)** Enhance amenity within parks (seating, shade, dog park, community facilities, rubbish collection, maintenance etc);
- Develop Design Guidelines for new development, which includes principles that outline the retention of neighbourhood character and achieve high quality housing.
- Improve particular intersection upgrades and treatments;
- General improvement of maintenance, rubbish collection and suitable lighting;

Constraints

- Consider appropriate places for development. It was noted by the community that not all Lazy Lands should be developed, rather assessed against flood risk, design principles and overall suburb objectives;
- Size of lots should be appropriate for proposed form, achieve a mix of housing type, have appropriate parking and relationship to road network;
- Resistance to increased densities was noted;
- Careful consideration of east west link to ensure it remains a local road rather than a major thorough fare.

A key element of the preparation of the Karratha Revitalisation Strategy was the engagement of the community and stakeholders to gain key inputs and generate support for the strategy at suburb level. This opportunity was facilitated via two (2) Community Workshops and an online web tool 'Collaborative Map'.

The purpose of Workshop 1 was to discuss the project objectives, project process and workshop objectives, as well as provide a short overview of the background and site analysis information. The audience also broke into smaller groups to discuss the values, likes and dislikes of a respective suburb in more detail. Following workshop 1, all input and feedback was collated and reviewed. In synthesizing the feedback four key themes emerged;

- Development;
- Transport;
- Parks; and,
- Amenity.

Expansion of each of these four themes was discussed during Workshop 2 including:

- Project Principles;
- Project Objectives;
- Opportunities & Constraints; and
- Sketch Design explorations.

Refer to Appendix 4 for further details on Community & Stakeholder Engagement.

Key Findings & Response

Key community preferences identified during Workshop 2 and the associated project response is outlined in the Table 2.8 opposite.

Community Feedback and Project Response

Comment / Feedback	Response
Development	
Consider appropriate places for development. It was supported that not all Lazy Lands should be developed, rather assessed against flood risk, design principles and overall suburb objectives.	A review and preliminary assessment of all development opportunity parcels has been undertaken and priority development sites identified.
Size of lots should be appropriate for proposed form and achieve a mix of housing type.	Revitalisation Strategy recommends Design Guidelines to be developed which provide a framework for housing diversity, high quality materials and appropriate form to surrounding context.
Density of development should be appropriate for the road network.	Revitalisation Strategy recommends Design Guidelines to be developed which provide a framework for housing diversity, high quality materials and appropriate form to surrounding context.
Keep Bulgarra mainly low density for families. (note workshop 2 included high percentages of Bulgarra residents attended workshop 2 therefore more conversation centred around this suburb).	The Revitalisation Strategy builds on the existing character, nominates key development opportunities and retains the central Public Open Space Corridor that was identified as an important community asset.
Preference to increase density near City Centre and Tambrey Neighbourhood Centre to facilitate pedestrian travel.	Revitalisation Plan recommends higher intensity development near City centre. Increased density around the Tambrey was not supported during City of Karratha Project Control Group Meeting.
Design guidelines for new development are needed to retain neighbourhood character and achieve high quality housing.	Revitalisation Strategy recommends Design Guidelines to be developed during Stage 2.
Recognise a perceived reduction in property values from new road connections.	Priority road links have been identified to improve connectivity, allow increased evacuation and safety routes.
Parking needs to be sufficient for the number of residents.	Parks and ownership of 'toys' are inherent to the Pilbara lifestyle. Appropriate parking / storage solutions to be investigated in more detailed within Design Guidelines.
Transport	
Suggestion of possible intersection upgrades and treatments;	Revitalisation Plan has identified intersection upgrades likely to be required and locations to improve crossing provisions of Dampier Highway & Broadhurst Road.
Proposed future road links.	Future road links have been identified in the Revitalisation Plan
Improving connectivity and shared path network.	Improve connectivity for all modes of transport between the residential cells both east-west and north-south connections and shared path network.
Parks	
The community supported the proposed closure of Ashton, Rex Webb and Richardson Way Parks, with the condition that value is added to Malster Place and Scout Hall Parks.	Additional support received by CoK Project Control Group. Recommendation included within Revitalisation Plan.
Community response to Watters Park favoured the improvement of amenity and facilities in the southern area if the northern half was closed.	Additional support received by CoK Project Control Group. Recommendation included within Revitalisation Plan. The KRS also notes there is initial planning / works underway for improved amenity within this area.
Community input noted that enlarging the Scout Hall Park (important community asset) to include surrounding parcels of lazy lands is a better option than constructing a new park elsewhere.	Additional support received by CoK Project Control Group and relevant stakeholder. Recommendation included within Revitalisation Plan.
Community input suggested that a junior soccer training function is maintained within the Bulgarra Oval precinct.	Investigate location for training grounds in Bulgarra KEC Oval.
Amenity	
Priority should be given to Minor Access Streets and the preferred treatment option was gravel and a street tree which is appropriate for the climate and use of verges.	Develop verge treatment brochures to encourage shared ownership with residences in the maintenance of verge areas.
Community supported enhancement to Dampier Highway and preference was given to planting on north side of the road only.	Identify priority area for planting e.g. intersections, bus stops, high treatment towards City Centre.
High value of swales and this is currently an underutilised asset.	Identify priority swales for revegetation, small breakout areas and seating opportunities, wildflowers etc.

Table 2.7 - Community Feedback

3 Opportunities & Constraints

Evidential Base

This section examines opportunities and constraints from an evidential base and relates them to the principles and objectives of the Karratha City of the North (KCN) document.

Broadly this section addresses:

- Environmental influences (drainage and flooding);
- Built form (age, condition and ownership);
- Planning controls & overlays (land use, lazy lands and residential density);
- Movement networks (pedestrian, vehicular, informal tracks);
- Heritage & Views;
- Community Infrastructure (Walkable catchments);
- Parks & Open Space; and
- Community mapping & inputs.

Each category is spatially mapped and tabulated where relevant.

3.1 Existing Land Use & Urban Form

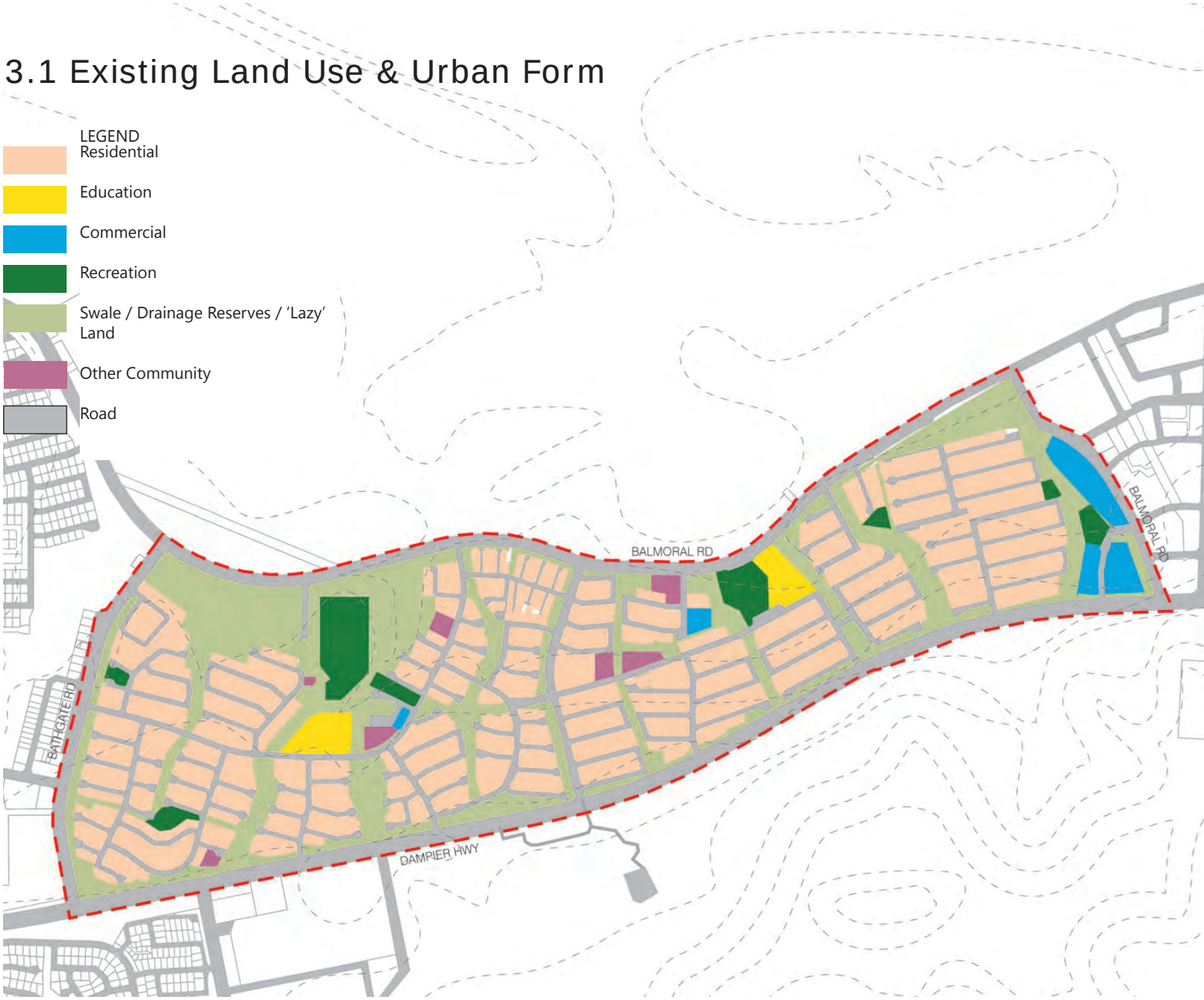


Figure 3.1 - Existing Land Use & Urban Form

Urban Form and Structure

The layout of Karratha is generally lineal, stretching from east to west occupying the 'easy land' between the physical constraints of the Karratha Hills to the south and the inundated coastal plain of Nickol Bay to the north.

The planning design of the older suburbs of Karratha is sometimes referred to as being based on 'Radburn' planning principles, a town developed in New Jersey from the 1930s (Stein, 1958). One of the main principles of the plan for Radburn was to separate cars from residents' non-motorised movements rather than allowing cars to dominate residential areas. This included the use of the pedestrian underpass under streets. Narrow, linear, highly developed and maintained parks formed a backbone to the Radburn estate with groups of short cul de sacs having houses directly abutting and facing the park with pedestrian lanes linking non-abutting houses to the parkland.

A key feature of the urban structure is the major road network of Dampier Highway, Balmoral Road and Searipple Road. The main access into Karratha is via Dampier Highway with the older suburban areas Millars Well, Pegs Creek and Bulgarra accessed either directly from Dampier Highway or from Balmoral Road and Searipple Road that ring these suburbs to the north.

The suburbs are poorly connected both to each other and internally, a symptom of the planning trends at the time. This is further constrained by the drainage swales that dissect the suburbs from north to south.

The suburbs are also poorly connected to the City Centre with only Balmoral/Searipple ring roads or Dampier Highway providing access. Alternative access to the City Centre via shared pathways is disconnected, further constrained by the hot climate, and there is virtually no public transport network.

The KCN discusses the residential areas as being:

Karratha's urban areas are characterised as a series of 'cells', linked by a series of connected internal park systems, cul-de-sacs and loop roads. This design philosophy creates exclusivity and minimises local residential traffic however it also creates a fragmented town of disconnected dormitory residential cells with almost no urban vitality and relatively high car dependence.

(KCN An Integrated Strategy 2.6, Built Environment & Public Realm pg.58)

Opportunities

- The existing urban form of the study suburbs responds to drainage, provides views and vistas to the Karratha Hills and tidal flats. These local landscape references together with the fluctuations in climate (heat and flooding) define the suburbs identity, sense of place and existing character;
- A series of drainage swales dissect all of the study suburbs and serve to create 'green fingers' through the suburbs. Opportunity exists to transform drainage reserves with native vegetation to mimic natural creeklines and provide opportunities for passive recreation;
- Opportunity for study suburbs to improve connection (vehicular and pedestrian) and to support the Karratha City Centre;
- Opportunity to improve maintenance of verges and drainage reserves;

Constraints

- Poor legibility and permeability creating traffic congestion on key neighbourhood roads (Ref to Section 3.9);
- Poor safety and surveillance of public open space as many of the residential areas back onto POS;
- Relatively under utilised asset of drainage reserves;
- Streetscapes are defined by wide road verges, however there is limited pedestrian-friendly infrastructure, with scattered street trees providing little shade and broken footpaths. Furthermore, the wider verges are predominantly used for vehicular or boat parking, further decreasing pedestrian visibility;

(KCN An Integrated Strategy 2.6, Built Environment & Public Realm pg.58,59)

3.2 Condition of Building Stock

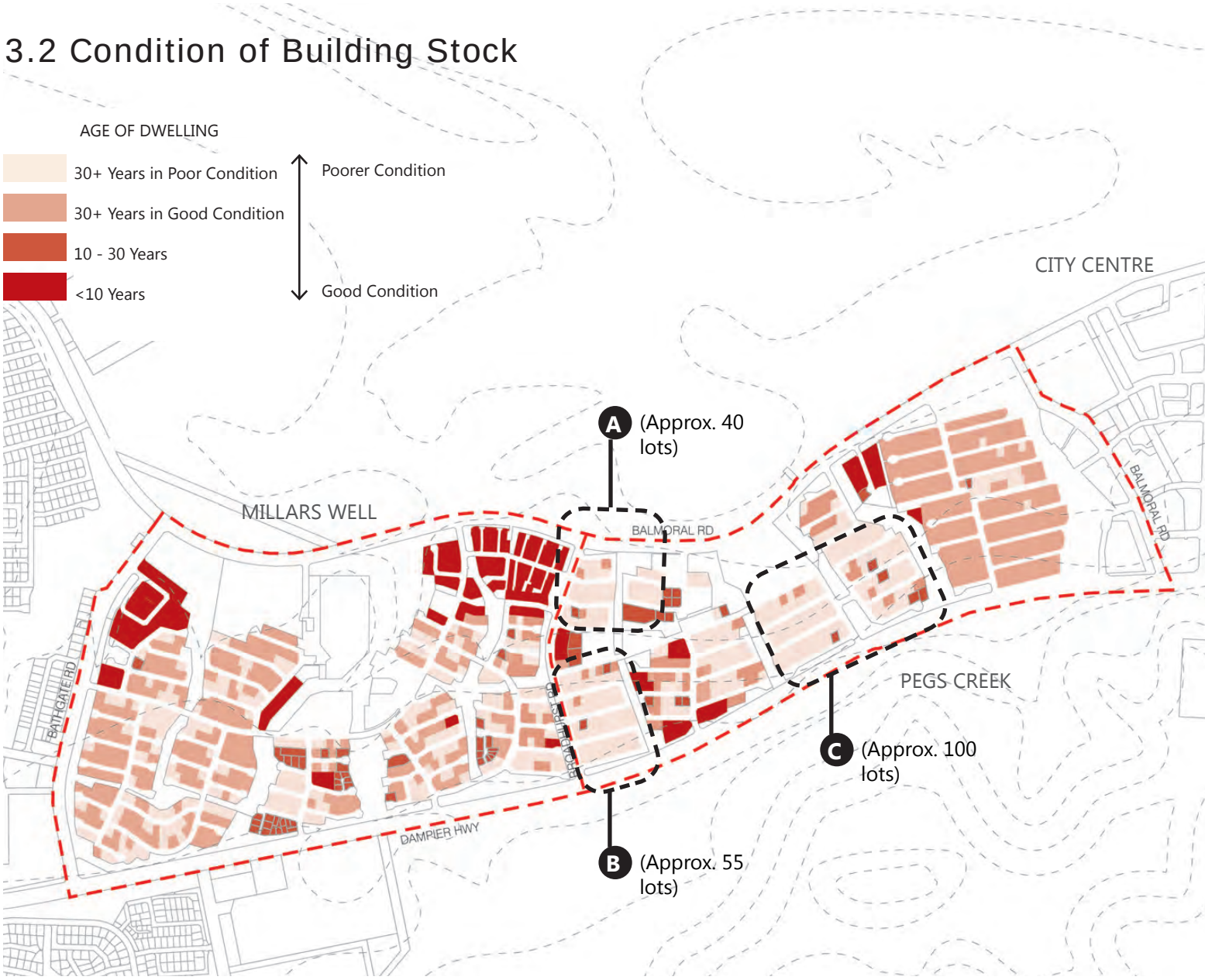


Figure 3.2 - Condition of Building Stock

Building on KCN Principles

The KCN describes the oldest precincts of Millars Well, Pegs Creek and Bulgarra having...

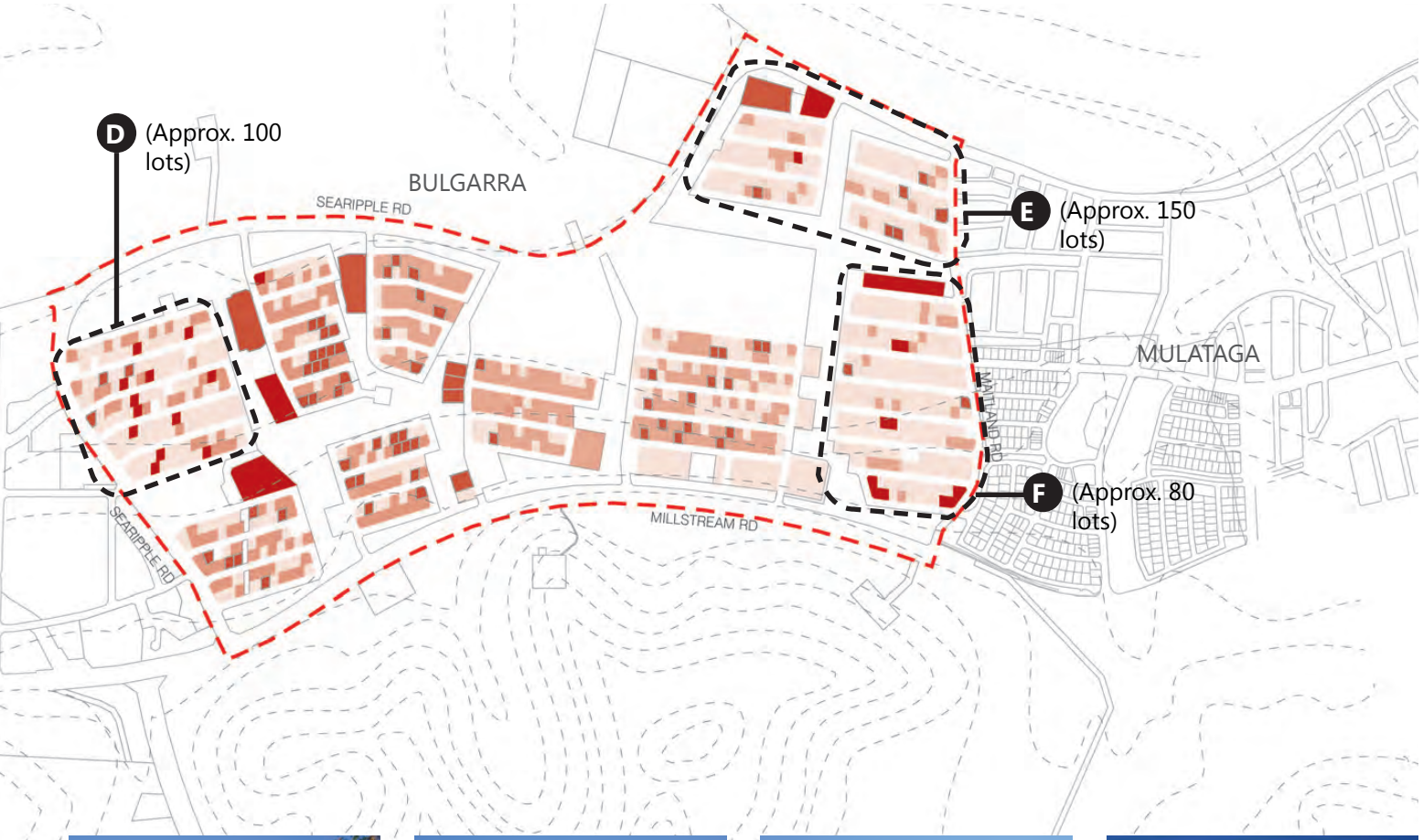
... significant potential for upgrade and extension of redevelopment of older housing stock, in particular, those lots adjacent to open space areas and/or public transport routes. Increased density should be supported across the neighbourhood. This may include subdivision of lots to create more compact dwellings. The approach of split, residential coding, where the higher density is permitted...

(KCN An Integrated Strategy 4.0, Pegs Creek/Millars Well & Bulgarra pg.126)

In the four years since the KCN there has been the continuation of an aggressive extractive industry expansion boom and associated population growth. This has predominantly effected the fringe of Karratha Township where new subdivisions such as Baynton, Baynton West, Madigan Estate etc have added significant new lots and housing supply to the market.

The existing Karratha inner suburbs of Millars Well, Pegs Creek and Bulgarra contain single storey residential swellings with infrequent commercial and community facilities. Housing stock is generally 30 – 40 years old with most structures being built between 1974 and 1981. Due to poor construction and inadequate response to the environment numerous dwellings are past their useful life and either require major renovation (often a prohibitive cost option) or replacement. Some housing stock has been internally renovated however this is not evident externally.

Figure 3.2 illustrates the distribution of dwellings based on age and apparent external condition. The diagram overlays age and condition to demonstrate that a majority of the housing stock is of an age whereby replacement or improvement is viable.



30+ Years Poor Condition

30+ Years Good Condition

10 - 30 Years

<10 years

Opportunities

- Properties with dwellings aged over 30 years are potentially more favourable for renewal (indicated as the lighter tone). As a generalisation, this is due to the type of functional style housing developed, which after approximately 30 years without renovation has reach its functional lifespan;
- Properties where dwellings are in poor condition, as a generalisation, are potentially more favourable for renewal;
- Properties with similar qualities to above and owned by government or the mining sector provide greater opportunity for renewal .
- The diagram clearly indicates three potential clusters within Pegs Creek indicated as **(A)** (approx 40 lots), **(B)** (approx 55 lots) and **(C)** (approx 100 lots) on Figure 3.2 that indicate older and poorer stock, viable for renewal.
- Bulgarra indicates areas of strong opportunity for stock replacement viability adjacent the City centre indicated as cluster **(D)** (approx 100 lots) and adjacent Mulataga **(E)** (approx 150 lots) and **(F)** (approx 80 lots) .

Constraints

- Properties with dwellings less than 10 years, are potentially less favourable for renewal in the short to medium term. Properties this young are generally in good condition and early within their functional lifespan.
- Millars Well housing condition mapping indicates a more sporadic spread of good and poor houses that suggest less viable opportunity to cluster renewal including joining of lots and/or split residential coding.

3.3 Ownership Patterns

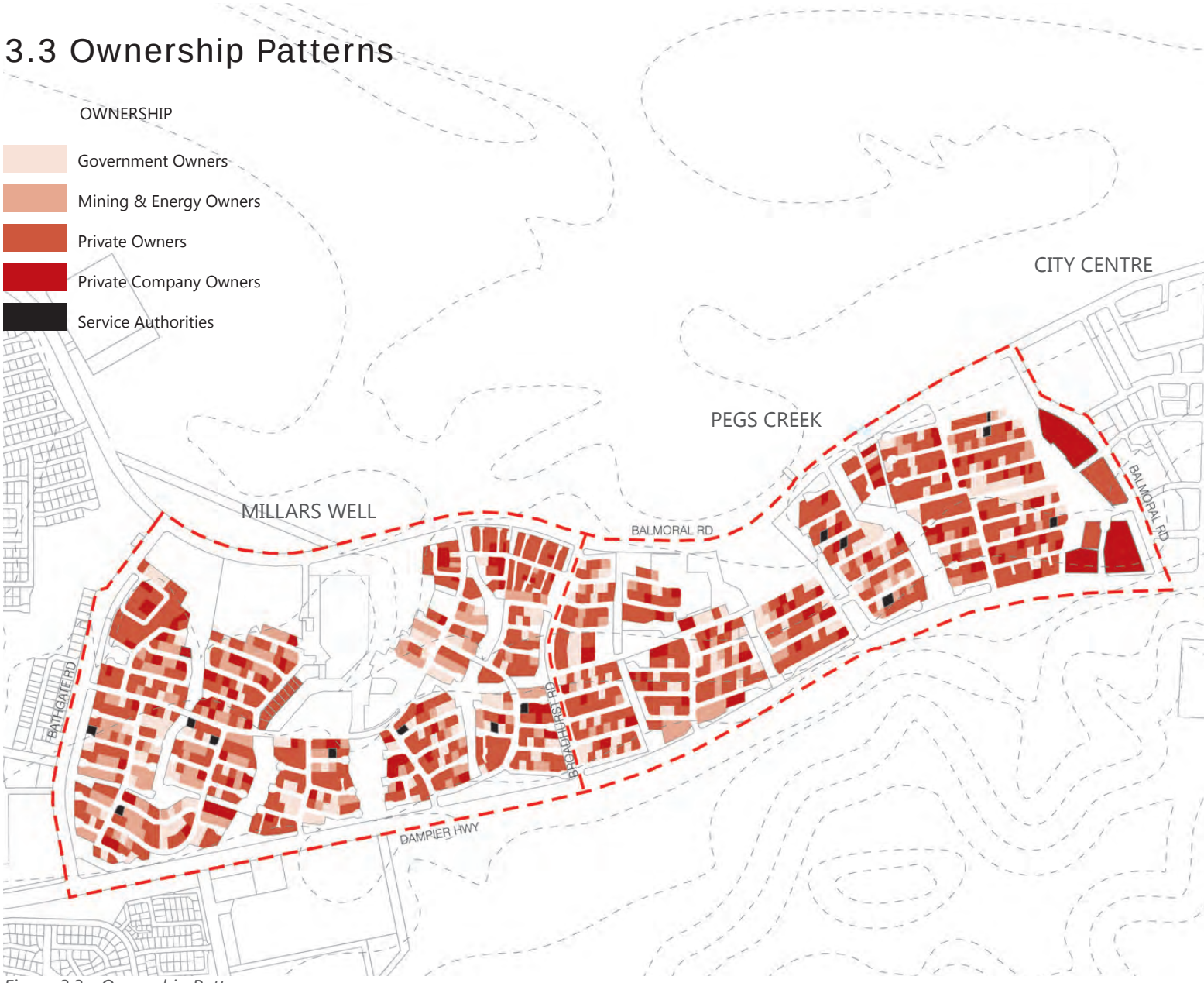


Figure 3.3 - Ownership Patterns

Building on KCN Principles

'Ownership Patterns' opportunities and constraints mapping provide another overlay opportunity for residential renewal.

The Karratha Revitalisation Strategy (KRS) recognises that there is opportunity for renewal if ownership patterns align and adjacent housing lots owned by a single stakeholder can be clustered and/or combined and become viable for renewal.

The KRS has provided the below list in probable order of negotiating renewal viability with stakeholders. The order acknowledges ownership amalgamation opportunities with regard to working with a single stakeholder and clustering patterns, i.e. 1) large government ownership - most likely to deliberate over renewal prospects, 2) large mining ownership - next likely, 3) individual private ownership, etc.

Mapping shows patterns including a strong Rio Tinto ownership and sporadic 2-4 lot amalgamation opportunities in Bulgarra and equally a strong ownership of Woodside residence in Millars Well and Pegs Creek.

Within the KRS Figure 3.3 opportunities and constraints mapping illustrates ownership patterns providing possible diagnosis for residential renewal. The overlayed ownership patterns include;

1) Government ownership

- *City of Karratha*
- *Department of Defence*
- *Department of Education*
- *Department of Environmental Regulation*
- *Department of Health*
- *Department of Housing*
- *Department of Local Government & Communities*
- *Department of Planning / Regional Development / Lands / Transport*
- *Department of Attorney General*
- *Department of Training and Workforce Development*

- *Federal Government*
- *LandCorp*
- *Dampier Port Authority*

2) Mining and energy ownership
   - *Woodside*
   - *Rio Tinto*
   - *Other Mining*
3) Private ownership
4) Private Company ownership
   - *Corporate*
5) Service Authorities
   - *Power*
   - *Water*
   - *Sewer*
   - *Communications*
   - *etc,*

The ownership patterns within the study area are not dissimilar to other Pilbara towns. Key points to highlight include;

- 54% per cent of the lots within the study area are privately owned;
- Key corporate owners include Rio Tinto (9%) and Woodside (6%);
- Departments of Housing and Planning owning over 8% each;
- For a full breakdown of housing ownership in the subject suburbs please refer to Appendix 6.

Opportunities

- Sporadic amalgamation of 2-4 lots for the purpose of renewal can occur with Government owned properties alone, across Millars Well, Pegs Creek and Bulgarra (indicated on Figure 3.8 as the lightest tone)
- Increased number of opportunities for amalgamation, including the provision of larger lot amalgamations, 2-6 lots, can occur if mining properties coordinate with government owned properties (indicated on Figure 3.3 as the two lightest tones).

Constraints

- Areas to cluster property amalgamation based on ownership patterns is limited across the KRS area
- Greater urban renewal based on ownership patterns would require the coordination of ownership entities and may include one stakeholder such as government to purchase properties, such as mining owned properties to strengthen the prospect

3.4 Lazy Lands

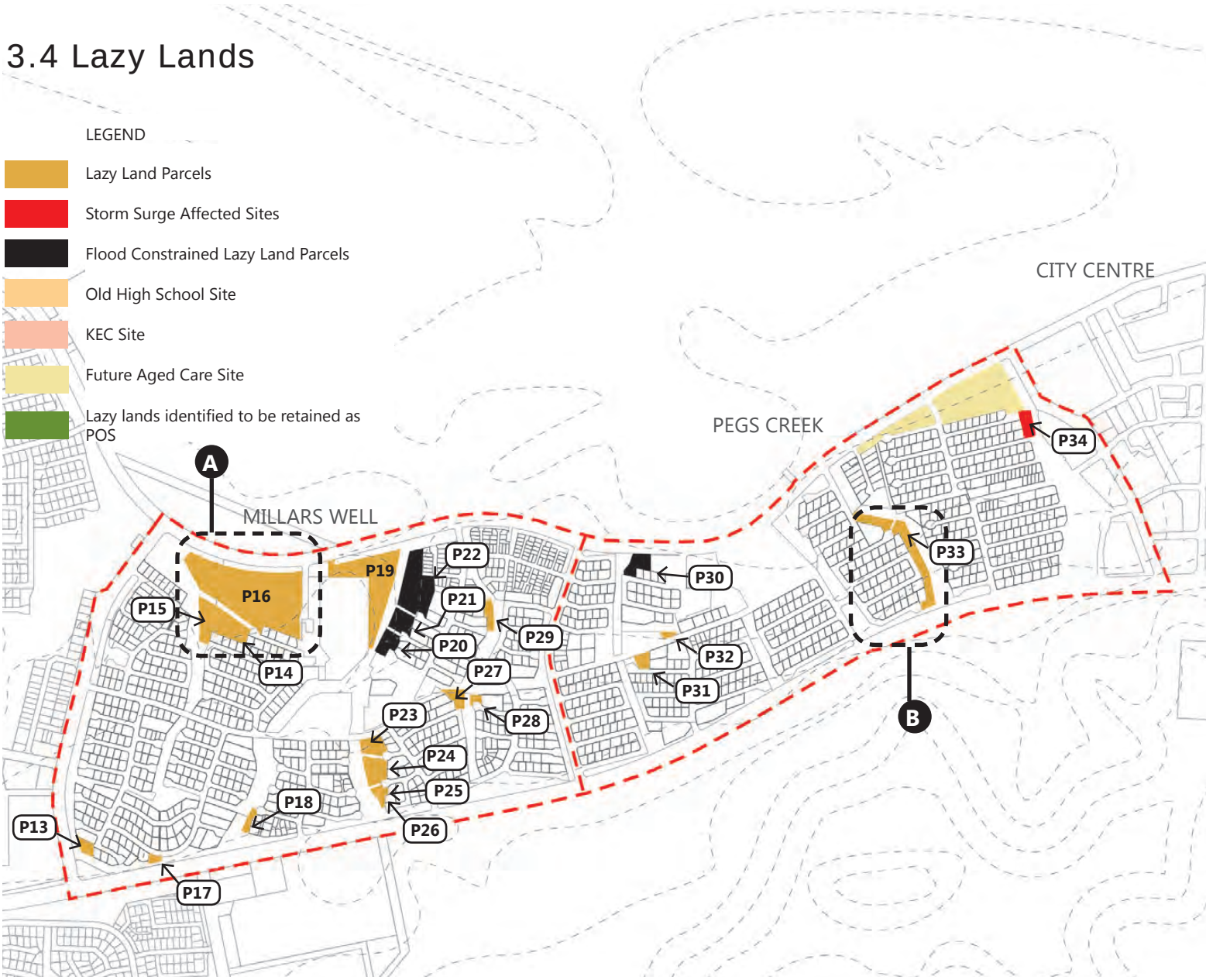


Figure 3.4 - Lazy Lands

The 'Lazy Lands' initiative in Karratha was described within the 2D Flood Study & Local Water Management Framework (JDA 2013) as the following;

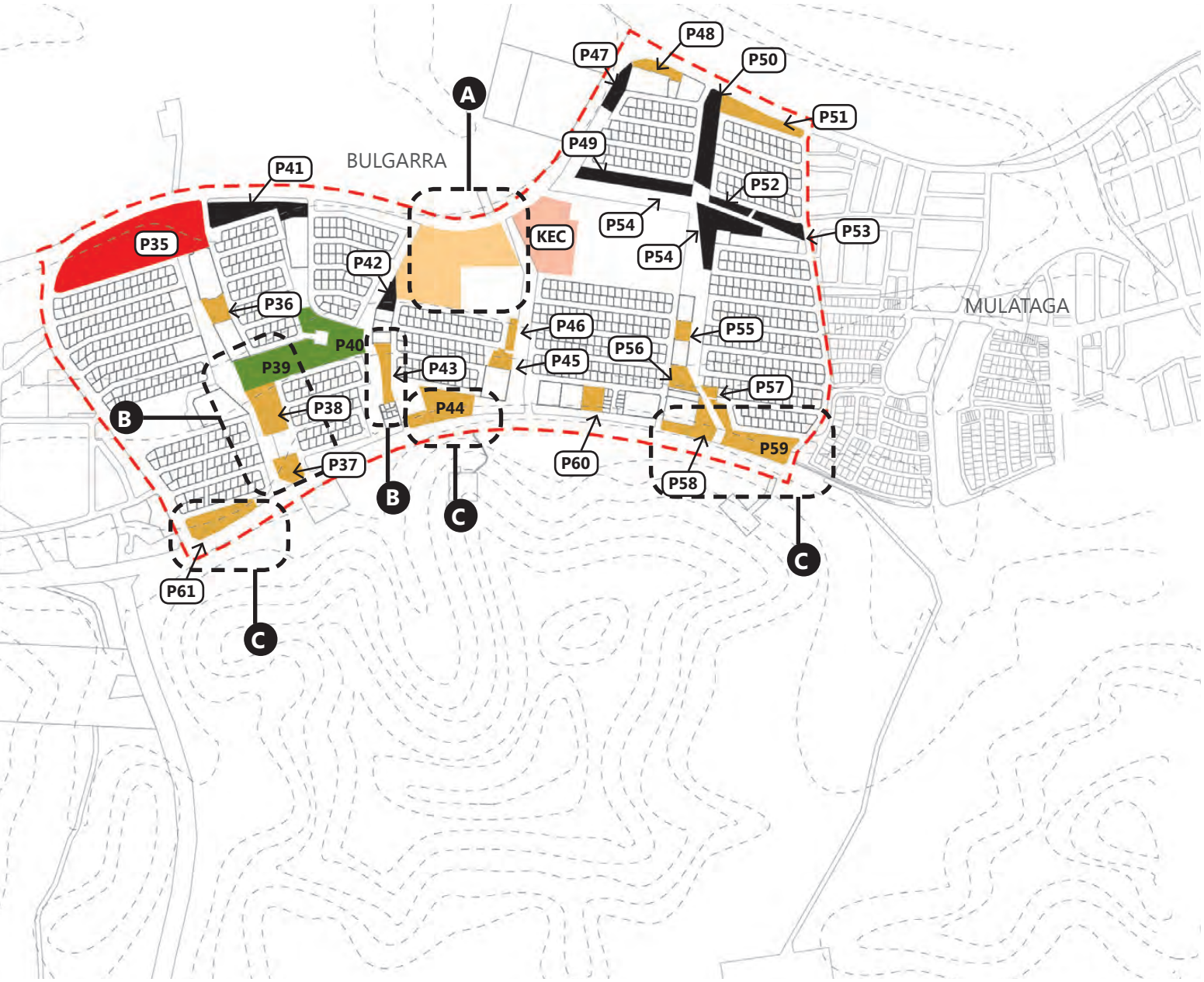
'The Department of Regional Development and Lands (RDL) through its Pilbara Cities Office (PCO) is carrying out a residential infill program in Karratha known as 'Lazy Lands'. The Lazy Lands Program seeks to identify vacant Crown Land within existing urban areas that can be quickly brought into the residential land release pipeline to help alleviate the current supply shortage of development-ready land in Karratha. A total of 61 parcels of land have previously been identified, with 7 being targeted for release as a priority under Stage 1. All 61 sites are located within existing drainage corridors and are currently zoned as Parks, Recreation & Drainage.' Lazy Lands, Karratha – 2D Flood Study & Local Water Management Framework (JDA 2013) pg.1

The 'Lazy Lands' initiative occurred at the height of the local mining (infrastructure development) boom and at the pinnacle of land shortage within Karratha.

Present day the development expansion boom has significantly decreased, however its not yet considered a normalised market.

The 61 parcels of land are noted on Figure 3.4 with most lots occurring in Bulgarra and least in Pegs Creek. The lots are located on the fringes of the urban fabric both north and south and within the drainage corridors.

Figure 3.4 indicates 'Lazy Land' parcels that are flood constrained (black) and storm surge constrained (red). Parcels of land in orange indicates potential development sites, however are to be considered holistically within the Karratha Revitalisation Strategy (KRS).



Opportunities

- Opportunity to develop 'Lazy Lands' parcels, considered appropriate after being filtered through the KRS, and
- Opportunity to infill the north south built form neighbourhood pattern indicated as **(A)**

Constraints

- 'Lazy Lands' parcels situated within drainage corridors indicated with a **(B)** on Figure 3.4 have the potential to limit views from east west roads that presently terminate at a natural green swale buffer. Placing insensitive built form in these areas may not only close in natural views within the neighbourhood, however obstruct significant views to the Karratha Hills.
- 'Lazy Land' parcels situated on the southern end of the urban fabric, notably Bulgarra **(C)** have the potential to block views to the Karratha Hills, and would require sensitive development if developed in the future.
- Additionally, the 'Lazy Land' parcels situated within existing drainage corridors have the potential to limit drainage capacity at a holistic level causing inundation during large storm events (Shown as Black).

Refer to Appendix 1 for further information on Lazy Lands Data.

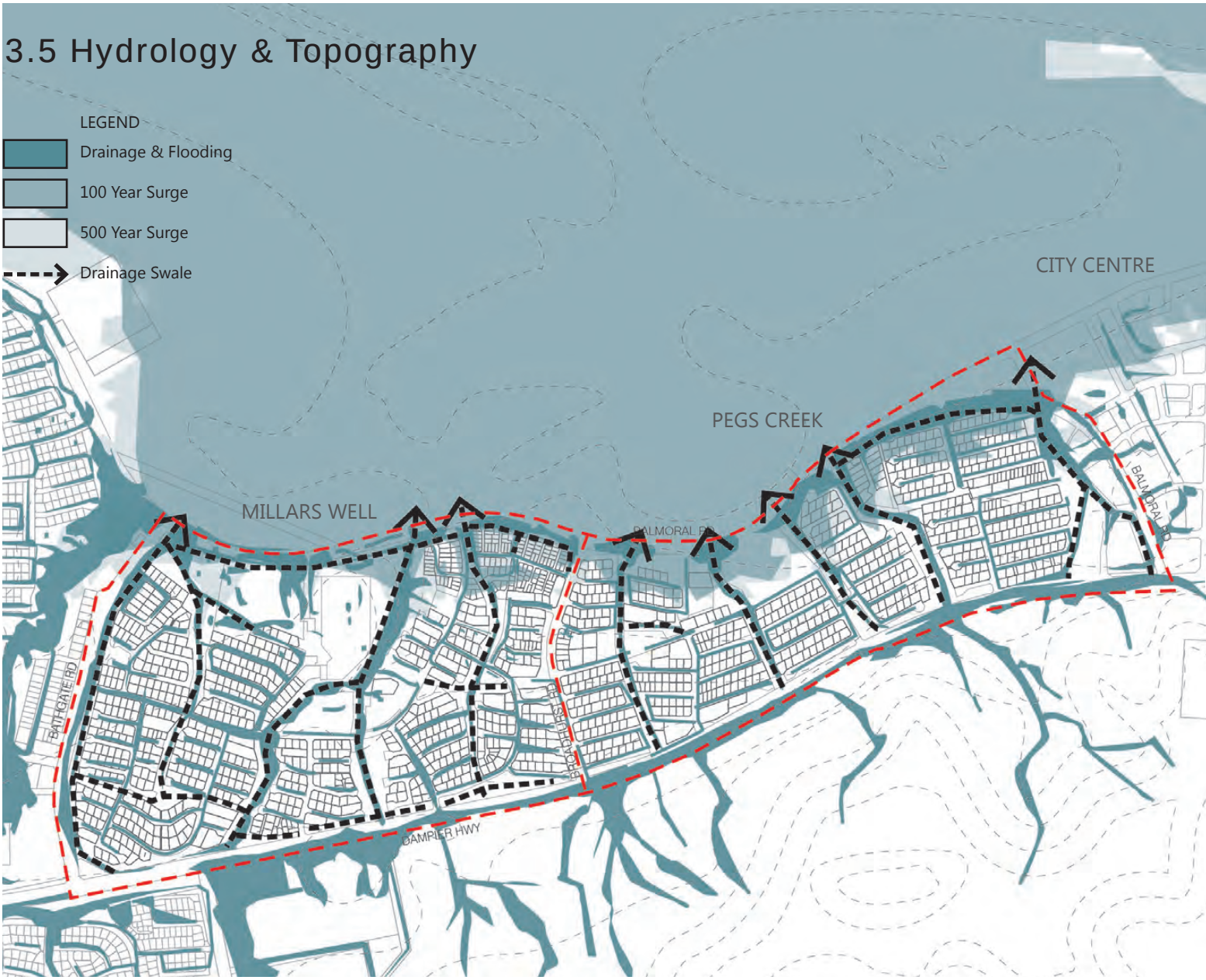


Figure 3.5 - Drainage & Storm Surge

Building on KCN Principles

The Karratha City of the North Plan (KCN) principles considers hydrology and topography and recommends the following:

'Establish a local identity through climate responsive and place-based design, utilising a design rationale that uses one challenge to solve another and focuses on nourishment of the land rather than depletion.' KCN Goals & Objectives, Sustainable & Replenishing 3.0, pg.88

The KCN discusses the objective of responding to the environment, acknowledging the existing condition as an opportunity, not a problem.

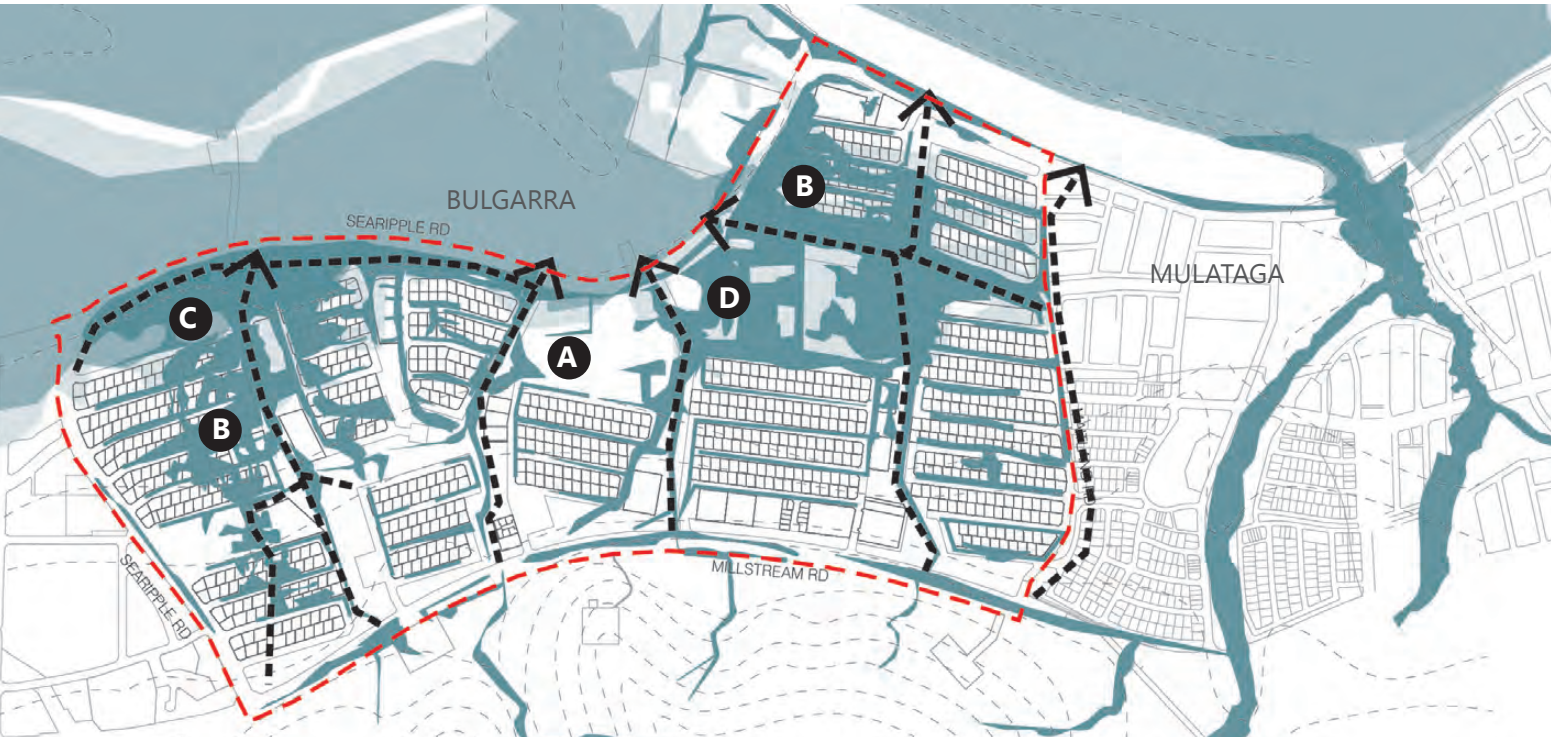
'...utilising the flow of water through the town as an asset, allowing it to add value to the urban environment and landscape as it flows from the Hills into Nickol Bay will be a significant shift in the approach to water management. Karratha's drainage reserves would become key public places and conduits for movement within the community, landscaped to provide shade, shelter and areas for respite. Therefore, the flow of water ceases to be treated as a problem but as a solution to a variety of needs.' KCN Goals & Objectives, Sustainable & Replenishing 3.0, pg.88

Topography

The elevation of the study area is highest in the south averaging 18m Australian Height Datum (AHD) at the base of the Karratha Hills. Elevation decreases to the north and averages around 8m AHD on the southern edge of Searipple and Balmoral Roads. As a result, rainfall runoff from the Karratha Hills flows predominately northwards through the study area towards the coast via a network of open swales, 2-3m in depth.

Storm Surge

Recent Karratha flood mapping indicates the 1 in 100 year storm surges extent under the 2110 climate conditions indicates that land immediately south of Balmoral Road and Searipple Road will be impacted by storm surge and in addition possible 'backed up' flooding if a rain event occurred simultaneously over Karratha Hills would affect low lying land further south into our study area. In Figure 3.5 light blue indicates the storm surge and dark blue indicates run-off flooding.



Drainage & Inundation

A series of drainage swales, mostly modified natural creek lines leading from the Karratha Hills, dissect all of the study suburbs running from south to north and perform an important natural and urban overland water function, especially during infrequent high rainfall events.

1 in 5 and 1 in 100 year ARI rainfall event flood assessment modelling has been recently prepared for Karratha including the Karratha Revitalisation Strategy (KRS) study area. The study indicates that for the 1 in 5 year ARI event, the flood extent is contained within most of the drainage reserve area.

For the 1 in 100 year ARI event the majority of inundation in Millars Well and Pegs Creek is conveyed as overland flow by the road network and contained within existing drainage reserve areas. Swales with limited flooding occurring in the vicinity south of Balmoral Road.

The same results for Bulgarra indicate several areas where the road and drainage network has insufficient capacity to convey overland flows and inundation of adjacent residential areas occurs. Inundation also occurs due to drainage water not being able to flow freely beyond the Searipple Road tending to 'back up'.

Opportunities

- The stormwater strategy for Mulataga, east of Bulgarra intends to divert overland flow with the objective to ultimately relieving drainage within this area.
- Topography across the whole study area is relatively level and favourable for urban development.
- Most areas within Millars Well and Pegs Creek are not affected by inundation and providing the drainage regime is kept similar most of the area can be considered for renewal.
- **(A)** The former high school site in Bulgarra is clear of flooding issues and considered appropriate for re-development without considering extensive flooding mitigation.
- The drainage reserves are a permanent conveyance infrastructure, however can be considered for complimentary urban uses such as lineal open space, view corridors beyond the urban fabric (e.g. to the Karratha Hills), aesthetic green urban buffers or breaks in the urban form, ecological corridors, precinct gateways and for public recreation nodes (e.g. Cattrall Park).
- Inundated areas, particularly within Bulgarra can consider innovation such as raised built form similar to housing in North Queensland and the Northern Territory.

Constraints

- **(B)** Existing properties on the northern and western extent of Bulgarra experience substantial inundation during major storm/rainfall events, hence renewal of these properties will require specific strategies to alleviate inundation (i.e. fill, reshaping of roadways to convey water more efficiently or alternate built form).
- **(C)** 'Lazy Land' sites impact on limiting reserve drainage capacity has to be more stringently considered. For example the site adjoining the City centre in Bulgarra is shown to be impacted by overland inundation and storm surge. Filling and elevating this land for development has to be considered in the light of having possible impact on adjoining properties and due to further restricting overland flow path including volumes and possibly in turn affecting properties up stream.
- **(D)** The KEC site in Bulgarra experiences substantial flooding from overland inundation and would require drainage or built form strategies if development was considered in this area.

3.6 Heritage & Significant Views

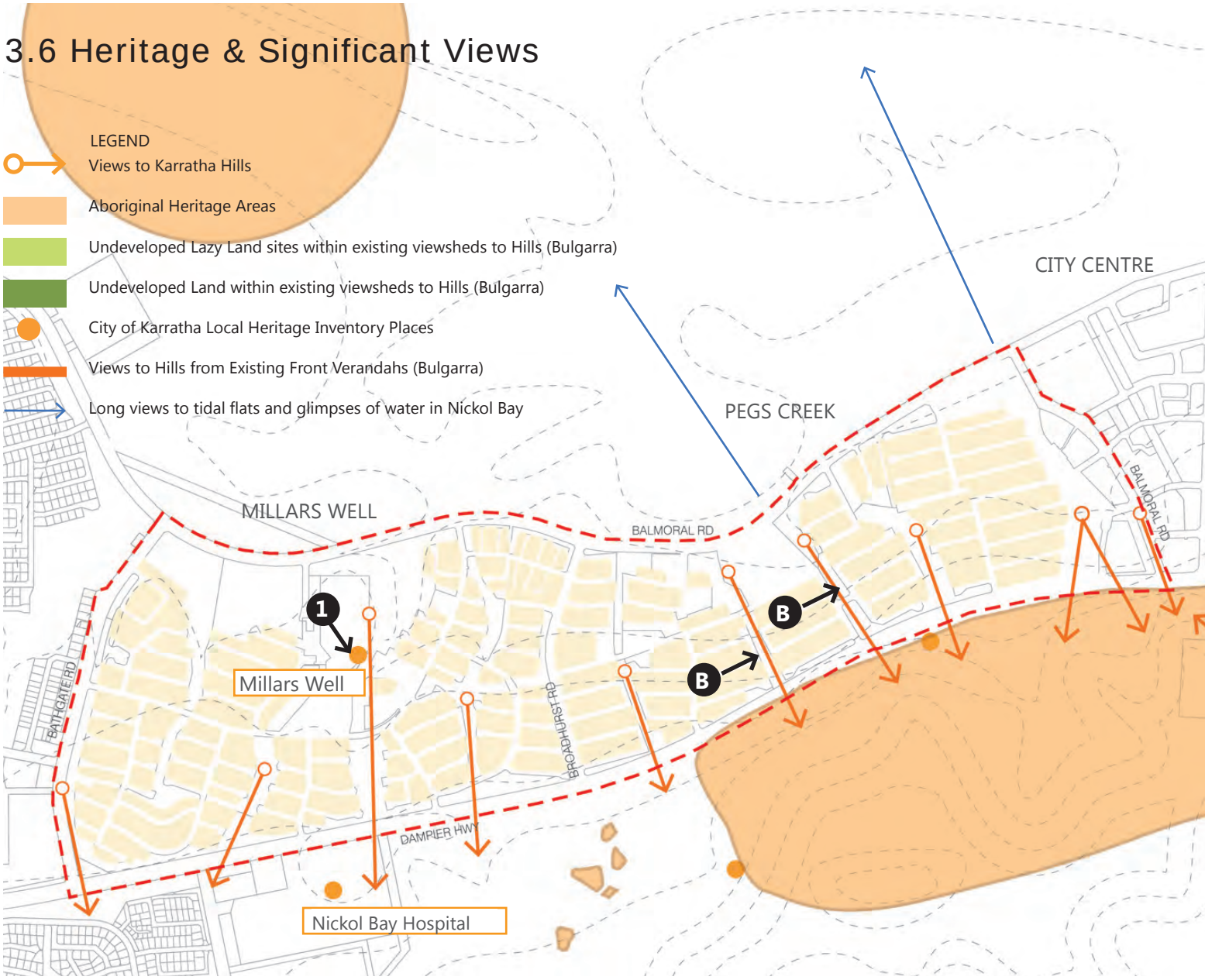


Figure 3.6 - Heritage & Significant Views

Building on KCN Principles

The KRS recognises the Ngarluma People as the Traditional Custodians of Karratha, their ongoing connection to 'Country', a continuous living cultural heritage. There are state registered Aboriginal heritage sites adjacent the subject suburbs (including Mulataga) which include mittens, petroglyphs (especially within rocky outcrops in and around the hills), artefact scatters and food preparation (gnamma holes) with the strong possibility that heritage sites, evidence of Aboriginal habitation prior colonisation exists throughout Karratha and within the subject suburbs.

Heritage

The two Local Government Heritage Inventory sites are indicated in Figure 3.5. , they include;

1) Millars Well (management category C) a former stock watering well within Karratha Station. Now situated adjacent the Kevin Richards Memorial oval in the suburb of Millars Well.

'Apart from the suburb being named after the well, it provides an important visual connection with the origins of the town as a pastoral sheep station' City of Karratha Local Government Heritage Inventory, pg.224

and,

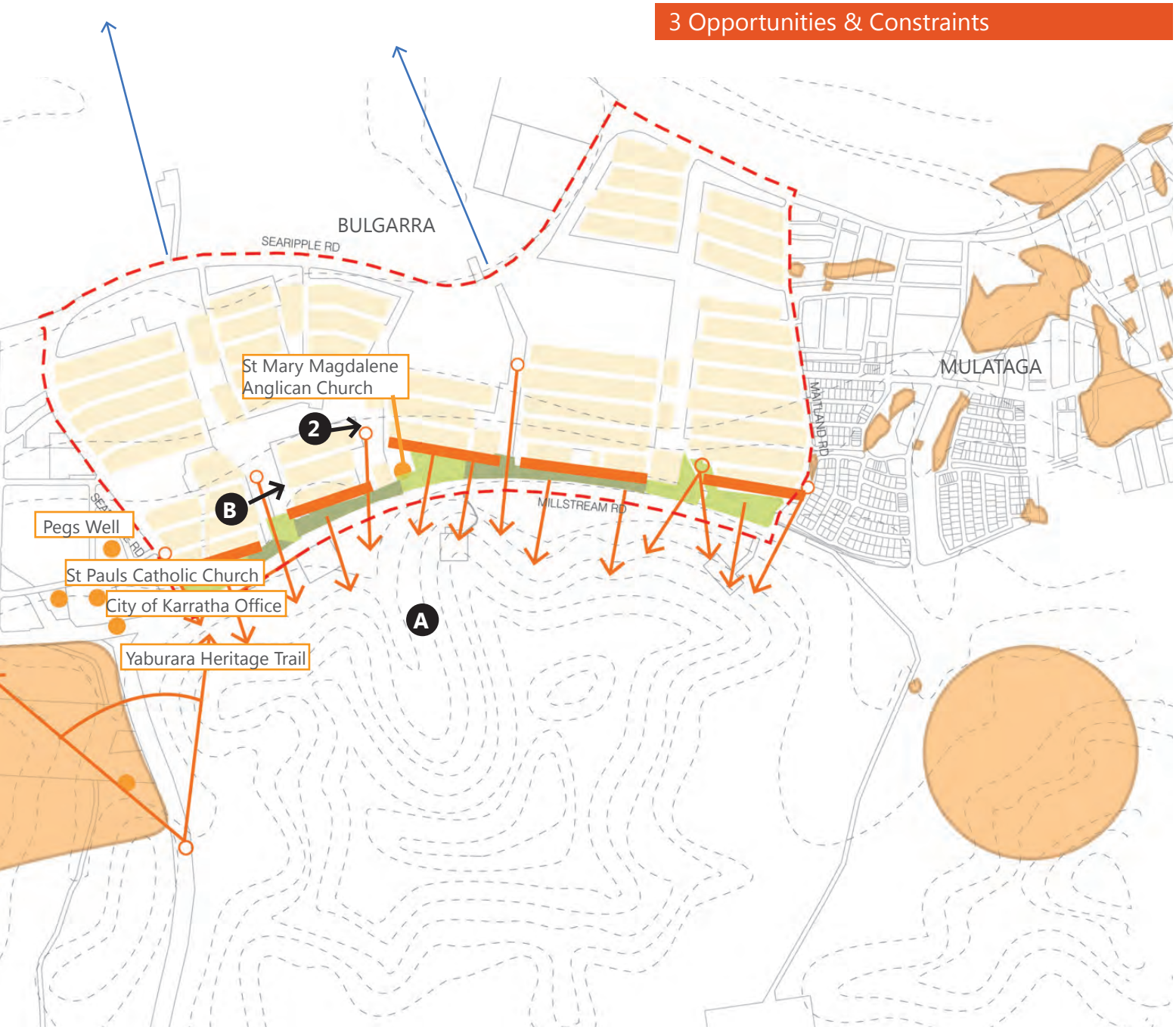
2) The St Mary Magdalene Anglican Church (management category C) est. 1977.

'The St Mary Magdalene Anglican Church has spiritual and social significance for locals with the building associated with the settlement and growth of Karratha as a town.' City of Karratha Local Government Heritage Inventory, pg. 326

Views

The KCN discusses the importance of protecting significant views to natural landform. Within the subject suburbs the two significant natural views relate to the following;

A) The Karratha Hills in the south - the value in



maintaining southern viewlines to the Hills, including sensitively locating elevated built form and keeping built form from obstructing views to and through the north south aligned swale corridors.

and,

'With vistas extending between the Karratha Hills and the Burrup Peninsula, reference to the local landscape is a defining aspect of Karratha's local identity and sense of place. Maintaining a visual connection to landscape and place based design are two essential components of a place that is reflective of and responsive to the local environment.' KCN Project Goals and Objectives 3.0, Sustainable and Replenishing, pg.88

B) Retaining east west views along neighbourhood roads that terminate at the north south aligned swales, particularly with swales that are well vegetated and resemble a natural Pilbara creekline.

In relation to builtform views, since the KCN the biggest impact on built form views is the Pelago buildings in Karratha City Centre.

Opportunities

- The subject site has an opportunity to celebrate Aboriginal cultural heritage within its public space providing a rich approach to connect community to place.
- The subject site has an opportunity to retain views to the hills through sensitive use of built form within existing open spaces and maintaining east west views where roads terminate at natural swales.
- The subject site has opportunity to retain the distant glimpses of sea views and the connection to the tidal flats along the northern side including Searipple and Balmoral Road.

Constraints

- There is minimal acknowledgment of Aboriginal cultural heritage within the public realm.
- Infill sites have obstructed southern views to the Karratha Hills and east west views that terminate at the vegetated swales.

3.7 Walkable Community Infrastructure

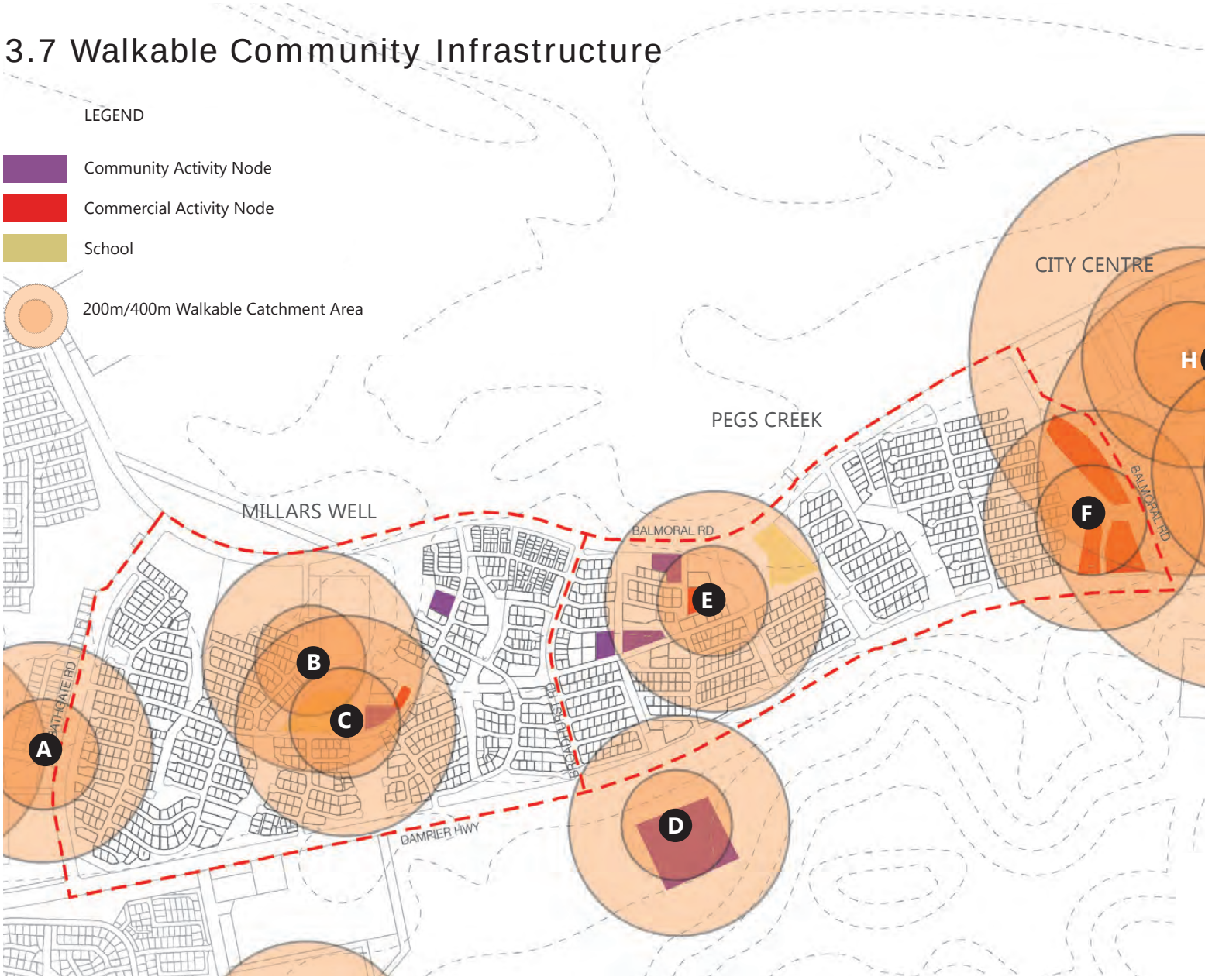


Figure 3.7 - Walkable Catchments to Activity Nodes

Building on KCN Objectives

Two of the key KCN City Planning Principles aim for Karratha to be:

- Walkable & Connected; and
- Integrated & Conducive

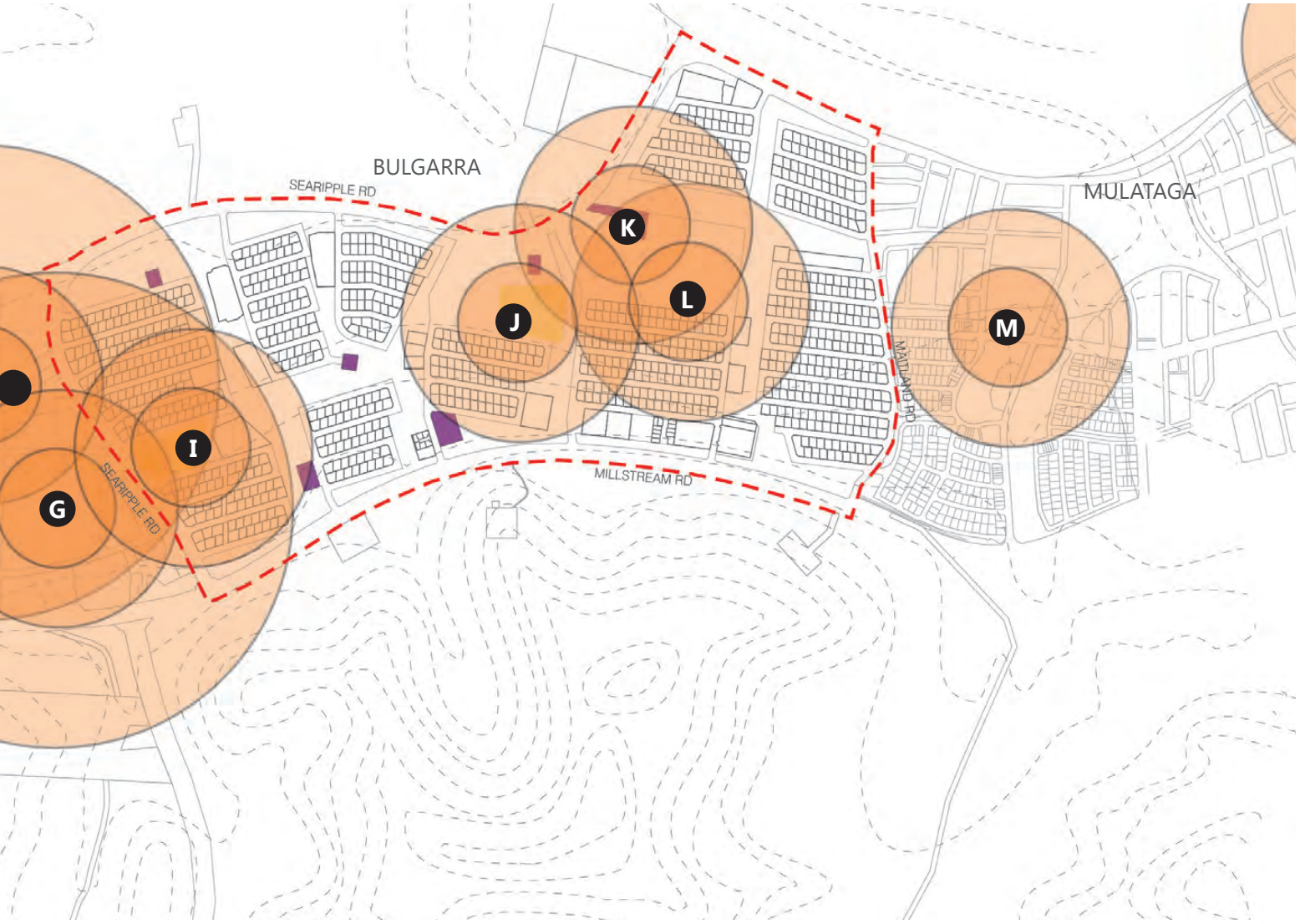
In support of these principles, the WAPC Liveable Neighborhoods document that encourages intensification within walkable catchment areas of local activity nodes.

Liveable Neighbourhoods movement network objectives include...

To design street networks to optimise walkable access to centres, schools, public transit stops and other destinations.' Guide to Liveable Neighbourhoods, Element 2 – Movement network objectives No. 11, pg. 20

Figure 3.7 in the KRS introduces 200/400m (4-5minute) walkable catchments based around existing community activity nodes. These catchment areas are where some of the resident's daily needs can be met, encouraging active use of local streets, local employment opportunities and enhancing self-containment of neighbourhoods within suburbs, within the City.

The WAPC's Liveable Neighbourhoods policy advocates the structure of new urban areas be formed by the clustering of compact, walkable neighbourhoods, each incorporating a centre that comprises a range of compatible uses, including retail to provide for a variety of daily needs as well as act as a community focus, a range of residential densities and a variety of housing types that increase towards the centre, and an interconnected street network that focuses on the centre and provides good access for vehicles, cyclists and pedestrians in a pleasant, efficient and safe manner. - KCN 2.6.4.2 Pg 66



Millars Well walkable infrastructure includes:

(A) 24hour Caltex Service/Convenience
(B) Millars Well Pavilion/Oval
(C) Millars Well Primary School/Commercial Area

Pegs Creek Walkable infrastructure includes:

(D) Karratha Leisureplex & High School
(E) Karratha Tavern & Pegs Creek Primary School & Evangelical Church
(F) Karratha International Hotel & Youth Shed
(G) City Centre & Catholic Church
(H) City Centre Pelago mixed use development

Bulgarra walkable infrastructure includes:

(I) St Pauls Bulgarra Primary School
(J) Karratha Primary School & possible future activity node following further planning (old high school site)
(K) Karratha Recreation Club
(L) Frank Butler Community Centre
(M) Mulataga Primary School and community hub site

Opportunities

- Millars Well central district has moderate walkable catchment area with opportunity for future intensification.
- Pegs Creek has a moderate western and potentially a stronger (adjacent to City) eastern walkable catchment area.
- Bulgarra has a potentially strong western walkable catchment area being (adjacent to City) and a potentially strong eastern walkable catchment due to high school development with opportunity for future intensification.

Constraints

- All suburbs have a limited capacity to fulfil Liveable Neighbourhoods definition with regards to community walkable catchment attractor/ amenity.
- Major areas of all study suburbs are not within a noted existing or future walkable catchment and are isolated with regard to walkable community infrastructure.

3.8 Pedestrian Movement Network

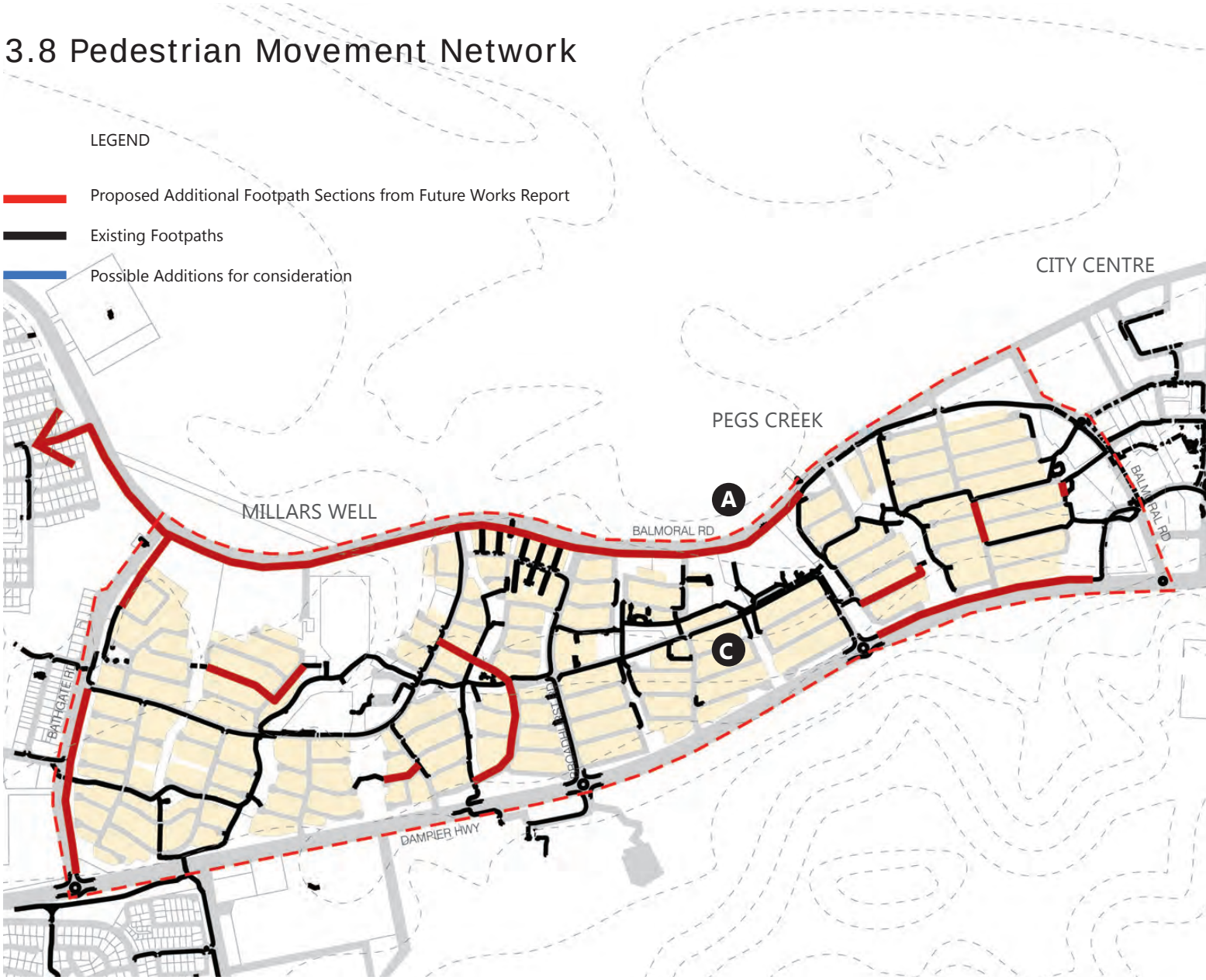


Figure 3.8 - Pedestrian Movement Network

Building on KCN Principles

The KCN discusses the objective of the study area being walkable and connected...

'A healthy city is not only about access to health services, it is the creation of a town that promotes and encourages the use of active transport options such as walking and cycling. This can be achieved through the establishment of a comfortable, interesting and attractive public realm... ...a more intuitive movement network within the City Centre and a more equitable balance between pedestrian and vehicle movement... ...with shady streets encourages people out of their cars into main streets, providing more opportunities for meetings, the development of social bonds and a stronger community feel.' KCN Goals & Objectives, Walkable & Connected 3.0, pg. 87

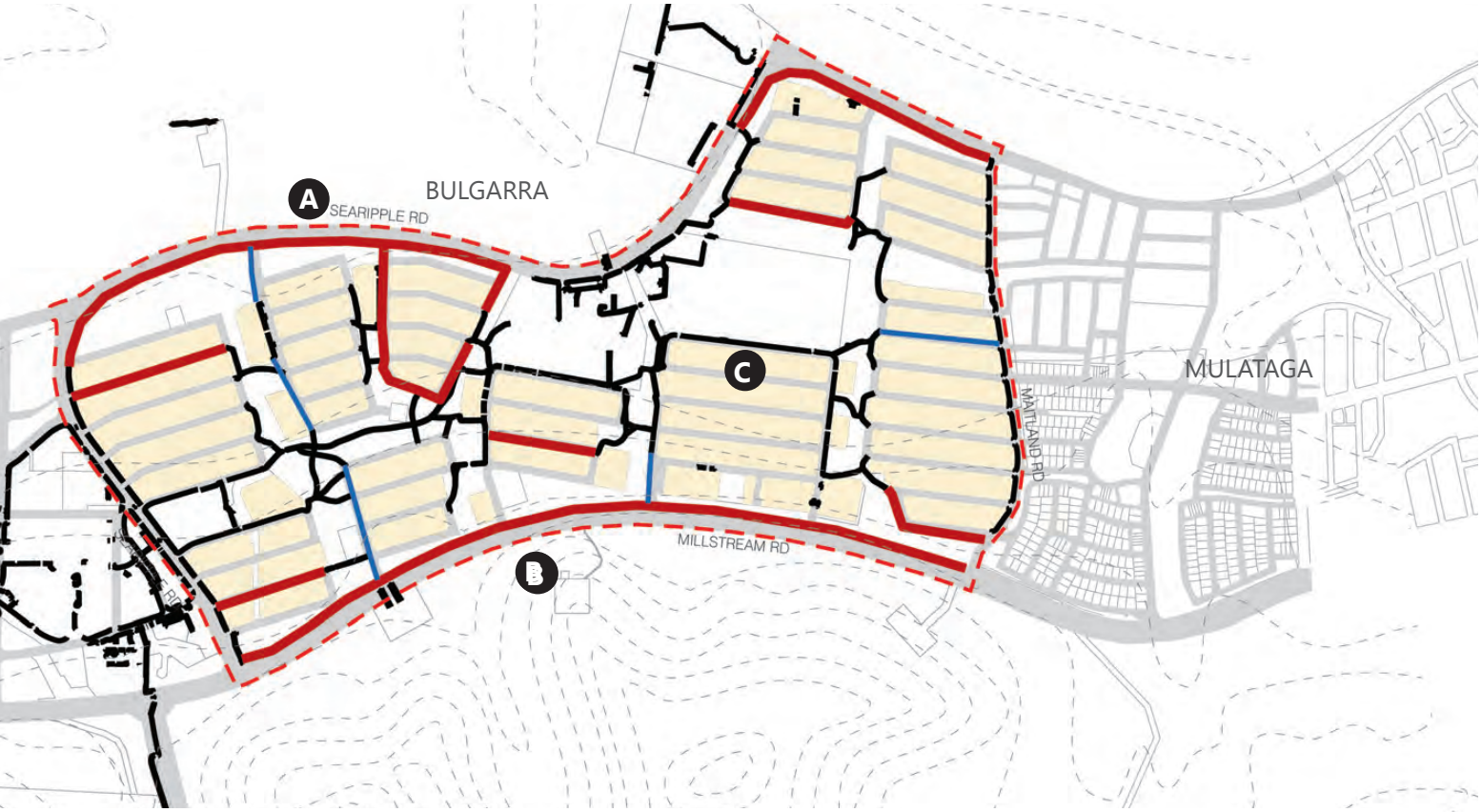
The KRS builds on the KCN implementation strategy including...

'Refitting the existing footpath system with missing links so that it complies with the pedestrian movement network guidelines outlined in Liveable Neighbourhoods. This generally entails provision of a footpath on at least one side of the street, or ideally both. A combination of a footpath on one and a shared path on the other side of the road is also desirable, particularly in the vicinity of schools, sport centres and similar land uses.' KCN An Integrated Strategy, Pedestrian and Cyclist Facilities 4.0, pg. 159

The creation of a Footpaths Strategy was identified in the KCN document and this work has since been undertaken as the *Footpaths Future Works Report.*

This document makes specific reference to the WAPC Liveable Neighborhoods initiative and uses the following principles as a basis for improvements to the pedestrian network:

- *To provide a safe, convenient and legible movement network for pedestrians, principally along the street network; to provide excellent accessibility between residents and safe and efficient access to points of attraction in and beyond development.*



- *To design street networks to optimise the walkable access to centres, schools, public transit stops and other destinations.*
- *To design major routes as integrator arterials with extensive and frequent opportunity for pedestrian to move safely along and across them.*
- *To design and detail new developments to promote and support walking to daily activities.*
- *To provide pedestrian paths through parks for recreation purposes wherever practicable.*

Footpath Future Works Report Pg 4.

Figure 3.8 above illustrates the existing and proposed pedestrian/cycle network. The existing pedestrian movement network, although often disconnected, links the east west neighbourhood cells where vehicle links are presently non-existent. With the existing and proposed pedestrian movement network isolated Radburn styled neighbourhood cells are connected through open space reserves and drainage swales.

The proposed future pedestrian movement network indicates the prospect of further connecting the north south and east west disconnected path networks including the provision of a strong path network that corresponds with the major north (Balmoral & Searipple Roads), major South (Dampier Highway & Millstream Roads) and proposed central road corridors.

The criteria outlined in the *Footpaths Future Works Report* for the selection of future path sections is stated as:

- *Provides linkage with other paths to create a network;*
- *Provides access to facilities and recreational areas;*
- *Community concern;*
- *Political agendas;*
- *Close proximity to pedestrian generated facilities;*
- *Significantly enhances public safety and opportunities for promotion of healthy lifestyle habits.*

Footpaths Future Works Report Pg 5.

Proposed / additional footpaths should be given in consideration to the route outlined in the Dampier Highway Landscape Plan Document.

Opportunities

- Connecting/integrating minor pedestrian paths east west through swales to link isolated neighbourhood cells.
- Connecting/integrating minor pedestrian links north south linking cul de sacs and isolated cells with major north, south and central east west corridors.
- Connecting/integrating major pedestrian links along east west corridors including developing a strong pedestrian network hierarchy **(A)** north corridor, **(B)** Southern Corridor and most importantly a **(C)** central corridor to reflect the transport movement network hierarchy.

Constraints

- Existing network disconnected with regard to connecting neighbourhood cells and providing strong pathways to the City centre .
- Existing network does not prioritise north south or east west connections.

3.9 Vehicular Movement Network

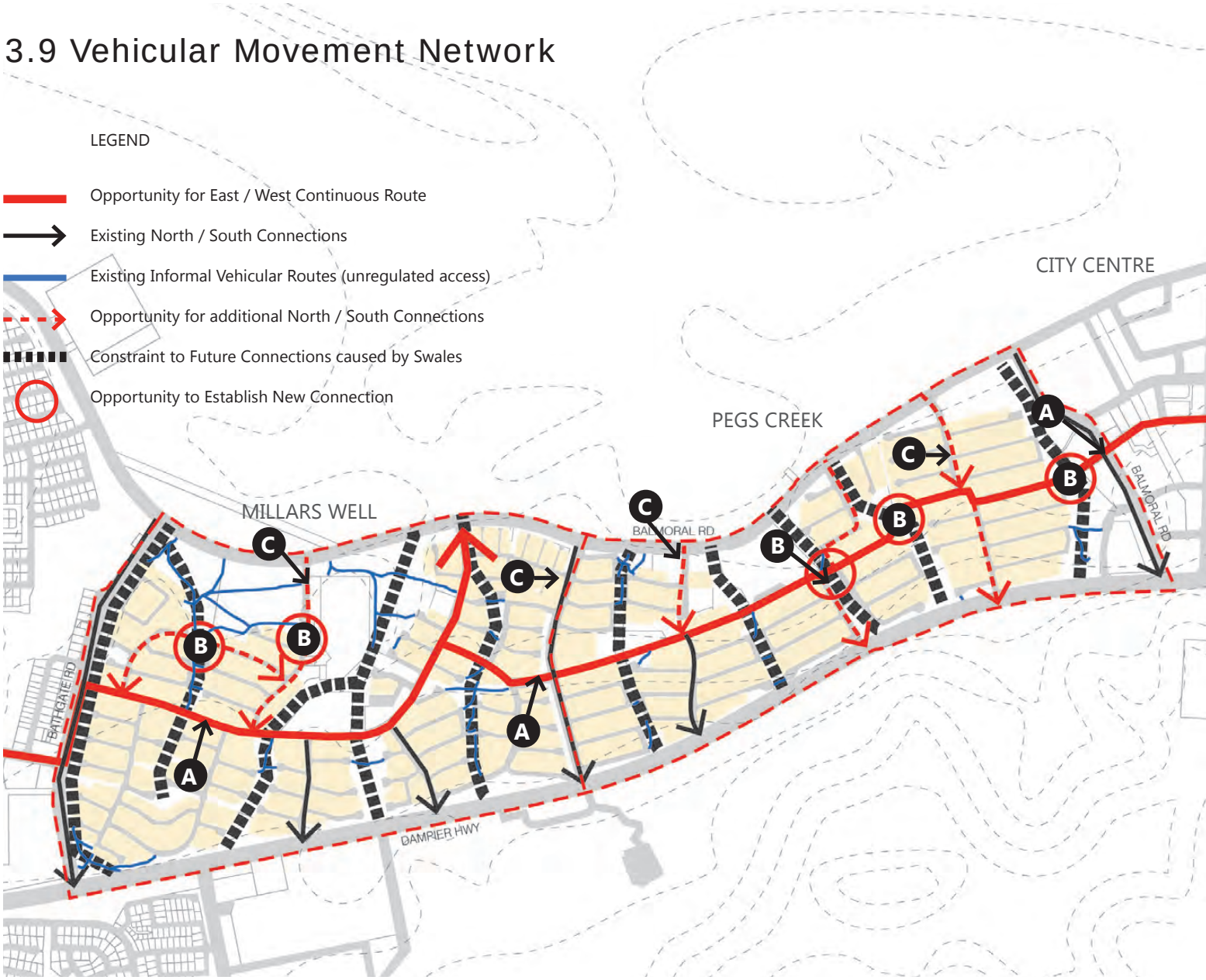


Figure 3.9 - Vehicular Movement Network

Building on KCN Principles

The KCN discusses interconnected streets through the objective of being 'integrated and conducive'...

'...improving the vitality and connectedness with the community through the introduction of mixed use development and enhanced interconnected street networks into the City Centre and local centres...' KCN Project Goals and Objectives, Integrated and Conducive 3.0, pg. 88

The KCN's implementation strategy includes...

'Developing an Integrated Transport Strategy for Karratha incorporating street hierarchy, parking, public transport, walking and cycling links' KCN An Integrated Strategy, An Integrated Transport Strategy 4.0, pg. 162

Figure 3.4 of the KRS illustrates the opportunity for a strong continuous central east west link that provides for a lower order neighbourhood connector road through to the City centre.

Karratha's established suburbs have a linear (east-west) layout. Dampier Road/ Millstream Road is a dual-carriageway (west of DeWitt Road) and Karratha's key transport spine connecting the study suburbs with the City Centre and major employment locations including Gap Ridge, Dampier and other industry to the west. The Karratha Industrial Area (KIA), another key employment node to the south, is accessible via Dampier Road/ Millstream Road and DeWittRoad. The distributor road network includes Balmoral Road and Searipple Road/ Mystery Road/ Maitland Road, which ring the study suburbs

The opportunities and constraints diagram illustrates the opportunity to connect broken north south links providing neighbourhoods interconnected access to major north and south district connector roads (i.e. Southern Dampier Highway & Millstream Roads and Northern Balmoral and Searipple Roads).

In addition the diagram examines informal roads that connect neighbourhoods and are especially strong if providing access to a community attractor similar to the International Hotel.

Opportunities

- Limited traffic on local streets because they offer very limited or no through-traffic function;
- Relatively safe local streets for on-street cycling given the low traffic volumes;
- A clearly defined distributor network;
- **(A)** To provide a strong continuous central east west link that links study area neighbourhood cells with the City;
- **(B)** Central east west link utilising swales to provide neighbourhood entry statements or gateways;
- **(C)** Interconnect north south links within neighbourhood cells.
- **(D)** Where appropriate use the informal track desire lines that cut across swales to link neighbourhood cells. Opportunity for lower order swale crossing with dry weather concrete causeway.
- Possible future link to Light Industrial Area (LIA).
- Opportunity to formalise/mitigate some of the cross reserves that vehicles are using as a short cut.

Constraints

- East west disconnection of vehicles due to north south swale alignment;
- Limited and incoherent north south linkages to major distributor roads (major issues with regard to emergency evacuation routes);
- Poor vehicle movement network legibility especially within neighbourhood cells;
- Assignment of sub-district and district traffic to a limited number of through-traffic routes, with resulting congestion issues;
- Road network is disconnected (circuitous) and lacks a viable public transport route.
- Present need to support the pedestrian environment through better connected pathways with shade and improved connectivity;
- Areas of the study suburbs are impacted by flood risk from both stormwater and storm surge. Escape routes from homes in these areas are compromised by the disconnected road layout;
- Substantial financial cost to upgrade; and,
- Potential community opposition to providing greater east - west connectivity.

3.10 Parks & Open Space

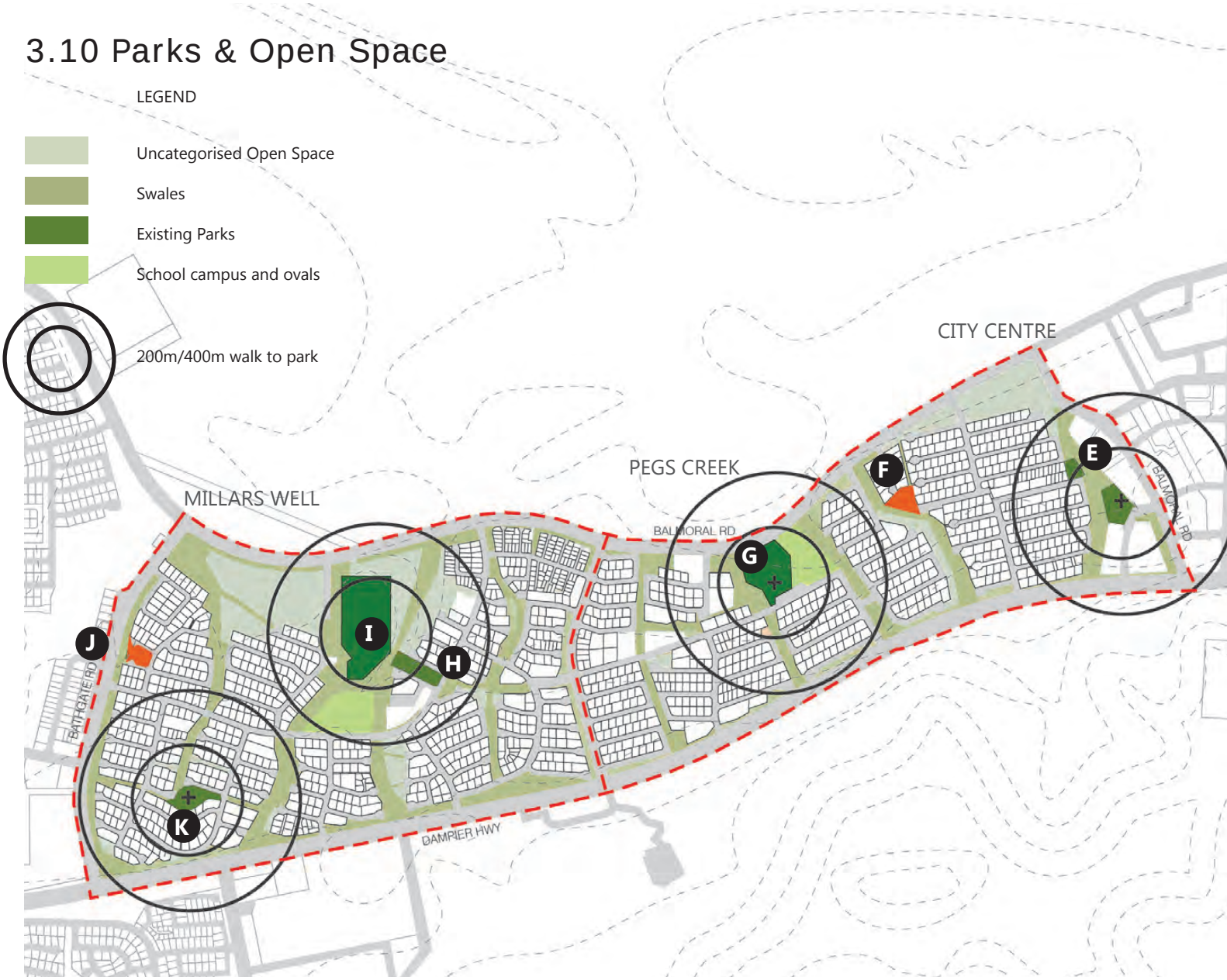


Figure 3.10 - Open Space Network

Building on KCN Principles

When discussing the patterns of Parks and Open Space the KRS recognises that the drainage corridors serve multiple open space functions and have the potential to provide greater amenity for the established suburbs of Millars Well, Pegs Creek and Bulgarra, as follows:

'The present pattern of open space within Karratha varies between its older and newer suburbs. In the older suburbs of Bulgarra, Pegs Creek and Millars Well, the open space system is formed primarily by its extensive drainage corridors and associated sporting facilities.' KCN An Integrated Strategy 4.0, Patterns of Open Space pg.108

and,

'...suburbs are fortunate that drainage corridors following natural flow paths have been preserved. This provides an opportunity to create high level community amenity and connectivity throughout the Precinct. These drainage corridors (creeks lines) can be utilised as important ecological, recreational and cultural corridors, and connected with paths from adjoining residential streets will form a comprehensive path network.' KCN An Integrated Strategy 4.0, Public Realm Principles pg.126

The KRS recognises the amenity and connectivity opportunity provided by the north south swale system.

The KCN recognised that Millars Well, Pegs Creek and Bulgarra open space, parks and sporting facilities were best linked and centrally located within its neighbourhoods. The KRS employs the Liveable Neighbourhoods walkable distant approach (Local park 400m catchment, Neighbourhood Park 800m catchment and District Park in excess of 800m+) to assess and rationalise where there is park/open space gaps and excess.

Parks Review & Policy Position

An initial review of the parks network was undertaken by the City in 2008 as part of the preparation of the Local Planning Strategy which resulted in a report entitled *Karratha Open Space Strategy: Draft for Community Consultation* (July 2008). This made some preliminary

comments on possible rationalization and sale of some portions of the open space, including areas designated as parks.

On 16 May 2011, a City officers' report entitled *Review of Public Open Space in Karratha (Item 12.2)* was considered by Council which endorsed a three level hierarchy of parks:

- **'Level 1 + 2 Parks'** (min. 1ha, within 1km of most residents, multipurpose with playing fields & full range of facilities – in the study area: Bulgarra Oval; Cattrall Park & Oval; Kevin Richards Memorial Oval.);
- **'Level 3 Parks'** (min. 5,000m2, within 500m of most residents (playground, seating, grassed and reticulated area, BBQs with lighting, paths, shade trees & structures – in the study area: Scout Hall Park, Shakespeare St, Bulgarra; Watters Park, Frinderstein Way, Pegs Creek; Dodd Court Park, Pegs Creek; Malster Place Park, Millars Well); and
- **Level 4 Linkage Parks:** Michael Lewandowski Park, Gawthorne Drive, Millars Well.

The Council also resolved to support the recommendation that the following parks required further assessment:

- Richardson Way Park, Bulgarra;
- Rex Webb Park, Gregory Way, Bulgarra; and
- Ashton Way Park, Millars Well.

In 2013, the Council endorsed its Play Space Standards which included a revised hierarchy of parks based on those in its P*arks and Open Space Operational Levels of Service* (2013) and classified the City's parks according to this hierarchy.

Opportunities

- Make use of the north - south swale system to provide multi-purpose amenity including; linear pathways, natural green buffer to neighbourhoods, gateway links to neighbourhoods, adequate drainage to limit inundation from infrequent storm events, passive open space and view corridors beyond the suburb to the Karratha Hills.
- Rationalise parks and open space to centrally connect and sustainably serve the subject suburb neighbourhoods.
- Use funds generated through park rationalisation to develop and improve other more centrally located open spaces.
- Futher consideration / investigation to expand the effulent reuse system to irrigate street trees on key distributor roads.

Constraints

- North south swales are being developed without holistically understanding inundation issues.
- North south swales are not used for multi-functional open space purposes; i.e. to connect, buffer, provide views and linear pathways and for passive recreation nodes.
- Using the 200/400m, 5 -10 minute walkable catchment there are parks and open space that overlap and not suitably centralised within neighbourhood catchments.

Note, the active parks within the subject sites equals 8.7% total area. Although this is 1.3% less than the minimum 10% allocation recommended by the LN Planning Guideline this does not consider the open space associated with the lineal swales system, which comprises approximately 30% of the total area. There is additional capacity to develop and improve other open spaces generated through disposal of some overlapping parks.

Existing Parks

	Park	CoK Park Level	Area (ha)	% Public Open Space Provided	Description of Existing
(A)	Bulgarra Oval	1	11.4173		Playing fields, passive, soccer training field ('KEC' oval 2.8ha).
(B)	Scout Hall Park	3	0.2614		Passive, play equipment, adjacent to large area of non-drainage, well vegetated, high amenity Crown reserve with shared path.
(C)	Richardson Way Park	3	0.3220		Play equipment.
(D)	Rex Webb Park	4	0.3152		Dated play equipment. Council has resolved to close and relocate.
Total Bulgarra			**12.3159**	**8.9%**	
(E)	Watters Park	3	0.7230		Passive. Southern portion presently subject to upgrading including partly outside park boundary into other reserve.
(F)	Dodd Court Park	3	0.4847		Low key passive
(G)	Cattrall Park & Pegs Creek Oval	2	4.6507		High quality passive and playing fields.
Total Pegs Creek			**5.8584**	**7.8%**	
(H)	Michael Lewandowski Park	3	1.2295		Elongated, passive linkage park
(I)	Kevin Richards Memorial Oval	1	5.7173		Playing fields and passive. Portion serves as primary school playing fields
(J)	Ashton Way Park	4	0.4102		Passive park with informal active play opportunities.
(K)	Malster Place Park	3	0.8034		Good quality passive park with play equipment.
Total Millars Well			**8.1604**	**9.2%**	
Total All Suburbs			**26.3347**	**8.7%**	

Table 3.1 - Existing Parks

4 Design Process

Figure 4.1 - Design Process

4.1 Methodology

The process of analysis and research was conducted alongside a series of community workshops and interactive mapping. Together, this process determined the broad opportunities & constraints for the study area.

These findings were then crystallised in a design process involving "McHargian" mapping overlays in order to determine opportune areas for intervention and areas to avoid or study in more detail.

A 'Design Filter' was created by summarising the core environmental constraints and community based opportunities. The Filter helps test the opportunities and constraints and underpins the 'shape' of the strategy by ensuring that strong urban design principles flow through into the final recommendations.

The Revitalisation Strategy itself reconciles opportunities with constraints whilst being 'shaped' in terms of priority and implementation areas by the Design Filter.

4.2 Design Filter

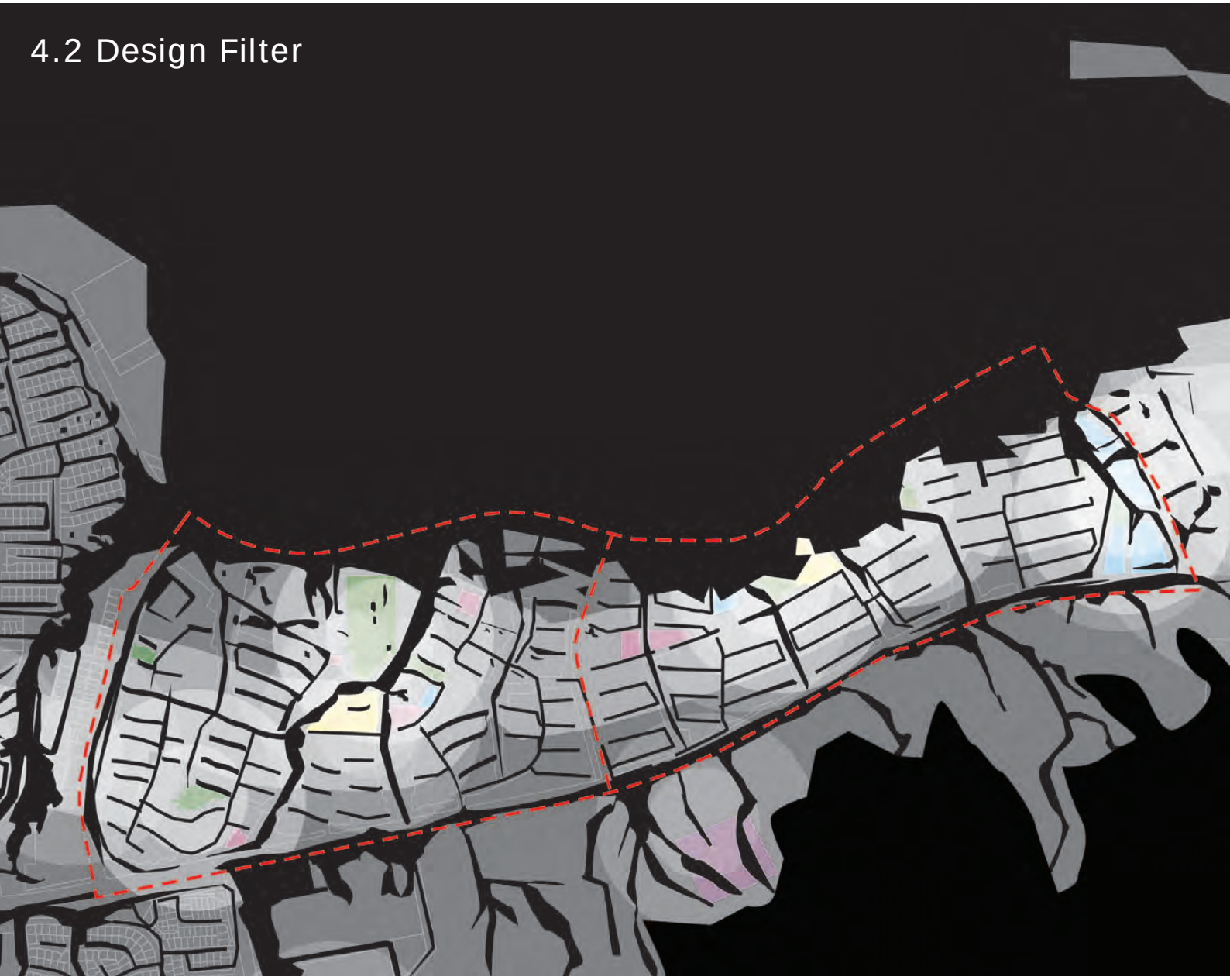


Figure 4.2 - Design Filter

The Design Filter (Fig 4.2) is created by combining the Built Environment Sieve (Fig 4.3.1), Environmental Sieve (Fig 4.3.2) and the Amenity Sieve (Fig 4.3.3). Its purpose is to reconcile the broad environmental constraints of the study area with the core principles of "good urban design" as expressed by both the *KCN Growth Plan (3.2 City Planning Principles Pg 86-88)* and the WAPC "Liveable Neighborhoods" Appendix 2.

The Design Filter is not exhaustive and is presented as background information only.

The Built Environment Sieve captures:

- Landuse and zoning (Fig 4.3.10)
- Condition of Building Stock (Fig 4.3.11)
- Ownership Patterns (Fig 4.3.12)
- Lazy Lands (Fig 4.3.13)

The Environmental Sieve captures:

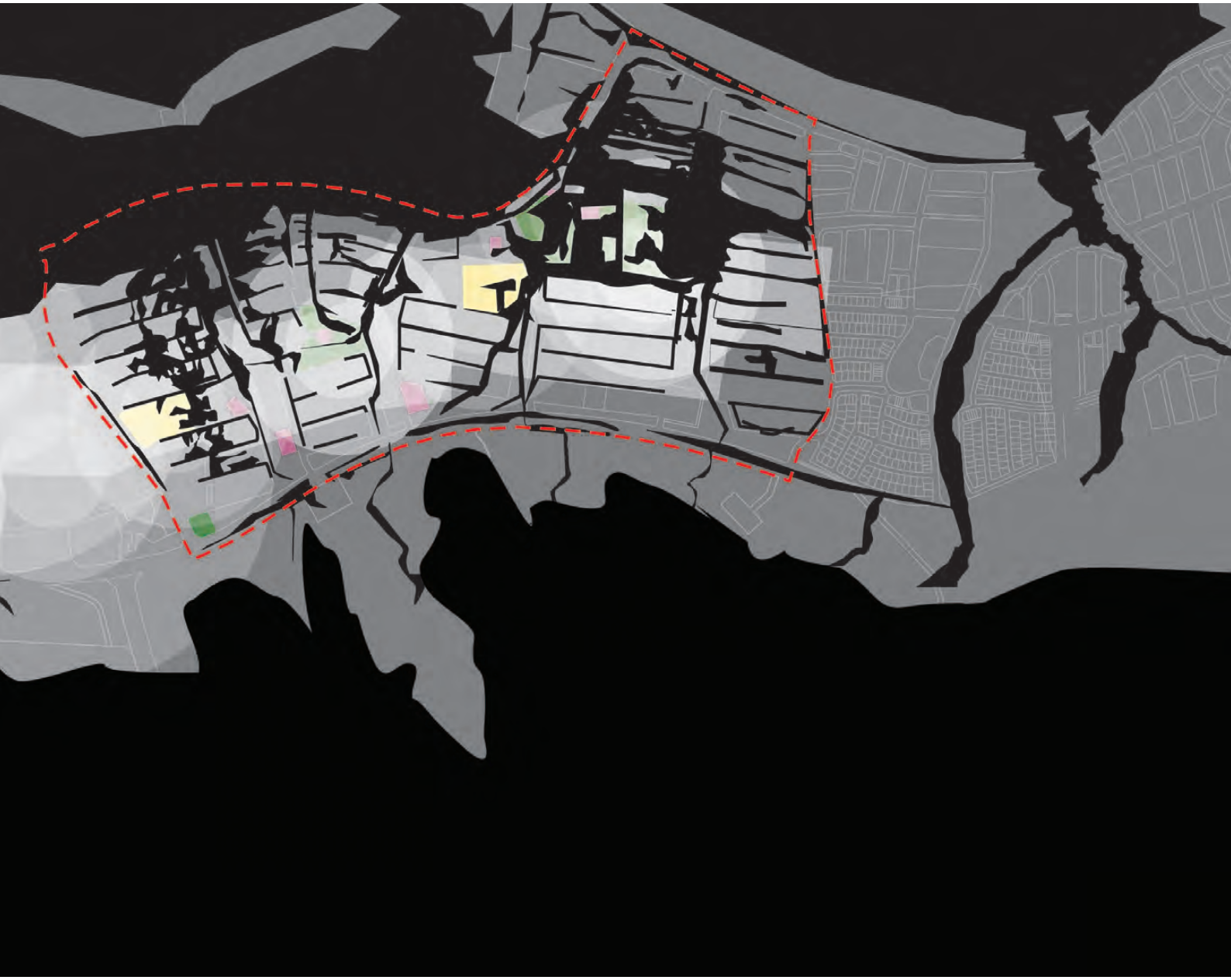
- Drainage (Fig 4.3.20)
- Flooding & Surge (Fig 4.3.21)
- Topography (Fig 4.3.22)

The Amenity Sieve Captures:

- Walkable Community Catchments (Fig 4.3.30)
- 200m Catchment from EW Thread (Fig 4.3.31)
- Walkable Amenity Catchments (Fig 4.3.32)
- Amenity Sieve (Fig 4.3.33)

The application of the Design Filter to the study area is used to determine the following:

- Areas where environmental constraints are such that development and/or improvement either does not occur or only proceeds if enhanced and detailed site specific strategies are undertaken (shown as black).



- Areas that are potentially conducive to development and improvement initiatives (shown as gradients of white, where the 'bright spots' are the most favourable).

Community
School
Commercial
Park & Open Space

4.3 Sieve Mapping

Built Environment Sieve

Landuse & Zoning +
Condition of Building Stock +
Ownership Patterns +
Lazy Lands

Figure 4.3.10 - Existing Landuse and Urban Form

+

Figure 4.3.11 - Condition of Building

+

Figure 4.3.12 - Ownership Patterns

+

Figure 4.3.13 - Lazy Lands

=

Figure 4.3.14 - Readiness for renewal

Environmental Sieve

Flooding+

Drainage +

Topography

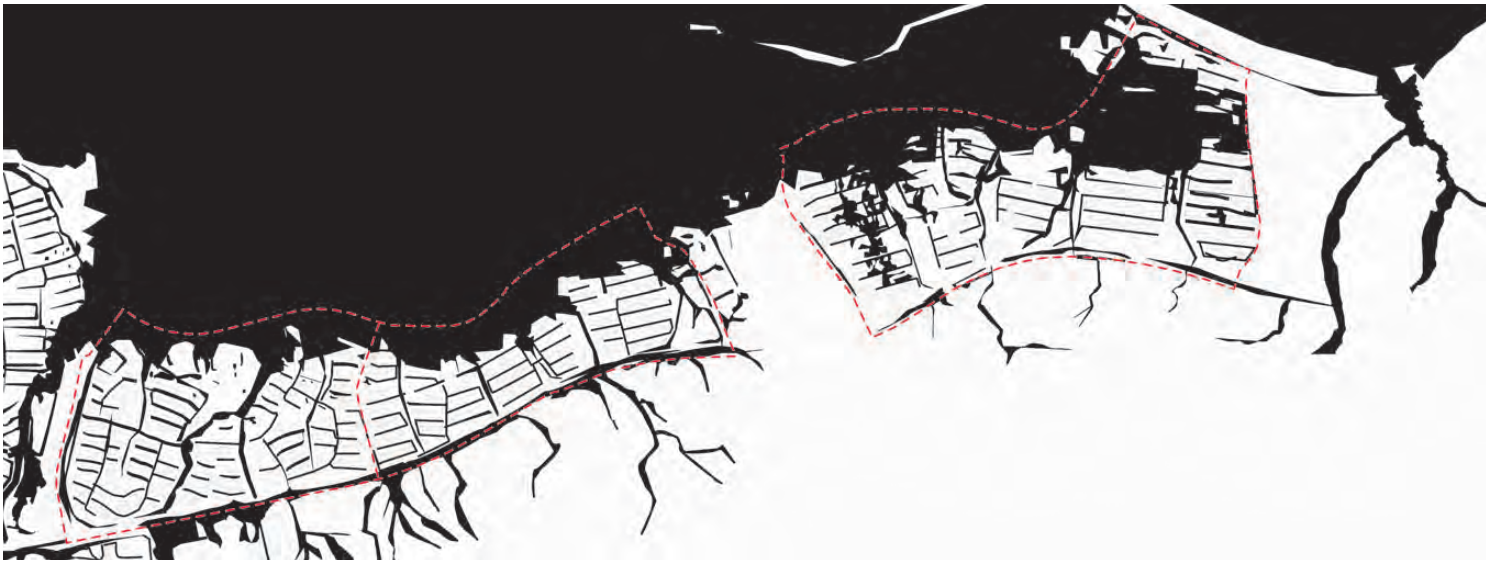


Figure 4.3.20 - Drainage & Storm Surge

Design process mapping illustrating Flooding + Surge

+

Figure 4.3.21 - Drainage & Storm Surge

Design process mapping illustrating Drainage Network

+

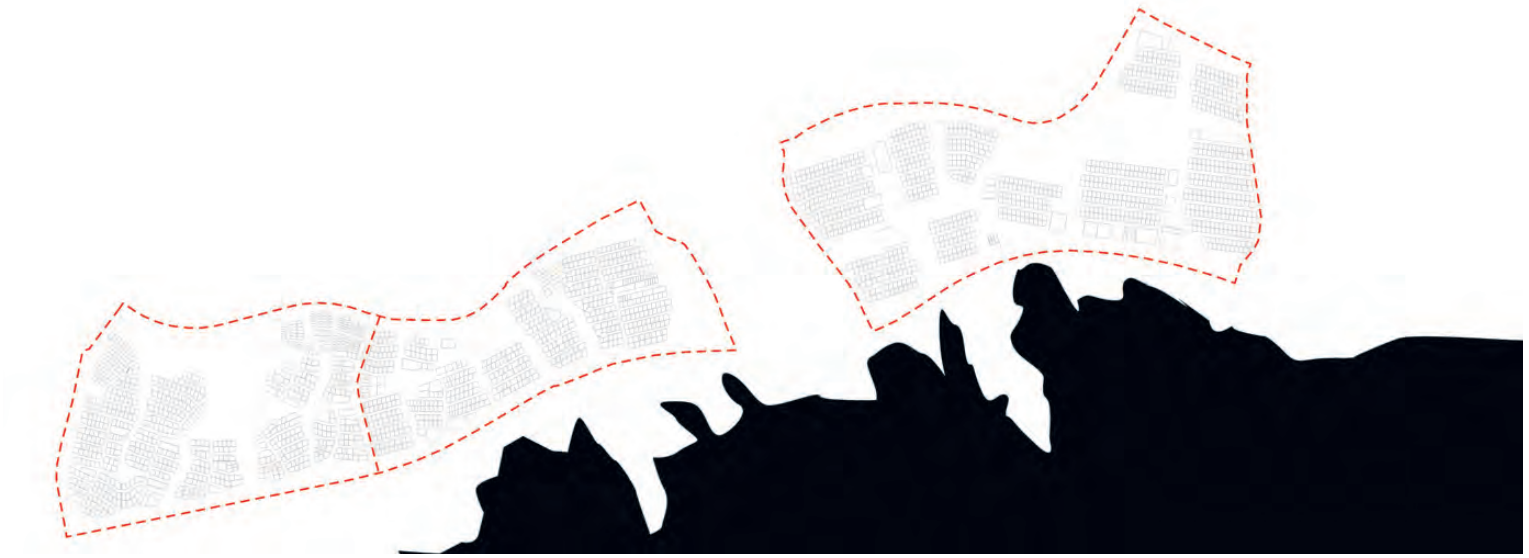


Figure 4.3.22 - Drainage & Storm Surge
Design process mapping illustrating Topography

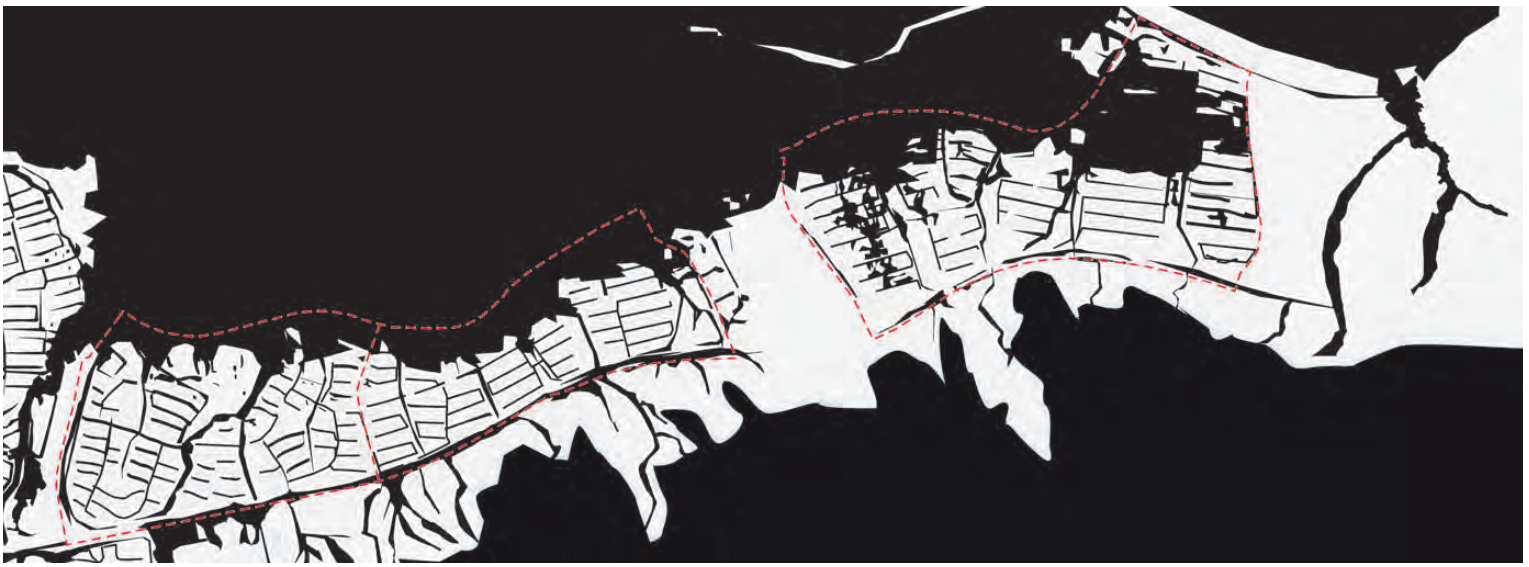


Figure 4.3.23 - Environmental Sieve

Amenity Sieve

200m Catchment from EW Thread +
Walkable Community Catchments +
Walkable Catchments from parks

- Community
- School
- Commercial
- Park & Open Space

Figure 4.3.30 - Vehicular Movement Network
Design process mapping illustrating 200m Catchment from EW Thread

+

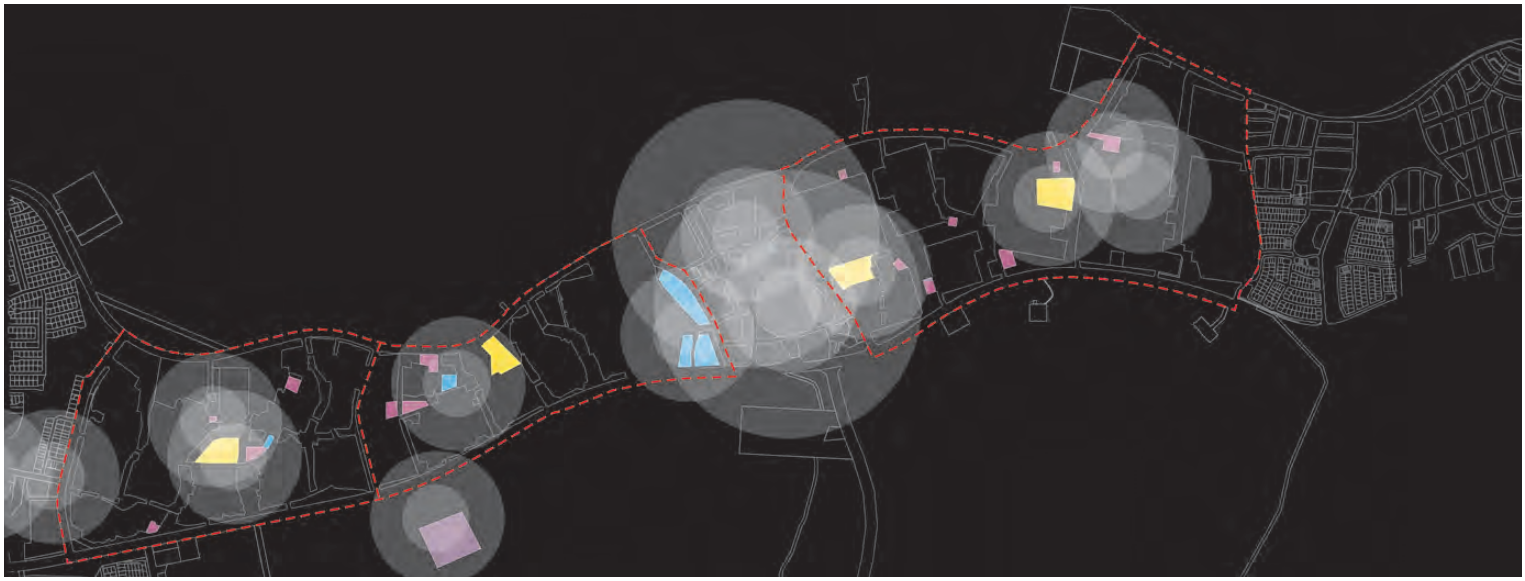


Figure 4.3.31 - Walkable Catchments to Activity Nodes
Design process mapping illustrating walkable community catchments

+

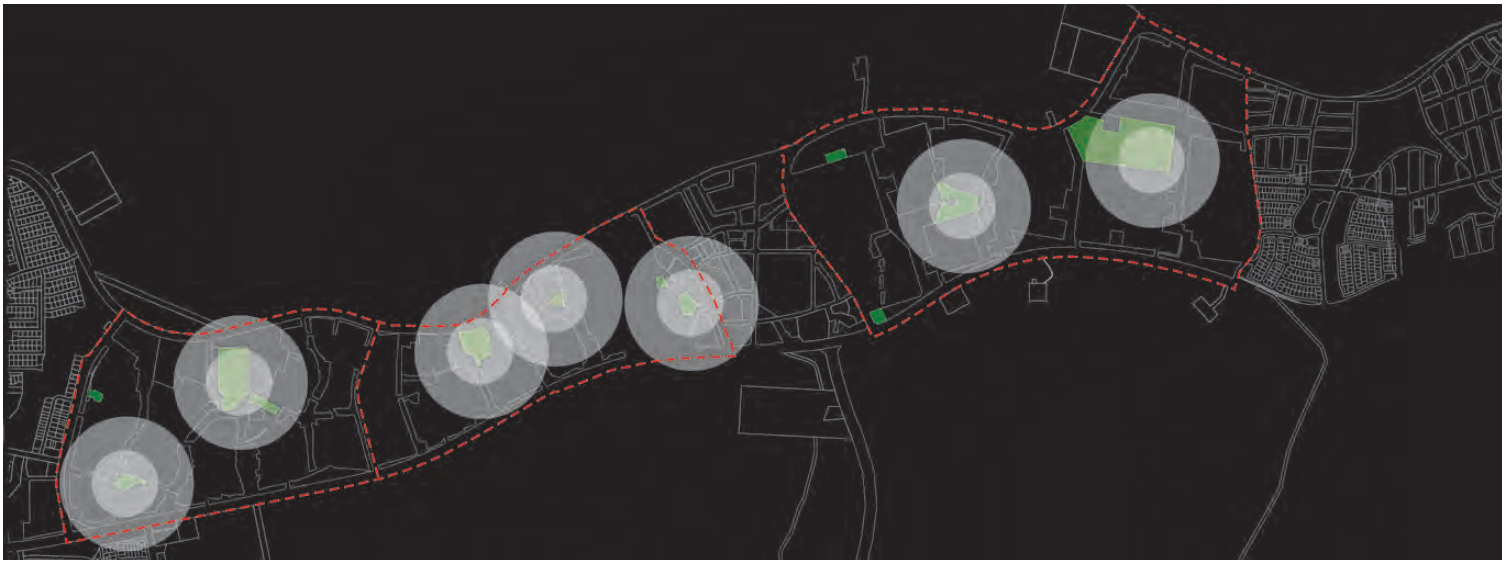


Figure 4.3.32 - Parks & Open Space
Design process mapping illustrating walkable catchments from parks

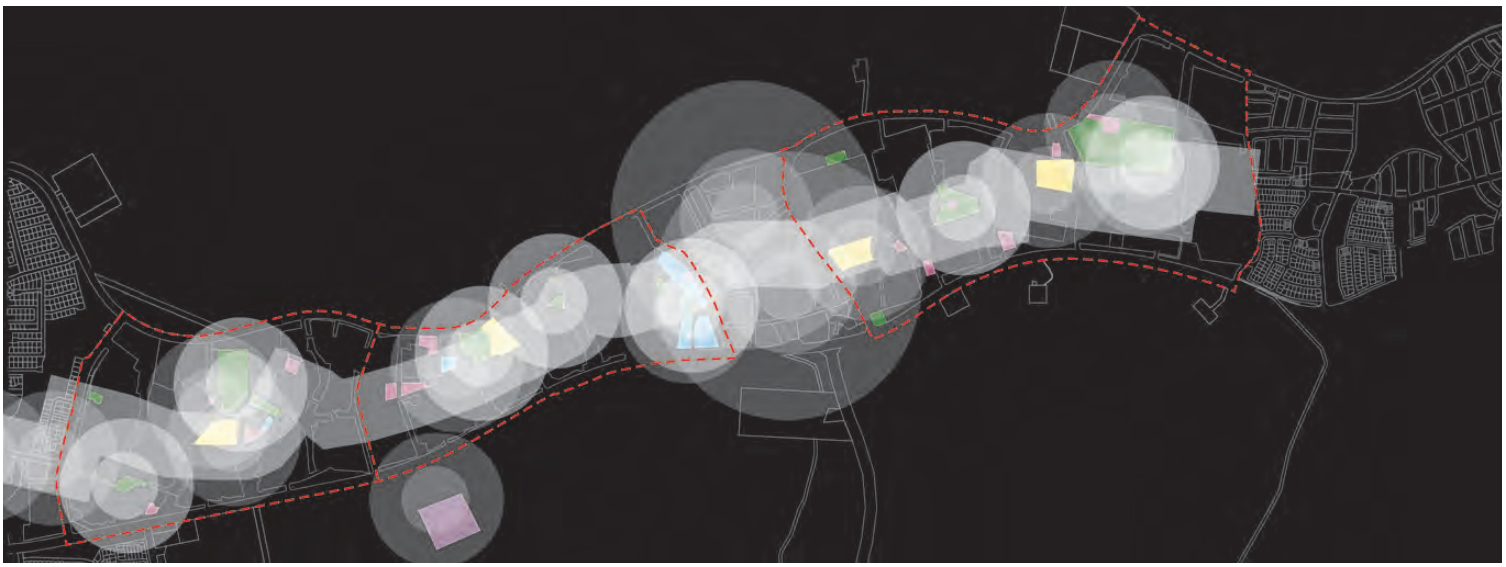


Figure 4.3.33 - Amenity Sieve

5 Revitalisation Strategy

5.0 Revitalisation Concept

The following section outlines the concept for the revitalisation of the older suburbs of Bulgarra, Pegs Creek and Millars Well in Karratha to improve their liveability and facilitate the delivery of the Pilbara City vision.

As outlined previously, development of the preferred concept was guided by:

- Testing & application of KCN principles and objectives;
- Input from the community and key stakeholders;
- Sieve mapping from evidential base and analysis;
- Review of relevant policies, reports, guidelines and studies; and
- Design & planning process guided by WAPC Liveable Neighborhoods.

The Strategy responds to the identified opportunities and constraints in the three suburbs in order to meet the following objectives of the study:

5.1 Built Environment: Provision of additional dwellings with sufficient diversity to meet future housing demand, which are reflective of the climate and character of Karratha, contributing to enhanced liveability, amenity and economic security.

5.2 Transport: Provide a better connected and legible integrated movement network that reduces travel distances and improves safety for residents of Bulgarra, Millars Well and Pegs Creek irrespective of the modes they use.

5.3 Parks: Develop a hierarchy of parks and connected open spaces within reasonable, safe, pleasant, walking distance of all dwellings that can be developed and maintained with high quality facilities within the long term financial and water resources available.

5.4 Amenity: Enhance the local character and amenity of the streetscapes and swales within Millar's Well, Pegs Creek and Bulgarra to improve liveability and community pride.

Revitalisation and redevelopment will result in the following improvements for the study area:

- Improved amenity of suburbs through redevelopment of older, uneconomic or outdated housing stock;
- Increased diversity of dwellings to cater for future population and demographic needs;
- Enhanced neighbourhood character through improved streetscapes, climate responsive building design and appropriately located medium density;
- The revitalisation of suburbs, which support the City centre to help keep it vibrant by introducing greater densities of dwellings and population within walking or cycling distance of the City centre.
- Decreased overall travel requirements of residents, particularly by cars where overall kilometres travelled for work and non-work trips can be reduced with savings on fuel, vehicle wear and tear, travel time and greenhouse emissions;
- Safer emergency access routes and guidance on the management of flood and inundation risk;
- Improved recreation facilities and use of scarce water resources in parks within walkable distances of neighbourhoods;
- Enhanced amenity of public places and spaces through additional plantings of vegetation which create shade and improve the green linkages and streetscapes;
- Better use of existing capacities in infrastructure such as water, sewerage and power including non-potable water for irrigation (from the Effluent Reuse Project); and
- Increased resident populations which make infrastructure and services more viable such as public transport or to be of a higher standard such as parks with more available rate and tax revenue;
- Greywater re-use scheme as an alternative irrigation water source.

5.1 Proposed R-Codes

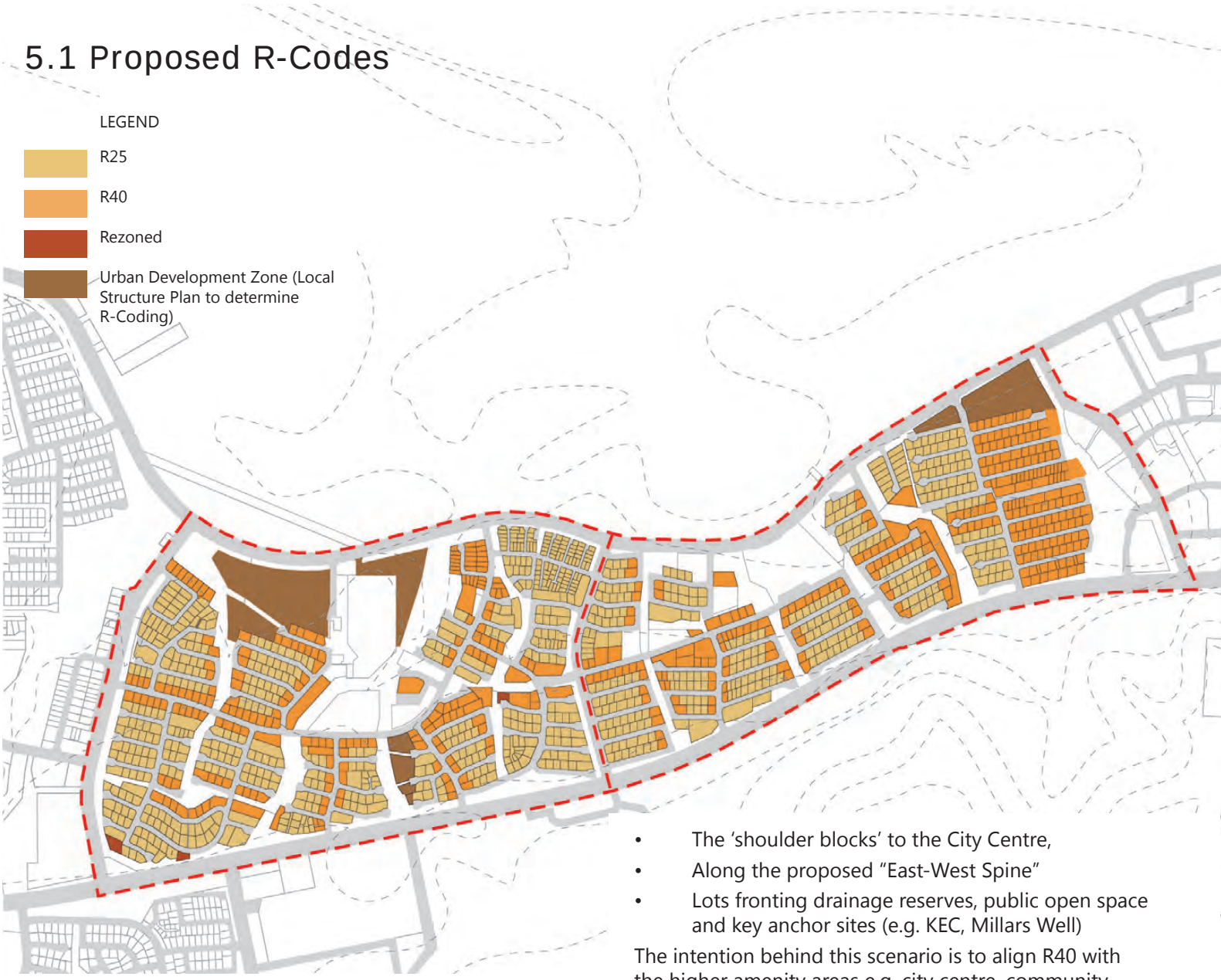


Figure 5.1 - Proposed R Codes

Key KCN and KRS objectives identified earlier in this document focus on delivering compact neighbourhoods and diversity of housing in Pegs Creek, Millars Well and Bulgarra.

Accordingly the KRS recommends residential re-codings which;

- Retain the existing character of the subject suburbs;
- Maintain the large lot size which are highly valued due to the Pilbara lifestyle; and
- Allow for an increase in density in strategic locations; and,
- Assist in creating more diverse housing stock and streetscapes.

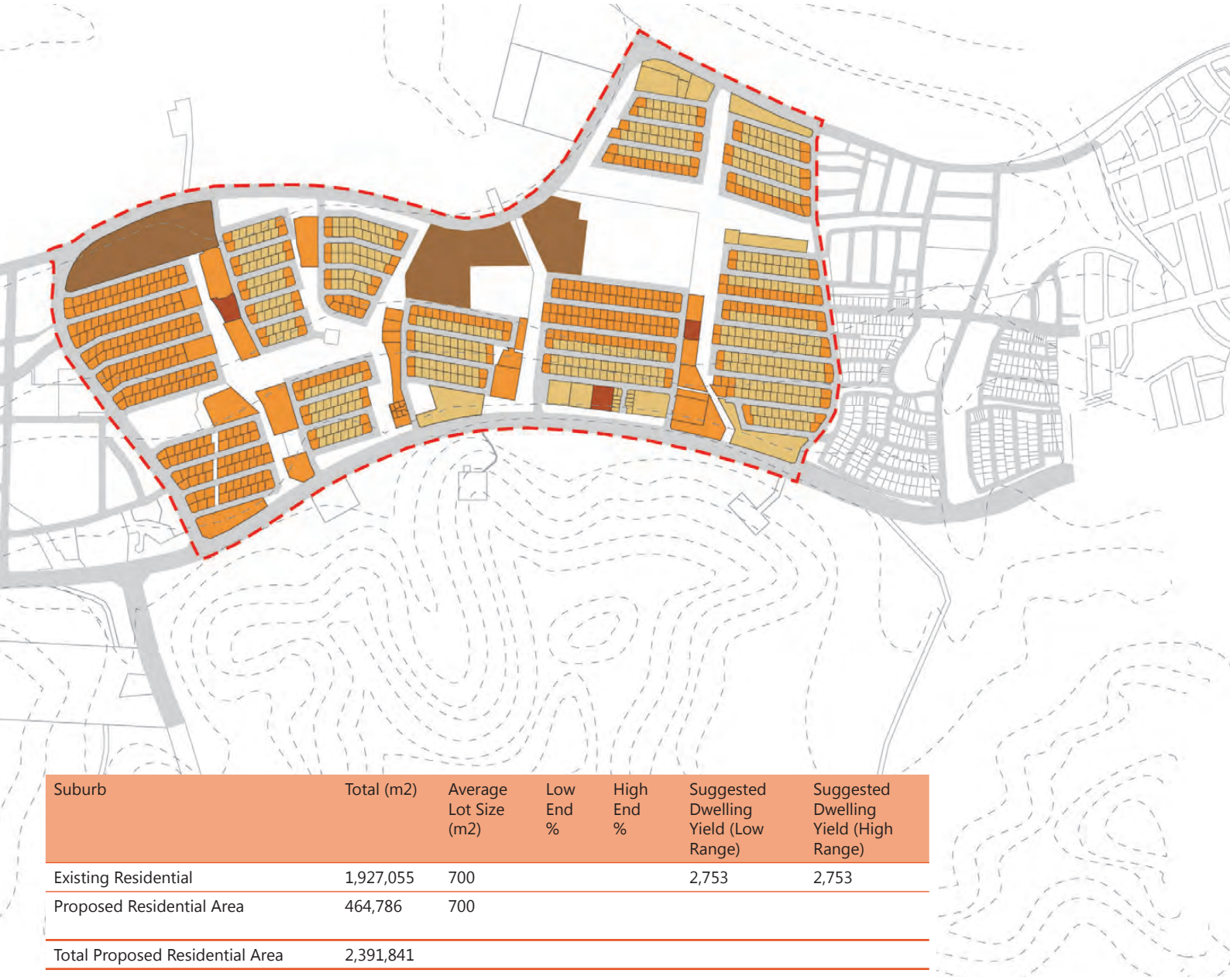
The proposed R Codes scenario draws upon two codes R25 and R40. Across a large portion of the existing residential cells, the proposed R Codes will be largely unchanged with a minor coding uplift to R25. The higher density, R 40, is reserved for;

- The 'shoulder blocks' to the City Centre,
- Along the proposed "East-West Spine"
- Lots fronting drainage reserves, public open space and key anchor sites (e.g. KEC, Millars Well)

The intention behind this scenario is to align R40 with the higher amenity areas e.g. city centre, community facilities, public open space and east west spine etc as per the objectives of Liveable Neighbourhoods. Subsequently the provision of R40 will help support and intensify these areas, while also allowing capacity for the city centre to grow and accommodate additional population in the future.

The proposed R Codes plan highlights lots which have been rezoned according to a development application approved by the City of Karratha. This was current at the time the document was being prepared.

Furthermore, the plan also highlights a number of key development sites which have been proposed as Urban Development Zone. For these areas it is recommended that Detailed Area Plans (DAPs) should be undertaken to provide design control measures for key aspects of the urban design and the overall aesthetic of the built area. Initial sketch scenarios have been included in Section 5.3- New Development Sites, to show schematic layout and high level urban design principles. These sketches are schematic only and are subject to further investigation.



Suburb	Total (m2)	Average Lot Size (m2)	Low End %	High End %	Suggested Dwelling Yield (Low Range)	Suggested Dwelling Yield (High Range)
Existing Residential	1,927,055	700			2,753	2,753
Proposed Residential Area	464,786	700				
Total Proposed Residential Area	2,391,841					
R25	1,098,571					
No change		700	96%	90%	1,507	1,412
Redevelop Lot (R20)		350	2%	5%	63	157
Amalgamate and Redevelop (R40)		350	2%	5%	63	157
Sub Total					**1,632**	**1,726**
R40	1,001,021					
No change		700	96%	85%	1,373	1,216
Redevelop Lot (R30)		220	2%	5%	91	228
Amalgamate and Redevelop (R40)		200	2%	10%	100	501
Sub Total					**1,564**	**1,944**
Urban Development Zone (Local Structure Plan to determine R-Coding)*	292248				677	677
Sub Total					**677**	**677**
TOTAL					**3,873**	**4,347**
INCREASE					**1,120**	**1,594**

Assumptions:
The provided take up rates are conservative estimates only for the 5 year period from 2015 to 2020 (across the whole study area)
The estimates are based on the assumption of an average lot size of 700m2.
The estimates above are indicative only and subject to change due to influence from outside and market conditions etc
* Refer to page 70-73 for further information on the redevelopment sites

Table 5.1 - Proposed Residential Density Table

5.2 Renewal Opportunities

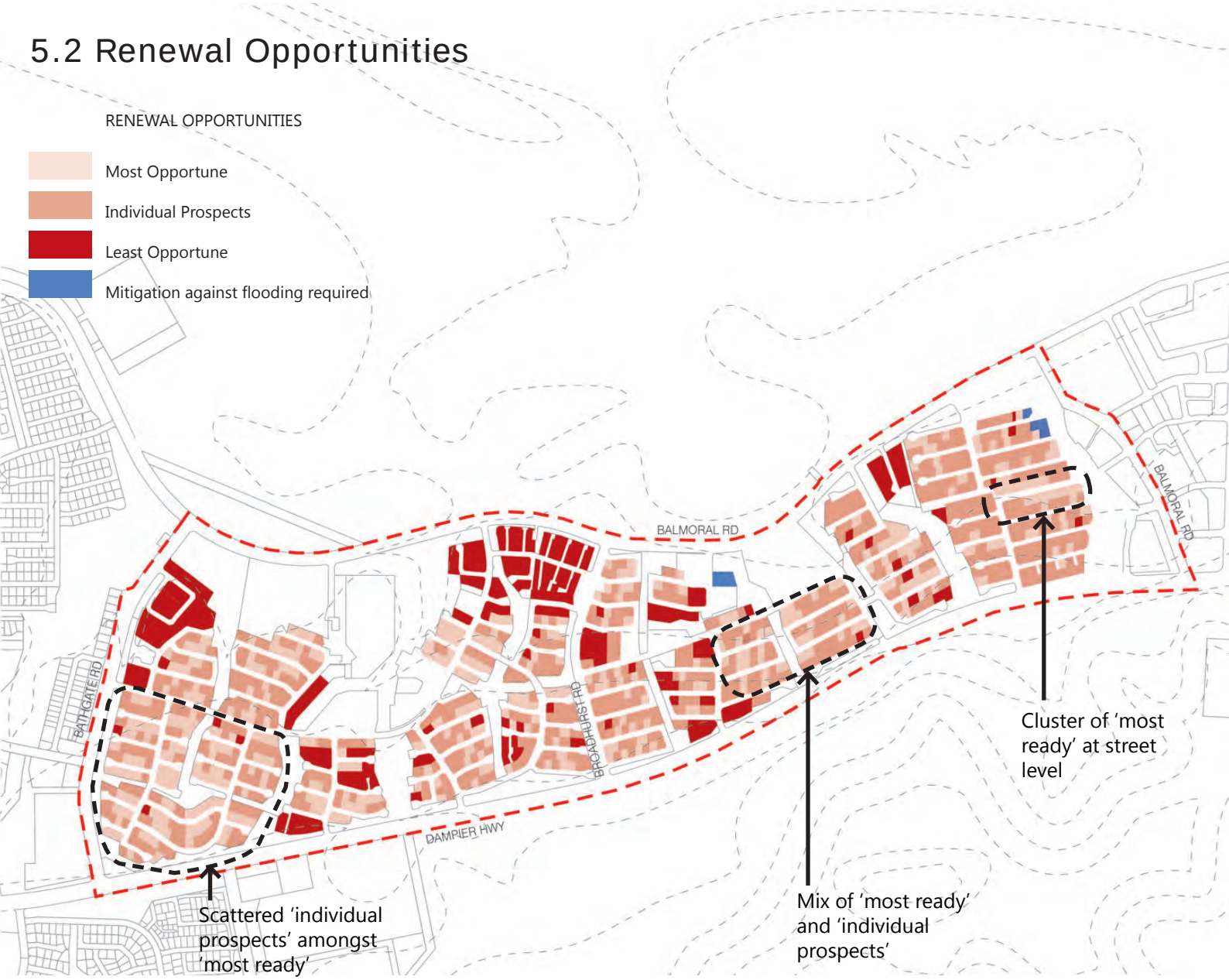


Figure 5.2 - Redevelopment Opportunities

The rate of redevelopment of house-lots with the KRS area is determined by a number of factors including:

- The attractiveness for redevelopment based on location (greater demand close to services and amenities, lower demand further away)
- The age, layout and condition of existing housing stock (ie, 'ripeness' for redevelopment)
- The economic feasibility of redevelopment on a lot by lot basis, and
- The aspirations and intentions of individual owners (ie, many owners may be disinterested in redeveloping their properties, whereas a handful of owners may wish to undertake individual projects).

The proposed coding plan (previous pages) is a measure of attractiveness for redevelopment, established through the design filter process, and accordingly it is anticipated that the R-Codes reflect the potential for demand for diverse housing stock.

The capacity for redevelopment due to 'ripeness' is less well defined being a combination of age, ownership, and condition of stock, which varies considerably. The mapping above in part depicts the distribution of properties based on 'ripeness' and condition (based on street view survey only).

Notably however, even these properties are relatively scattered throughout the suburbs, reinforcing the likelihood that redevelopment will be dispersed and organic in form (ie 'salt and pepper'), rather that comprehensive and character-changing.

Redevelopment Typologies

KRS recommends the R25 Code as a baseline for approximately half of the residential area, effectively establishing a 'minimal change' condition that is likely to only affect the very largest blocks (ie upward of 850m2). It is expected that relatively little redevelopment would occur in these areas. This is evidenced by the low rate of duplex or triplex redevelopment on existing house lots that has already existed in the Karratha Revitalisation area under the Scheme for several years.

In areas adjacent to centres and amenity, slightly higher base codes and upper codes apply. The figure opposite schematically illustrates the different conditions that are expected to occur under the two coding categories (ie, R25 & R40).

Generally, it is expected that the existing condition (ie, single house remaining on each lot) will continue to be the dominant condition of most suburbs.

It is also anticipated that whilst the up coding to a R25 baseline may encourage occasional redevelopment of individual house lots, it is expected that this will occur mostly in areas where stock has significantly deteriorated (ie, is 'ripe' for redevelopment), and where there is demand for compact housing.

Amalgamation is expected to also be exploited relatively infrequently, as it relies on either property assemblage by builders or developers, or by residential owners being financially geared to undertake acquisition and fund development. At the highest coding R40, an amalgamated lot may be expected to deliver up to 8 dwellings, in either single level or two story semi-detached or detached configuration (See Figure 5.2.1 Performance Based Redevelopment Typologies).

The control of built form (Design Guidelines or DAPs) will be required to ensure consistency with the Pilbara Vernacular Study, and to achieve appropriate street interfaces.

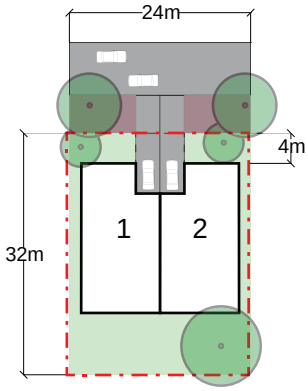
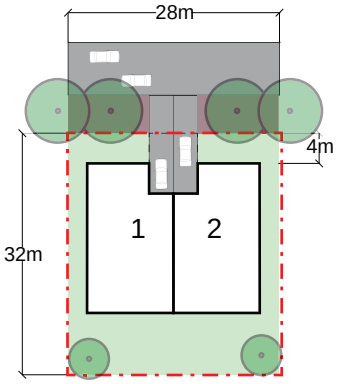
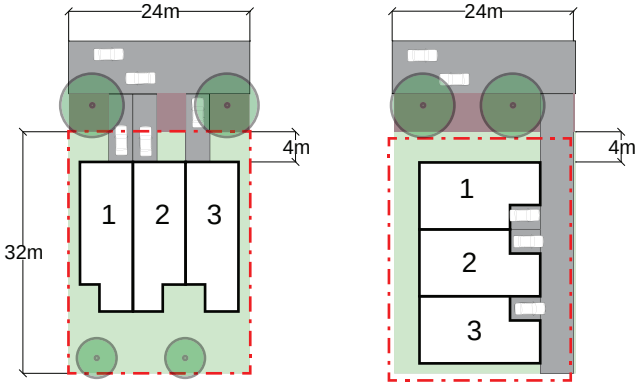
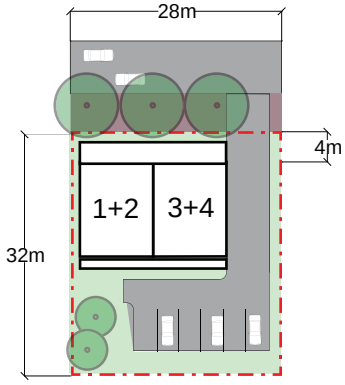
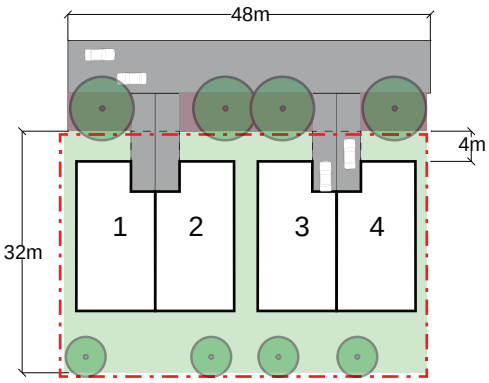
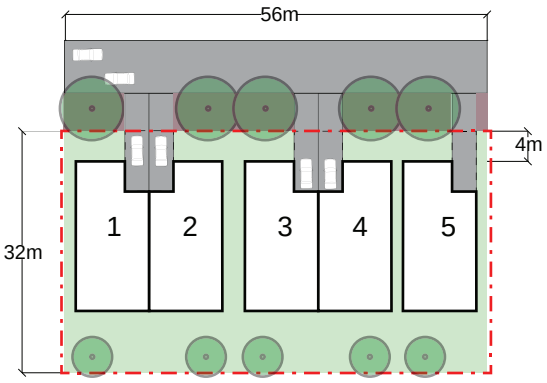
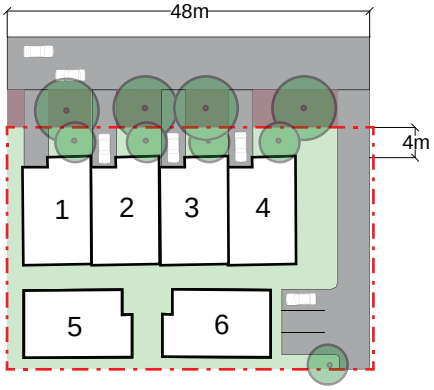
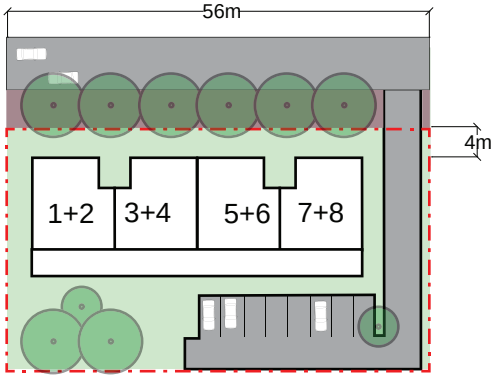
	LOT SIZE A 768m2 SINGLE LOT & MAX DEVELOPMENT	LOT SIZE B 896m2 SINGLE LOT & MAX DEVELOPMENT
R25	 Up to 2 dwellings Single storey Dwelling size: 192m2 Minimum 50% open space 1 x single dwy per dwelling	 Up to 2 dwellings Single storey Average dwelling size: 212m2 Minimum 50% open space 1 x single driveway per dwelling
R40	 Up to 3 dwellings Single storey Dwelling size: 128m2 Minimum 45% open space 1 x single dwy per dwelling	 Up to 4 dwellings 2 levels Dwelling size: 120m2 Minimum 45% open space 1.5 x car bays per dwelling

Figure 5.2.1 - Performance Based Redevelopment Typologies

	LOT SIZE A, AMALGAMATED x 2 1536m2	LOT SIZE B, AMALGAMATED x 2 1792m2
R25	 Up to 4 dwellings Single storey Dwelling size: 192m2 Minimum 50% open space 1 x single dwy per dwelling	 Up to 5 dwellings Single storey Dwelling size: 179m2 Minimum 50% open space 1 x single dwy per dwelling
R40	 Up to 7 dwellings Single storey Dwelling size:120m2 Minimum 45% open space 1 x single driveway or 1.33 x carbay per dwelling	 Up to 8 dwellings 2 levels Dwelling size:120m2 Minimum 45% open space 1 x carbay per dwelling

5.3 New Development Sites

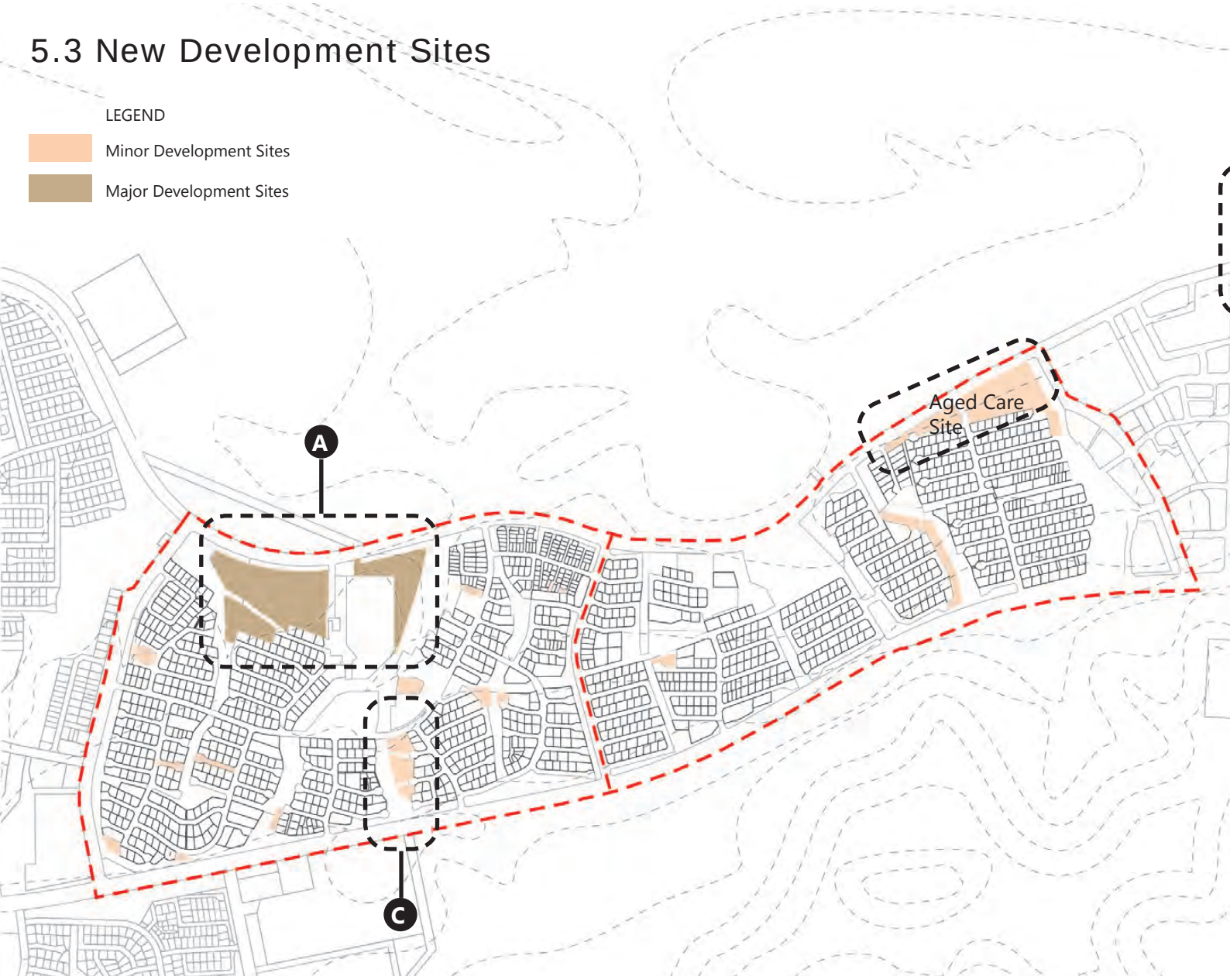
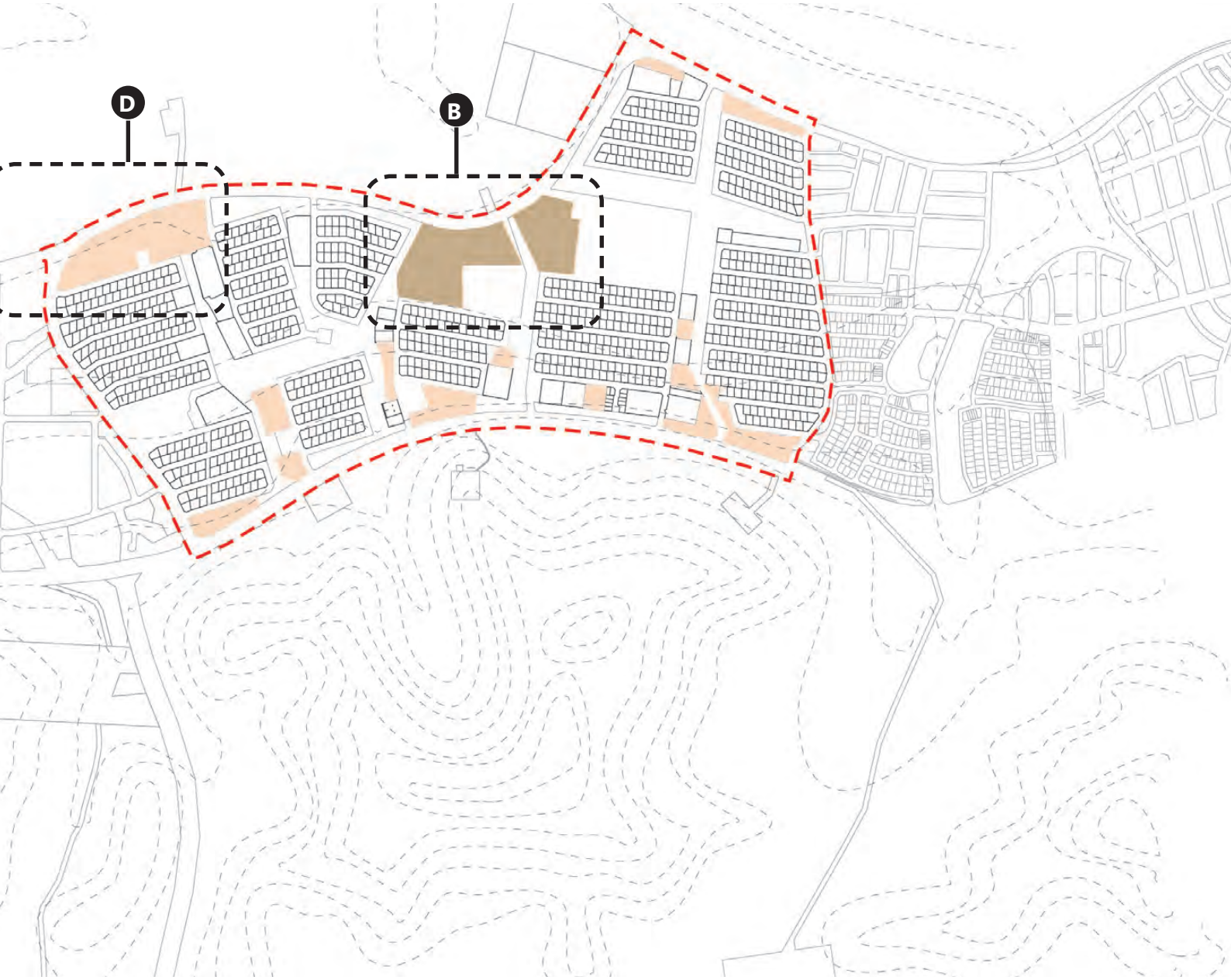


Figure 5.3 - New Development Sites

New Development Opportunities

In addition to the Lazy Land sites identified in Figure 3.4, the following section investigates four new development areas along with general development guidelines. The four new development areas are as follows;

- **(A)** Lazy Land sites P14,15,16 & 19 in the vicinity of the Kevin Richards Memorial Oval in Millars Well;
- **(B)**The Old High School site in conjunction with the KEC site in Bulgarra;
- **(C)** Development site adjacent to swale on Gawthorne Drive / Sun Court & Tue Place; and,
- **(D)** The site in Bulgarra on Richardson Way.



SUBURB / SITE	Address	P Lot No.	Area (m2)	Suggested Yield
Millars Well | A	Atkinson Way, Tilbrook Close, Balmoral Road	P14, P15, P16, P19	98,319	210
Bulgarra | B |	Old High School Site	Lot 4615 of Crown reserve 30602)	58,426	152
Bulgarra | B	KEC Site	Crown reserve 32320	35,600	120
Millars Well | C	Gawthorne Drive / Sun Court & Tue Place	P23, P24, P25	11,362	80
Bulgarra | D	Richardson Way	P35	58,875	115

Table 5.2 - Development Sites

Figure 5.3.1 - Area A/Millars Well Development Area
Schematic drawing only

A – Millars Well (Implementation Area 2)

The redevelopment Area A in Millars Well, (Improvement Area 2) can potentially stimulate the rejuvenation of the Millars Well community.

A similar series of key actions will again be required, including:

- Preparation and Adoption of an Improvement Area Local Structure Plan
- Rezoning
- Ancillary Planning instruments including Design Guidelines and DAPS
- Undertake various swale and POS upgrades, and
- Undertake various local street improvements.

The illustrative plan above highlights some of the key principles to be considered in developing a structure plan, namely:

- Consolidation and rationalisation of existing recreation facilities (including strategies for broadening the range of community facilities offered by the existing club/recreational facilities)
- Improving N-S road connections
- Establishing a mix of housing typologies
- Creating exemplar streetscapes in new development as a benchmark for the revitalisation of existing streets in Millars Well (including localised place-creation), and
- Improving drainage and parkland corridors, potentially integrated with housing and local streets.

A preliminary inventory of possible implementation actions for these precincts is described in section 6.4.

In considering prospective designs for the Millars Well Development Area, three alternative options to that depicted in Figure 5.3.1 may be suitable for further investigation as follows:

- **Alternative 1**: Retention of Kevin Richards Memorial Oval with a modified local movement network and redevelopment of adjacent area(s).

Figure 5.3.2 - Area B/Bulgarra Development Area
Schematic drawing only

- **Alternative 2**: Expansion of a consolidated Kevin Richards Memorial Oval through relocation of surplus POS rationalised elsewhere pursuant to an expanded Millars Well sporting precinct.
- **Alternative 3**: Relocation of Kevin Richards Memorial Oval (with or without expanded recreational facilities) north of Balmoral Road as a significant POS precinct development.

B - Old High School Site and KEC Site (Implementation Area 1)

The planning and development of the KEC site and adjoining soccer field should be undertaken in conjunction with the High School site. Together they comprise nearly 9 hectares, a significant development opportunity. Some new road reserves would need to be created from both sites (which will lessen the theoretical yields presented). The Revitalisation Plan recommends a new north-south road from Turner Way to Searipple Road forming a boundary to the primary school site as well as a new road abutting northern boundary of the primary school crossing the drainage swale to link to Hunt Way. Detailed planning would need to determine lot and street block dimensions and the need for any further roads although a concept has been presented in Fig 5.3.2

The high school site (Lot 4615 of Crown reserve 30602) has been placed in the State government's Property Asset Clearing House (PACH) system as being surplus to the Department of Education and Training's requirements. Funds from the sale of this land will be returned to the Department under government policy. The KEC site and soccer field comprise about 3.6 ha in area. They form part of Crown reserve 32320 (council to advise the tenure of the KEC site).

Any disposal of the 2.8 ha soccer field would be subject to Department of Lands Policy 4.1.5 with most of the funds being made available to the City for capital improvements to other POS within the locality. The same should apply with the proceeds of the sale of the KEC site.

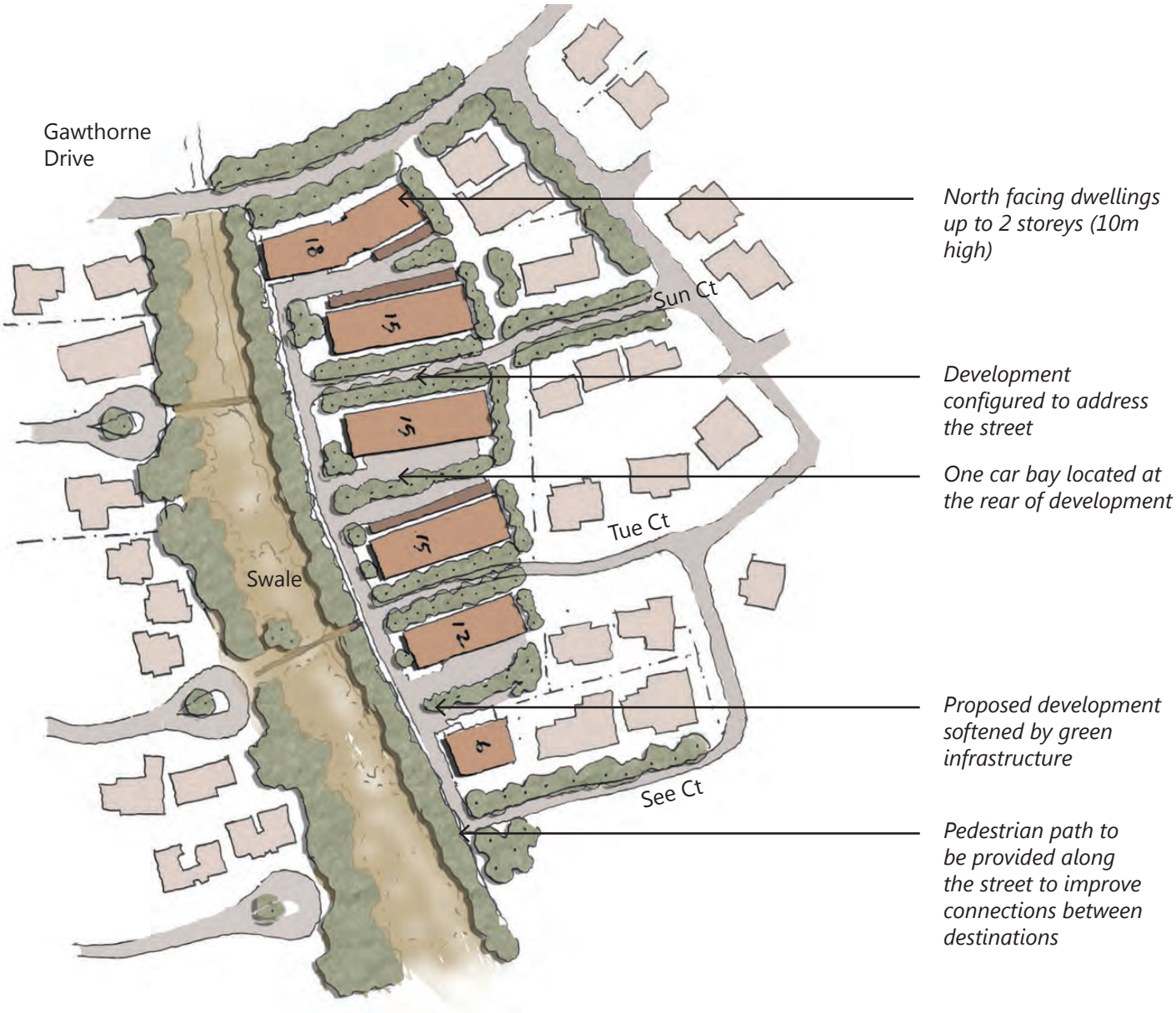


Figure 5.3.3 - Area C/Development opportunity next to swale

The redevelopment of Improvement Area 1 (Bulgarra SHS and KEC Site) will provide a catalyst for the rejuvenation of Bulgarra by providing new housing, upgraded streetscapes and parks, and a clearly revitalised public domain.

The process will include:

- Preparation and Adoption of an Improvement Area Local Structure Plan
- Rezoning
- Resolving a mix of private and government tenure and responsibilities,
- Guidelines and DAPS
- Constructing various bridge links across swales
- Undertake various swale and POS upgrades,
- Undertake various local street improvements.
- The indicative principles plan above illustrates some of the key development outcomes that the project can deliver, including:
- A consolidation of education facilities into the Primary School precinct (and encourage the Education Department to externalise some key facilities such as the library),
- Utilising the Primary School as an anchor for a mixed use community node located on the E-W movement Corridor,
- Improving connections to Searipple various E-W connections for vehicular, cyclist and pedestrian traffic,
- Establishing a mix of housing typologies
- Creating exemplar streetscapes in new development as a benchmark for the revitalisation of existing streets in Bulgarra, and
- Improving drainage and parkland corridors, potentially integrated with housing and local streets.

Figure 5.3.4 - Area D/Sketch of flood constraint site

Area C - Development Sites adjacent to swale

There are a number of new development opportunities that are located adjacent to swales. Detailed flooding studies would need to be undertaken to ensure any development doesn't compromise drainage. Development fronting swales could take the form of group housing or potentially apartment development depending on economic conditions. In either scenario, built form should address the swale rather than turn its back to it. Opportunities should also be sought to improve the adjacent swale and undertake revegetation actions at the time of development. This activity may be considered by the City as part of the landscaping requirement for the development.

A concept for this type of development has been prepared for sites P23, P24, P25 and 26 in Millars Well. This concept ensures buildings are north facing, and that access and amenity are integrated both with the existing street network and with the swale.

Area D - Flood constrained site adjacent to City Centre

The Lazy Lands sites identified as flood constrained are considered to have low potential for development. This is due to the need for additional technical studies to demonstrate how the proposed development will impact on flood risk both up and downstream, as well as the potential cost of the strategies that are likely to be required to adequately manage flood risk. Potential flood mitigation options may include importing fill, a built form response or infrastructure upgrades.

The City has prepared Policy 19: Storm Surge Risk Local Planning Policy to guide development in areas of storm surge risk. This policy provides acceptable development standards and performance-based criteria for development in risk areas. The draft policy requires the planning approval of all development in the area potentially affected by a 1 in 500 yr ARI storm surge event.

The concept design for one such site explores the idea of a series of 'island' fill areas to mitigate flood constraints. The islands could accommodate three to four storeys of a mix of 1 – 2 bedroom dwellings with one storey of ground floor car park. Swales could be designed to wrap around the 'islands' to mitigate flood constraints and provide aesthetic and environmental benefits by vegetating with native species including Eucalyptus victrix and Melaleuca lanceolata, (Western Black Tea Tree) as well as, green infrastructure in the spatial areas between buildings and around the development to ensure an appropriate interface with surrounding areas.

Detailed Area Plans

Detailed Area Plans are recommended to provide better design control measures for aspects of urban design and the overall aesthetic of the built area, in addition to measures outlined under the Residential Design Codes (R-Codes). Detailed Area Plans could be adopted under a specific provisional council scheme and mandate guidelines on items such as:

- driveways;
- building setback;
- fencing;
- building envelope;
- dwelling mix;
- diversity;
- open space;
- garage locations;
- passive surveillance;
- solar orientated building design; and
- maintaining adequate breeze corridors.

Detailed Area Plans should be prepared for large lots and areas of development that incorporate a number of smaller lots. This will ensure that developments have a consistent and coordinated approach, an acceptable design standard is achieved and the subject suburbs retain their character.

Design Guidelines

It is recognised that both the general public and stakeholders value the retention of the existing character of the suburbs as well as desire quality design outcomes in new built forms. In order to retain the character as future development occurs, it is recommended that design guidelines are prepared for the Strategy area.

The guidelines should have sufficient prescription to ensure a quality outcome, but also enable creative design responses that generate appropriate built form outcomes. Relevant references include *Pilbara Vernacular Handbook (*LandCorp, April 2012) and the *Karratha Vernacular Interim Report* (LandCorp 2010). Both of these documents identify principles to guide good design.

The Pilbara Vernacular document contains the following over-arching design principles:

- Responding to climate;
- Incorporating the natural landscape;
- Building on the Pilbara character and identity;
- Enhancing liveability; and
- Mobilising for change.

Any new guidelines should build on these design principles as appropriate for the study area. Recommendations may include:

- Potential development up to 3 storeys (10m tall) with a mix of dwelling types (1 bedroom, 2 bedroom apartments);
- Dwellings to be north facing, where possible;
- Development to be configured to address the street;
- Each dwelling to have one car bay located at the rear of development with consideration given to "toy storage" bays;
- Building design to incorporate allowance of breeze corridors;
- Proposed development softened by green infrastructure to promote pedestrian scale and amenity, climatic protection and softening of build form; and
- Pedestrian path to be provided along the street to improve connections between destinations.

General Development Guidelines

Guidance is recommended to be provided for all future development within the study area to enhance and retain neighbourhood character and deliver the desired revitalisation outcomes. Key areas that need to be addressed include:

- **Scale** – ensure appropriate size and bulk of new buildings including the height, width and depth of the building in relation to surrounding buildings, the street, setbacks and surrounding open space. Building heights could be limited to 10 metres which is the height threshold above which construction costs increase considerably due to cyclone protection requirements. This would assist in the achievement of affordable housing.
- **Parking** - The use of boats, caravans, camper trailers, jet-skis, quad bikes sometimes referred to as 'toys' is recognised as a part of the Pilbara lifestyle; it's a manifestation of the 'work-hard-play-hard' ethic. New developments will need to consider the need for storage of these 'toys' however it is also recognised that not all tenants in new developments, particularly smaller dwellings can expect to have extensive toy storage. Developers will need to include innovative measures to facilitate this need and provide a balance between toy storage and dwelling yield.
- **Fencing** - Guidance for height, porosity, and materiality of fences to ensure visual consistency with the public/provide interface
- **Green Infrastructure** - is important in 'gluing the street together'. In addition to the visual, climatic and environmental benefits, a tree canopy helps soften built forms, provides important shade and allows new development to be integrated into older suburbs. Tree canopy height should not exceed 6m in order to reduce likely damage from cyclones.
- **Height and Massing** – should be appropriate to retain sense of openness and improve pedestrian amenity of streets.
- **Interface** - between streets and urban form should contribute to non-physical factors including culture, health, well-being and community participation.
- **Details & Materials.** – should be appropriate for the climate and landscape and consistent, contributing to peoples comfort, safety, legibility and amenity.

This guidance may include:

- Detailed Area Plans (DAP's); and
- Design Guidelines.

5.4 Movement Network Improvements

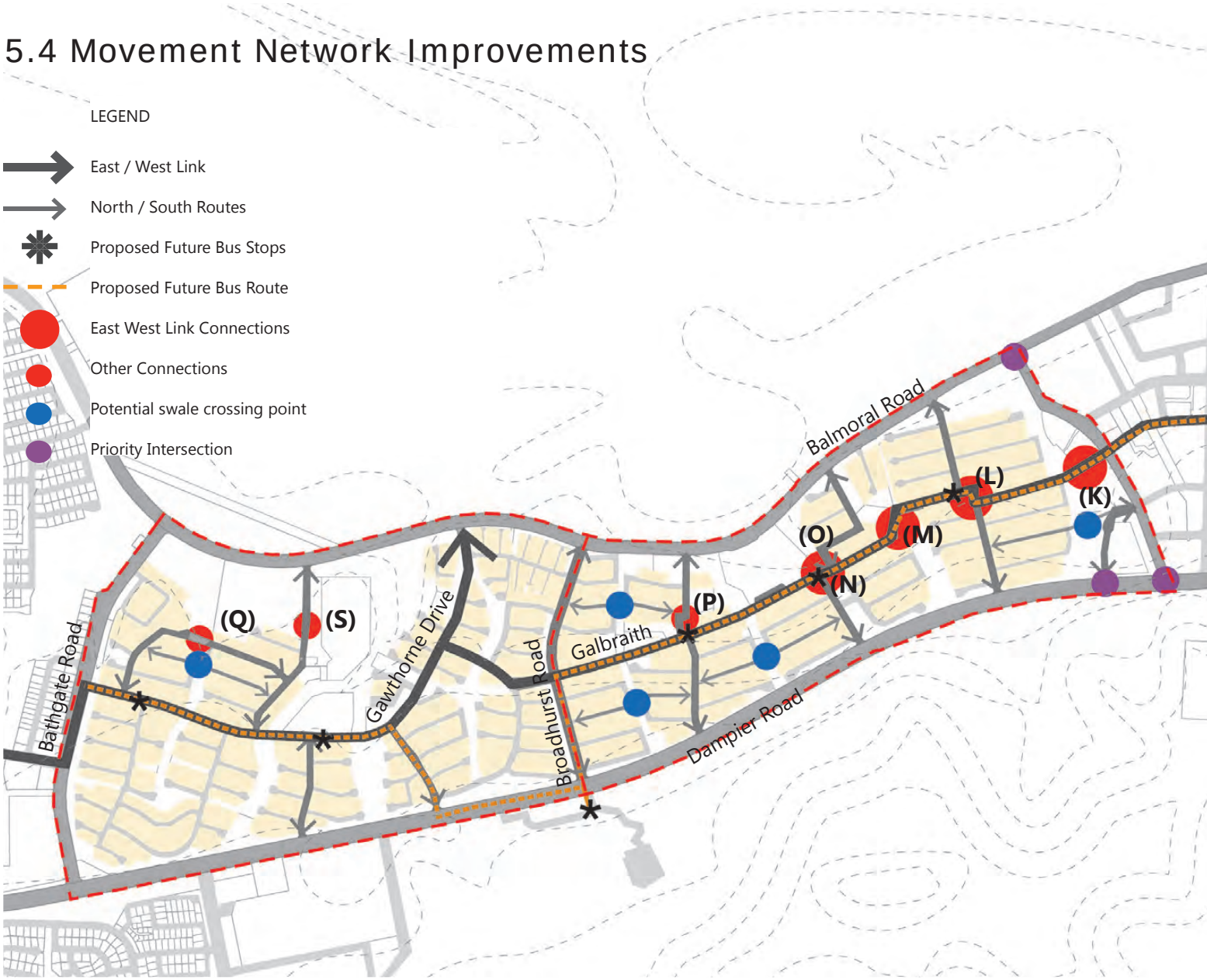


Figure 5.4 - Movement Network Improvements

Integrated Movement Network

The strategy for an Integrated Movement Network comprises the following objectives of the KCN:

- Connectivity at local, district and regional scale;
- A network and hierarchy of streets and public spaces that provides permeability and legibility;
- An integrated movement network that ensures the safe movement of pedestrians, cyclists, and vehicles; and
- An accessible and legible City centre destination.

The City Growth Plan for the whole of the Karratha townsite nominates 35 key elements, of which only one applies directly to the study area. This element is effectively the creation of a continuous East-West route through the central axis of the study area which can accommodate a future bus route and cycle route. Specifically, for this area the KCN recommends:

Construction of missing links to form a continuous single carriageway road link between Bathgate Road and Maitland Road through the town centre; - KCN 4.4.2.3 An Integrated Movement Network Pg 109

The KRS supports this core initiative and aspirations of the KCN by proposing the following:

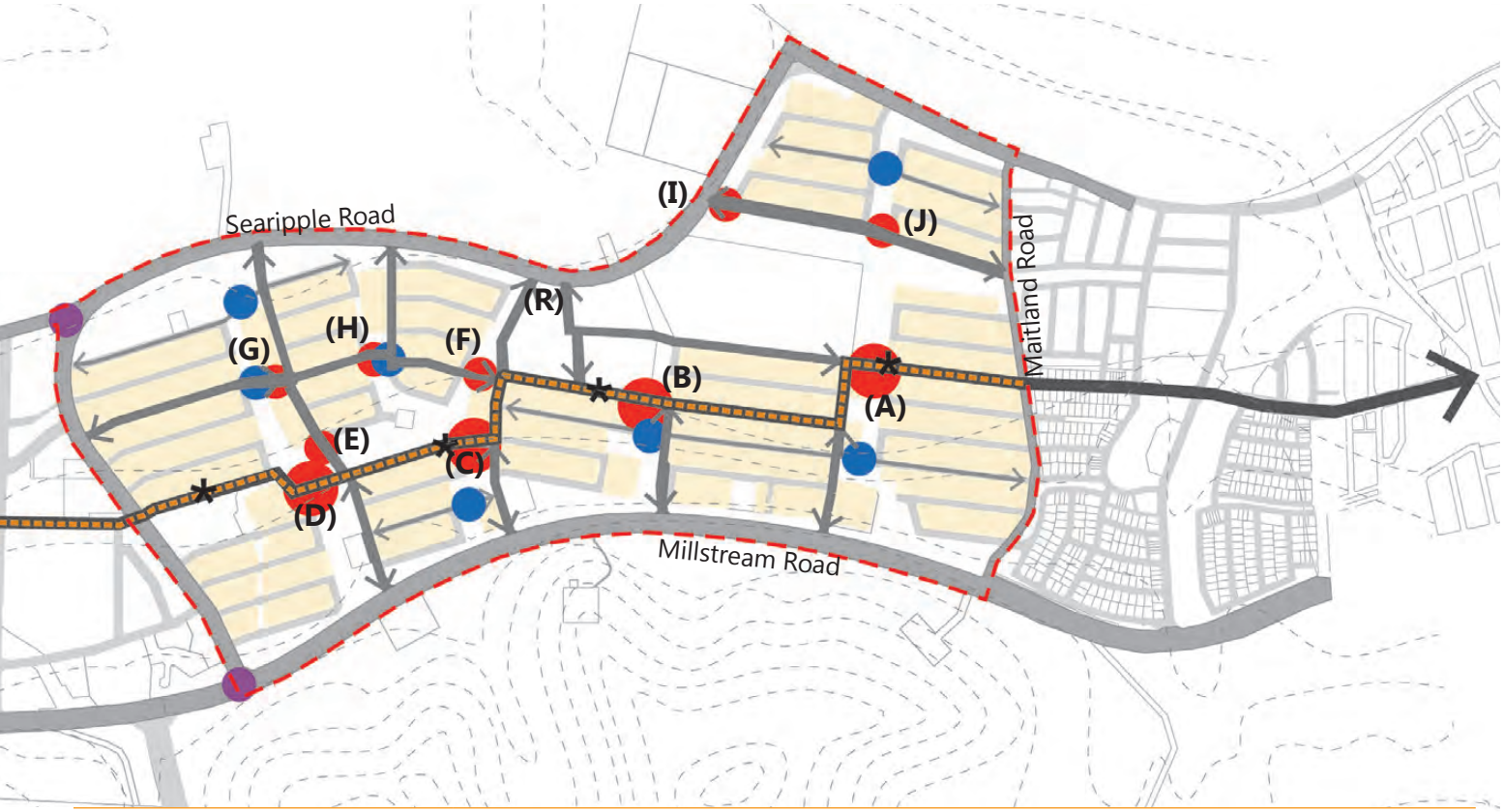
1. Establishment of a continuous East - West connection linking all 3 suburbs with the City centre (via DeWitt Road) and into Mulataga.

2. Consideration of a Future Public Transport Bus Route.

3. General improvement of connectivity within and between the suburbs and City centre.

4. Additional studies have also demonstrated the necessity for improved evacuation routes from flooded areas.

5. Consideration of formalizing some informal connections across swales



Link	Alternative Flood Evacuation Route	East West Thread	E/W Links	N/S Links	Future Bus Route	Improvement Area
Bulgarra						
(A) Hunt Way to Andover Way		✓	✓✓		✓✓	7
(B) Turner Way to Emma Street		✓	✓✓		✓✓	1
(C) Viveash Way to Samson Way		✓	✓✓		✓✓	1
(D) Wellard Way to Viveash Way		✓	✓✓		✓✓	3
(E) Finnerty St to Nairn Street	✓			✓		3
(F) Hall Street to Turner Way	✓		✓			1
(G) Withnell Wy to Lewington Wy	✓✓		✓			9
(H) Lewington Way to Hall Street	✓✓		✓			9
(I) Harding Way to Searipple Road	✓✓		✓			11
(J) Elliot Way to Harding Way	✓✓		✓			11
Pegs Creek						
(K) Balmoral Rd to Frinderstein Wy	✓	✓	✓✓		✓✓	5
(L) Frinderstein Way to Cossack Rd	✓✓	✓		✓	✓✓	4
(M) Demetre Cres to Dodd Court		✓	✓		✓✓	4
(N) Galbraith Rd to Demetre Cres.		✓	✓		✓✓	4
(O) Hyde Road to Demetre Cres	✓✓			✓		4
(P) Bond Place to Galbraith Road	✓✓			✓		6
Millars Well						
(Q) Allen Court to Atkinson Way	✓		✓			15
Development Sites						
(R) Bulgarra: Searipple Road to Turner Way (south) and Hunt Way (east)	✓		✓	✓		1
(S) Millars Well: Tilbrook Place to Teesdale Place	✓			✓		2

Table 5.3 - Movement Network Improvements

Improving Connectivity

In order to improve connectivity, a range of new east-west and north-south connections are proposed as part of the KRS (see Figure 5.4 and Table 5.3).

The connections proposed have been defined in accordance with the following criteria:

- Provide alternative flood/ evacuation routes for residents;
- Maintain the integrity of crucial green links/ open space and drainage channels;
- Improve connectivity between adjacent residential cells, and the study suburbs and the City centre to help reduce vehicle hours travelled and vehicle kilometres travelled;
- Formalising some 4WD 'desire lines' across swales as swale connections.
- Possibly provide some relief to existing arterials forecast to attract significant additional traffic volumes in the short-medium term;
- Leverage off existing roads to minimise future capital works;
- Define an efficient route for possible future bus services;
- Build new infrastructure as part of the redevelopment of key sites; and
- Understand that cashflow will require staged implementation.

East West Link

Karratha Terrace, between Balmoral Road and Searipple Road, is planned to be constructed as part of the Karratha City Centre Infrastructure Works Project.

Once the missing connections (shown as large red circles in the plan) are constructed, an alternative east-west link would extend from Bathgate Road to the west to Maitland Road to the east.

A new east-west link may operate as a Neighbourhood Connector (B) attracting between 1,000 and 3,000 vehicles per day. It would therefore function as a reasonable release valve for other established distributor roads. This traffic load is unlikely to be experienced for some time, however given the connection would be constructed in stages and not provide a direct path of travel.

Future stages of the project will need to determine:

- Capital costs associated with construction of each piece of infrastructure;
- Specific timings for construction; and
- Specific carriageway designs

Potential Traffic Growth

While previous modelling forecasted growing traffic congestion, out-dated demographic data was used to derive vehicle trip demands. A refresh of demographic forecasts as part of the revitalisation strategy project shows that growth is not occurring at the rate anticipated previously and is likely to continue at a lesser rate over the short-medium term. Consequently, congestion and network performance issues may be deferred.

Recommendations:

- Further study is required to solidify the case and inform timing/ staging requirements for network upgrades.
- Duplication of Balmoral Road appears to be the most likely upgrade required in the next 5-7 years.

Public Transport

Community input during engagement was relatively lukewarm regarding a regular bus service operating through the study suburbs and so there appears to be relatively low perceived need for such a service at this time. However, public transport is considered to be a critical component of successful and vibrant activity centres and communities and is central to the long term KCN vision for the study area.

Recommendations:

- Revitalisation of the suburbs should set the context for a future bus services. Bus-enablement is therefore a key part of an integrated movement network.
- A logical route for buses and some provisional stop locations are shown in Figure 5.5 which builds on the Transit Plan prepared for the Karratha City Centre Infrastructure Works Project. This route is dependent on the East-West Link connections being implemented. The plan is subject to review and endorsement by the Public Transport Authority.

Intersections

A number of intersections are proposed to be upgraded/ modified as part of the Karratha City Centre Infrastructure Works Project. These include:

- Conversion of Balmoral Road/ Dampier Road to left-in/ left-out;
- Conversion of Hillview Road/ Dampier Road to left-in/ right-in/ left-out;
- Upgrade of DeWitt Road/ Dampier Road to traffic signals;
- Construction of Bayview Road between Balmoral Road and Searipple Road as single carriageway; creation of T-junctions at Balmoral Road/ City North Boulevard and Searipple Road/ City North Boulevard with traffic control to be determined; and
- Upgrade of Searipple Road/ Dampier Road/ Millstream Road to traffic signals.

There are no specific timings attached to any of these works; however, all are anticipated to be completed in the next five years and may occur in the order specified.

Relevant references include *Dampier Highway Streetscape Upgrade Project (*CODA March 2012). This document identifies principles to guide good design, starting plant selection and schematic concept design for Dampier Highway, nodes - rest areas and verge treatment.

Speed Zones

Recommendations:

- Existing speed zones are proposed to be retained.
- Some speed zone changes may occur as part of the Karratha City Centre Infrastructure Works Project.
- There is no support currently from the City or residents for a permanent reduction to the speed limit on all local roads to 40 kph.

Future Considerations:

- Reduced speed limits of 50 kph on Balmoral Road East and Searipple Road north of Dampier Road may also be considered as part of future stages of work.
- Reductions to the speed limits on Bathgate Road and Broadhurst Road from 60 kph to 50 kph may be considered. This would be subject to some densification to Millars Well and Pegs Creek, potential for these roads change in character (e.g. become more suburban rather than through roads), and an increase in crossing demands (particularly by pedestrians and cyclists).

Shared Path Network

Implementation of the *City's Future Works Report (Footpaths) 2013-2023* is supported and is regarded as essential in underpinning the core KCN principles of a walkable, connected, sustainable and healthy city.

Recommendations:

- An additional section of footpath along Andover Way in eastern Bulgarra to complete the cycle / pedestrian component of the East-West Link.
- Additional sections of footpath on the NS route of Nairn St and Finnerty St in western Bulgarra as a part of upgrades to this area.
- Ensure that any new streets/ linkages have a footpath constructed on at least one side; paths should integrate with existing infrastructure or precipitate investment in new infrastructure so no facilities are isolated from the network;
- Completion of the shared path along Dampier Road between Bathgate Road and the City Centre given this is a key desire line;
- Improving crossing provisions over Dampier Road at Broadhurst Road, given current facilities are inappropriate for the traffic environment.
- Special consideration to the crossing connecting Millars Well and Pegs Creek with Karratha High School and the Leisureplex. The improvement may entail signalisation of the intersection of Broadhurst Road and Dampier Road;
- Annual review of the proposed implementation timetable of the *Future Works Report (Footpaths)* report should be undertaken to ensure that the roll out of new pathways synergises with other public amenity and movement network upgrades proposed by the KRS.

Fording the Streams

There are several locations where informal crossing points have been formed through unregulated 4WD access across drainage pathways. These informal crossings can lead to significant erosion of banks and destruction of vegetation. Where this has occurred, consideration should be given to the construction of bridge crossings or less formal ford type structures formed from concrete or rock which allow for crossing to occur without a significant infrastructure cost. These should be designed to minimise the velocity of flow and would require signage to inform of potential flood risk and clearly identify water depth.

5.5 Streetscape Improvements

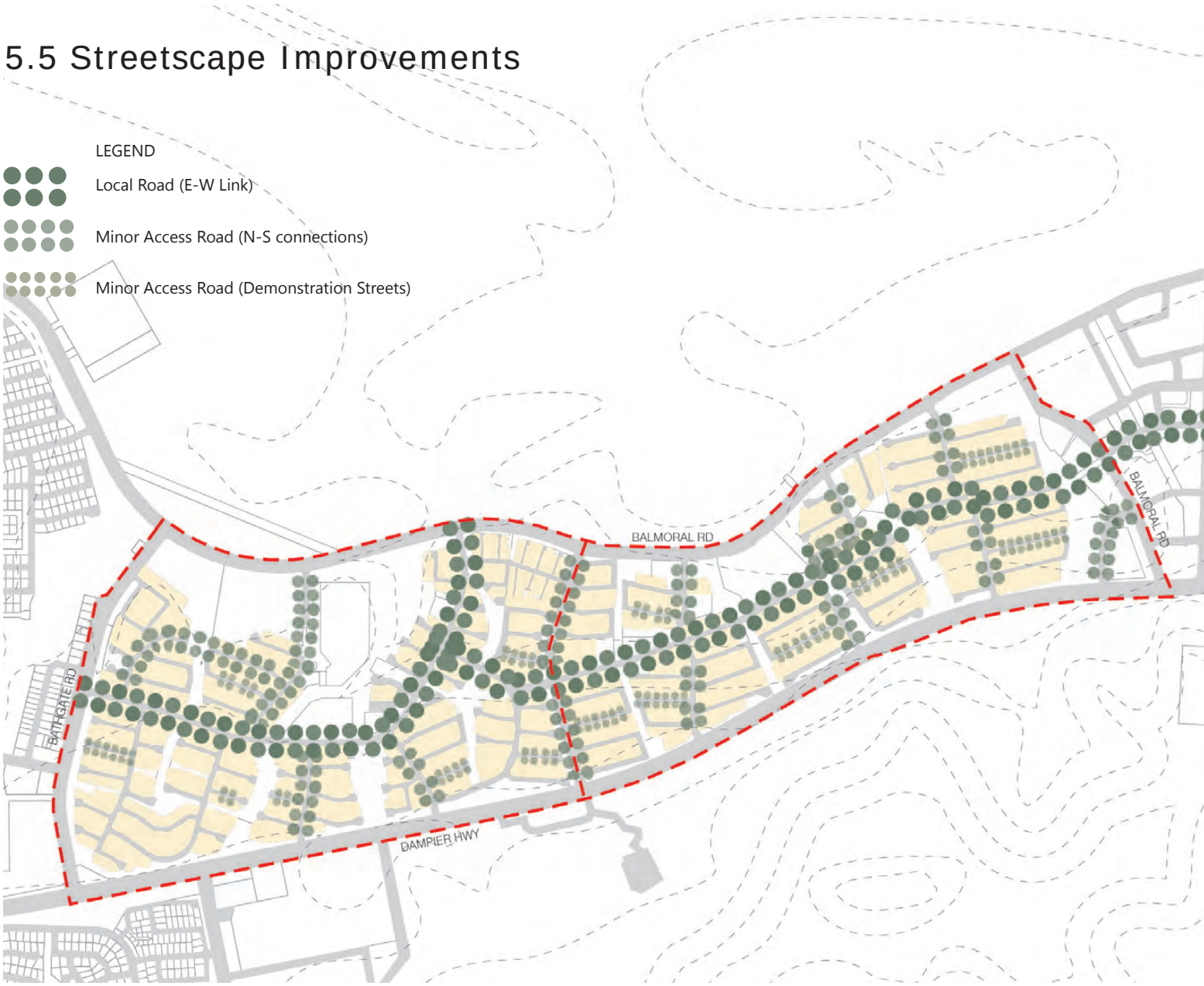


Figure 5.5 - Streetscape Improvements

The strategy for streetscape improvements comprises the following objectives from the KCN:

- A network and hierarchy of streets and public spaces that provide permeability and legibility;
- An integrated movement network that ensures the safe movement of pedestrians, cyclists and vehicles; and,
- A 'place' based response that reflects the climate, context and site.

The KRS supports the core streetscape initiatives and aspirations of the KCN by proposing the implementation of the following green links along:

- Local Road (east west link);
- Minor Access Road (north south connections); and,
- Minor Access Road (demonstration streets).

The intent of this strategy is to improve amenity within streetscapes by;

- Strengthening street hierarchy to enhance sense of place and reflect the existing unique Karratha landscape character;
- Maintain the integrity of crucial green links/ open space and drainage channels;
- Improve connectivity and legibility to community facilities and City centre; and,
- Foster a shared responsibility for maintenance of streetscapes.

East West Link

In order to improve pedestrian and vehicular connectivity, a range of new east-west and north-south connections are proposed as part of the KRS.

North-south connections are primarily to link neighbourhood cells with a short route to the main north and south distributor roads, being Balmoral/ Searipple and Dampier Roads respectively.

The streetscape recommendations aim to enhance the 'spine' through the study suburbs. It is recommended this 'spine' becomes a 'low key' green link between neighbourhoods encouraging a slow traffic environment and pedestrian scale through the establishment of a street tree planting program.

A pedestrian scaled green east-west link will add enormous value to the character of these suburbs. The central link will provide amenity from where neighbourhood revitalisation can grow.

Refer to figure 5.5.1 and 5.5.2 for diagrams on suggested treatments to east west link through residential and residential / POS areas.

It is recommended that the City of Karratha take the lead on promoting the green link along the east-west link by undertaking a street tree establishment program. Refer to Section 6 – Implementation for further information on identification of improvement areas, implementation actions and associated time frames.

Relevant references include *Dampier Highway Streetscape Upgrade Project (*CODA March 2012). This document identifies principles to guide good design, starting plant selection and schematic concept design for Dampier Highway, nodes - rest areas and verge treatment.

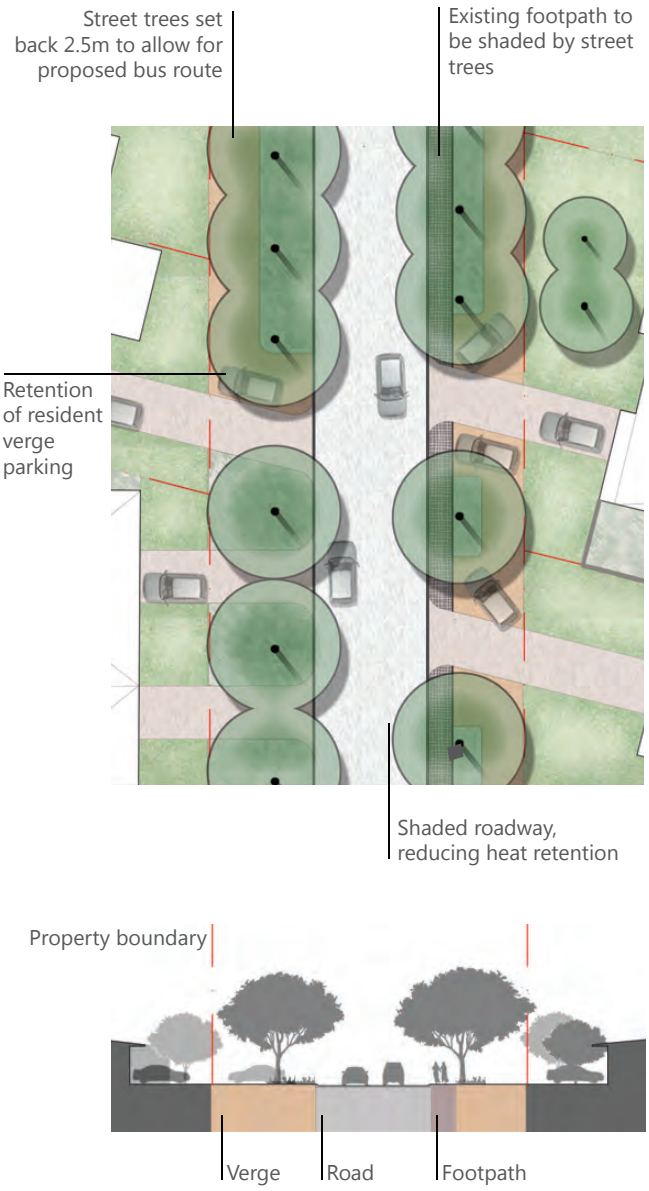


Figure 5.5.1 - The East-West Link - Residential

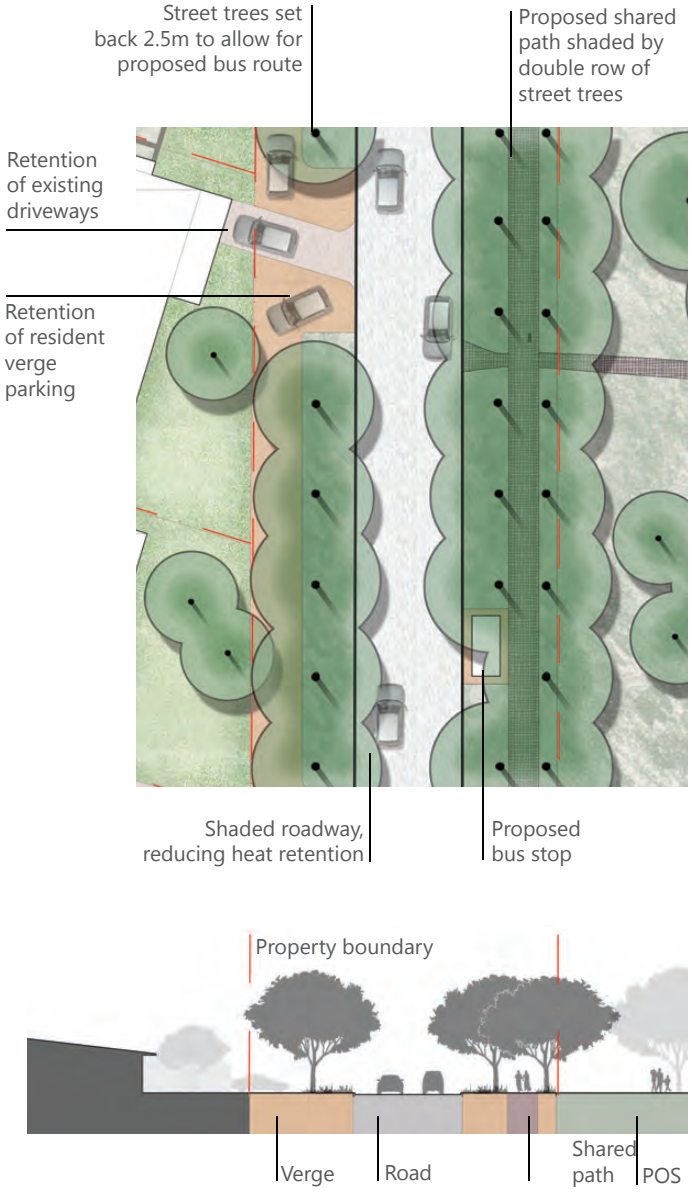


Figure 5.5.2 - The East-West Link - Residential & POS

Local Streets

Local Streets traverse neighbourhoods creating linkages within and between the subject suburbs and are primarily fronted with residential properties. These streets still form the route to specific destination points and therefore have a strong influence upon the character of a suburb to visitors and residents. Medians are rare on these roads, however the verges are often spacious and provide residents with a buffer from traffic, allowing good tree planting opportunities.

Strengthening the 'vein network' through tree planting will improve way finding, provide shade and climatic protection and increase the pedestrian scale of spaces. It is desirable that the front verges are irrigated by residents, with supplementary irrigation to the street tree by the City of Karratha if required.

This strategy identifies Local Streets to include:

- The completed East-West Link;
- Several North-South Links;

These roads are clearly identified in Figure 5.6

Recommendations:

- City of Karratha to take the lead regarding improvement of verges on local streets. Priority Streets in each Improvement Area are identified in Fig 5.5. A demonstration street in each suburb can be undertaken as a 'quick win' and as a precedent to test and verify species choice, details, management etc.
- Link Local Street implementation to the delivery of the *Footpath Future Works Plan* to increase pedestrian amenity and liveability by promoting shaded and protected walkways.
- Consider opportunities for irrigation in priority streetscapes with high quality recycled wastewater from the Karratha Effluent Reuse Scheme.
- Principles for street tree planting are evident in Figures 5.5.1 and 5.5.2

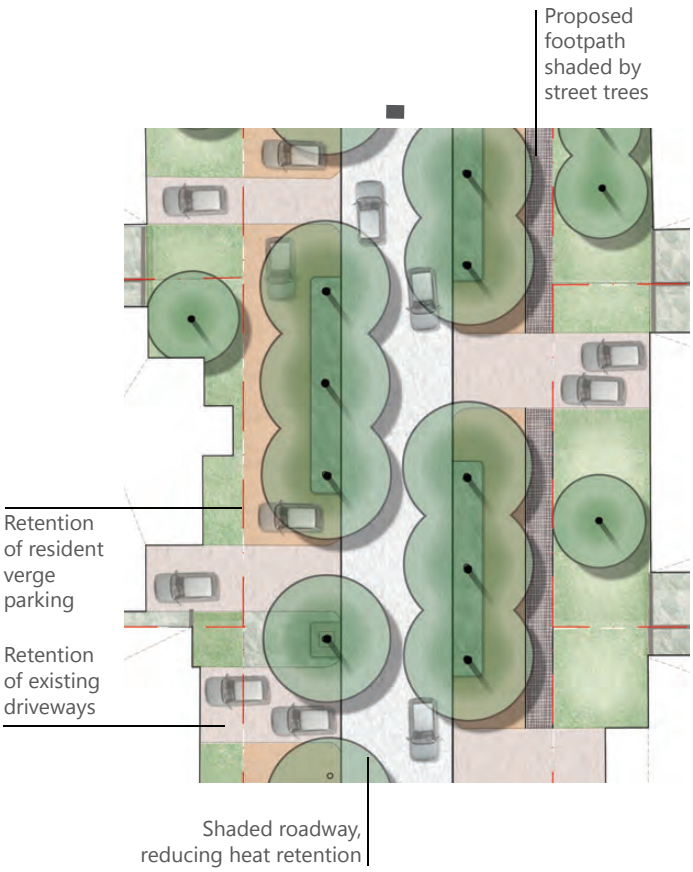


Figure 5.5.3 - Minor Access Road (Residential)

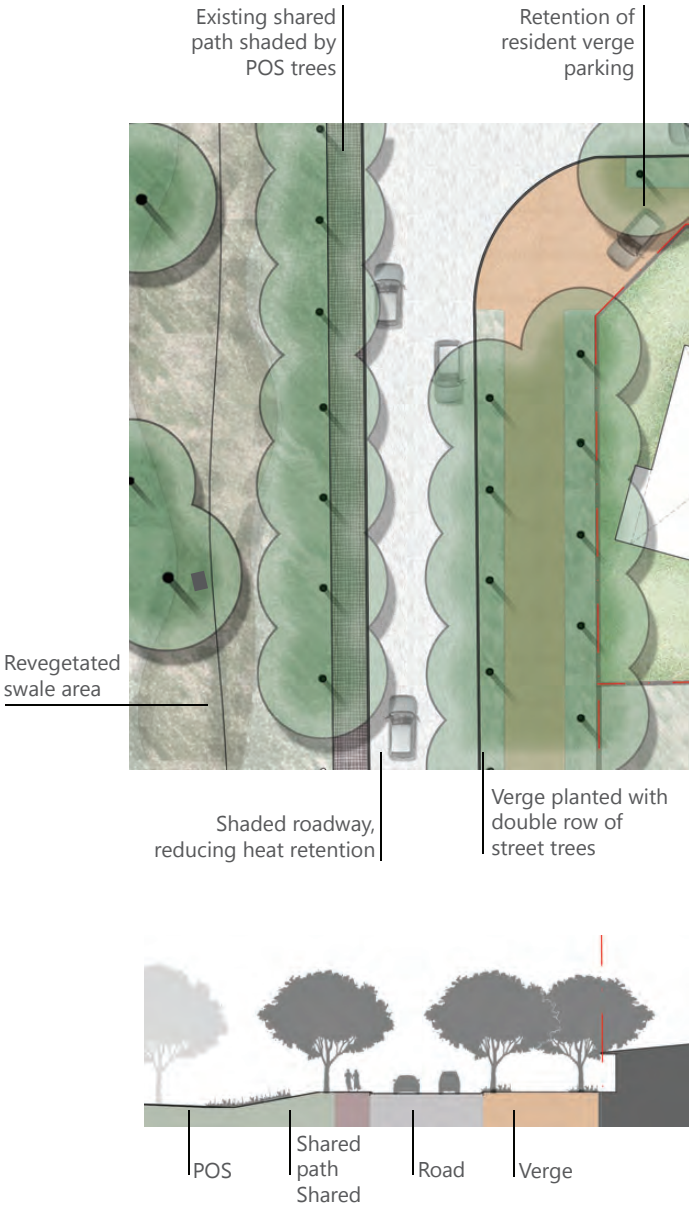


Figure 5.5.4 - Minor Access Road - Single Loaded

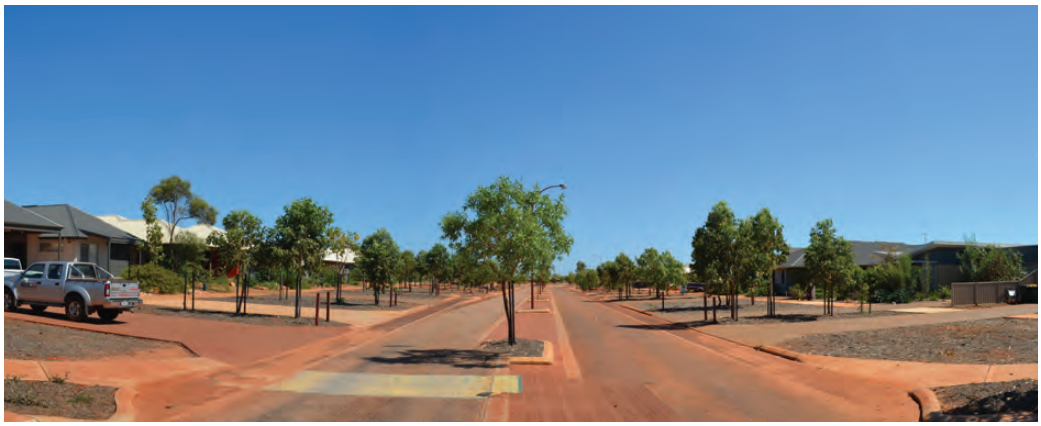
Minor Access Roads

Minor Access streets comprise the fine grain of the transport network and are often final destination points for traffic. These streets provide a sense of 'home' to residents and can have strong personal association and sentiment.

The intimate scale of the streets requires smaller trees and enhances opportunity for the appreciation of the ornamental features of trees e.g. flowers, trunk, leaf colour etc. There is restricted opportunity on public land (conflict between location of tree and services) therefore opportunity exists to encourage the contribution of private landowners by planting trees on their land.

Recommendations:

- Development of verge guideline brochures for the community to assist planting and maintenance of private verges;
- Work with the community to develop engagement programs and encourage shared responsibility towards the verge. Maintenance of lower species, weeds and irrigation to be undertaken by owners, whereas maintenance of street tree to be undertaken by City; and
- Key streets within each Improvement Area to be undertaken as demonstration projects to promote neighbourhood incentives amongst further streets.
- Principles for street tree planting are evident in Figures 5.5.3 and 5.5.4



Example of similar east west linkage of Madigan Road in Broome and right canopy of suggested suitable tree species, Delonix regia.

Example of planting which provides shade along local connector streets.

Example of native planting along minor access streets.

Suggested Tree Species

The following list of tree species are intended as a starting guide only.

East West Link

Delonix regia
Royal Poinciana
12m H x 6m W

Peltophorum pterocarpum
Yellow Poinciana
8 - 15m H x 8-12m W

Local Streets

Cupaniopsis anacardioides
Tuckeroo
8-15m H

Mimusops elengi
Spanish Cherry
16m H

Terminalia catappa
Indian almond
9 - 12m H

Tipuana tipu
Rosewood
8-15m H x 8-10m W

Minor Access Roads

Eucalyptus alba
White Gum
5 - 15m H

Eucalyptus victrix
Coolibah
12 - 22m H x 7m W

Melaleuca leucadendra
Cajeput
10 - 14m H x 8-10m W

5.6 Swale & Drainage Improvements

Figure 5.6 - Swale Improvements

Swale Upgrades

The drainage swales have a significant role in providing diverse open space amenity and defining the character of the older suburbs of Karratha. In addition to their primary drainage function, the amenity provided by swales includes:

- Green linear buffers within the suburbs
- Gateway and wayfinding device between suburbs
- Endemic ecological corridor;
- Provide views out from the suburbs towards the Pilbara landscape - Karratha Hills; and,
- Highly used informal and formal circulation networks for the local community.

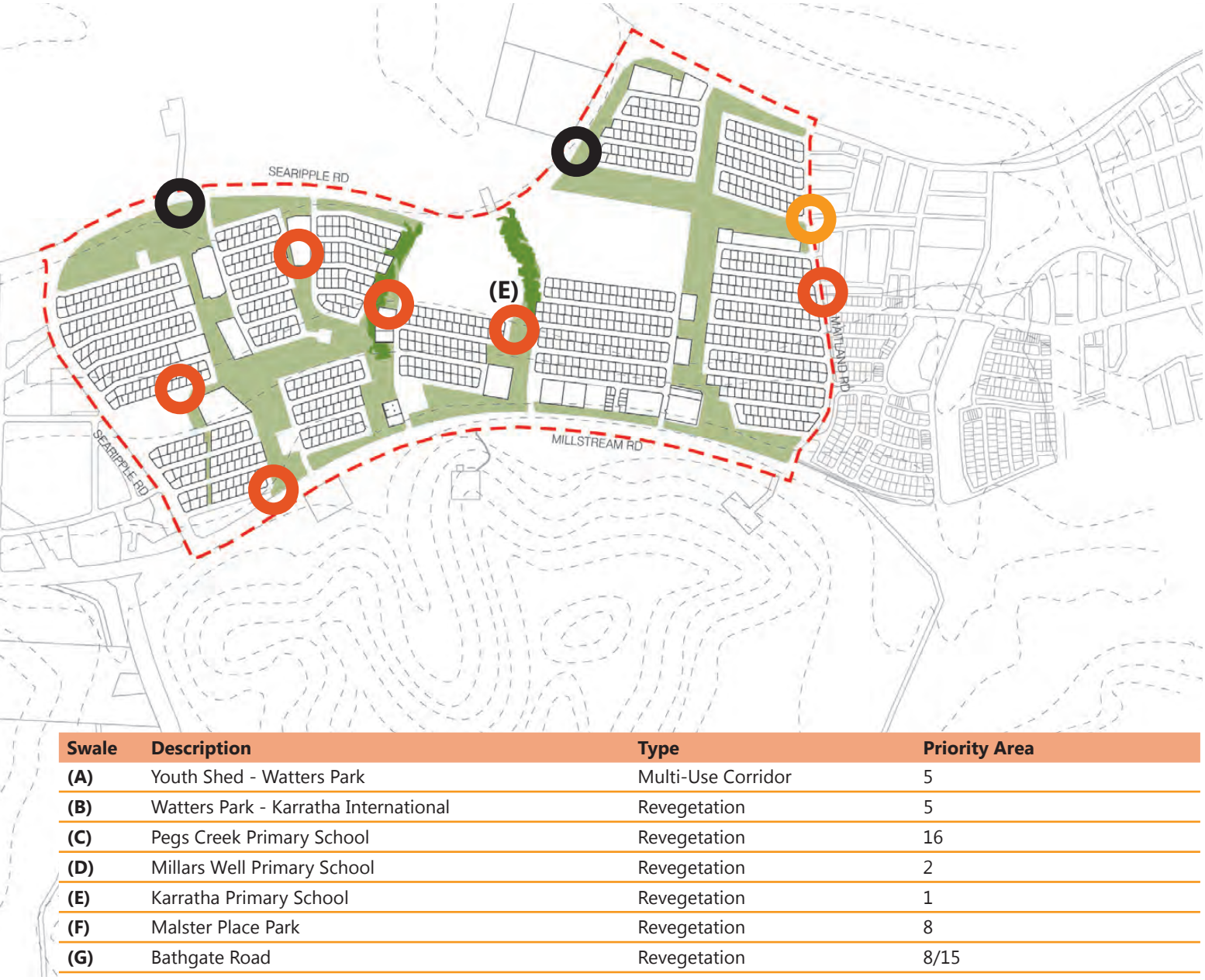
Swales are dominated by Eucalyptus victrix which offer a shady respite to the harsh Pilbara climate. It was observed that the quality of swales is associated with level of tree cover, the best of which can be found in Bulgarra. As a generalisation the quality decreases when moving further west towards Millars Well.

The KCN states that:

".....utilising the flow of water through the town as an asset, allowing it to add value the urban environment and landscape as it flows from the Hills into Nickol Bay will be a significant shift in the approach to water management. Karratha's drainage reserves would become key public places and conduits for movement within the community, landscaped to provide shade, shelter and areas for respite. Therefore, the flow of water ceases to be treated as a problem but as a solution to a variety of needs." - KCN 3.2.1.7 Sustainable Living Pg 88.

Integrated Stormwater & Flood Management

The strategy for storm water and flood management considers and responds to the following KCN objectives:



Swale	Description	Type	Priority Area
(A)	Youth Shed - Watters Park	Multi-Use Corridor	5
(B)	Watters Park - Karratha International	Revegetation	5
(C)	Pegs Creek Primary School	Revegetation	16
(D)	Millars Well Primary School	Revegetation	2
(E)	Karratha Primary School	Revegetation	1
(F)	Malster Place Park	Revegetation	8
(G)	Bathgate Road	Revegetation	8/15

Table 5.4 - Priority Swales

- Protection of significant natural ecology and landform;
- Prevention of pollution and erosion from storm water;
- Retention of predevelopment water balance; and
- A place based response that reflects the climate, context and site.

There are no district scale drainage improvements or upgrades currently proposed by the KRS. However, it is recognised that there are sites in the City which are currently subject to flooding from the drainage system that have previously been under consideration for development. These sites are currently critical to the function of the drainage system and where their development is seriously entertained detailed consideration of the potential impacts of development must be undertaken to consider:

- Management of any increases in rainfall runoff resulting from development;
- Management of any increases in flood level both up and downstream resulting from development; and,
- Consideration of district scale works to provide overall improvements to the efficiency of the drainage system.
- Investigations should be undertaken to determine the drainage modifications that could be introduced to reduce flood risks, model those modications and cost preferred modifications.

Figure 5.6.1 - Existing drainage reserve

Figure 5.6.2 - Example of Pilbara creekline

Figure 5.6.3 - Existing photo of Cattrall Park 2009

Figure 5.6.4 - Cattrall Park Multi Use Corridor

Figure 5.6.5 - Existing random vehicle tracks

Figure 5.6.6 - Potential flood causeway treatment

Drainage System Flooding Effects

Preliminary review of flood modelling carried out in consideration of the Lazy Lands development sites indicates that there are a number of potential upgrades and improvements that could be undertaken to facilitate development of these sites and generally improve the performance of the drainage system during major flood events.

These improvement opportunities, which should be further investigated and refined where development of flood constrained lots is considered, include:

- Possible major upgrades to culverts and bridges along Searipple road and Balmoral Road; and,
- Investigation and mitigation of locations where significant breakout flows occur.
- Further investigation on drainage system upgrades including costings. Consideration should be given prior to seeking developer contributions to ensure the needs are justified as reasonable.

In addition to these opportunities it is also important to recognise that the development of Mulataga and associated drainage works is expected to significantly improve the flooding that is currently predicted to occur in the eastern end of Bulgarra.

Storm surge influences

As well as the areas subject to flooding from the drainage system there are substantial areas where 100 year and 500 year coastal storm surges are predicted to cause inundation. These areas are generally remote from the direct 'erosive' effects of these storm surges. This means that development could potentially be allowed in these areas given an appropriate response to the predicted flood level. This could be achieved through the use of stilts and/or fill to elevate habitable areas in accordance with the City of Karratha's Storm Surge Risk Policy (DP-19).

Enhancing the value of drainage swales

Karratha has an existing drainage system that works with the natural topographic and hydrographic features of the City to provide flood protection to the community. The result of these features is a network of wide drainage reserves based around natural creek lines augmented, where necessary, with constructed drainage swales. In addition, the suburbs have been constructed with lots generally elevated from roads provided with high kerbing such that the roads can themselves act as surface water flow paths during large rainfall events.

The need to minimise mosquito breeding habitat in built up areas often leads to drainage systems designed to maximise efficient conveyance in all rainfall events. This has led to straight, trapezoidal drainage pathways with minimal vegetative cover.

It is important to note that there are also substantial natural mosquito breeding areas around Karratha including swamps, wetlands and mud-flat areas. Improving the water quality and overall ecological health of these areas including maintenance of healthy populations of mosquito predator species is a critical part of mosquito management. Many mosquito species are highly adaptable and as such are less affected by environmental degradation and change than their predators. They are also highly effective at re-establishing following eradication, meaning that their populations recover far faster than predator species when an environmental impact has occurred.

The key objectives for drainage systems to support improvement the ecological health of these areas are:

- Minimise sediment and contaminant mobilisation and deposition, which prevents positive flow and increases the presence of stagnant pools;
- Maintain water temperature within natural ranges; and,
- Establishing vegetative cover through drainage swales helps to prevent soil erosion, improves amenity and can assist with achieving improved water quality and ecological outcomes.

Encouraging a naturally vegetated swale can be used to create a less efficient low-flow pathway within the drainage swale, whilst maintaining its conveyance capacity for large flood events. As with a natural Pilbara creek line the appropriate vegetation can then provide additional benefits as follows;

- Improved erosion and sediment control;
- Water temperature and ambient temperature control;
- Provision of shade amenity and a green buffer within the urban fabric;
- Improved mosquito control; and,
- A substantial reduction in maintenance requirements and resources.

Recommendations:

- The revegetation and restoration of priority drainage swales. To consider lessoning the existing maintenance practice and recognise these swales as natural creek lines with the potential to significantly improve ecological and social outcomes in Karratha. Gap Ridge Industrial Estate is the best example of draining reveg within the area;
- Creation of active and passive recreation areas ("Multi-use Corridors")where appropriate;
- Development of hydraulically constrained sites as well as other sites adjacent to drainage swales must be undertaken in a way that considers the current and future hydrological, ecological and social functions of the drainage system; and
- Formalisation of some informal vehicular crossings.
- Relevant references include *Dampier Highway Streetscape Upgrade Project (*CODA March 2012).

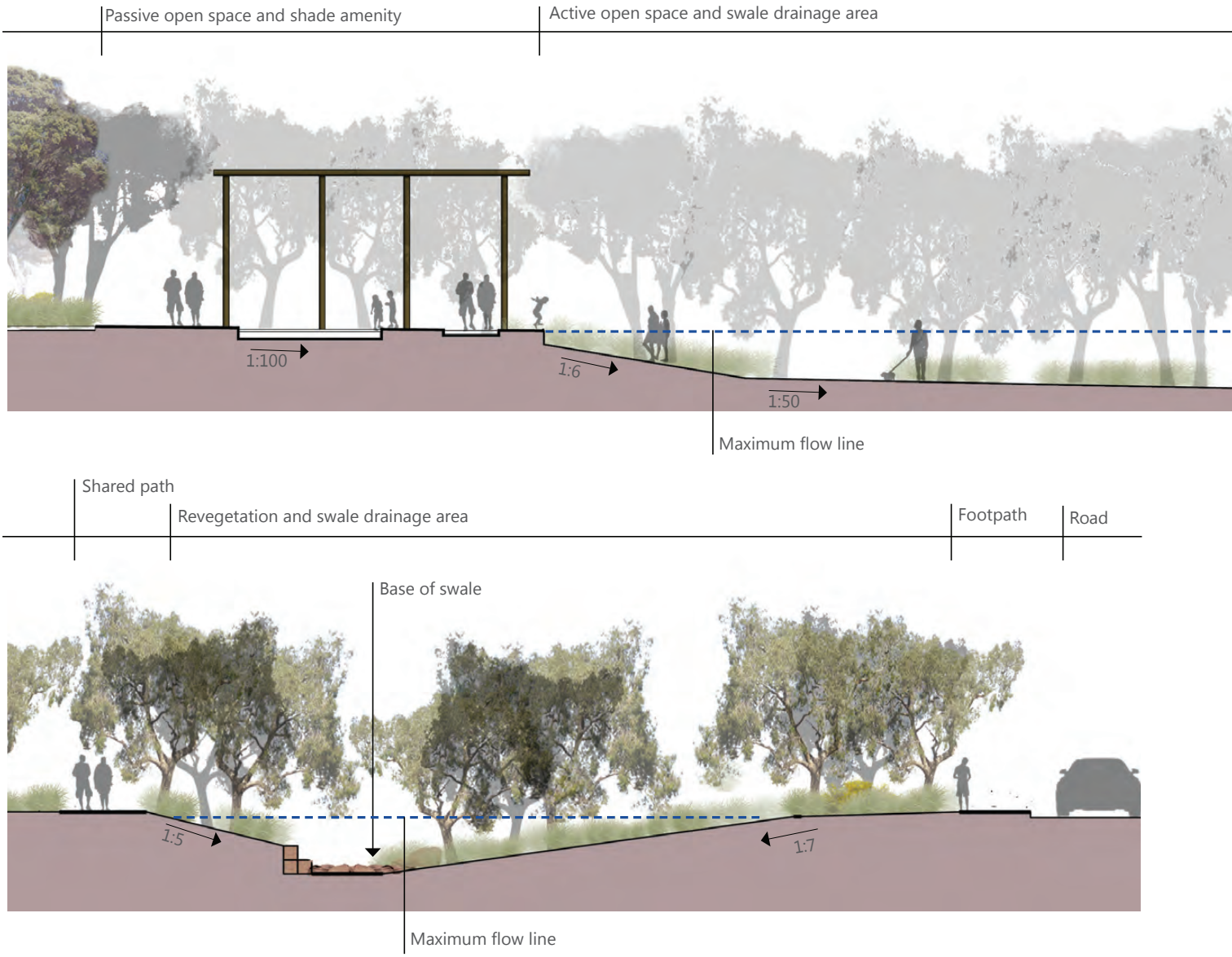


Figure 5.6.7 - Swale sections

Priority Swales

Given the extent of the drainage swales across the subject suburbs it is not feasible or appropriate from a maintenance perspective to undertake improve works across all areas. Therefore priority swales have been identified and discussed throughout the engagement phase.

Recommended priority swales are:

- **Swale linking Karratha International the Youth Shed and Watters Park.** The City of Karratha have budget allocated for landscape works to link Watters Park and the Youth Shed, however it is suggested this is further extended to include revegetation works to connect this key hub to Karratha International. As well as being a strong community hub and close to the City centre this is a highly visible area from Dampier Highway.
- **Swale adjacent to Pegs Creek Primary School**. It was noted during the engagement phase there is opportunity to encourage involvement of existing community groups including the Pegs Creek Primary School in the implementation of swales. Priority should be given to area adjacent to the Primary School and areas adjacent to the proposed east west road connection. Early engagement and involvement of Pegs Creek Primary School should encourage shared responsibility via input during the planning phase, assistance in implementation e.g. school / community planting and maintenance days.
- There is also opportunity that a similar approach may be possible to parts of the swales located near **Millars Well Primary School** and **Karratha Primary School,** as well as, community involvement in improving swales connections to Malster Place Park.

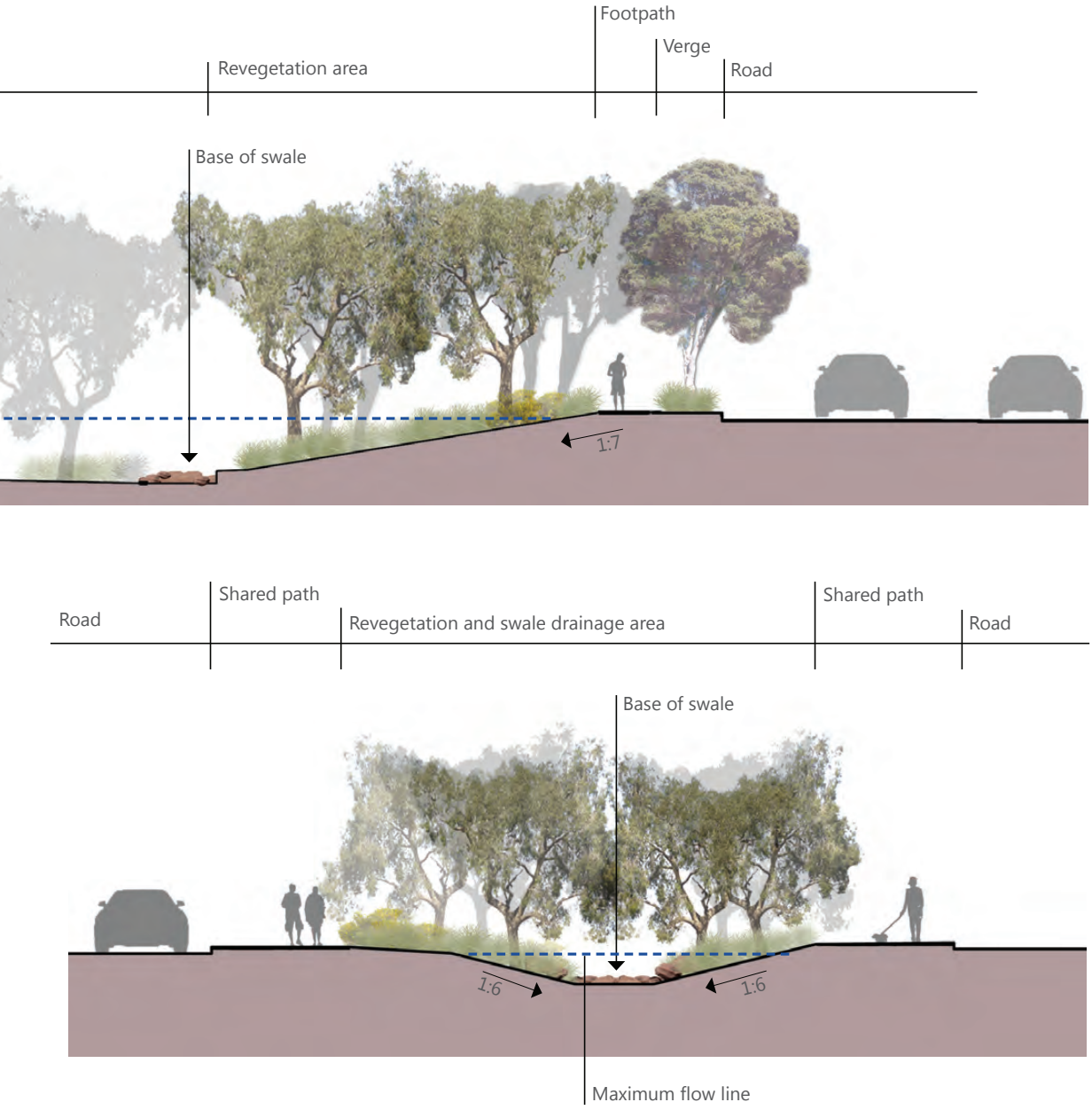


Figure 5.6.8 - Swale sections

- The swale along **Bathgate Road** has also been identified as a priority, due to its function as a major north south thoroughfare. Street tree planting and revegetation to the swale will play a significant role in improving the neighbourhood character, way finding, offering shade and pedestrian scale, as well as screening of the colour bond fences of properties which back onto the area.

In addition to the landscape works proposed around the Karratha Youth Shed the City is also undertaking a pilot project to seed the swale from Cattrall Park to Dampier Hwy. It is recommended that this revegetation approach should be monitored and evaluated. If effective, this larger scale revegetation approach could be undertaken on other priority swales including Bathgate Road, southern ends of swales extending to Millars Well Primary School, Pegs Creek and Karratha Primary School.

5.7 Parks Improvements

Figure 5.7 - Park Improvements

Park Amenity

There is no comprehensive data on usage of the parks within the City or the study area.

In 2011, the Council commissioned a residents' survey regarding all of the parks in the City (Public Open Space Survey Analysis, Geografia, October 2011). This provides some guidance on user attitudes, although the survey had a limited circulation and response rate, and the authors indicate there was a bias towards stay-at-home mums with 5 years+ residence in the City. The results indicated:

- Respondents were willing to walk up to 1km (15 minutes) to a quality park.
- Most walk or drive to parks, and spend more than 30 minutes there.
- There was general satisfaction with the quantity of parks provision, but lower satisfaction with the quality of the parks.
- There was a strong preference for better quality parks over more parks.
- There was a strong desire for more shade, playground equipment, benches, trees, grassed areas and parking.

Key Considerations

- Some existing parks are unfit for purpose as they are not readily accessible, lack amenity, are relatively close to other more useable or potentially more useable parks, have poor security, and/or appear to be not well used;
- Drainage swales provide a safe flow path for stormwater during infrequent flood events and are a key element of the "open" landscape character of the study area; However, the swales are not part of the formal parks system and require substantial maintenance;
- Apart from those parks in the study area, there are many other parks within the City that place demands on the Council's capital and maintenance budgets. Major facilities include: Tambrey Park and Oval, Baynton West Oval, the planned Nickol West soccer

field, a proposed shared playing field with Mulataga primary school and the Leisureplex's multi-purpose playing fields, intended in part as a replacement for the Bulgarra Oval's soccer field ('KEC oval');

- Insufficient council funding/resources and/or water resources are likely to be available to improve and maintain all existing and planned parks to a high standard with a wide range of facilities in accordance with the City's Parks Hierarchy. One possible strategy to improve open space outcomes is to concentrate efforts on the best located, sized, shaped parks. i.e. less, but better quality parks, combined with improved management of the other parts of the open space system and public realm that are not managed as formal parks by the City. These include drainage swales, natural areas and street verges;
- Results from the 2011 Geographia residents' survey and community consultation indicate that many residents have a preference for better quality parks and would be prepared to trade-off less well located parks if there was certainty that it would result in better quality parks in terms of location, facilities, design and maintenance;
- If some parks are closed and are able to be sold and developed for housing, then there is the advantage that Crown Recreation reserve sale funds, subject to government approval in accordance with Department of Lands Policy No. 4.1.5, could be applied to capital improvements of the remaining parks in the locality. In addition, more residential development will result in more rateable property and hence greater rate revenues with the consequence that the Council would have the ability to invest more capital in, and to better maintain, high quality parks and other public spaces in the study area (the State Government would also receive greater land tax receipts from additional properties that were subject to that tax); and
- Development of more housing within the established suburbs near the City centre would contribute to the wider economic, environmental and social goal of making better use of existing infrastructure and supporting the City centre, rather than creating new more distant subdivision areas.

Recommendations:

- Changes to the existing park system including closure of some parks and enhancement of others. This is in order to address a lack of amenity and facilities in some existing parks, which are also currently constrained by water availability, through the reallocation of resources to improve the remaining parks. Refer to Fig 5.7 and Table 5.5 for specific recommendations for existing and new parks.
- Expand and formalise "Scout Hall" Park into a Level 2 Passive Park featuring native plantings, and corresponding amenity. Park to be formed by Lazy Land sites P39 and P40 and the northern portion of P38. Incorporate provision for relocation of Rex Webb.
- Decommission Rex Webb Park, Ashton Way Park, Dodd Court Park, & Richardson Way Park.
- Minor upgrades and amenity additions such as improved shade, bbqs and seating to Bulgarra Oval, Kevin Richards Memorial Oval and Cattrall Park.
- It is noted that Cattrall Park is a commonly used park by the community. Cattrall Park although already one of the best parks in Karratha, has the 'bones' of being a 'great' park – a civic park that will attract people from the broader city. Stakeholder / community feedback noted there is opportunity to further improve this park by increasing shade. Further improvements could include additional and improved play equipment, public art, plantings and improved amenities.
- Consider opportunities for irrigation in priority parks with high quality recycled wastewater from the Karratha Effluent Reuse Scheme.

	Park	CoK Park Level Existing / Proposed	Park Use	Improvement Area	Recommendation	Description
Bulgarra						
(A)	Bulgarra Oval	1/1	Active Recreation	1	Improve	Playing fields
(B)	Scout Hall Park	3/2	Passive Recreation	3	Expand & Improve	Combine Lazy Land sites P38, P39 & P40. Formalise into new park. Irrigate using recycled water. Use mostly native planting. Upgrade to Level 2 Park. Provision for the relocation of Rex Webb Park.
(C)	Richardson Way Park	3/-	Local Park	14	Decommission	Close Park & Re-assign Land
(D)	Rex Webb Park	4/-	Link ark	10	Decommission	Close Park & Re-assign Land
Pegs Creek						
(E)	Watters Park	3/3	Local Park	5	Expand & Improve	Enhance Southern section and increase Park amenity
(F)	Dodd Court Park	3/-	Local Park	4	Decommission	Close Park & Re-Assign land
(G)	Cattrall Park & Pegs Creek Oval	2/2	Passive & Active Recreation	16	Minor Improvements	Improve Shade and increase park amenity
Millars Well						
(H)	Michael Lewandowski Park	3/3	Passive Recreation	2	Maintain	Elongated, passive linkage park
(I)	Kevin Richards Memorial Oval	1/1	Active Recreation	2	Minor Improvements	Playing fields and passive. Portion serves as primary school playing fields (agreement with Education Department).
(J)	Ashton Way Park	4/-	Linkage Park	15	Decommission	Close Park & Re-assign Land

Table 5.5 - Park Improvements

G - Cattrall Park
Improve shade and increase park amenity

B - Scout Hall Park
Supplement existing native planting

K - Malster Park
Improve existing play equipment

K - Malster Park
Improve grass and native planting

I - Park on Richardson Way
Suggested to be closed and reassigned

G - Cattrall Park
Suggestion to improve shade at Cattrall Park

6 Implementation

6.0 Avenues for Implementation

This Strategy aims to provide a framework for revitalisation of the suburbs of Bulgarra, Pegs Creek and Millars Well by providing recommendations to guide decisions on future planning, subdivision and development applications; the City's capital works programs governing maintenance of parks, pathways, roads and swales; and revegetation and amenity improvements. It is recognised that due to a slow-down in the Pilbara resources economy and consequently the Karratha housing market, the implementation of this strategy is likely to extend into the medium to longer term.

Key avenues for implementation by the City are as follows:

- Planning and development (rezoning, subdivision, development, redevelopment) – including requirements to be incorporated into the planning scheme (amendments), and development of supporting policy and design guidelines;
- Community planning (open space, recreation, facilities and landscape planning) – including assessment of community needs for facilities, engagement with community groups and development of marketing/informational material; and
- Infrastructure and asset management (asset management and operational plans) – including road maintenance; drainage upgrades; and parks maintenance and enhancement.

Although it is recognised that the City of Karratha will be responsible for the implementation of a large part of the Strategy, the support and participation of other stakeholders is still critical. Avenues to facilitate implementation include:

- Demonstrated leadership from the City through actions on council land; advocacy of agreed objectives and principles; and commitment to the delivery of the Strategy through incorporation of recommendations into the Strategic and Operational Plan;
- Partnerships with other agencies and facilitation of catalyst projects;
- Incentives;
- Community-led action; and
- Actions of landowners (individual lots).

Key recommendations, roles, responsibilities and timing are indicated in Table 6.1 on overleaf.

6.1 Stage 2 Initiatives

This draft Strategy completes Stage 1 of the Karratha Revitalisation project. It is anticipated that Stage 2 will result in the development of tools that are necessary to implement the Strategy recommendations. This may include:

- Development of text to support the preparation of an Amendment(s) to the Scheme;
- Guidance on important development elements including site cover, plot ratio and parking;
- More detailed guidance on preferred development outcomes in particular locations;
- Design guidelines for development within the strategy area to retain character;
- Development of a live traffic model to assist in the assessment of intersections and road linkages;
- Integration of the policy requirements and design response required for the management of storm surge flood risk;
- Better linkages to parks maintenance works including access to recycled water;
- Costed and prioritised works schedules; and
- Funding options and mechanisms

6.2 Improvement Areas

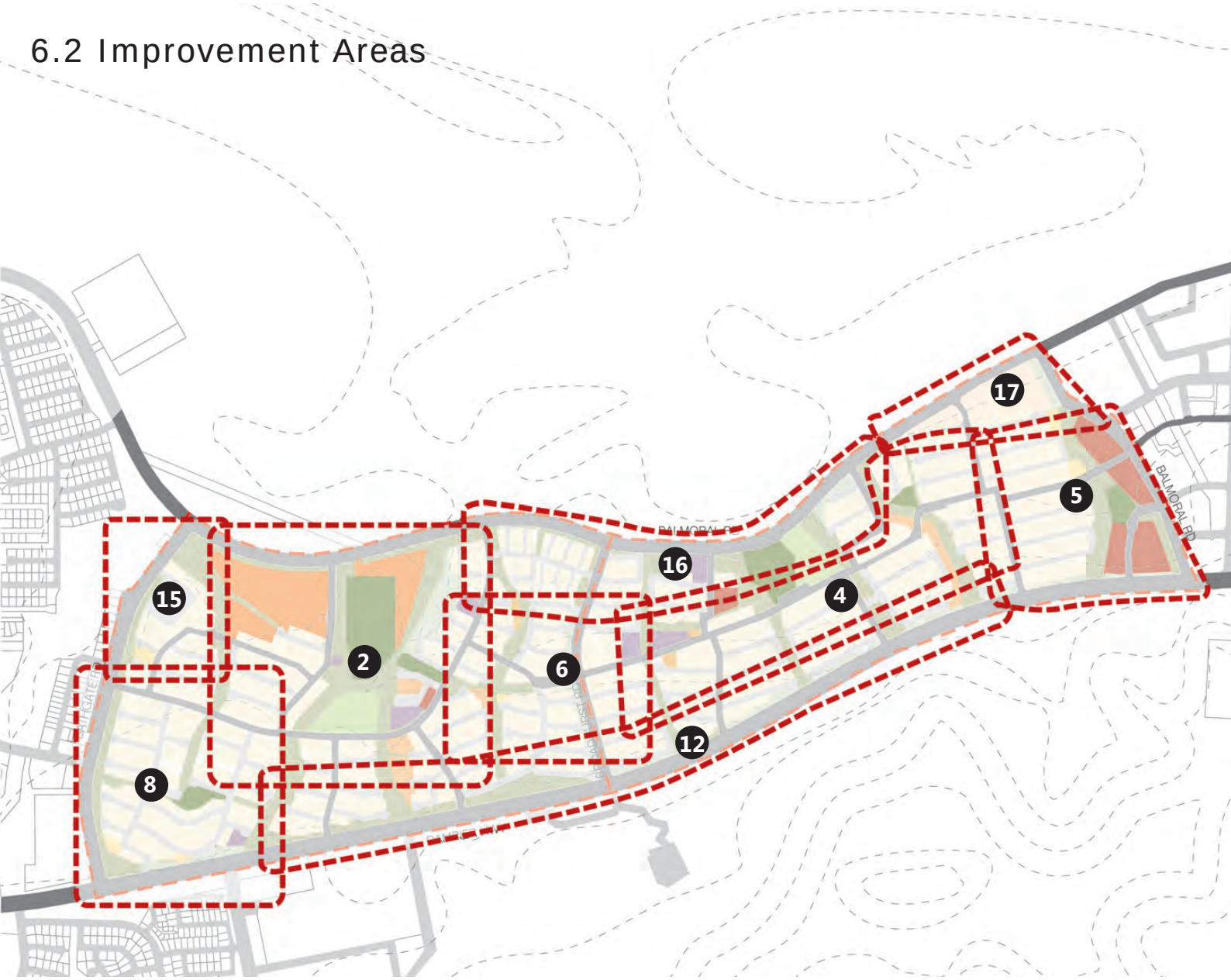


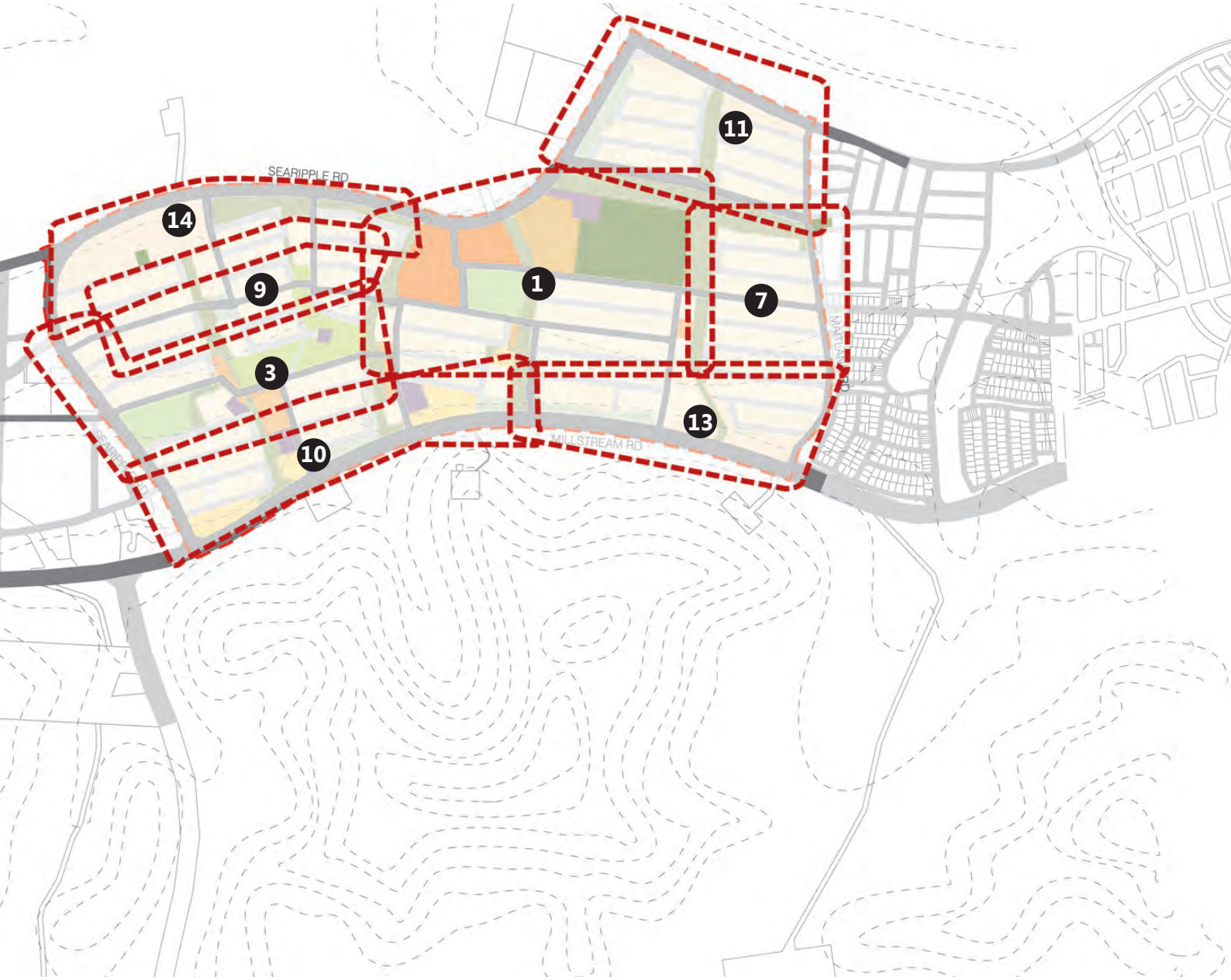
Figure 6.1 Improvement Areas for Renewal

Based on the design filter process, approximately 17 improvement areas were identified as areas for coordinated programmes. These vary from major redevelopment precincts (eg, the High School/KEC precinct in Bulgarra) to peripheral residential precincts.

The full breadth of initiatives under the Strategy represent up to several decades of investment and intervention by the City, and consequently and conceptual sequenced program is presented overleaf. The program identifies the major redevelopment areas being prioritised (due to the complex and possibly protracted actions required), with priority then flowing to the catchments around the City Centre and nodes.

As identified by the sieve mapping resulting in 'Filter 1', Seventeen (17) improvement areas have been identified as follows:

(1) Bulgarra Central East
(2) Millars Well Main
(3) Bulgarra West
(4) Pegs Creek Central
(5) Pegs Creek East
(6) Millars Well East
(7) Bulgarra East
(8) Millars Well West
(9) Bulgarra Central North
(10) Bulgarra South
(11) Bulgarra North
(12) Dampier Highway
(13) Bulgarra South East



(14) Bulgarra North West
(15) Millars Well North West
(16) Pegs Creek North
(17) Pegs Creek North East

Section 6.4 depicts a provisional program of implementation actions, broken down by Improvement Area, and prioritised from short term to long term. The provisional program forms the basis of Stage 2 Karratha Revitalisation Strategy, which establishes a detailed implementation strategy for the subject area.

Figure 6.2 Pegs Creek Primary School Swale Plan

Community Quick Wins

The Pegs Creek Primary School have initiated the revegetation of the swale that runs adjacent to the Primary School and is a prominent swale, which links the Karratha Hills to the tidal flats of Nickol Bay.

The swale is frequently used by students and the community of the Pegs Creek Primary School for daily commuting, as well as, forming part of the schools cross country track.

Surrounding residents also regularly use the swale for morning and afternoon walking and cycling leisure activities. The swale also acts as a 'blank canvas' and forms part of the local off-road motorbike paths, which randomly meander through town where possible.

The design intent of this community project is to transform the existing swale, which is an under utilised asset, into a revegetated swale mimicking a natural creekline. This will provide benefit to the school, as well as, surrounding residents,whilst also improving major view corridor through the town.

STAGE 1

The suggested first stage of works focuses on the swale area north of the pedestrian crossing bridge and within the swale batter.

Suggested landscape works include weed control, and if can be obtained spreading of local topsoil/mulch and rocks to help stabilise swale and promote local plant regermination. Supplementary tubestock, Eucalyptus victrix is suggested to be planted in clumps (groups of 3,5,7) at approximately 30m spacing.

Stage 1 works area, to maintain area under Power Lines clear to avoid disturbance when underground power is being installed. Consideration should also be given to minimising vandalism.

Figure 6.3 Context Plan & indicative staging diagram

Precedent project: Stage 1 Mulataga Corner of Millstream and Maitland Road

STAGE 2

Its suggested the Pegs Creek Primary School should start with revegetating the swale. Once this is successful and there is ongoing support from school, surrounding residents and City of Karratha consideration should be given to further extending landscape works from boundary of swale to Primary School.

Key features of stage 2;

- Swale can become an extension of the school (maintenance and educational resource)
- Link into indigenous planting within school
- Maintain fire break and reduced fuel load between swale and Primary School

6.3 Implementation Actions

ACTION	**IMPLEMENTATION ACTION**
1	Prepare and Adopt Improvement Local Structure Plan for Development Project Area
2	Development Project Area Rezoning
3	Rezone general residential areas with split coding (R20/R60)
4	Rezone City Centre Transitional residential areas with split coding (R20 / R60)
5	Prepare and Gazette Developer Contributions Scheme (Development Project Area)
6	Implement Interim traffic crossing over swale
7	Implement bridge traffic crossing over swale
8	Establish bus service along E-W movement corridor
9	Implement key road links
10	Implement minor pedestrian crossings over swales
11	Undertake footpath extensions and upgrades, particularly along the central movement spine
12	Undertake major POS upgrade and redevelopment
13	Undertake street tree establishment program / Free trees quick win
14	Decommission surplus parks
15	Establish Community Reference Group
16	Undertake Swale Improvements / Community swale project quick win (page 108)

Table 6.1 - Implementation Actions

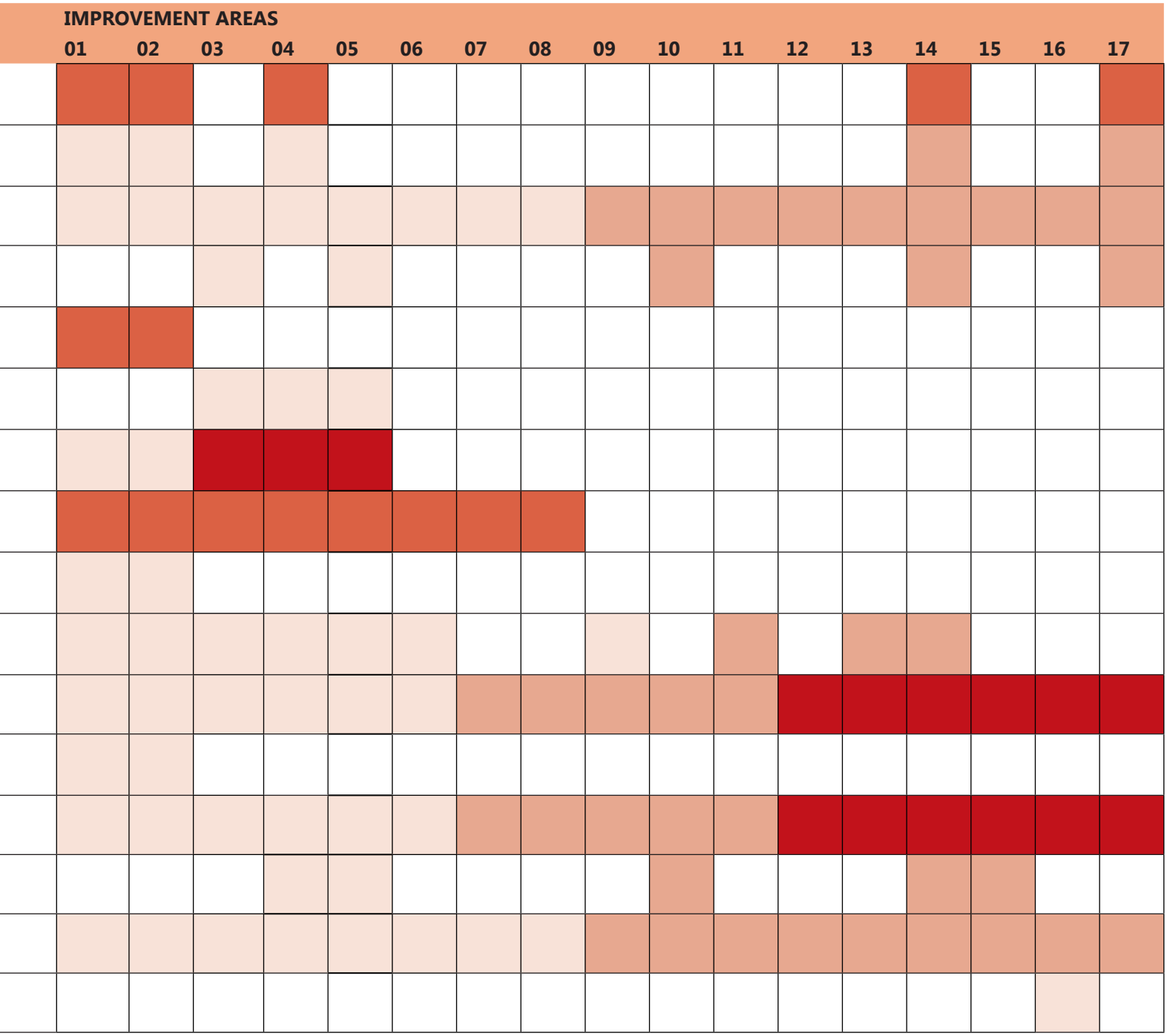
Implementation Action not within Respective Improvement Area

Short Term

Medium Term

Medium - Long Term

Long Term


IMPROVEMENT AREAS
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ACTION CODE	RECOMMENDATION	RATIONALE/NOTES	LEAD AGENCY	SHORT TERM	MEDIUM TERM	LONG TERM
IMPROVEMENT AREA 1 – BULGARRA CENTRAL EAST						
IA1(1)	Prepare and Adopt Improvement Area 1 Local Structure Plan	A Structure Plan will form the basis of zonings, subdivision, costing, agreements and construction programs	CoK	X		
IA1(2)	Rezone KEC site	Rezoning will provide the enabling mechanism for subdivision, development and management	CoK	X		
IA1(3)	Rezone Former School Site	Rezoning will provide the enabling mechanism for subdivision, development and management	CoK	X		
IA1(4)	Rezone general residential areas with split coding (R25/R40)	Rezone the existing residential cells to R25 and R40 to; • Retain the existing character of the subject suburbs; • Maintain the large lot size which are highly valued due to the Pilbara lifestyle; and • Allow for an increase in density in strategic locations, and assist in creating more diverse housing stock and streetscapes.	CoK	X		
IA1(5)	Prepare and Gazette Developer Contributions Scheme	The DCS will provide a mechanism to assist in funding certain public works	CoK	X		
IA1(6)	Prepare and Adopt DAPS and Guidelines for core project area (KEC/School)	DAPs and Guidelines will assist in guiding appropriate built form outcomes, and help enable place making	CoK	X		
IA1(7)	Prepare and Adopt Guidelines for Residential Consolidation of individual or amalgamated lots	Guidelines will assist in guiding appropriate built form outcomes where individual houses are redeveloped to group housing or multi-units (see IA1(P)(4)	CoK	X		
IA1(8)	Update Flood analysis and confirm mitigation strategies	Parts of the oval and associated lands were previously shown to be vulnerable to flood, but will be aided by drainage infrastructure proposed in Mulataga. An updated study is required to confirm revised development standards for incorporation into guidelines and plans	CoK	X		
IA1(9)	Establish Development Partnership for KEC/ School site, including Heads of Agreements	Key landowners within the core redevelopment project area must establish a working structure to jointly advance redevelopment, including cost sharing	CoK/ LandCorp	X		
IA1(10)	Implement Andover/ Hunt bridge link over swale	Required as an essential part of the East-West movement corridor.	CoK		X	
IA1(11)	Implement Emma/ Turner bridge link over swale	Required as an essential part of the East-West movement corridor.	CoK		X	

Table 6.2 - Improvement Area Actions

ACTION CODE	RECOMMENDATION	RATIONALE/NOTES	LEAD AGENCY	SHORT TERM	MEDIUM TERM	LONG TERM
IA1(13)	Implement minor pedestrian crossings over swales	Various path connections through drainage swales to improve pedestrian and cyclist connectivity	CoK	X		
IA1(14)	Undertake footpath extensions and upgrades, particularly along the central movement spine	Key walking paths to be reinforced by footpath construction or remediation in order to improve	CoK	X		
IA1(15)	Undertake Oval upgrade and redevelopment	Establish core public domain and recreational activity core for suburb, and provide trigger to encourage density. Consider inclusion of a junior soccer pitch	CoK		X	
IA1(16)	Undertake key swale upgrades	To establish secondary public domain areas and provide trigger to encourage residential redevelopment	CoK	X		
IA1(17)	Undertake street tree establishment program, particularly along the central movement spine	To improve walkability, reduce unnecessary heart gain and provide improved amenity to stimulate redevelopment of individual houses to group housing or multi-units. NB, irrigation of trees may be linked to redevelopment approvals	CoK	X		
IA1(18)	Decommission parks, Review future use	Consider removal of unutilised and unserviceable open space, and examine ongoing management, including possible redevelopment.		X		
IA1(19)	Establish Community Reference Group	A CRG will provide an ongoing conduit for communication, feedback, and an opportunity to facilitate community-led efforts for place making projects	CoK	X		
IMPROVEMENT AREA 2 – MILLARS WELL CENTRAL						
IA2(1)	Prepare and Adopt Improvement Area 2 Local Structure Plan	A Structure Plan will form the basis of zonings, subdivision, costing, agreements and construction programs	CoK	X		
IA2(2)	Rezone Kevin Richards Memorial Oval Precinct	Rezoning will provide the enabling mechanism for subdivision, development and management	CoK	X		
IA2(3)	Rezone general residential areas with split coding (R20/R60)	Split coding for general residential areas: R20 where lots are less that 1000m2 in area, up to R60 where lots are greater than 1,000m2 in area. This will enable redevelopment of select lots by willing owners. It is expected that resulting redevelopment will be 'salt and pepper'; not widespread.	CoK	X		
IA2(3)	Prepare and Gazette Developer Contributions Scheme	The DCS will provide a mechanism to assist in funding certain public works	CoK	X		

ACTION CODE	RECOMMENDATION	RATIONALE/NOTES	LEAD AGENCY	SHORT TERM	MEDIUM TERM	LONG TERM
IA2(5)	Prepare and Adopt Guidelines for Residential Consolidation of individual or amalgamated lots	Guidelines will assist in guiding appropriate built form outcomes where individual houses are redeveloped to group housing or multi-units (see IA2(P)(3)	CoK			
IA2(6)	Update Flood analysis and confirm mitigation strategies	An updated study is required to confirm revised development standards for incorporation into guidelines and plans	CoK			
IA2(7)	Undertake Oval upgrade and redevelopment	Establish core public domain and recreational activity core for suburb, and provide trigger to encourage density	CoK			
IA2(8)	Implement minor pedestrian crossings over swales	Various path connections through drainage swales to improve pedestrian and cyclist connectivity	CoK			
IA2(9)	Undertake street tree establishment program, particularly along the central movement spine	To improve walkability, reduce unnecessary heart gain and provide improved amenity to stimulate redevelopment of individual houses to group housing or multi-units. NB, irrigation of trees may be linked to redevelopment approvals	CoK/ LandCorp			
IA2(10)	Undertake footpath extensions and upgrades, particularly along the central movement spine	Key walking paths to be reinforced by footpath construction or remediation in order to improve	CoK			
IA2(11)	Decommission suggested parks and review future use	Consider removal of unutilised and unserviceable open space, and examine ongoing management, including possible redevelopment.	CoK			
IA2(12)	Establish Community Reference Group	A CRG will provide an ongoing conduit for communication, feedback, and an opportunity to facilitate community-led efforts for place making projects	KEC/ School			

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8 Appendix

Contents

Appendix 1. Economic and Demographic Drivers

The full economic and demographic analysis on which this summary is based draws on a wide range of quantitative data sources (international and local) and interviews with stakeholders in both the public and private sectors.[1] It also takes account of the outcomes of the three community consultations carried out in Karratha. The Annex is attached to the main report

The economy of the Pilbara, including Karratha is very dependent on the global economy and commodity markets (principally iron ore and liquefied natural gas). No forecasts of growth, employment and population are plausible without analysis of the global economy including the major economies of the United States (USA), the European Union (EU), China Japan and other countries in Asia and the impact of changes to growth on commodity marketts.

Populations in Karratha are mobile. Therefore it is necessary to analyse forecasts for the demand and supply for Karratha as a whole in determining the needs for additional accommodation, retail and commercial opportunities and the other possible components of revitalisation in the three study suburbs. Within the Karratha wide framework the demographics of the three study suburbs are also analysed.

1. Economic Context and Investment

1.1. Economic Context: Assumptions Global Economy[2]

- Global Gross Domestic Product (GDP) 2014 to 2017 3 - 4 % per annum in line with recent International Monetary Fund (IMF) and World Bank (IBRD) forecasts
- After 2017 the normal business cycle will resume, with a likely decrease in growth due to higher interest rates as inflation rises and fiscal and monetary policies are adjusted
- Growth in GDP of the USA is expected to fluctuate between 2.5 % and 3.0 % per annum
- Although it is not widely recognised growth in almost all of the 27 EU Member States is now positive and growth rates of 1% to 1.5 % are anticipated in the medium term – although there are still considerable headwinds in Europe the situation has improved significantly[3]
- The implication of higher rates of growth in these two major economies is significant. They have a major impact on imports from China and elsewhere, including goods that depend on iron ore as part of the production supply chain
- Imports of goods and services by the developed world from China and other Asian countries will remain fairly high in the medium term and this will support commodity prices to an extent, as will inter Asian trade[4]
- In the medium term GDP growth in China will slow to between 6.5 % and 7.5 % (double digit gains prevailed after the $ 800 billion stimulus in 2009) and will be about 5 % for most other countries in Asia
- Longer term it is likely that growth in China will fall to somewhere between 4 - 6 % as the economy matures. This is very important to the Australian economy
- There has been a degree of improvement in the economy of Japan over the last year after two decades of stagnation (by far the largest market for LNG for Australian producers)
- The rate of growth in India has declined over the last 18 months to between 4% and 5%. It is possible that this trend may reverse and one consequence (amongst others) is that India may become a larger buyer of iron ore and LNG in the future

1.2. Investment and Production

Estimates of future employment and population have been based on the past history of employment and likely developments in the economy of the City. A very sharp slowdown in mining and LNG investment has been underway since mid 2012, most of the Royalties for Regions expenditure for community facilities will be completed by 2013, the road developments and other public infrastructure investments will mainly be completed by 2014 and most of the construction of new ongoing or approved residential/ retail and commercial precincts by MIRVAC, FINBAR and other commercial investors will also be completed by 2014. Moreover the relocation of the High school and the construction of the trade training centre have been or will be completed soon.

Investment in the resources sector depends on commodity prices and costs.

1.2.1. Iron Ore Markets and Investments

Historic prices (Note 1) are shown below to place current

1 The consultant preparing this section of the report undertakes a detailed and broad ranging analysis of the economy of the world and commodity markets on an ongoing basis. Part of the content of this section is based on this analysis

2 Sources: International Monetary Fund (IMF): World Bank (IBRD) and Organisation for Economic Cooperation and Development (OECD)

3 The most important indicator (amongst many) of healthier economies in The European Union over the last few years is the 10 year yield rate – in the peripheral countries most at risk (Italy, Portugal, Greece and Ireland) bond yields have been falling for over two years and currently stand at less than half the crisis rates and in the case of Greece have fallen by over 60 %)

4 According to China's Foreign Minister(2013) , China's trade with Asian countries is now more than its trade with the US and Europe. Beijing's trade with its neighbours rose to $1.2 trillion (£800bn) in 2012, about $120m more than its combined trade with the European Union (EU) and the US. China is now the largest trading nation in the world

2011	2012	2013	January 2014	February 2014	March 2014 1/
168	128	135	128	121	115

1/ Consultant estimate

Table - Average Iron Ore Prices 2011 to February 2014 (at nominal US$ / dmt)

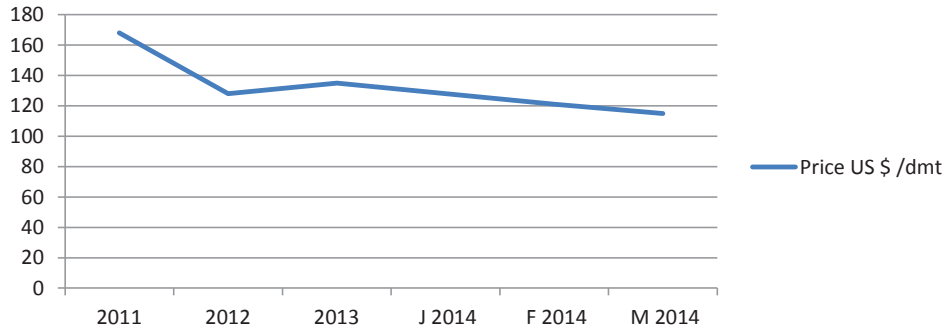


Figure - US $ / dmt

price levels and movements in perspective.

There are three scenarios for iron ore prices, which will impact on production and investment decisions.

Scenario One:

The price of iron ore falls below US $ 90 per tonne[5] over the medium term[6]. This is less likely, but not impossible. Under this scenario iron ore producers will continue to reduce costs (following cost reductions of over US $ 10 billion by Rio and BHJP alone over the last two years) and there could actually be reductions in employment levels as a result.

The two larger producers are in a position to continue to make reasonable levels of profit at lower prices (BHP and Rio are believed to have operating costs of about $ 45 per tonne); The operating costs of FMG are higher (about $ 54 per tonne) and they still have large debts (despite having paid off about $ 4 billion of debt in 2013) and their financial stability is more questionable at these price levels. Medium and smaller miners would not all be able to continue to produce at lower price levels.

5 Benchmark price for 62 % fines delivered Tianjin Port in China

During 2013 the benchmark price of iron ore held up well. It traded around $ 130 per tonne for most of the year (AU$ 143 equivalent due to a lower exchange rate) as a result of a 10 % increase in consumption in China and delays in increased iron ore production by BHP, Rio Tinto and other producers. Firmness in the price led to Rio Tinto deciding to proceed with its 3rd phase of increased investment and output from existing mines by some 70 million tonnes per annum to a total of about 360 million tonnes per annum in total. BHP, FMG (up to 155 million tonnes per annum) and other producers have been increasing output and BHP still has a production target of just less than 300 million tonnes per annum. Roy Hill will produce up to 55 million tonnes per annum. Other producers around the globe are preparing to increase production.

6 Source: World Bank

Allied to cost reduction programmes it is well known that the major miners are on the way to reducing employment levels through technological means. Under this scenario decisions on developing the Port Hedland outer harbour (estimated $ 20 billion capital expenditure) facility and construction of Port Anketell will probably be delayed.

Scenario Two:

Iron ore trades in a range of US$ 100 to 130 per tonne (AU$ 110 to AU$ 140). This is the most likely price range. Increased demand from the USA and Europe for imports may cushion a recent downward trend for iron ore prices and in the USA if policy with regard to infrastructure spending (the government is seeking $ 300 billion for infrastructure) is followed through there will be a direct increase in demand for iron ore from the USA. At this price producers will retain current production levels and in the case of Rio they will continue with their 3rd phase expansion. Other producers may expand production by modest amounts. The first phase of Port Anketell will be implemented. Otherwise there will be no incentive for further major investments and employment levels will remain steady.

Scenario Three:

The price of iron ore rises to above US $ 130 per tonne. This scenario is less likely. It may occur if the government in China decided yet again to provide fiscal and monetary stimulus; growth in India strengthens and the USA and Europe consume more iron ore than forecast. Under this scenario production and investment decisions will remain in line with those of scenario two; however the first phase of Anketell Port will probably proceed

In the medium term known investments and increases in

production and capacity are as follows:

- Rio Tinto has announced the 3rd phase of its iron ore expansion to 360 million tonnes per annum, with maximum capacity reached in 2017 at a capital cost of AU$ 400 million. Some 500 to 750 persons are currently being settled in Wickham – the impact of the expansion on the population of Karratha will be minimal
- CITIC Pacific has announced (March 2014) that it will continue with construction of its Sino Iron magnetite project at Cape Preston with all six lines to be completed by 2016 (some 266,000 tonnes has been produced to date)
- A few smaller operators will be increasing production in the City
- There is unlikely to be any other major expansion of existing iron ore mine capacity in the City of Karratha in the period 2014 to 2017
- Increased levels of investment and production thereafter will only occur when increased supplies have been absorbed
- The expansion of the port facilities at Cape Lambert to some 355 million tonnes will be completed by 2015 at the latest. Almost all operational staff will be based in Wickham
- Smaller port construction such as the Balla Balla magnetite iron ore mine and trans-shipping project in the Pilbara at a cost of $1.3 billion midway between Port Hedland and Karratha may have a minor impact on the demand for services in Karratha
- The Western Australian Government intends to develop a new deepwater port and strategic industrial area at Anketell for increased iron-ore exports and industry in the Pilbara. The location of the proposed port and strategic industrial area is approximately 30 kilometres east of Karratha and 10 kilometres west from Cape Lambert. Objectives of the development are to:
  - Establish a multi-user, multi-commodity deepwater port capable of exporting at least 350mtpa of iron ore, developed on a proponent pay basis
  - The port development plan includes constructing a 15km shipping channel, jetties and associated shore-based infrastructure including a desalination plant, power plant and road and rail links
  - Create industrial land of some 840 ha which will be sufficient to cater for industrial use that may arise in the future
- A strategic area of about 5000 hectares (total port area) will be developed to accommodate a range of different users and different commodities and will include an infrastructure corridor to the North West Coastal Highway.
- It is possible that the State Government (discussions with the Department of Planning) will support development of stage 1 of the project, with a view to operations by the end of 2015 with an initial capacity of some 100 million tonnes per annum
- This would result in the employment of some 950 persons in its construction phase for a 6-month period and 150 in the operational phase. During the full construction phase the port project has the capacity to create about 4000 new jobs during construction and an operational workforce of around 900 personnel.
- The port will be serviced by existing towns, especially nearby Karratha, providing further business and development opportunities. It is understood that construction camp facilities are under discussion to "spread the benefits".

1.3. LNG Markets and Investment

1.3.1. Markets

- Historic prices (Note ii) are shown below to place current price levels and trends in perspective.
- The picture with regard to LNG prices is different to that of iron ore. It is more positive
- The structure of the global LNG market and possible developments were described in a recent study on "The Cost of Doing Business" in the Pilbara[7].
- Changes to pricing mechanisms are possible and Australian producers will face increased competition from the USA and other producers
- However demand is increasing rapidly in Asia and elsewhere.
- The LNG price forecast range is between US $ 14 to $ 20 per MMbtu and as with iron ore the lower AU$ exchange rate is beneficial on the price side.
- At any point in the forecast price range current production and employment levels in the LNG sector will remain steady
- In the fields offshore of the neighbouring City of Ashburton and elsewhere in the Pilbara LNG prices are likely to support the vast increase in production already achieved or underway/ planned and this will have a limited impact on service provision in Karratha

1.3.2. LNG Investments

The basic scenario for LNG investments indicates that the demand for services from the LNG will remain steady and that the level of employment will not increase in the next few years. In the medium term the investment

7 Regional Development Australia (RDA). Imani Development Austral. March 2013. This report is currently being updated

	2011	2012	2013	January to March 2014 1/
Europe	10.5	11.5	11.8	12
USA	4.0	2.8	3.7	4.5
Japan	14.7	16.6	15.2	17

Note 1/ Consultant estimate

Table - Historic LNG Prices USA: Europe: Japan 2011 to March 2014 (US $ per mmbtu)

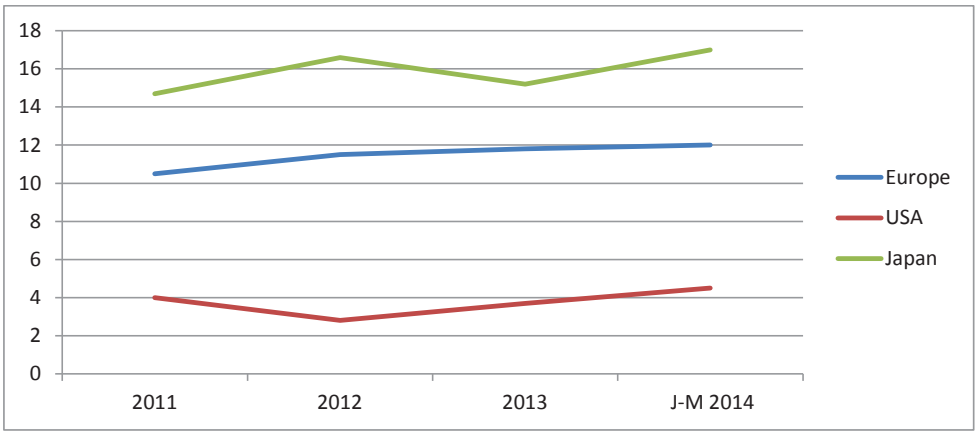


Figure - LNG Historical Prices (Europe, USA, Japan 2011 to March 2014 (US $ mmbtu)

landscape is as follows:

- Additional investment in the LNG industry in the City of Karratha has not been flagged and will depend on the quantity and quality of exploitable reserves and the cost of doing business, which is amongst the highest in the world regarding capital costs
- As far as is known the Woodside led consortium for the Pluto project is not investing further on construction and processing in the medium term and no other explorers have indicated that they will be exploiting reserves in the immediate future
- Further investment will depend on the discovery of commercially exploitable reserves on the N.W. Shelf and no recent announcements have been made in this regard
- The Chevron led LNG projects of Gorgon and Wheatstone during the period 2014 to 2017 have had an impact on the level of service provision in Karratha over the last 3-4 years. It is understood that Chevron will not increase its presence in Karratha
- There are a number of LNG developments which may have a small impact on the level of demand for services in Karratha. These include:
  - The EXXONMOBIL and BHP Billiton plan to produce LNG from either a $10 billion-plus floating LNG platform off Western Australia from their Scarborough gas field starting in 2014-15 or to pipe the gas to the Pluto facility (less likely). If the latter option was pursued this would have a positive impact on the demand for services and property in Karratha[8]
  - The Browse floating platform option for processing is the preferred option of the Woodside led consortium, however any investment is unlikely to have any impact on demand in Karratha as the development is too far away- one of the prior options under consideration which was to pipe the gas down to Karratha for processing is off the table now
  - The construction of the offshore processing Prelude project (Shell led consortium) in the

8 Submission for approval to the Federal Environment Department has revealed the timetable for first exports in 2020. Construction of a 495m long and 75m wide floating vessel that will house five LNG processing trains capable of producing between six and seven million tonnes of the liquefied fuel a year is the basis of the floating processing option

Browse basin about 450 km NE off Broome will continue in 2013 and reach the final phases of the schedule in 2014/15, however this will have no impact on the demand for services in Karratha

- Given high levels of exploration there is a possibility that additional commercially viable LNG reserves may be found off shore of the Pilbara and additional investment would then follow, provided current favourable prices remain in place

1.4. Other Investments in the City

Other investments with a small impact on employment and services include:

- In Karratha the development of the Gap Ridge light industrial area will continue over the medium term, although take-up in 2013 and 2014 (March) has been slow
- In Karratha the construction of the $775 million Yara Pilbara Nitrates plant will be constructed on the Burrup Peninsula with civil works expected to begin in April 2013 and production to start in July 2015
- The possible construction of a new hotel in the Mirvac precinct in the Karratha town centre
- The reopening of hospitality services in Whim Creek

1.5. Diversification

The need to diversify the economy of the City of Karratha has been recognised for some time. Given the climate, remoteness, high cost structure and small market, diversification is a challenge.

Recently investment in social/community facilities through the Royalties for Regions Programme and other funding sources has been substantial. Various government agencies, the City, and private enterprise have contributed to upgrading and expanding services such as roads, water, energy and telecommunications and there have been major property developments. The appeal of the town as a place to live and do business has been considerably increased. Health and education facilities have been improved (or are under improvement).

Thus much of the infrastructure development to improve the level of service provision has already been completed or is coming to an end. There are possible construction projects in the pipeline such as a new hotel and the (probable) renovation of the Karratha airport to start about mid 2014 and to be completed some 12 to 18 months later. These developments will assist in improving facilities still further and provide a limited amount of additional work over the medium term.

Other diversification opportunities are limited. The most likely intervention that may make commercial sense is tourism. Ideas for industrial tourism linked to a marina are possibilities worth exploring. However the value added to the economy of the City will not be really large in the foreseeable future.

2. Demography

2.1. References

In estimating population growth the impact of production and investments in the resources industries and related port development as described in the preceding section is taken into account. Also taken into account are other studies[9][10] amongst which are:

- The 2013 ID Consulting[11] estimates for the City of Karratha
- The Chamber of Minerals and Energy of WA (CME), Pilbara Population and Employment Study, November 2012 (prepared by PriceWaterhouseCoopers)
- City of Karratha Population Model (prepared by Syme, Marmion – March 2014)

2.1.1. Employment

Levels of employment are the main determinant of population growth. Employment in the City[12] has grown very fast over the period 2006 to 2011. From 2012 onwards it is likely that the rate of growth in employment slowed down and limited growth is likely in the future.

In 2011 the three highest employers by industry sectors were:

- Mining (2,719 people or 22.8%)
- Construction (2,642 people or 22.1%)
- Transport, Postal and Warehousing (774 people or 6.5%)

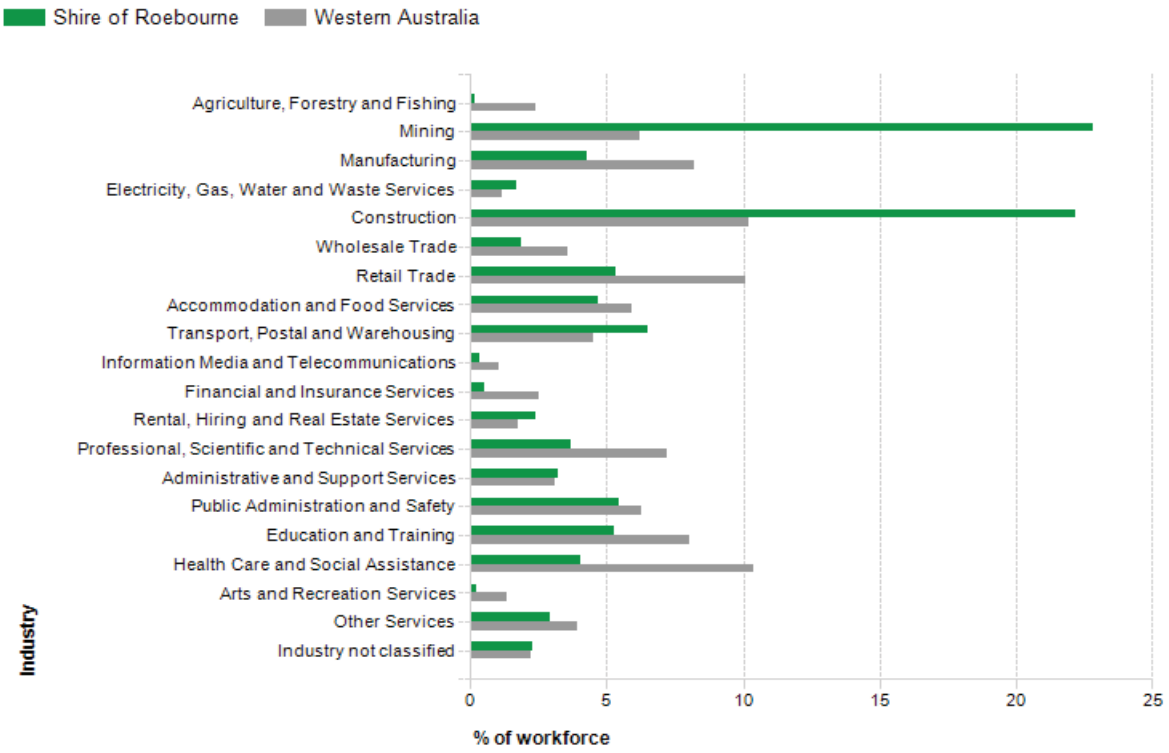
Changes in the composition of the labour force between 2006 and 2011 illustrate the growing importance of construction and mining. The level of mining employment will have increased after 2011 and will have continued to increase in 2012. After 2012 limited employment increases in the mining sector have been estimated by the CME continuing until 2017. Supporting investments in port facilities and infrastructure, in social/ community facilities and in large-scale property development have now been largely completed. It is anticipated that large falls in the construction labour force have prevailed since about mid 2012 and no major increases are expected in the medium term.

9 Older studies such as the Heuris Report of 2009 are now out of date

10 The studies do not go beyond 2031 and where possible estimates have been extended to 2035

11 Population consultants to the City

12 National Institute of Economic and Industry Research (NIEIR) and .id consultants



Source: Australian Bureau of Statistics, Census of Population and Housing, 2011
Compiled and presented in economy.id by .id, the population experts.

Figure - Local labour force industry of employment

On the other hand there are positive aspects to employment on a small scale: the Gap Ridge Industrial Estate still has some way to go before all sales are complete (note that sales activity is slow at present); the Karratha airport is to be expanded and redeveloped; the additional investment in the manufacture of fertilisers ($ 750 million) is ongoing; there is a need for staff in recently completed mixed use precincts such as the Pelago complex; the likelihood that the first stage of the new Anketell Port will go ahead in phases will add some 150 persons to permanent employment and about 900 construction workers; the first stage (72 lots) development of Mulataga is on hold/delayed and this will mitigate against likely falls in the construction sector overall.

It is likely that future employment trends in Karratha will differ somewhat to those of the City as a whole:

- Resource sector will continue to be a major employer in Karratha because of a larger number of permanent residents employed by the resource companies, however it will not be as dominant as Wickham
- Since Karratha is a major service centre for the projects operating out of the N.W. shelf and elsewhere in the Pilbara (notably the LNG investments in Onslow) this category of service workers will likely remain stable
- The number of construction workers may have declined in 2013 and 2014 and may decline further after 2015, unless further property development takes place
- The number and proportion of workers in the food and accommodation industry will grow as the town develops and the market size increases as a result. There is a wide range of potential Investments in this sector, from small restaurants to a possible Hilton Hotel. In fact the new developments in the town have been of mixed use, with a limited number of small new facilities constructed
- If the tourist industry passing through Karratha increases it is likely to do no more than replace the labour demand in the accommodation and food services sector after the FIFO population reductions in 2012 and 2013.
- Despite Karratha being the largest retail trade industry in the City of Karratha, the proportion of workforce employed in this sector is only 6%. This will probably grow
- The number and proportion of the workforce in public administration will probably remain more or less at current levels
- The number and proportion of workers in the health sector may rise as the population increases and ages
- The retail, food and accommodation sectors are

2011 EPS	2012 EPS	2016	2021	2026	2031	2035
Low Forecast 1/						
17,096	17,892	19,271	20,760	22,364	24,093	25,571
High Forecast 2/						
17,096	17,892	19,557	21,592	23,840	26,321	28,490

1/ Based on growth rates of 4.7 % in 2012; 2 % in 2013 and 1.5 % thereafter

2/ Based on growth rates of 4.7 % in 2012; 2.5 % in 2013 and 2.5 % thereafter

Table - Karratha population estimates

likely to expand the fastest

2.1.2. Karratha Population Estimate[13]

Methodology for estimating the population of Karratha includes reference to several reports that give indications of the likely future growth rate of the population of Karratha. It is comprised of a low growth estimate and a high growth estimate. For both scenarios the 2011 and 2012 ERP are used as the baseline populations. The City-wide model and other studies tend to suggest that growth rates will be low in the range of 0.8 % to 1.6 % per annum. It is possible that in late 2012 and in 2013 and early 2014 the rate of growth has been very low and even flat (with a maximum of 2 % per annum). This possibility is based on:

- Sharply reduced property prices and rents
- Reduced commercial and retail property rents (recent)
- Slow take up of recently completed property developments
- Slowing demand for Gap Ridge development
- A downturn in construction activity
- Weaker retail sales
- A fall in the number of passengers at the Karratha airport by 5.8 % from 2012 to 2013 (2012 - 818,415 passengers; 2013 - 770,950 passengers). This is the first fall for several years
- There is no indication of an increase in employment in Karratha from the major resource companies (and in fact numbers may well be reduced in the future[14]))
- Anecdotal evidence from a wide range of stakeholders[15] of a widespread slowdown in economic activity

From 2015 the rate of population growth will not fluctuate much. There are no major anticipated developments in the City apart from the first phase of Anketell. Whilst there will be an increase in construction activity if this does occur the number of additional persons settling in Karratha will be small.

On the other hand Karratha is a more diversified town than the other City towns and for this reason the projected low growth rate is 1.5 % per annum and the high growth rate is 2.5 % from 2015 onwards. The higher rate of growth takes into account the role of Karratha as a service centre in the City and for operations in the City of Ashburton and further afield in the Pilbara. There is the possibility of an expanded tourism sector. In addition the recent improvements to almost all aspects of "liveability" and the attraction of Karratha as a town in which to reside and significantly lower property and rents has certainly enhanced the prospects for an increased level of persons deciding to live and work in Karratha due to reduced costs[16] and as a lifestyle choice.

The population estimate for Karratha is shown above.

At the higher growth rate the increase in population is:

- 2011 to 2021: 4,496
- 2011 to 2035: 11,394

These estimates are very much smaller than the Pilbara Cities (aspirational) Vision – the growth rate required to achieve a population of 50,000 by 2035 is more than 5 % per annum. This would be the fastest sustained rate of growth anywhere in the world. The estimates are also lower than the ID Consulting estimates. These are almost sure to be revised downwards when they are next adjusted[17].

2.1.3. Study Suburbs Population Estimates

Recent population growth has been highest in the Western suburbs of Baynton- Gap Ridge, Mulataga and Nickol, whilst growth in the older suburbs of Bulgarra, Pegs Creek-Stove Hill and Millars Well will be slower.

The population estimates for the suburbs are based on growth rates of 2 % in 2012 and between 0.5 % and 1 % thereafter. The lower rates of growth compared to Karratha as a whole are because most growth in the town has been in the new suburbs and consumer preference to locate in more modern, recently completed dwellings. Population estimates are shown

13 References include the id.consulting estimates; the City of Roubourne population Model; the Karratha LPS; Chamber of Minerals and Energy 2012 forecasts of employment and population - and several other studies/documents

14 Discussions with Woodside, Rio and Chevron

15 Pilbara Development Commission (PDC); Chamber of Commerce; Banks; Retailers; Landcorp; Property developers; real estate agent

16 RDA is preparing an update on the 2013 Cost of Doing Business in the Pilbara in March to May 2014 and the results can be used to place a finer judgement on this aspect in due course

17 Discussions with ID Consulting February 2014

2011 ERP	2012	2016	2021	2026	2031	2035
Bulgarra						
Low Forecast 1/						
3,578	3,650	3,798	3,991	4,195	4,409	4,588
High Forecast 2/						
3,578	3,650	3,874	4,173	4,495	4,843	5,140
ID Consulting estimates						
3,578	NA	3,754	3,991	4,455	5,206	NA
Pegs Creek – Karratha- Stove Hill						
Low Forecast 1/						
2,718	2,772	2,885	3,032	3,187	3,349	3,485
High Forecast 2/						
2,718	2,772	2,942	3,170	3,415	3,679	3,905
ID Consulting estimates						
2,718	NA	3,759	3,770	4,025	4,604	NA
Millars Well						
Low Forecast 1/						
2,278	2,301	2,394	2,516	2,645	2,780	2,892
High Forecast 2/						
2,278	2,312	2,454	2,644	2,848	3,068	3,256
ID Consulting estimates						
2,278	NA	2,285	2,294	2,311	2,334	NA

1/ Based on growth rates of 2.0 % in 2012; and 1.00 % thereafter

2/ Based on growth rates of 2.0 % in 2012; and 1.00 to 1.50 % thereafter

Table - Study suburbs population estimates

2011 ERP	2016	2021	2026	2031	2035
23,634	28,102	30,390	32,738	35,268	37,433 1/

1/: Consultant Projection based on same growth rate of the model after 2021 (1.5 % pa)

Table - City resident population estimate

above.

Comparisons with recent previous studies are:

- CME report – an additional direct employees together with their families are expected to result in an additional 1,300 people to 2021 in Karratha – this is an increases of 0.8 % per annum.
- A recently compiled model for the City I[18] is "City-wide" and does not estimate populations for the main centres it is used as one source for estimating Karratha employment and population growth[19].
- The annual growth rate of the population shown in the City population model is 4 % in 2012, 6 % in 2013 and 6 % in 2015. Thereafter the growth rate varies between 1 and 2 %[20]. Some additional 500 to 700 persons are being settled in Wickham from 2013 to 2015 and would account for a large proportion of the additional population in the City between 2013 and 2015
- The increase from 2011 to 2031 is estimated in the City model to increase by some 11,600 and from 2011 to 2035 13,800. This is very much smaller than previous estimates (some 50 % in some cases).
- A report by Syme Marmion & Co[21] estimates a long-term FIFO operations workforce of around 2,000 – 2,500 (consisting of Woodside 300; Rio 600-650; and Others 1,000 to 1,500).

18 City Population Model. Syme, Marmion March 2014

19 The basic population model links economic activity in the City with population (tied to ERP) and FIFO numbers including estimating the direct employment from the economic sectors that form the economic base of the City; Estimating the indirect employment resulting from an incremental increase in direct employment in the base economy. The indirect multiplier is only applied to the increase in resident worker numbers. Using family multipliers, estimate the annual population increment resulting from direct employment changes in the base economy and the indirect employment arising from that.

20 2035 is the year in which the Pilbara Cities Vision of 50,000 persons is to be achieved

21 Syme Marmion & Co, Fly in Fly out (FIFO) and Community Facilities in the City of Karratha, October 2012

	2012	2016	2021	2026	2031	2035
Low Forecast						
Dwellings Cumulative	289	791	1332	1,916	2,544	3,082
High Forecast						
Dwellings Cumulative	289	895	1,635	2,452	3,354	4,143

Table - Number of dwellings Low and High Forecast 2011 to 2035

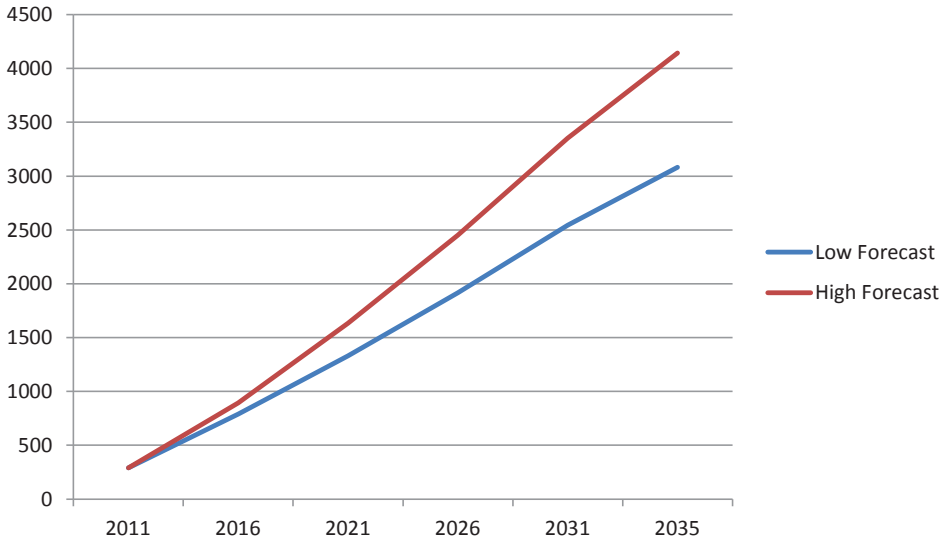


Figure: Number of dwellings Low and High Forecast 2011 to 2035

2.1.4. Estimate of Karratha Population based on City Population Model

The City model does not estimate population by town and therefore this has to be estimated based on the model City wide data. Estimates of population have been prepared for the towns of Wickham, Dampier, Roebourne and Point Samson for the period to 2035. The balance of the population estimated in the City population model has been assumed to reside in Karratha and this gives an estimate of the likely population of the town.

Based on this methodology the population of Karratha will increase:

- From 17,096 persons in 2011 to 28,053 by 2021 - an increase of some 11,000 persons
- From 17,096 persons in 2011 to 29,764 by 2035 - an increase of 12,000 persons

These estimates based on the City model are considerably lower than any previous forecasts and in line with the estimates made by the consultant as described above in section 2.1.2.

3. Demand and Supply Residential, Commercial and Retail

3.1. Residential Demand

3.1.1. Forecast Dwellings Demand for Karratha

The forecast demand for dwellings in Karratha is shown above. These estimates are below previous estimates made in the past by other forecasters.

3.1.2. Forecast of Dwellings Demand for Three Study Suburbs

The dwellings forecasts for the three study suburbs based on increases in the population are shown above. It should be noted that property markets do not really work this way. Demand and supply in Karratha as a whole is the most important determinant of the demand and supply of dwellings in the three study suburbs. Nonetheless to complete the "population based"

	2012	2016	2021	2026	2031	2035
Bulgarra						
Low Forecast						
Dwellings Cumulative	26	80	150	224	302	367
High Forecast						
Dwellings Cumulative	26	107	216	334	460	568
Pegs Creek – Karratha- Stove Hill						
Low Forecast						
Dwellings Cumulative	27	83	157	234	316	384
High Forecast						
Dwellings Cumulative	27	112	226	348	480	593
Millars Well						
Low Forecast						
Dwellings Cumulative	8	42	87	133	182	223
High Forecast						
Dwellings Cumulative	12	64	133	207	287	356

Table - Dwellings forecasts for three study suburbs based on increases in the population

	Karratha	%	Western Australia	%	Australia	%
Occupied private dwellings						
Owned outright	352	8.4	234,627	29.5	2,488,149	32.1
Owned with a mortgage	619	14.8	300,334	37.8	2,709,433	34.9
Rented	3,032	72.5	231,824	29.2	2,297,458	29.6
Other tenure type	45	1.1	8,880	1.1	70,069	0.9
Tenure type not stated	132	3.2	18,493	2.3	195,213	2.5

Table - ABS Estimates of dwellings occupancy

estimates of demand estimates have been made of future demand.

3.1.3. Tenure Type[22]

The characteristics of tenure are:

- Of occupied private dwellings in Karratha (Urban Centres and Localities), 8.4% were owned outright, 14.8% were owned with a mortgage and 72.5% were rented.
- In addition the tenure of dwelling stock in the City is different to that of most markets and indicates that significant proportions of dwellings are rented by employers to house staff as part of their employment package i.e. 40.5% of all dwellings in the City were being rented by 'other landlord type
- The proportion of occupied dwellings in the City of Karratha (and by implication Karratha) in 2011 consisted of:

One bedroom properties – 5%

Two bedroom properties – 10 %

Three bedroom houses – 42 %

Four or more bedroom houses - 37.2% of the dwelling stock.

- The preponderance of larger types of accommodation is clear. In more recent times some diversification of dwelling types has been achieved with the construction of apartment blocks such as the Pelago 1 and 11 complexes in Central Karratha[23]

3.1.4. Household Composition and Age Structure

- In the Karratha District families with dependents dominate the market and a rise of 39.9 % over the period to 2031 is anticipated.
- Overall there are no significant changes in household type in the future. Lone person households show the largest gain as a proportion

22 ABS 2011 Census data

23 Finbar

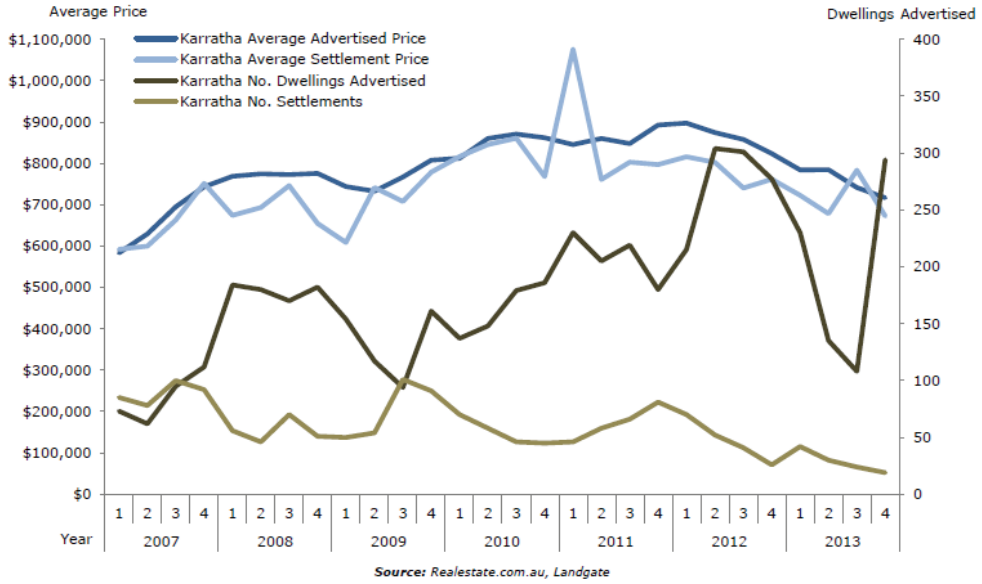


Figure: Residential dwellings for sale and settlements, Karratha

	Number	Min $	Max $	Avg $
Karratha For Sale	**294**	**$ 285,000**	**$ 1,300,000**	**$ 716,486**
One Bedroom	12	$ 285,000	$ 659,000	$ 444,000
Two Bedroom	17	$ 379,000	$ 1,200,000	$ 556,176
Three Bedroom	140	$ 429,000	$ 1,300,000	$ 658,971
Four Bedroom & above	125	$ 470,000	$ 1,175,000	$ 828,864

Karratha Settlements	Sales	Min $	Max $	Avg $
Mar-13	42	$ 499,000	$ 1,250,000	$ 722,702
Jun-13	30	$ 499,000	$ 1,000,000	$ 678,133
Sep-13	24	$ 470,000	$ 3,000,000	$ 783,416
Dec-13	19	$ 375,000	$ 1,375,000	$ 672,421

Table - Karratha properties for sale and settlements

of households from 15.8 % in 2011 to 17.9 % in 2031 and thus demand for smaller properties will increase slightly as a result.

- Between 2011 and 2021, the age structure forecasts for Karratha District indicate an 80.7% increase in population under working age, a 278.0% increase in population of retirement age, and a 49.9% increase in the population of working age
- The household composition and age profile indicates the continuing need for family type accommodation, and an increased need for retirement homes and smaller more easily managed and less expensive homes for the larger aged population brackets

3.1.5. Residential Property Market 2007 to 2014

Overview

The residential property market (both sales and rental) in Karratha is the weakest it has been in many years following the end of the construction boom related to resources projects; royalties for regions projects and other government agency developments.

Properties listed for sale

- The number of properties listed for sale in Karratha has increased significantly over the past five years due to new developments increasing the supply of stock available in the area and decreases in demand.
- The number of advertised residential properties for sale in Karratha has more than doubled in the last quarter; from a four year low of 108 properties in September 2013, to 294 listings in the December quarter of 2013.

Property Prices

- The average advertised 'for sale' price in Karratha is at its lowest since the September 2007 quarter,

	Lots		Detached dwellings		Medium / high density dwellings	
Suburb	**No. Sold**	**Median Price ($)**	**No. Sold**	**Median Price ($)**	**No. Sold**	**Median Price ($)**
Baynton	452	220,000	106	988,000	3	665,000
Bulgarra	2	NA	113	760,000	34	560,000
Gap Ridge	14	233,000	0	NA	0	NA
Karratha	0	NA	0	NA	5	217,000
Millers Well	2	416,250	35	740,000	28	620,000
Nickol	24	304,290	79	890,000	32	849,000
Pegs Creek	0	NA	49	732,500	43	618,000

Table - Karratha District Sales Activity by Property Type for 2011/12

with advertised four bedroom properties from $470,000

- On average purchase prices have fallen from a high in early 2011 to the end of 2013 by over 30%. This is a formidable decrease.

3.1.6. Breakdown of Residential Sales by Property Type

- In Karratha medium and high density property type (i.e. townhouses, duplex units and apartments) accounts for 17.3% of all property sales or 83 sales per annum on average.
- The proportion of medium and high-density dwellings as a percentage of total dwellings sold increased significantly over the same timeframe, identifying a possible shift in purchasing preference from a traditional detached dwelling to higher density product.
- In 2000, high-density products accounted for 18.2% of total dwellings sold, by comparison to 25.7% in 2012. This is possibly due to such products being more affordable than detached dwellings and an increased level of supply within the City.
- The value of detached dwellings in the City is substantially higher than medium and high density product. In 2012 the median sales price for detached dwellings is $810,000 per dwelling with medium and high density products some 28.4% cheaper.
- Sales activity and dwelling prices for individual suburbs within the town of Karratha are shown below. This indicates the differences in sales levels and prices between suburbs in Karratha.

The data indicates:

- House prices for detached dwellings in the three study suburbs are below that of the other suburbs and are fairly uniform
- Prices for medium/ high density properties are lower than the highest price suburb of Nickol, but higher than Karratha centre itself
- New subdivisions on the fringe of Karratha Township such as Baynton have added both new lots and housing supply to the market
- Over the last two years there were approximately 452 lots sold in Baynton, which accounted for 84.5% of all lot transactions over this time period
- In addition, 106 detached dwellings were sold with a median price of $988,000 per dwelling. Baynton has the highest median price for dwellings in Karratha, demonstrating that a premium has been paid for newly developed housing product in the area.

3.1.7. Market Dynamics

- The dynamics of the market have changed with higher quality and more diversification of properties available more recently. The population has responded to these changes
- The older suburbs will need to improve facilities, amenities, and services and supplies will have to be adjusted to market demand if these suburbs are to compete in attracting a greater number of residents
- More attractive offerings and "supply led" demand can be created with the attendant risks that this approach bring

Listed Rental Properties

- The number of properties listed for rent has increased significantly since mid 2012over the past few years. This is due to a major increase in the levels of supply and falling demand.
- In March 2007 there were approximately four properties listed at an average (not median) weekly rental of $1,472.

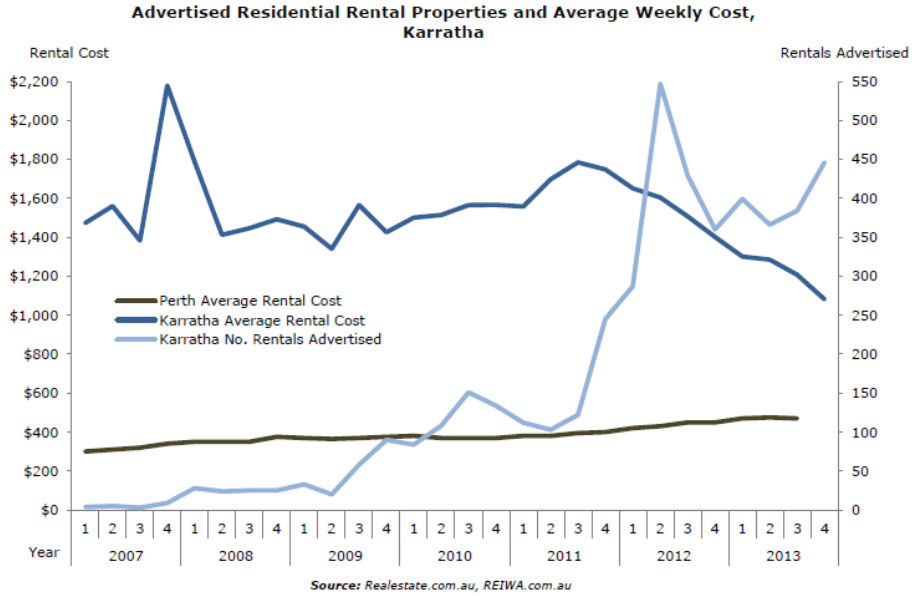


Figure - Advertised residential rental properties and average weekly cost, Karratha

	Number	Min $	Max $	Avg $
Karratha Rentals	**446**	**$ 390**	**$ 2,150**	**$ 1,081**
One Bedroom	60	$ 390	$ 1,000	$ 731
Two Bedroom	32	$ 400	$ 1,500	$ 761
Three Bedroom	175	$ 450	$ 1,750	$ 963
Four Bedroom & above	179	$ 800	$ 2,150	$ 1,372

Table - Karratha rentals

- The 446 properties advertised for rent during this quarter is also the second highest on record

Weekly Rental Prices

- Karratha's average advertised weekly rental has dropped for the ninth consecutive quarter (December 2013), down from $1,784 in the September 2011 quarter to $1,081 in the latest quarter, which is the lowest since figures have been collected by the Commission – the weekly rental has fallen by some 35 % during this period, which is significant from an affordability point of view
- The figure below shows the trend in the number of residential properties advertised for rent in Karratha, and the average advertised weekly rental cost. The table below illustrates the average weekly cost of the advertised rental properties in Karratha, based on the number of bedrooms.

Government Regional Officers' Housing Stock

The supply of Government Regional Officers' Housing (GROH) stock in Karratha has increased in the past two years due to new dwellings being built. There are now more than 600 government houses in Karratha.

Affordability[24]

The analysis of affordability is based on income and residential purchase and rental costs. An RDA study prepared by Imani Development in 2013 is currently being updated. The update will not be completed until May 2014, however interviews with stakeholders in the Pilbara have been held and indicative changes in incomes and costs have been estimated. Although they may be changed they are useful for the purposes of this section of the report.

ABS Median Individual and Family Weekly Income

24 Sources: ABS: RDA Study on the Cost of Doing Business in the Pilbara – Imani Development Austral 2013

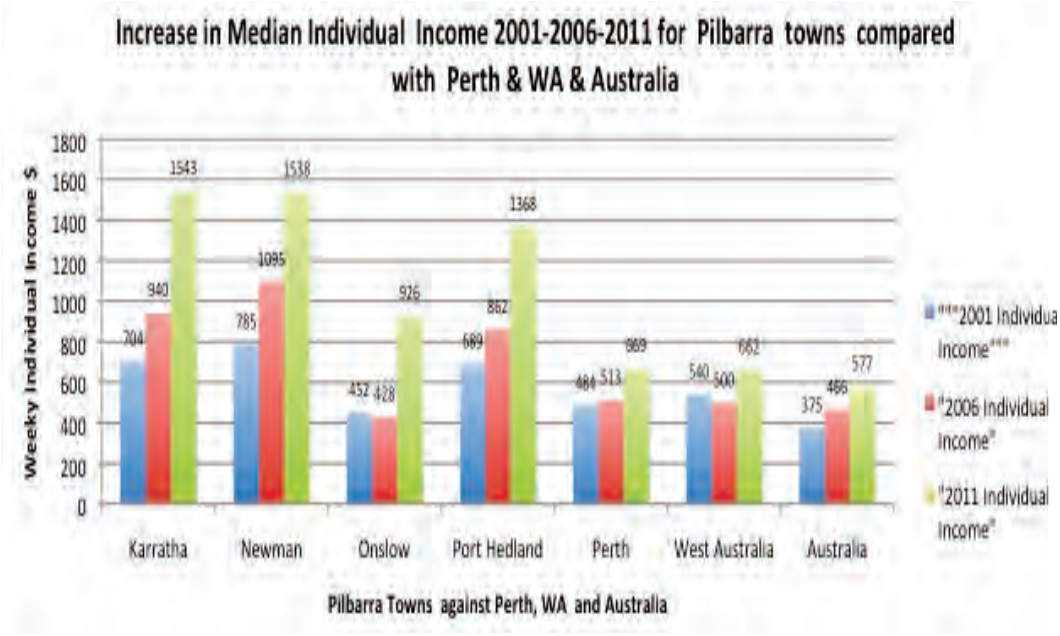


Figure - Median Individual Income Pilbara towns 2001 to 2011

	$	$	$	Percentage Change on Base Year		
	2001	**2006**	**2011**	**2001-2006**	**2006-2011**	**2001-2011**
Karratha	704	940	1543	34%	64%	119%

Table - Median Individual Weekly Income Karratha 2001 - 2011

2001 to 2011

The ABS data highlights both the very high income levels in Karratha and the very rapid increase that took place from 2001 to 2011 when the boom reached its height.

- The percentage increase in individual incomes has been between 96% and 119% for the Pilbara cities, as opposed to an increase of only 38% for Perth and 54% for Australia generally

Changes to income levels are depicted in the graph and table above.

Median Weekly Income levels for families are depicted in the graph and table above.

City of Karratha Employment Profile[25]

The profile of occupation of employment indicates that a significant proportion of employees are in occupations that have remuneration levels that are well below the individual median of $1540. Persons in these occupations comprise up to 25% of the work force with salaries that are generally between $600 and $1,250 per week. Policies that reduce the cost structure in the Pilbara for employees should be aimed at this group in particular.

25 Source: ABS

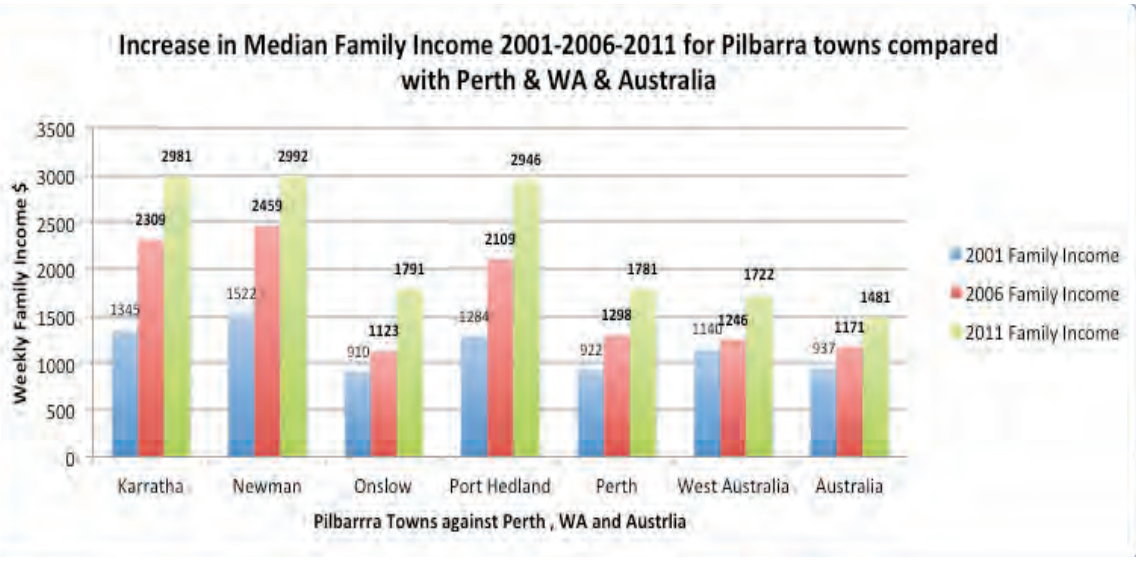


Figure: Median Family Income Pilbara towns 2001 to 2011

Town	2001 $	2006 $	2011 $	% Change 2001-2006	% Change 2006 - 2011	% Change 2001 - 2011
Karratha	1,345	2,309	2,981	72	72	29

Table - Median Family Weekly Income Karratha 2001 to 2011

Pilbara SME Survey Data 2013[26]

Persons working in higher paid professions can potentially cope with the high costs of living. For persons in lower paid categories such as clerical and administrative workers the high cost structure in the Pilbara is problematic.

Household Income in the Study Suburbs

Household income levels in 2011 were all extremely high in the Study suburbs, particularly in Millars Well:

- **In Bulgarra:** 57% of households earned $2,500 or more per week.
- **In Karratha - Pegs Creek:** 48% of households earned $2,500 or more per week.
- **In Millars Well:** 64% of households earned $2,500 or more per week.

Remuneration Changes 2012 to 2017 (Medium term)

- Incomes consist of basic pay, overtime and benefits. Only broad conclusions can be drawn regarding income changes in the period 2012 to 2017 (these will be analysed in more depth in the updated study on the Cost of Doing Business in the Pilbara):
- Interviews with stakeholders in Karratha indicates reductions in basic pay , overtime and benefits such as housing allowances from about mid 2012 until the present with a downward trend
- The extent of basic pay reductions varies – examples are 10 to 15 % reductions for engineers; up to 40 % for labourers; up to 20 % for technicians engaged in the construction industry
- Limited reductions have occurred in the administrative and service provision categories (water, power, health, education, accountancy etc)

26 Source: RDA study on the Cost of Doing Business (2013 – Imani Development Austral)A working week of 40 hours has been used to convert hourly rates to full time equivalents

Occupation	Number	%
Managers	1,119	9.4
Professionals	1,619	13.6
Technicians and Trades Workers	3,181	26.7
Community and Personal Service Workers	715	6.0
Clerical and Administrative Workers	1,613	13.5
Sales Workers	567	4.8
Machinery Operators And Drivers	1,443	12.1
Labourers	1,415	11.9
Inadequately described	260	2.2

Table: Occupation of Employment: City of Roubourne 2011

Employment Cost Item	$
Managers Full Time	2,640
Managers Part Time1/	1,810
Professionals Full Time	2,190
Professionals Part Time	2,080
Technicians and Trade Workers Full Time	2,600
Technicians and Trade Workers Part Time	2,000
Clerical and Administrative Workers	1,120
Machinery Operators and Drivers Full Time	2,880
Machinery Operators and Drivers Part Time	2,040

1/ The average excludes one exceptional response for a company supplying highly skilled services in the marine sector – remuneration is far higher than the average

Table - Employment Costs ($ salaries and wages - averages per week)[1]

1 Care should be taken in using the survey data which is based on a relatively small sample

- Housing allowances have fallen between 10 and 40 %
- Overtime work is now rare
- The major companies and their contractors are reducing remuneration levels
- Employees are now very much more concerned about security of tenure in the workforce

Property Purchase and Rental Costs

The overall fall in property prices from 2011 to 2014 has been over 30 %. Rental prices have fallen by about 35 %

Discussions with stakeholders indicate that purchase and rental prices may fall another 10 to 15 % over the remainder of 2014

The implication of these price falls is that properties are now more affordable to high income earners despite reductions in incomes. Discussions with more highly paid professionals in Karratha indicate that this is the case

For lower income earners purchasing property this is not the case and they remain priced out of the purchase market. The weekly repayment of interest only loans at rates of interest as shown below indicates that for and middle income earners house prices are too high to be affordable.

Market Outlook

- Given the prospect of a greatly reduced level of investment over the medium term; a possible decreased presence of the major resource companies in the town; and low rates of population growth and additional dwellings required the market will remain soft for several years.
- Should phase one of Port Anketell proceed the market may flatten out temporarily. The number of operational staff required is only some 150 and not

	Rate of Interest (%)	Rate of Interest (%)	Rate of Interest (%)
	5.5	6.5	7.5
Amount of Loan ($)	Weekly Payment		
400,000	423	500	577
600,000	635	750	865
800,000	846	1,000	1,154

Table - Affordability: Interest only loan repayments

all of these personnel will live in Karratha.

- It is clear that despite income reductions for persons in the upper brackets of pay this category of workers is still in a strong position to purchase property, whilst in the middle and lower levels of income decreases in remuneration levels mean that accommodation purchases are often out of reach and rentals are still likely to consume a large proportion of incomes.
- There is a high level of uncertainty at present regarding employment security and prospects and this will deter even the higher income earners from purchasing. This may diminish somewhat over the course of 2014 as the employment market steadies to an extent
- Improvements to the ambience and facilities in the town and lower prices will probably result in an increased resident population. How large this will be remains to be seen.
- The slowdown in the demand for both purchased and rental accommodation has led to a higher level of properties on the market and a higher vacancy rate
- There are delays at present in development in the property sector (see ensuing sections for details).

3.1.8. Demand for Land/ Lots

- Demand for lots within Karratha has increased significantly and Karratha has played a major role in meeting the housing demand in the City averaging 179 lot sales per year since 2000, which accounts for 97.1% of all lot sales.
- The median price for lots sold in Karratha was $264,000 as at December 2012. This represents a rate of $472 per sq m based on a median lot size of 560sq m.
- Median lot sizes in Karratha have decreased over the past 12 years, from approximately 702sqm in 2000 to 560sqm in 2012.
- The trend in the number of advertised residential parcels of land for sale in the Pilbara, and the average advertised price is shown in the graph on the following page (caution should be exercised in reading the graph as the average price can be skewed by minimal lots and varied price within each town). In the following table details of the number and average price of advertised residential land within the main Pilbara towns in the last quarter is shown (Land parcels are only recorded when advertised for residential owner occupied and not when advertised for development or investment).
- Land prices in Karratha are below those in all centres except Newman.

3.2. The Demand/ Supply Balance Residential Property

3.2.1. Overview Supply/ Demand Balance Estimates

There is an obvious need for a supply/ demand balance model for Karratha as a whole to be developed by agencies responsible for residential planning in the City which needs to be continuous and adjusted as information and data changes.

At present planning agencies are basing their supply strategy to meet the aspirational target of 50,000 persons by the 2035. Whilst it is possible that the population will be lower than this there is an advantage in planning for the "target population" in order to avoid shortages that may occur if there are unanticipated increases for whatever reason. No doubt adjustments will be made by government agencies and developers to speed up the rate of construction if necessary. Development will proceed at a pace and scale based on the economics of construction, demand and supply.

Planning agencies include the City, PDC, Landcorp, and Government Departments. Data will change as the population scenario changes over the next 18 years and adjustments need to be made on an ongoing basis. In this regard PDC data is updated quarterly. Different projections have been made by ID Consulting who it is understood will be updating their estimates later in 2014.

3.2.2. Karratha City Master Plan

The KCN Plan continues to guide the overall structural revitalisation of the town. The aspirational aspect of the 50,000 total population by 2035 has relevance from a strategic planning perspective. For Karratha and its immediate surrounds to achieve a long term sustainable population size there is an imperative

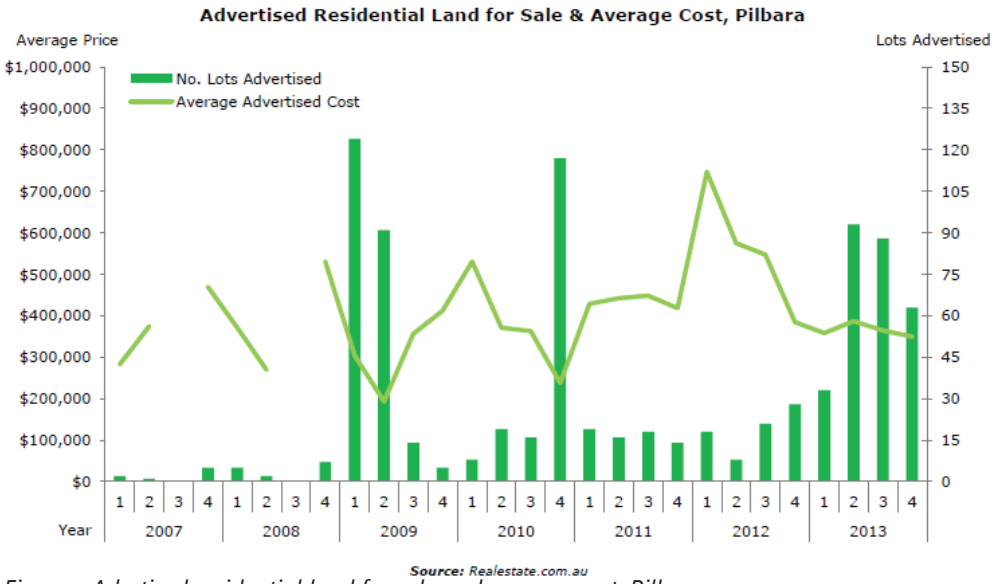


Figure - Adertised residential land for sale and average cost, Pilbara

	Number	Min $	Max $	Avg $
Port Hedland	0			
South Hedland	12	$ 245,000	$ 650,000	$ 493,455
Karratha	10	$ 250,000	$ 365,000	$ 317,714
Newman	34	$ 252,000	$ 495,000	$ 297,144
Dampier	0			
Marble Bar	0			
Nullagine	0			
Onslow	4	$ 370,000	$ 370,000	$ 370,000
Pannawonica	0			
Paraburdoo	0			
Point Samson	2	$ 499,000	$ 499,000	$ 499,000
Roebourne	0			
Tom Price	0			
Wickham	1	$ 340,000	$ 340,000	$ 340,000

Table - Number and average price of advertised residential land within main Pilbara towns, last quarter

for greater economic and social diversification. It is highly unlikely that in the foreseeable future that the resources industries will not continue to be the main drivers to the local economy. However from a long term planning perspective there needs to be a conscious effort to diversify this reliance through a combination of measures. Some of these are already happening such as the development of an education and health precinct within Karratha.

The foundations for this growth are now showing themselves through the significant infrastructural renewal of the town centre as well as the commercial, retail and industrial space developments already occurring, and in the pipeline.

There has also been for the first time the recognition that the town can also go up (apartments) and not only horizontal (houses). This has already created a significant change to the liveability of the city centre and should be encouraged further. Apart from anything else higher buildings also create shadows and encourage different forms of overhead shading, e.g. arcades and other types of covered walkways, which can mitigate the harsh climate.

3.2.3. Recently Competed /Under Development or Planned Development Known Estimates

Development /Estate	Description	Proponent/ Agent	Total Dwellings	Estimated Residents
Jingarri Estate	Located off Dampier Rd, adjacent to Nickol West (Karratha) 195 single lots – final 20 lots now selling 75 houses built with further dwellings under construction Estate also incudes 6 group dwelling sites	Pindan Realty Pty Ltd Ray White Karratha	330	960
Pelago Apartment Development	Located at Cnr Warambie Rd and Sharp Ave, Karratha Pelago West 114 apartments Pelago East 170 apartments	Finbar	284	825
The Baynton Karratha	Located at 55 Gardugarli Drive, Baynton West (Karratha) 80 apartments (2 & 3 bedroom) Complex completed and now selling some with corporate leases in place	Mindaroo Pty Ltd Crawford Property Group	80	230
Madigan Estate	Located on Madigan Rd and adjacent to Baynton West Stage One completed with 234 lots for sale 22 sales to date Housing construction on some lots commenced	Landcorp Pilbara Real Estate	234	680
Tambrey, Balmoral Road	House and land packaged development bounded by Balmoral Road, Bowerbird Drive, Manta Ray Loop and Bluebone Street, Nickol (Karratha) First stage of 41 dwellings completed and now selling/leasing Second stage yet to commence construction	Alcock Brown Neaves Group and TR Homes Ray White Karratha	80	230
Yaburriji Estate (Ngarluma Sustainable Housing Project)	New estate located on corner of North West Coastal Highway and Point Samson Rd, Roebourne First 99 residential lots completed and for sale Eventual yield expected of up to 400 lots	Ngarluma Aboriginal Corporation Ray White Karratha	99	290
Mulataga	New suburb located to the east of Bulgarra (Karratha) bounded by Mystery, Maitland and Millstream Roads Construction to commence in January, 2014 First stage of 72 lots to be completed by August 2014 Estimated yield of 250 lots by end of 2015, 350 lots by mid 2015 and 400-500 lots by end 2016	Mirvac	1,400	3,780
The Quarter	Located at the corner of Sharp Ave and Barlow Place, Karratha CBD 50 service worker apartments Construction from May 2014 - completed by July 2015	Mirvac	50	145
Karratha Lazy Lands Program	61 parcels of land throughout Karratha and suburbs to be offered to the local market Stage One – 7 parcels of more than 3.2 ha Stage One estimated to provide 200 dwellings – due for completion by 2014	Questus, Sulcon, Blue Waters Development Corporation, Big Wig Enterprises	200	580
Total Estimated Residents	7,720			

Table: - Summary of Recently Completed / Under Development/ Proposed Major Housing/Accommodation Developments in Karratha

Suburb	Area (HA)	Dwellings
Bulgarra	20.18	484
Millars Well	15.13	329
Pegs Creek	0.28	1

Table - Summary of Areas under Development (or planned):Three Study Suburbs

- It is likely that due to the rapid slowdown in demand related to supply that some of the proposed new developments such as Mulataga will not proceed beyond an initial placement. At present there is no commercial justification for expansion beyond the initial offering of 72 properties. In addition there are still only 70 units out of 100 sold in the Pelago East precinct.
- If all planned developments were to proceed a major oversupply of between 3,000 and 4,000 dwellings would result

3.2.4. PDC Estimates (September 2013)

PDC estimates of the supply of accommodation indicates that some 2,600 units will be constructed up to 2017 and a further 4,850 thereafter. If these developments do proceed according to estimates then demand will be more than fully met by supply under any current forecasting scenarios based on population and household growth.

The known projected dwelling mix shows that single residences will constitute 23.2 % of future dwellings; Group Multiples 14.8 % and duplexes, apartments and town houses will provide a small percentage each (0.5 % to 2.3 %) and service worker accommodation will provide 0 %. "To be confirmed" makes up about 59 % of future dwellings. The data indicates a developer preference for constructing single residences and is in line with other forecast of dwelling types.

The PDC forecasts for property development show that over the period to 2017 about 2,480 dwellings will be completed and 2,201 Lots will be created. From 2018 onwards a further 4,845 dwellings will be constructed and 1,984 Lots will be created.

With regard to these projections there is some uncertainty and it should be noted that:

The key issues needing attention are:

- 66% of total dwellings do not have a planned completion date.
- 47% of total lots do not have a planned release date.

What the figures tell us:

- Slight increase in number of known developments from the last quarter.
- Fall in number of developments with TBC completion date since last quarter.
- Dwelling mix remained largely unchanged.

Clearly the number of dwellings will depend on density and design. The detailed breakdown of PDC forecasts of supply in the three study suburbs is shown on the following pages (based on an analysis of the spreadsheets supplied by PDC in January 2014.

City Ownership Data: Vacant Land in the Three Study Suburbs

The City data form the Rate Payers data base is shown below. Obviously the number of dwellings that can be developed depends again on density and design characteristics.

Summary of Data (M2)

Lazy Lands Data

Hot spots ref	Area in ha.	Project address	Cadastre		Date of Completion
Bulgarra					
KA47	0.51	Lot 1926 on Deposited Plan 182316 (Ridley Street, Bulgarra)	Lot 1926 on DP182316 (Ridley Street, Bulgarra)	29	2014
KA47	8.63	Parcels P37, 38-40, 42, 43 Bulgarra	R32335 Lot 3000 on DP54462 (C/T: 3153/415)	151	To be Confirmed
KA47	0.55	Parcel P36, Bulgarra	R32335 Lot 636 on DP71342 (C/T: 3153/415)	11	To be Confirmed
	0.08	199 Richardson Way (Bulgarra)	Lot 199 on DP211474 Richardson Way	7	2013
	0.08	200 Richardson Way, Bulgarra	Lot 200 on DP211474 Richardson Way, Bulgarra	7	To be Confirmed
KA47	1.70	Lot 644 on DP (Samson Way, Bulgarra)	Lot 644	104	To be Confirmed
KA47	0.30	Lot 655 on Deposited Plan 71341 (Warrier Street, Bulgarra)	Lot 655 on DP71341 (Warrier Street, Bulgarra)	9	To be Confirmed
KA47	5.87	Parcel P35, Bulgarra	R32335 Lot 635 on DP71342 (C/T: 3153/415)	117	To be Confirmed
Nil	1.11	Parcel P51, Bulgarra	R32335 Lot 651 on DP71341 (C/T: 3155/676)	22	2016
KA47	1.35	Parcel P61, Bulgarra	R32335 Lot 661 on DP71341 (C/T: 3153/415)	27	To be Confirmed
Total Bulgarra	**20.18**				
Millars Well					
	2.65	Parcel P20-22 Millars Well, Karratha	R40041 Lot 620 on DP71328 (C/T: 3155/678)	53	To be Confirmed
KA49	1.34	Parcel P23-26 Millars Well, Karratha	R40080 Lot 623 on DP71332 (C/T: 3140/494)	27	To be Confirmed
	0.377	Lot 2364 on DP214696 Petries Court, Millars Well	Lot 2364 on DP214696 Petries Court Millars Well	8	To be Confirmed
Nil	0.09	Lot 617 on Deposited Plan 71315 (Shadwick Drive, Millars Well)	Lot 617 on DP71315 (Shadwick Drive, Millars Well)	5	To be Confirmed
Nil	0.18	Lot 613 on Deposited Plan 71315 (corner of Wotherspoon Road and Gleeson Place, Millars Well)	Lot 613 on DP071315 (corner of Wotherspoon Road and Gleeson Place, Millars Well)	8	To be Confirmed

KA49	10.38	Parcel P14-16, P19 Millars Well, Karratha	R40041 Lot 4609 &4618 (C/T: 3145/909 & 3145/911)	220	To be Confirmed
Nil	0.10	Lot 628 on Deposited Plan 71333 (Burnside Close, Millars Well)	Lot 628 on DP71333 (Burnside Close, Millars Well)	8	2015
Total Millars Well	15.13				
Pegs Creek					
KA48	0.28	Lot 1680 on Deposited Plan 214196 (Galbraith Road, Pegs Creek (EOI))	Lot 1680 on DP 214196 (Galbraith Road, Pegs Creek (EOI))	1	To be Confirmed
Total Pegs Creek	0.28				

Table - PDC forecasts of supply in the three study suburbs

Suburb	Area Residential	Area Commercial	Area Parks, Landscape and Drainage	Area Crown	Area School Land
Bulgarra	12,584	NA	1,217,750	NA	25,307
Millars Well	7,061	NA	125,624	22,310	NA
Pegs Creek	12,755		301,835	7,142	

Table - Summary of Data (M2)

3.2.5. City Ownership Data: Vacant Land in the Three Study Suburbs

The City data form the Rate Payers data base is shown above. Obviously the number of dwellings that can be developed depends again on density and design characteristics.

3.2.5. Lazy Lands Data

Additionally to the table on the following pages, the land areas available and their characteristics will be further analysed in other sections of the report.

3.3 Retail and Commercial Analysis

- It is clear from previous studies, recently completed developments and ongoing/ planned developments such as Pelago 1 and 2 and Mulataga that there is very little need for additional commercial and retail space.
- Up to only 9,500 M2 additional retail space is required in Karratha by 2021
- Bulgarra contributes some 23 % of retail turnover in Karratha
- Karratha- Pegs Creek-Stove Hill contributes some 15 % of retail turnover in Karratha
- Millars Well contributes some 13 % of retail turnover in Karratha
- Whilst major retail facilities are not warranted due to existing and planned facilities elsewhere limited food and beverage facilities are socially attractive and an economic possibility particularly in Bulgarra
- Perhaps one or two small coffee type shops could add to the attractiveness of Bulgarra and residents have mentioned this during consultations

4. Development Costs

4.1. Historical Costs

A range of recent surveys and data on construction costs[1] were referenced. The estimates indicate:

- The cost of building a standard home in 2011 in the Pilbara towns (four bedroom and two bathroom) is approximately $400,000-$500,000 (excluding land costs). ·· A typical standard dwelling costs approximately $180,000-$250,000 to construct in the metropolitan region, therefore the costs for a similar product in the Pilbara were approximately double that of the Perth metropolitan region.
- Construction costs have risen strongly in recent years due to large increases in energy costs, material shortages and skilled labour shortages.
- Interviews in 2013 indicated that in general construction costs are 1.75 to 2.00 times as high in the Pilbara compared to those in Perth. The Ranges Karratha estimates the cost of construction to be 1.8 times the cost in Perth.
- The estimated increased cost is partly due to a 5% to 10% differences in design and construction methodology
- Recent discussions indicate that although costs have fallen they remain well above Perth costs.
- The Rawlinson's Construction Cost Guides 2012 and 2013 indicate that the construction cost index for Perth compared to Sydney has increased from 122.36 in 2000 to 234.71 in December 2011. A range of indicators shows that Perth construction costs are the highest in the nation. Current costs to build an administrative building in Perth (singe storey, standard finish) are $2,145-$2,310 compared to Melbourne at $2,045-$2,205.
- In turn the high cost of construction in the Pilbara can be gauged from cost indices for main the towns in the Pilbara compared to Perth (Perth = 100). These are:
  - Karratha: 155.
  - Port Hedland: 160.
  - Newman: 165.

1 Pilbara Hotspots Report; Master Builders WA; Stakeholder interviews; Rawlinson's Cost Guide 2012 and 2013; 19th Annual Demographic International Housing Affordability Survey; RDA Study on Cost of Doing Business in the Pilbara – Imani Development Austral

- High construction costs are a result of:
  - Distance.
  - High labour costs – 50% higher than Perth excluding flights and accommodation.
  - High accommodation costs.
  - High material costs.
  - More rigorous standards to meet flooding and cyclone issues – this adds 30% to structural steel tonnages and 400% to 600% to concrete footing volumes.
  - Site visits add 10-20% to costs.
- The 2013 data shows little change concerning the price indexes. Karratha and Port Hedland remain at 155 and 160 respectively
- More than likely the 2014 indexes will show a decrease as activity has slowed almost across the board. Perth construction costs are anticipated to have increased by 1 % in 2013 compared to 2012 and the cost index is expected to be some 135 by the end of 2013
- Perth costs remain at higher levels than other major towns in Australia except Hobart where some costs are higher than Perth[2].

4.2. Future Costs

Discussions with stakeholders3 confirm that cost pressures are subsiding due to less demand for services. Prices will not increase unless there is further port development and/or exploitation of additional LNG or iron ore reserves.

- The extent of cost falls will not be known until later in the year when the 2014 Rawlinson cost guide is published and MIRVAC have received quotes for the development of Mulataga
- Employment costs will be lower over the period 2014 to 2017 - but will remain comparativel¬¬y high. The rapid increases of the past few years are unlikely to be repeated without major new investments
- Whilst the cost of water may rise only slightly the cost of electricity may well continue to rise quite significantly.
- The cost of materials is unlikely to have fallen as much as labour costs, but may well have decreased to an extent
- Environmental considerations mean that costs are higher in flood prone areas and standards related to cyclones also lead to higher costs than would otherwise be the case
- Overall it is believed that development costs have

2 Detailed prices for labour and other cost items for Perth are available for the full range of residential types, retail and industrial buildings.

3 Mirvac; Landcorp; Estate Agents: Finbar: Karratha Chamber of Commerce and Industry

4.3. Study Suburbs Cost Estimates

Regarding MIRVAC development costs for Mulataga it is understood that these may be made available to the study team when they are available and will be useful as a benchmark for estimating development costs in the study suburbs.

The Study suburbs have existing services: water, power, waste water, roads that can be supplemented, adjusted, increased at low cost compared to development of new suburbs. New Construction can take advantage of changing demographics and consumer preferences for modern, environmentally friendly, more diversified properties at a lower cost of construction than in the immediate past, although distance and environmental considerations mean that costs will remain higher than those in Perth in the medium term.

It will be necessary to estimate costs on a case by case basis for each type of activity (accommodation; transport, amenities, social etc). Unit costs will vary considerably depending on type, location, geography, design and density.

Clearly there is a cost benefit to higher density housing:

- Infrastructure costs (power, water, wastewater, ICT etc) per dwelling/ amenity will be lower per person
- Total construction costs per person will be considerably lower than stand alone dwellings
- Service costs per person/dwelling will be lower for the City and other service providers
- Maintenance costs will be lower

Higher density dwellings should be given prominence on a cost basis for developers, prospective buyers and service providers including the City. Residents have expressed a desire to maintain large block sizes and dwellings; however they are not averse to higher density development near the town centre and some of the less well used parks.

Lazy land ID	Area (m2)	Flood Constraint	Rezoned	New Zoning Stage 1	DA no.	Address	Suburb
P13	1,956	N	Y	R40	DA 45	27 Wotherspoon Road	Millars Well
P14	8,118	N	N			Atkinson Way	Millars Well
P15	6,325	N	N			Atkinson Way	Millars Well
P16	59,081	N	N			Tilbrook Close	Millars Well
P17	947	N	Y	R40	DA 40	14 Shadwick Drive	Millars Well
P18	1,695	N	N			Garland Place	Millars Well
P19	24,795	N	N			Balmoral Road	Millars Well
P20	4,036	Y	N			Rodrigo Court/Slattery Close	Millars Well
P21	4,265	Y	N			Rodrigo Court	Millars Well
P22	16,788	Y	N			Rodrigo Court	Millars Well
P23	4,268	N	N			Gawthorne Drive/Sun Court	Millars Well
P24	5,841	N	N			Gawthorne Drive/Sun Court	Millars Well
P25	1,253	N	N			Gawthorne Drive/Tue Place	Millars Well
P26	579	N	N			Gawthorne Drive/See Close	Millars Well
P27	2,827	N	N			Leeds Close	Millars Well
P28	1,008	N	Y	R50	DA 46	15 Burnside Close	Millars Well
P29	2,555	N	N			Law Court	Millars Well
P30	4,366	Y	N			Bond Place	Pegs Creek
P31	2,273	N	Y	R40	DA 43	Galbraith Road/Sing Place	Pegs Creek
P32	790	N	N			Galbraith Road	Pegs Creek
P33	14,420	N	N			Demetre Crescent	Pegs Creek
P34	3,090	Y	N			Nelson Court	CBD
P35	58,875	Y	N			Richardson Way	Bulgarra
P36	5,519	Y	Y			Nairn Street	Bulgarra
P37	7,154	N	N			Finnerty Street & Millstream Rd	Bulgarra
P38	18,169	N	N			Finnerty Street	Bulgarra
P39	13,213	N	N			Nairn Street	Bulgarra
P40	33,772	N	N			Viveash Way	Bulgarra
P41	15,970	Y	N			Nairn Street	Bulgarra
P42	3,609	Y	N	R40		Lockyer Street	Bulgarra
P43	6,429	N	N	R40		Lockyer Street	Bulgarra
P44	17,760	N	Y	R50	DA 44	Samson Way/Lockyer Street	Bulgarra
P45	3,741	N	N			Turner Way	Bulgarra
P46	2,646	N	N			Turner Way	Bulgarra
P47	5,959	Y	N			Walcott Way	Bulgarra

P48	4,947	N	N			Mystery Road	Bulgarra
P49	14,253	Y	N			Harding Way	Bulgarra
P50	11,992	Y	N			Brockman Street	Bulgarra
P51	11,175	N	N			Hancock Way	Bulgarra
P52	4,185	Y	N			Elliot Way	Bulgarra
P53	6,243	Y	N			Elliot Way	Bulgarra
P54	17,663	Y	N			Clarkson Way	Bulgarra
P55	2,959	N	Y	R40	DA 41	Warrier Street	Bulgarra
P56	5,213	N	N			Warrier Street	Bulgarra
P57	1,611	N	N			Kestral Way	Bulgarra
P58	8,983	N	N			Warrier Street	Bulgarra
P59	18,950	N	N			Kestral Way	Bulgarra
P60	5,119	N	Y	R40	DA 42	1926 Ridley Street	Bulgarra
P61	13,279	N	N			Gregory Way	Bulgarra
	490,664						

Table - Lazy lands data

5. Settlement Patterns

Settlement patterns have been analysed using the City Ratepayers data base. The major categories of settlement by type of organization are shown for each suburb.

5.1. Bulgarra

Total Rate Payers: 1,338

The characteristics of the settlement pattern of Bulgarra are:

- 54 % of ratepayers are individuals
- 46 % are listed as non individual rate payers :
  - Hamersley Iron (Rio) 17 % - 234
  - Private companies (other) 12 % - 165
  - Department of Housing 5 % - 68
  - Other major rate payers are Dampier Salt (4 %); the City of Karratha (3 %); the Government Employment Housing Authority (1 %) and the Roman catholic Bishop of Geraldton (1 %)
  - Utilities such as water and power have a presence
  - Other government agencies such as WA State and Main Roads have a presence

5.2. Millars Well

Total Rate Payers: 777

The characteristics of the settlement pattern of Millars Well are:

- 53 % are listed as individual rate payers
- 47 % are listed as non individual rate payers:
  - Woodside Petroleum 17 % - 132
  - Private companies (other) 11 %
  - Department of Housing 7 % - 54
  - Government Employment Housing 5 % - 38
  - City of Karratha 5 % - 37
  - Other major rate payers are the Regional Power Corporation Utilities such as water and power have a presence
  - Other government agencies such as Dampier Port Authority, the Defence Housing Authority. Department of Defence have a presence
  - Hamersley Iron and Shell have a minor presence
  - WA State and Main Roads have a presence

5.3. Pegs Creek

The characteristics of the settlement pattern of Pegs Creek are:

- 15 % of properties are listed as individual rate payers – this is very low
- 767 (85 %) are listed as non individual rate payers: - which is very high
  - Private companies (other) 14 % - 129
  - Department of Housing 8 % - 74
  - Government Employees Housing Authority 5% - 42
  - Woodside Petroleum 4 % - 38
  - City of Karratha 4 % - 35
  - Hamersley Iron 4 % - 38
  - Finbar 3 % - 28
  - Roman Catholic Bishop of Geraldton 1 % - 9
  - WA State , Water Corporation, the Regional Power Corporation, the Salvation Army, West Pilbara Health Service etc have a presence

Individual Rate Payers	Private Companies	Hamersley Iron	Dampier Salt	City of Karratha	Department of Housing	Govt. Employment Housing Authority	Roman Catholic Bishop of Geraldton	Total Non Individual Rate Payers
726	165	234	55	45	68	9	11	612
54 %	12 %	17 %	4 %	3 %	5 %	1 %	1 %	46 %

Table - Housing ownership in Bulgarra

Individual Rate Payers	Private Companies	Woodside	City of Karratha	Department of Housing	Govt. Employment Housing Authority	Regional Power Corp	Total Non Individual Rate Payers
409	82	132	37	54	38	8	368
53%	11%	17%	5%	7%	5%	1%	47%

Table - Housing ownership in Millars Well

Individual Rate Payers	Private Companies	Hamersley Iron	Woodside Petroleum	Department of Housing	City of Karratha	Finbar	Govt. Employment Housing Authority	Roman Catholic Bishop of Geraldton	Total Non Individual Rate Payers
140	129	38	38	74	35	28	42	9	767
15%	14%	4%	4%	8%	4%	3%	5%	1%	85%

Table - Housing ownership in Pegs Creek

Appendix 2. State Level Policies

Apart from strategic planning documents such as the *Pilbara Planning and Infrastructure Framework*, the WAPC's State Planning Policies (SPPs) provide an over-arching planning policy framework at State level. SPPs are approved by the Governor and under the *Planning and Development Act 2005*. Due regard must be given to them by local governments and the WAPC when local planning schemes and amendments to them are being prepared, and by the State Administrative Tribunal when considering review applications of planning decisions.

SPP No. 1 *State Planning Framework* brings together all the individual SPPs as well as the WAPC's regionalstrategies, regional and sub-regional structure plans, strategic policies and operational ('Development Control') policies, prepared from time to time by the WAPC. These subordinate policies are listed andcomprise a number of pages.

Many of the listed SPPs, strategic policies such as *Liveable Neighbourhoods,* and the Development Control policies have relevance to revitalisation aims in Karratha. These include policies that promote better use of existing infrastructure in older developed areas by their more intensive redevelopment and use with greater densities with more diverse and efficient housing types, accompanied by improved amenity and personal security. Policies also promote the maintenance of natural areas and the provision of an adequate range of public open spaces, as well as the protection of development from natural hazards such as coastal processes, flood and other climate events. Transport policies provide for design which encourages a greater proportion of movement within neighbourhoods by non-private motor vehicle modes (walking, cycling and public transport), and increased efficiency in the road network.

Other State agency policies may also impact on planning and implementation decisions for the Karratha Revitalisation Strategy. In particular, those of the Department of Lands relating to the disposal of Crown land need to be considered in terms of the constraints or opportunities they may provide, such as its policy relating to the sale of public open space, which is described in more detail below.

Recreation and open space planning policy

The recreation and open space (including drainage) systems of Pegs Creek, Millars Well and Bulgarra were created and set aside free of cost by the subdivider as part of the original 1970s and subsequent subdivisions of these suburbs. Whilst these were undertaken by the Department of Lands and Surveys as Crown land subdivisions, the Department's practice was to follow the WAPC's usual policies that applied to the subdivision of alienated land. Since 1997, all the subdivision of land that is to be alienated from the Crown has required WAPC approval.

The ceding of minimum of 10% of the 'gross subdivisible area' of a residential subdivision for 'public open space' (POS) has been a long standing policy position of the WAPC and its predecessors. The current policy, Liveable Neighbourhoods, requires the minimum 10% POS to be apportioned as at least 8% for active and passive recreation with a maximum of 2% for 'restricted use POS' (natural areas, drainage that is useable for recreation, cultural features). Any land required for drainage or natural area conservation over and above the 10% will not receive a POS 'credit'. Liveable Neighbourhoods provides for a hierarchy of parks:

- District Parks (2.5 – 7 ha, 600m-1km walk of most dwellings, for organised sport/informal games and passive recreation serving 3 – 4 neighbourhoods (1800 - 3,600 dwellings);
- Neighbourhood Parks (3,000m2 – 5,000m2),400m walk of most dwellings, for informal active play/ passive recreation;
- Local Parks (up to 3,000m2, 150 – 300m walk to most dwellings, for children's play/resting places / pedestrian connectivity / creation of a sense of place.

In addition, land for foreshore reserves as required and as justified by the circumstances of the subdivision is also set aside free of cost.

Liveable Neighbourhoods provides for regional variations to the 10% POS standard for areas such as the Pilbara (Element 4, R34). A reduction to 5% active/passive POS may be supported if it is designed and available solely for wide range of high quality POS areas and functions. Land for drainage/flooding and conservation needs to be in addition. Liveable Neighbourhoods is currently under review.

The State government also has had a Cabinet endorsed policy position since 1978 regarding the disposal of Crown reserves for 'Recreation' created in subdivisions, where the reserve is demonstrated to have limited recreational functionality. This policy allows such reserves or portions of reserves to be sold and the proceeds (less 5%) to be used by the local government to buy private land to add to existing parks and/or implement capital works on existing parks in the locality. The policy is based on the equitable principle that the subdivider gives up the POS land in good faith for the benefit of future residents of the subdivision and the purchasers of land have a reasonable expectation that the POS land should always be available for residents to use, having effectively paid for it in the purchase price of their residential lot. The current version of the policy is Department of Lands Policy No. 4.1.5.

Dwelling density and housing policy

The R-Coding applied to a lot stipulates the maximum number of dwellings per specified area of land. For instance, for 'single dwellings', 'grouped dwellings' and 'multiple dwellings', Table 1 of the Residential Design Codes requires an average minimum site area per dwelling of 450m2. Therefore, for two dwellings to be permitted, a 900 m2 lot is required, and for three dwellings, 1,350m2. For the R30 code, an average minimum site area per single or grouped dwelling of 300m2 is necessary, and for R40, an average minimum of 220m2 is needed. Often a greater area is required if it is desired to redevelop in battle-axe subdivision configuration with a new house behind the existing house that is located centrally on the lot.

From the R30 and above R-codings, Table 1 only applies to single and grouped dwellings. Multiple dwellings from R30 and above are controlled via Table 4 of the R-Codes. Multiple dwellings at these higher density R-Codes are controlled by maximum plot ratio, minimum open space, boundary setbacks and height, effectively establishing building envelopes for each R-Coding.

At the lower R-codings, there is usually a significant amount of surplus density 'capacity' in most lots because rarely does the lot size match the average minimum site area per dwelling for the coding.

The WAPC has recently adopted two density definitions for the purpose of applying target densities set for greenfield development in its Directions 2013 and beyond strategy for the growth of metropolitan Perth including the Peel Region: Gross Urban Zone Density and Residential Site Density (WAPC, 2012). Whilst it is appreciated that the study suburbs in Karratha are not 'greenfield', the description of the current aspirations of residential density at a state wide level help provide context.

Gross urban zone density

Directions 2031 established a target of 15 dwellings per gross urban zoned ha for new residential development. The 'gross urban zoned ha' measure includes all urban type uses that would be consistent with an urban zone in a region planning scheme. It excludes land zoned or reserved for industrial, regional open space, major roads, and regional public purposes including high schools. In the three study suburbs the 'gross urban zoned ha' is essentially all of the land bounded by the major roads although excluding their reserves.

Suburb	Private dwellings (occupied and unoccupied) (1)	Persons in dwellings occupied (1)	Persons counted at home on census night (1)	Gross urban 'Zone' Hectares (2)	Dwelling per gross urban 'Zone' Hectares ('Gross urban Zone Density')	Residential Site Hectares (2)	Dwellings per Residential Site Hectares ('Residential Site Density')
Bulgarra	1,001	2,580	3.242	210.4	4.8	84.6	11.8
Millars Well	594	1,445	1,716	138.9	4.3	55.9	10.6
Pegs Creek	660	1,594	2,018	107.15	6.2	49.2	13.4
Total	2,255	5,692	6,976	456.45	4.9	189.8	11.9

Notes:
(1) 2011 Census (Tables B01 & B31 in ABS SSC50103 Bulgarra; in ABS SSC50632 Pegs Creek; in ABS SSC50499 Millars Well). 'Private Dwellings (occupied and unoccupied)' does not include people staying in non-dwellings and excludes 'Visitors only' and 'Other non-classifiable' households. 'Persons counted at home on Census night' is a count of all persons enumerated in the dwelling on Census Night, including visitors from within Australia. Excludes usual residents who were temporarily absent on Census Night.

Table 1: Measurements of density

Residential site density

The 'residential site density' is the number of dwellings on land that is zoned for residential purposes in a local planning scheme. It excludes all non-residential uses, including local roads, parks, primary schools, drainage, commercial and utility sites. In an analysis of developed portions of 300 Perth metropolitan and Peel suburbs, the Department of Planning found that the 2011 gross urban zone density was about 10 dwellings per gross urban zoned ha, whilst the residential site density was 17 dwellings per residential site ha. The Directions 2031 target of 15 dwellings per gross urban zoned ha equated to a target of 27 dwellings per residential site ha in a similar analysis.

The existing dwelling densities in the three study suburbs are relatively low compared to metropolitan Perth and Peel when applying the two density definitions now adopted by the WAPC as described above. As Table 1 above shows, the gross urban zone density is nearly 5 when averaged over the three suburbs, only half of the average metropolitan density of 10. This can be explained to some extent by greater proportions of land necessarily set aside for drainage purposes and other non-development purposes in the Karratha subdivision designs. The average residential site density of the study suburbs is around 12 dwellings per residential site hectare, or 70% of the metropolitan 2011 average of 17. The Perth average is comprised of suburbs with both higher density development and relatively low density development. Whilst this does not necessarily indicate an argument for increasing densities in the three suburbs, it provides a useful point of reference.

8 Appendix

Appendix 3. Transport Technical Appendix

Project title	Job number
Karratha Revitalisation Strategy	**233362-00**
cc	File reference
Shelley Shepherd, Essential Environmental	**Version 3**
Andrew Lewis, Appian Group	
Prepared by	Date
Ryan Falconer	**7 April 2014**
Subject	
Background information: increased street connectivity in Bulgarra, Millars Well and Pegs Creek	

1. Introduction

Essential Environmental engaged Arup as part of a multidisciplinary team to assist the City of Karratha (the City) with preparation of a revitalisation strategy for the established suburbs of Bulgarra, Millars Well and Pegs Creek. The subject suburbs are shown in Figure 1.

The subject suburbs represent the historic residential core of Karratha. They were designed in accordance with the 'Radburn' planning model, meaning that they contain residential cells that are disconnected from each other and often only have one road connection to the external distributor road network. This Technical Note outlines some of the pros and cons associated with this design. It then provides background data regarding the case for adding to street network connectivity through the three subject suburbs. The final section of the Technical Note recommends further work to be undertaken on the basis of the results of previous work and gaps in information available.

The key takeaways from the information presented in this report are that:

- Prior work indicates increasing congestion on the distributor road network within Karratha and adjoining the subject suburbs. Conditions will worsen as a product of new development across the townsite
- The linear form of the townsite means there are limited existing route alternatives. Investment in alternatives would be highly likely to ease congestion on the existing network and potentially defer capital works required to increase capacity
- The main operational pinch-points are intersections, where the majority of vehicle conflicts occur. As operational performance worsens, upgrades to intersections become required on safety and capacity grounds. There are a number of existing intersections, particularly along Balmoral Road that are subject to priority control and therefore will require upgrade over time. Deferment of these works may be possible if alternative distributor routes are made available

These issues are strategic in nature: new connectivity within the subject suburbs is likely to be beneficial for the network but there will remain a strong case for the City to invest in other strategic routes such as a link between the Karratha Industrial Area (KIA) and Madigan Road

Existing tools cannot be relied upon for development of a programme of capital works. While they signpost growing traffic issues, they utilise significantly out-dated demographic data to derive vehicle trip demands. Some tools are also not accessible to the project team, and others were not developed to answer strategic network questions and incorporate the level of detail required to understand operational issues at key intersections

2. Pros and cons of existing layout and street network design

The key pros and cons associated with the existing cellular layout of the subject suburbs include:

Pros

- Minimisation of traffic on local streets because they offer very limited or no through-traffic function
- Local streets are relatively safe for on-street cycling given the low traffic volumes that use them
- A clearly defined distributor network

Cons

- Inefficient traffic circulation patterns, especially between adjoining residential cells because of a lack of connectivity. This leads to higher vehicle kilometres and hours travelled (VKT and VHT) compared to if cells were better connected
- Assignment of sub-district and district traffic to a limited number of through-traffic routes, with resulting congestion issues
- A lack of alternative emergency egress routes, particularly during major flood events. This is acute for northern cells within Bulgarra
- Reduced opportunities for a coherent and efficient future public transport line, given the lack of directness between adjoining cells. Distributor roads also ring the study suburbs and offer only half a catchment, should these form part of preferred routes

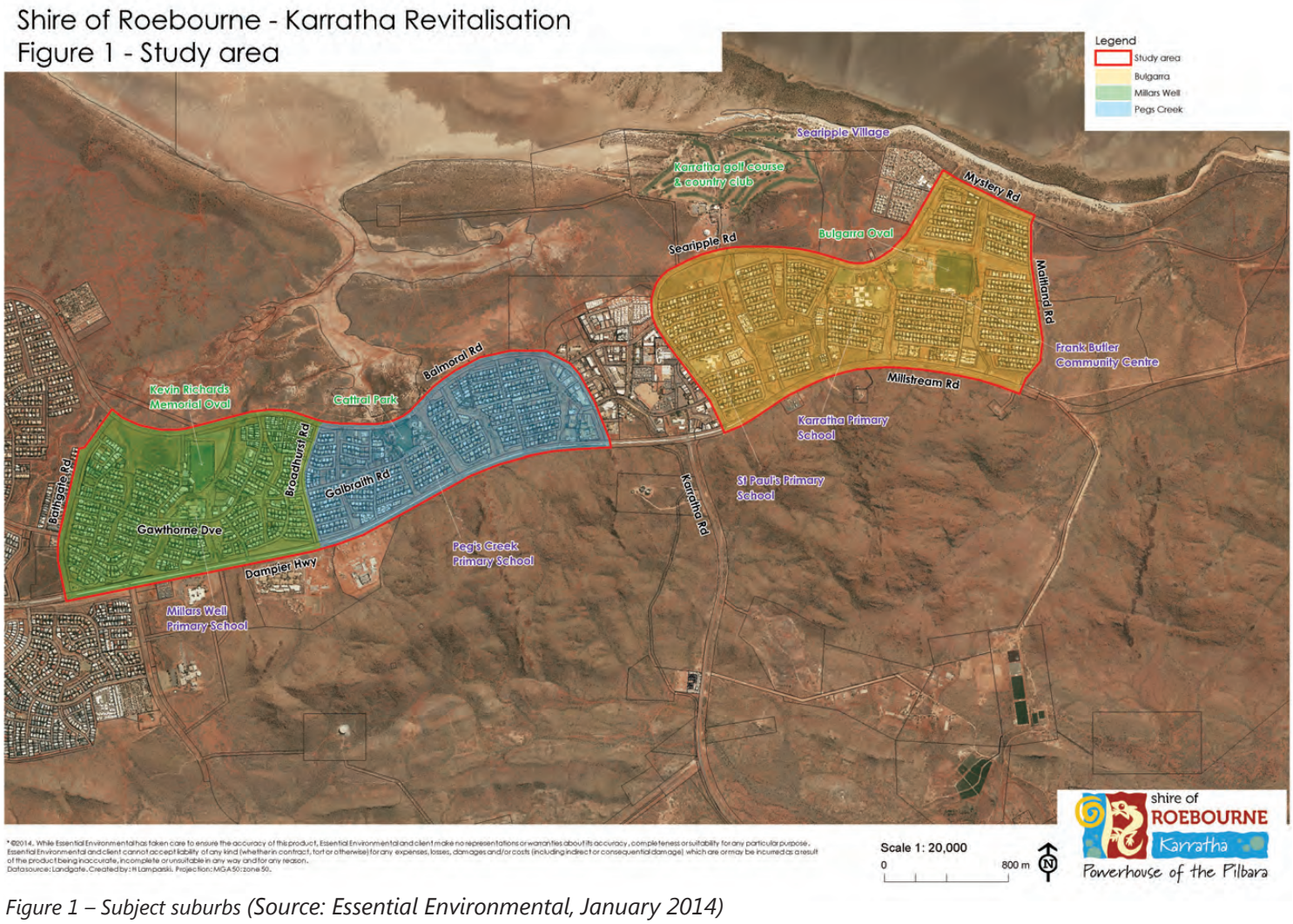


Figure 1 – Subject suburbs (Source: Essential Environmental, January 2014)

Together, the layout of the study suburbs, location of employment outside the suburbs and road network characteristics generate extremely high peak hour demand flows on a limited number of routes. In particular, Dampier Road is heavily congested during peak hours and this is forecast to worsen over time as Karratha grows. There are very limited alternative routes that traffic can reassign to (e.g. Balmoral Road and Searipple Road), meaning these are also likely to become very busy in the medium term. Critically, these alternative routes are currently single carriageway and may require upgrade.

Network congestion will also, over time, lead to increasing performance issues at key intersections. These issues are likely to be most acute in locations where there is existing priority control and therefore limited opportunities for traffic on the minor approach to access the distributor network (e.g. at Bathgate Road/ Balmoral Road and Higham Street/ Dampier Road).

Forecast performance issues at other locations, including Searipple Road/ Dampier Road and De Witt Road/ Dampier Road, have already led to recommendations for signalisation as part of the Karratha City Centre Infrastructure Works Project.

The key opportunities to help manage these issues relate to improving east-west and north-south connectivity through the study suburbs. There are other strategies than can be investigated, but these fall outside of the study suburbs. These strategies include construction of City North Boulevard and a new district linkage between the Karratha Industrial Area and Madigan Road.

3. Background data

3.1. Overview

Arup is aware of at least three particular pieces of work relating to network connectivity through, to and from the subject suburbs. These include:

- Previous strategic modelling by others (Transcore) as part of development of the Karratha City of the North (KCN) Plan (2010-2011)
- A spreadsheet model – the Karratha Spreadsheet Model (KSM) – developed initially in 2011 by Arup to generate demand flows for traffic accessing the Karratha City Centre as part of the Karratha City Centre Infrastructure Works (KCCIW) Project
- Transit alignment analysis conducted by the KCCIW Project and reported on by Arup in July 2013

3.2. Strategic modelling by others (Transcore)

Transcore provided traffic engineering services to assist with the preparation of the KCN Plan. As part of their commission, Transcore undertook a range of modelling activities including development of a strategic model for the Karratha Townsite using EMME software. Arup is aware of some scenario testing but does not have information as to all specific test years or scenario data.

Transcore's work assumed construction of a new east-west road through the subject suburbs. Some volume range plots produced forecast around 10,000 vehicles per day (vpd) using the new connection west and 7,500 vpd east of the City Centre (see Figure 2), although this particular iteration did not assume connection between O'Keefe Road and Karratha Terrace. Comparative volumes on Balmoral Road, Searipple Road and Dampier Road in this scenario are:

- Balmoral Road west of the City Centre – up to 31,700 vpd
- Dampier Road west of the City Centre – up to 36,900 vpd
- Searipple Road east of the City Centre – up to 25,900 vpd
- Dampier Road east of the City Centre – up to 23,300 vpd

The volume range plot included in Transcore's draft Karratha Revitalisation Project Transport Context Report (February 2010) and included as Figure 3 shows around 5,000 vpd and 3,000 vpd using a new east-west link outside of the City Centre. Transcore talks about the east-west link attracting some traffic from alternative routes such as Dampier Road but is not clear as to potential strategic effects (e.g. deferment of upgrades along existing distributor roads). Also, trigger points and route selection are not discussed in any detail.

The KCN City Growth Plan (p182) refers to the east-west link being available as a bus route within 1-5 years so ostensibly by 2015/ 2016.

The limitations of the earlier modelling work include:

- Transcore did not make the model/s available for review as part of the KCCIW Project and therefore the reliability of the models cannot be ascertained
- Demographics applied in model development are no longer applicable
- Some changes have been made to the road network within Karratha and surrounds since the models were developed

An east-west route appears to be an important element of the KCN Plan and the transport analysis that informed it; however, more work is needed to understand timing and potential impacts on other capital works requirements (e.g. capacity upgrades along other routes). Neither the KCN Plan nor Transcore's work appear to address improved north-south connectivity through the subject suburbs.

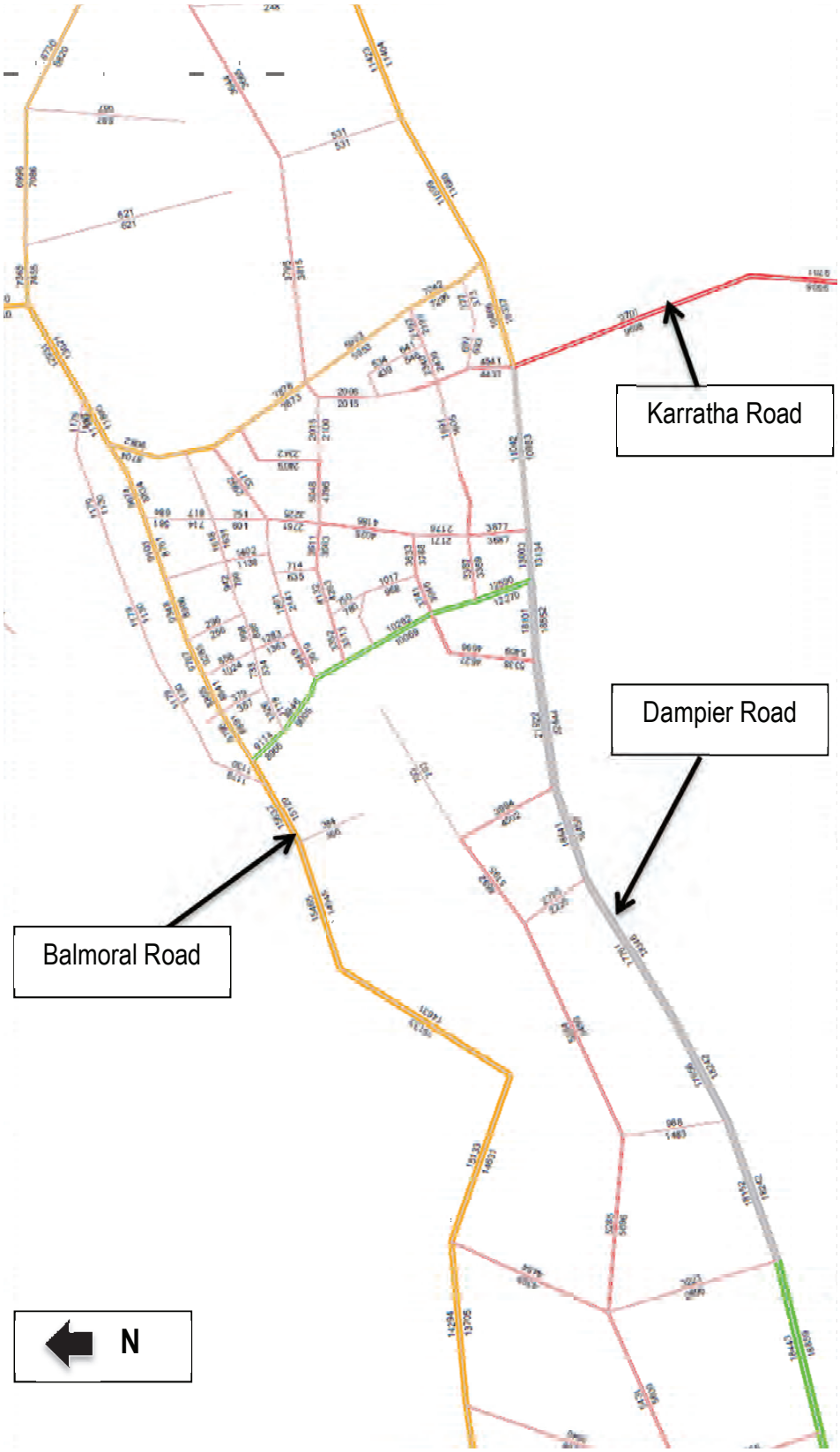


Figure 2 – Strategic modelling output in vehicles per day (unknown test case) (Source: Transcore, undated)

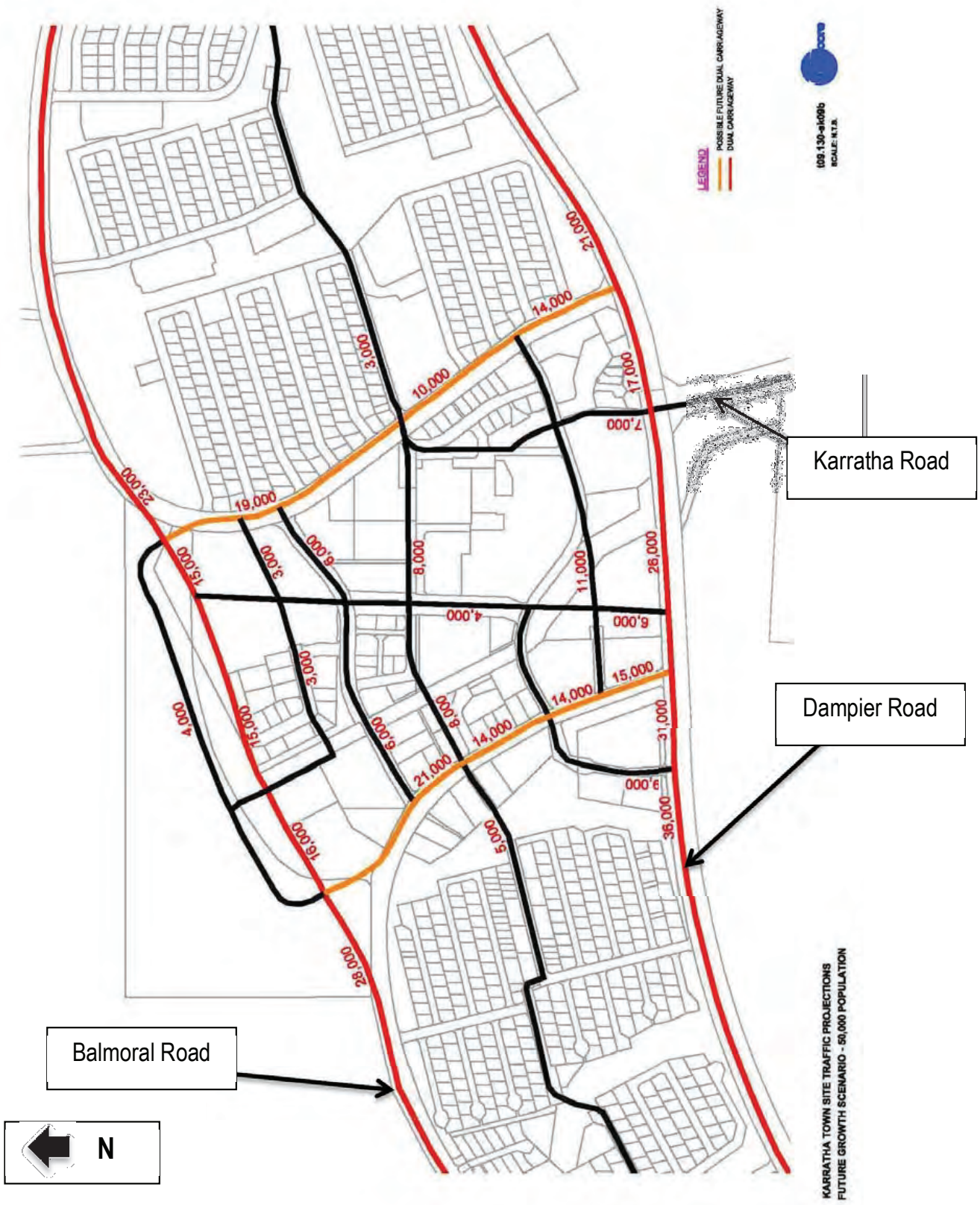


Figure 3 – Forecast volumes (vpd) through and adjacent to Karratha City Centre

(Source: Transcore, February 2010: p25)

Figure 3 – Forecast volumes (vpd) through and adjacent to Karratha City Centre (Source: Transcore, February 2010: p25)

3.3. The Karratha Spreadsheet Model (KSM)

Arup developed the KSM as to provide an understanding of future traffic demands in and around the City Centre and thereby help to make decisions on transport infrastructure provisions. The KSM is a three-step model encompassing trip generation, trip distribution and assignment.

Prior to assessing network requirements, a fitness-for-purpose assessment was undertaken on the base year model comparing modelled and observed traffic flows over a series of screen-lines and on individual links. The screen-line assessment demonstrated some moderate differences between modelled and observed traffic volumes but that overall, the KSM provided a good representation of the traffic volume to/ from the Karratha City Centre.

The KSM has limited accuracy when forecasts for individual links are considered given the constraints of traffic assignment within the spreadsheet model environment. The KSM was not intended to be used to make design decisions; instead, it was applied in the production of the more detailed Karratha City Centre traffic network model and otherwise provides a good overall snapshot of future traffic flows throughout the townsite. Specifically, the KSM forecasts link demands at a high level. It does not evaluate performance of intersections. Intersections represent key points of vehicular conflict, delay and therefore congestion within a busy network.

The *theoretical* capacity of a traffic lane is around 1,800 vehicles per hour (vph); however, this assumes no impedance (e.g. intersections along the route) and minimal vehicle spacing. In practice, a traffic lane in an urban context has much less capacity because of the frequency at which traffic is delayed because of intersection spacings and turning demands. If existing intersections along a busy link do not provide sufficient opportunity for vehicles to turn into or from minor approaches – often the case with priority controlled intersections where minor flows have to yield to major flows - unacceptable delays and safety issues can arise as conditions get busier and drivers begin to accept smaller gaps in traffic. A traffic lane on an urban arterial may therefore have a practical capacity of about 1,200 vph.

Directional traffic flows on many urban roads are not uniform. For example, there may be significantly higher traffic flows in one direction in the morning and then the opposite in the evening peak. This tidal flow is influence by commuter traffic travelling to employment centres in the morning and then back again in the evening. In Karratha, observed data shows tidal flow westwards in the morning and eastwards in the evening. The observed ratio between traffic flows in the peak and non-peak directions is around three to one.

On these bases, the practical capacity of a two-lane arterial road in Karratha – such as Balmoral Road – is somewhat less than 2,400 vph. For guidance, around 1,600 vph may be assumed. This suggests a daily flow of around 16,000 vpd.

An additional limitation of the KSM includes that it was developed using demographic data for the Karratha townsite provided to Arup in the first half of 2011. This dataset assumed population growth in Karratha to around 50,000 people by the mid-2030s; a projection now considered by the demographers on the Karratha Revitalisation Strategy team to be too aggressive.

In broad terms, the KSM forecasted emerging operational issues on the existing network. Volume plots were produced for short (2016), medium (2021) and long term horizons (2031) (see Figures 4 to 6). This work was then used to form strategic recommendations for improved network connectivity across the Karratha townsite, although this was not an explicit objective of the work. The outputs suggested that there will be a need for additional capacity along Balmoral Road (in particular) sometime between 2016 and 2021. The data also informed the case for refinement of the transit alignment specified in the KCN Plan.

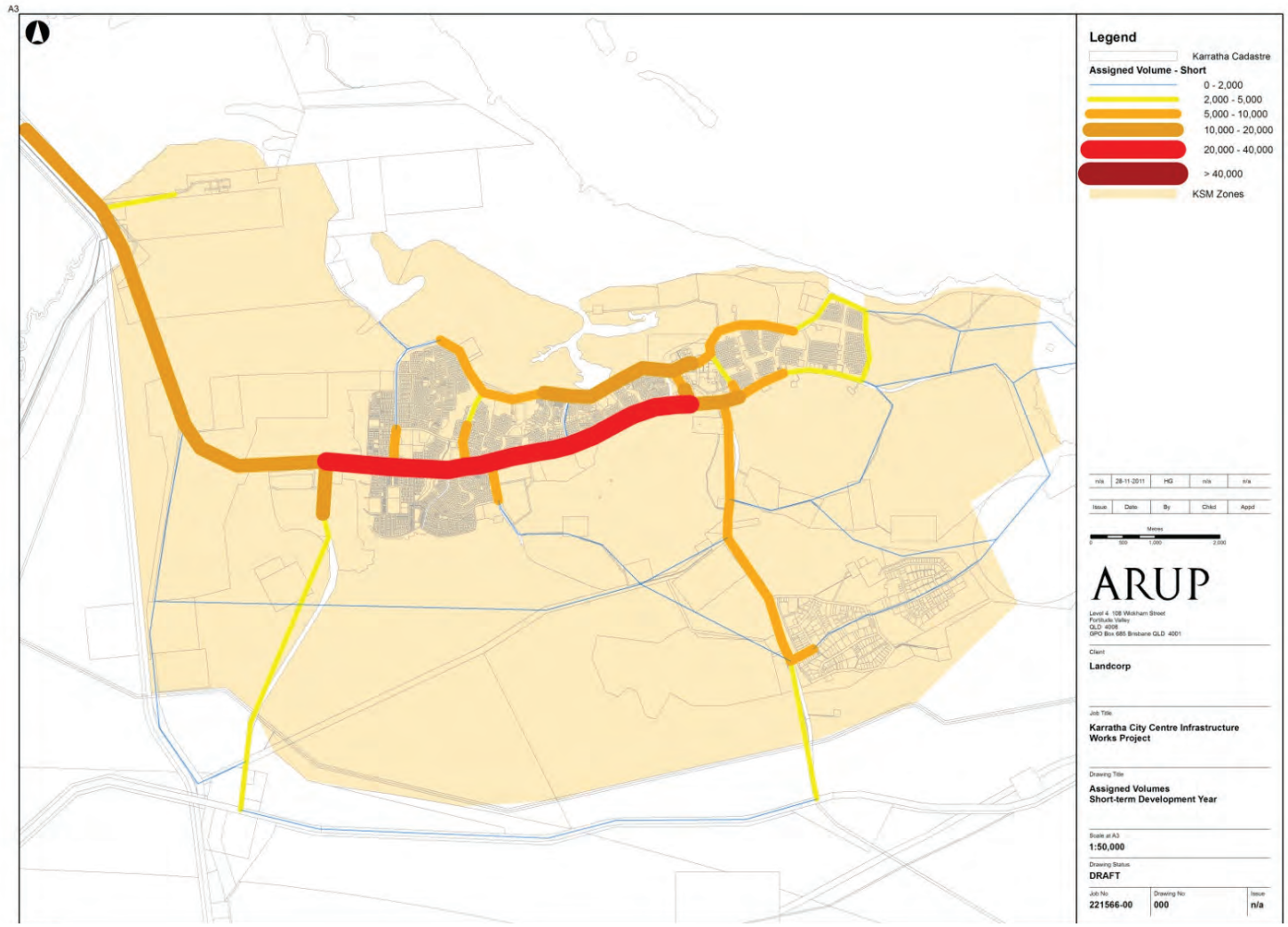


Figure 4 - Short term (year 2016) development modelled flows (vpd)

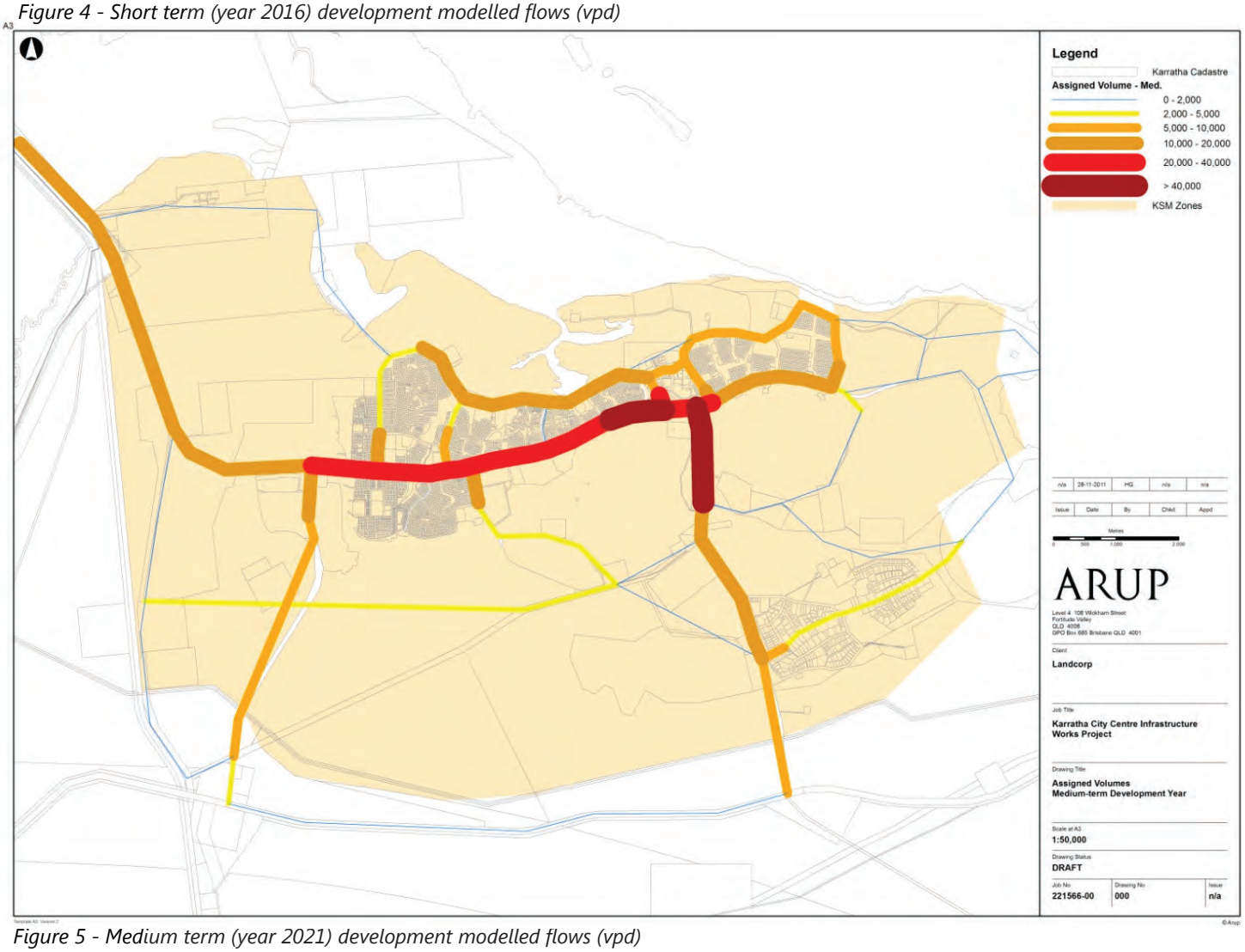


Figure 5 - Medium term (year 2021) development modelled flows (vpd)

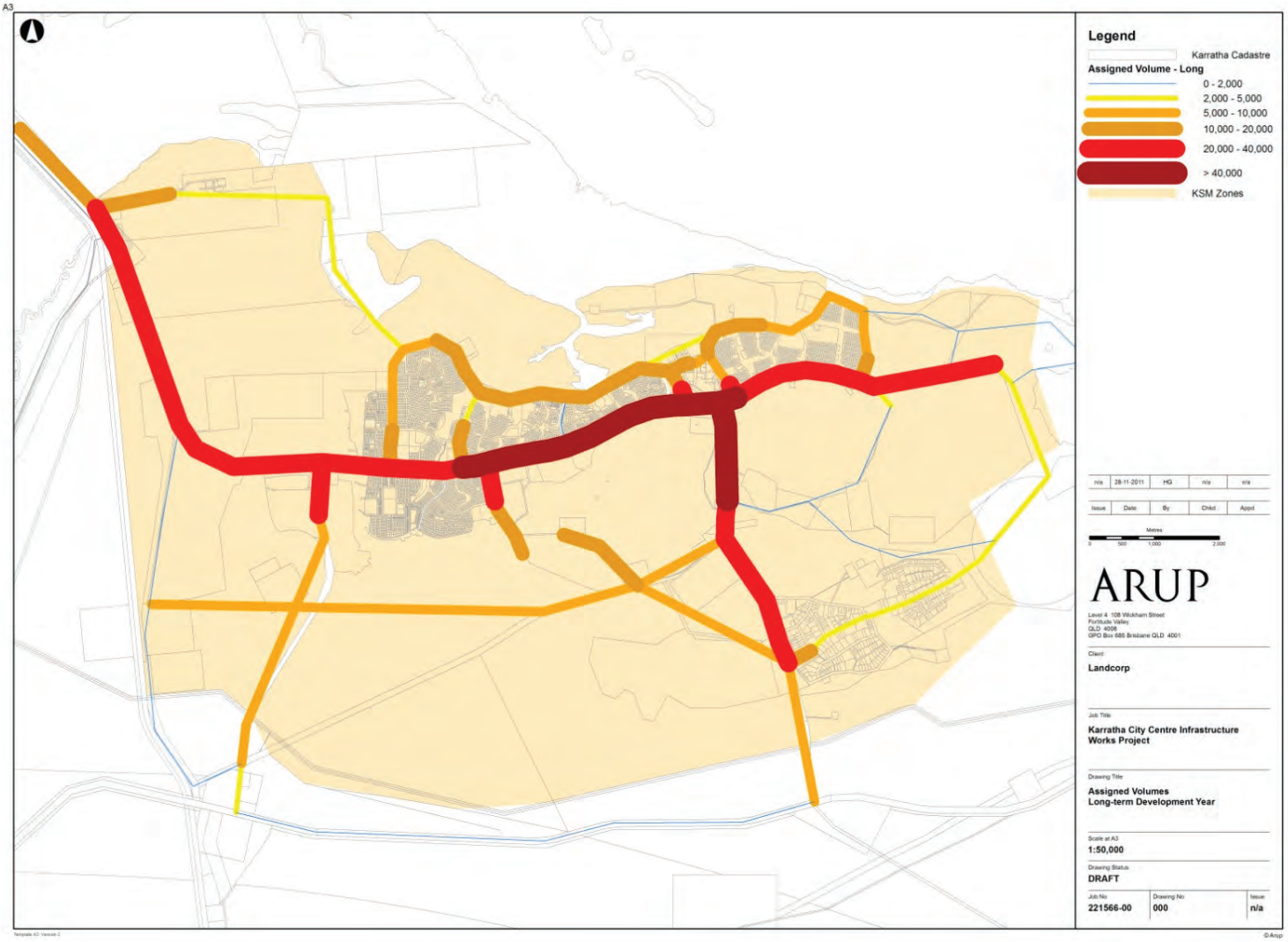


Figure 6 - Long term (year 2031) development modelled flows (vpd)

3.4 Transit alignment analysis

Transit alignment analysis was undertaken to support broader transport planning objectives of the KCCIW Project. These included:

- A transport system that supports the land use, amenity and sustainability objectives of the KCN Plan and the KCCIW Project
- Development of Karratha Terrace as an access to the City Centre, by connecting westwards to O'Keefe Road, with future potential traffic signals at the intersection of O'Keefe Road and Dampier Road
- Definition of the form and function of roads within an overall rational hierarchy, identifying streets that are likely to carry the most pedestrians, function as transit or cycle links and/ or provide direct property access, and those that are likely to be used by through-traffic
- Facilitation of future transit access to the city centre to increase opportunities for non-car transport
- Staged development of the transport network to support the growth of the city centre and a transition from automobile-dominated to multimodal access
- Arup's work included benchmarking services in a regional WA centre. Bunbury was selected for comparison. The critical elements of a service were defined as:
- Using the City Centre as the service anchor or fulcrum
- Selection of an alignment that would maximise the potential catchment for buses (e.g. avoid sections of route where development would only be on one side of the road)
- Yield efficiencies by minimising service kilometres and potential delays relative to the catchment size and townsite layout
- Identify prospective locations for stops that would balance catchment potential with access to pockets of activity intensity (e.g. higher density residential or non-residential nodes) and walking distances for patrons

The preferred transit alignment is shown in Figures 7 and 8, and represents refinement of the concepts presented in the KCN Plan and endorsed by the City. During planning for future transit, opportunity was also taken to consider improved north-south connectivity in key locations.

Construction of Karratha Terrace between Balmoral Road and Searipple Road, and plans to signalise these two new intersections were considered to form the first stage of the transit route. New road connections could then be established westwards (via Frinderstein Way) and eastwards (via Wellard Way). Specific timings were not attached to these works, excepting that subsequent stages of KCCIW traffic modelling assumed construction of the link between Balmoral Road and Frinderstein Way by 2016.

Figure 7 – Preliminary transit plan (east). Green line denotes transit route and red lines new road connections. The blue section is the City Centre alignment (Source: Whelans, July 2011)

Figure 8 – Preliminary transit plan (west). Green line denotes transit route and red lines new road connections (Source: Whelans, July 2011)

4. Data gaps and recommended future work

Previous work indicates a strong case for improved street network connectivity within and between the subject suburbs. The main driver for added north-south connectivity is flood evacuation opportunity. For east-west connectivity, there are added considerations:

- Establishment of an alternative route to existing distributors, which may defer requirements for capacity to be added to roads including Balmoral Road, Dampier Road, Millstream Road, Searipple Road and Mystery Road. Applying professional judgement to previous work and accounting for slowed growth, a new east-west link may function as a Neighbourhood Connector (B) attracting up to about 3,000 vpd and therefore acting as a reasonable release valve for other established distributor roads
- More direct vehicle trips between adjoining residential cells
- Improved connectivity of the walking and cycling network, assuming relevant infrastructure is constructed at the same time as new road links are created
- Increased accessibility benefits for any future bus services

The key takeaways from the information presented in this report are that:

- Prior work indicates increasing congestion on the distributor road network within Karratha and adjoining the subject suburbs. Conditions will worsen as a product of new development across the townsite
- The linear form of the townsite means there are limited existing route alternatives. Investment in alternatives would be highly likely to ease congestion on the existing network and potentially defer capital works required to increase capacity
- The main operational pinch-points are intersections, where the majority of vehicle conflicts occur. As operational performance worsens, upgrades to intersections become required on safety and capacity grounds. There are a number of existing intersections, particularly along Balmoral Road that are subject to priority control and therefore will require upgrade over time. Deferment of these works may be possible if alternative distributor routes are made available
- These issues are strategic in nature: new connectivity within the subject suburbs is likely to be beneficial for the network but there will remain a strong case for the City to invest in other strategic routes such as a link between the Karratha Industrial Area (KIA) and Madigan Road
- Existing tools cannot be relied upon for development of a programme of capital works. While they signpost growing traffic issues, they utilise significantly out-dated demographic data to derive vehicle trip demands. Some tools are also not accessible to the project team, and others were not developed to answer strategic network questions and incorporate the level of detail required to understand operational issues at key intersections

Further work, which is outside the scope of the current study is required to solidify the case and inform timing/ staging requirements. The traffic modelling undertaken previously was not intended to be used to strategic road infrastructure investment decisions (in the case of the KSM model). In addition, it utilised demographics to derive trip generation and attractions that are now superseded[1] (both the KSM model and Transcore's work). In the case of Transcore's EMME work, Arup is also not clear as to whether the City has access to the model.

Arup recommends that the City considers development of a new strategic traffic model that can be applied to determine a programme of infrastructure works. This should incorporate a refreshed set of demographic data.

1 Demographic forecasts for future years (including 2021 and 2031) are now significantly less and propose a differing pattern of growth across the Karratha Townsite.

8 Appendix

Appendix 4. Community and Stakeholder Engagement

As stated in Section 1.3, a key element of the preparation of the Karratha Revitalisation Strategy was the engagement of the community and stakeholders to gain key inputs and generate support for the strategy at suburb level. The program of consultation and engagement was developed to provide an opportunity for input and feedback from the community and stakeholders during all phases of the project. This included a number of phone calls, workshops, meetings and a web-based tool.

Stakeholders

The Karratha Revitalisation Strategy has been developed through a collaborative design facilitation process involving Government agencies, business and community stakeholders, some residents of the subject suburbs and the broader community of Karratha.

Stakeholder agencies

The following agency stakeholders were approached as part of the development of the Strategy:

- Ngarluma Aboriginal Corporation (NAC);
- Murujuga Aboriginal Corporation (MAC);
- LandCorp;
- Pilbara Development Commission (PDC);
- Department of Housing (DoH);
- Department of Education (DoE);
- Water Corporation;
- Main Roads WA;
- Karratha District Chamber of Commerce and Industry;
- RioTinto;
- Woodside; and
- Dampier Port Authority.

Community

Key community champions were identified from local community groups and these individuals were contacted via phone calls and invited to be a part of the strategy development process. Key groups targeted include:

- childcare services;
- arts and culture;
- ambulance, fire and hospital;
- churches and religious groups;
- community associations and individuals;
- industry groups;
- schools and education;
- sporting associations; and
- state government departments.

Engagement Tools

To gain input and feedback from a range of participants a number of engagement tools were employed. Engagement tools included:

- 3 x Design Facilitation Workshops;
- One-on-one meetings and phone calls with stakeholders and agencies;
- Collaborative Map (web portal);
- Project updates on City of Karratha Website; and
- Meetings and collaboration with City officers.

All feedback and input was collated at the end of each workshop and used to inform the next step in the process and the feedback was uploaded onto Collaborative Map. This continual circulation of feedback aimed to allow multiple opportunities for participants to provide feedback and comment on the direction of the process.

Design Facilitation Workshops

The process and content of the community workshop series was planned to follow a design process (Figure 1):

- Workshop 1 – Opportunities and Directions;
- Workshop 2 – Scenarios and Strategies; and
- Workshop 3 – Draft Concept Plan.

Invitations to attend the workshops and participate in the development of the Strategy were sent out by the City to all residences and businesses within the subject suburbs.

The workshops were attended by a range of residents, key stakeholders and representatives from the City of Karratha, with over seventy attendees at the first workshop and nearly fifty attendees at the second. The outcomes of each workshop including discussions that occurred, points that were recorded and issues that were raised by participants were considered by the consultant team as part of the development of the Strategy. A summary of the findings is provided in section 8.3.

Collaborative Map

Collaborative Map is a web-based tool that is built from the Google earth platform. The use of Collaborative Map allowed anyone who looked at the website to record comments of the information presented. Preparation of the Strategy involved two deployments of the tool.

Project updates on City of Karratha Website

Information about the project was posted on the City of Karratha's website. The project webpage included information on:

- summary of project objectives;
- planning framework and context of Karratha Revitalisation strategy;
- project process;
- how people can get involved;
- community workshop details; and
- links to collaborative map.

One-on-one meetings, phone calls

One-on-one meetings were undertaken with key stakeholders throughout each phase of the design process. This provided an opportunity to meet with stakeholders on their own terms, build relationships, and provide direct feedback and input on specific areas of interest. A summary of consultation outcomes is provided in Appendix 4 - Consultation Process and Outcomes.

Meetings with City Officers

Due to the significance of this project, engagement with City of Karratha officers was essential. To facilitate this, a Project Control Group was established including representatives from each directorate including:

- Planning;
- Parks and Gardens;
- Community Development;
- Engineering and Infrastructure; and,
- Economic Development.

The Project Control Group met on three occasions; during project planning, following Workshop 2 and to discuss the Draft Revitalisation Concept prior to Workshop 3.

Summary of Engagement Outcomes

Workshop 1 - Opportunities and Directions

The purpose of Workshop 1 was to discuss the project objectives, project process and workshop objectives, as well as provide a short overview of the background and site analysis information that had been collated including:

- building on the existing planning framework;
- land development;
- existing infrastructure;
- the wider and Karratha economic environment;
- population and housing forecasts;
- education;
- community facilities and retail;
- transport (existing roads and walking catchment); and
- environment (topography, flood modelling, vegetation types and water cycle, cultural and recent heritage).

During the presentation, participants were also asked to consider the existing character of the subject suburbs including streetscapes, housing styles, housing densities, recreation and facilities, public spaces and potential suburb opportunities.

At the end of the presentation, the audience broke into smaller groups to discuss the values, likes and dislikes of a respective suburb in more detail. A facilitator at each table helped guide conversation and record comments. At the end of the session, each table selected a representative to report their priorities back to the wider group.

Following Workshop 1 – Opportunities and Directions, all feedback, comments and input from the workshop as well as, stakeholder one-on-one meetings and additional engagement tools were collated and analysed. Opportunities and recurring themes became apparent which informed the four key 'themes' including; amenity, parks, development and transport.

Each theme and associated feedback was then further refined into:

- Theme Objective (Long term objective or goal);
- Key Principles (Key actions that will help work to achieving the theme objective);
- Considerations – (Brief summary of the key constraints); and
- Sketch design options (Informed by feedback and criteria above).

Collaborative Map – Deployment 1

WORKSHOP 1

SITE CONTEXT ANALYSIS, OPPORTUNITIES AND DIRECTIONS

- Introduce project, process and engagement tools (reference group and collaborative map)
- Discuss site context and analysis - cultural, social, evironmental, economic, transport etc
- Explore 'Opportunities & Directions' unique to each suburb

Held on 12 February 2014

WORKSHOP 2

EXPLORING SCENARIOS AND STRATEGIES

- From the collated feedback recieved during Workshop 1 the project team will prepare project sceanrios and prelimary strategies
- During Workshop 2, discuss and explore each scenario and strategy

Held on 5 March 2014

WORKSHOP 3

DRAFT CONCEPT PLAN

- From comments and ideas recieved from Workshop 2, the project team will prepare a Draft Concept Plan
- Workshop 2 will provide opportunity for further review and ongoing comments to develop an agreed revitalisation outcome and urban development approach

Date TBA

Figure 1: Design facilitation workshop process

Deployment 1 of Collaborative Map occurred after workshop 1 and aimed to gather additional information on site context issues, opportunities and ideas to help develop project scenarios and strategies. The text supporting the spatial depiction of the project area asked for comments about things people liked; didn't like; and would like in the future. Key areas of focus were streetscapes, buildings, parks and open space, transport and parking, and diversity. 138 comments were received with over 2100 indications of support or otherwise, through 'likes' and dislikes'.

Similarly to the range of participants at the workshop, more people from Bulgarra responded than the other subject suburbs. The home address of respondents was:

- 48% Bulgarra residents;
- 22% Pegs Creek residents;
- 7% Millars Well residents;
- 19% other Karratha residents; and
- 4% from elsewhere.

Table 1 provides a summary of the most supported comments received from Collaborative Map deployment 1.

Workshop 2 - Exploring Scenarios and Strategies

Workshop 2 was held on Wednesday 5 March 2014 at the Karratha Leisureplex between 5 and 7:30pm. It was attended by nearly 50 members of the Karratha community, although it was noted that there was a bias towards Bulgarra due to a higher attendance of Bulgarra residents / representatives who voiced strong opinion.

Similar to Workshop 1, Workshop 2 included a short presentation followed by breakout group discussion. The presentation content included:

- Summary of Workshop 1 and Collaborative Map feedback
- Feedback synthesised into four key themes ; Development, Transport, Parks and Amenity
- Expansion of each theme by describing objectives, principles, considerations (constraints), opportunities and sketch design options to help guide break-out group discussion.

A summary of each theme, as well as the feedback response is outlined below.

Amenity

Comment	Votes For	Votes Against	Theme
Retain vacant land in Bulgarra	34	1	Parks
Build an over or underpass so the High School and Leisureplex can be safely accessed	31	0	Transport
No main road through the centre of Bulgarra	30	1	Transport
Open space is the attraction to the Pilbara, leave Lazy Land so all the suburbs in Karratha don't look the same	20	0	Parks / Amenity
Retain the character of suburbs	29	2	Parks

Table 1: Most supported Collaborative Map comments (deployment 1)

Comment	Votes For	Votes Against	Theme
Keep KEC oval as needed for sport and rec in Bulgarra end of town	14	0	Parks
Retain Bulgarra as it is with large family friendly houses, parks and open space. Keep higher density living near the city centre only	14	0	Parks
Leave it green (Retain the character)	13	0	Parks
Please leave this area for sporting clubs and areas that local people can take their kids down to run around and play (Location of comment - Bulgarra Oval)	12	0	Parks
No new roads through Bulgarra. Suggestion to upgrade Dampier Road to reduce congestion	12	0	Transport

Table 2: Most supported Collaborative Map comments (deployment 2)

The opportunities presented for Amenity were separated into road network (Street Hierarchy of Primary Distributor, Local Street, Minor Access) and swales and focused mainly on improvements in landscaping.

The scenarios outlined were well received. In regards to the streets, it was felt that priority should be given to the Minor Access Streets, and the preferred treatment option was gravel and a street tree which is appropriate for the climate and use of verges. There was support for enhancements to be made to Dampier Highway, however the planting of trees along the northern side was preferred, with no planting on the southern side to retain views to the backdrop of the Hills.

The high value of the swale system was noted, based on their contribution to the character of suburbs, existing vegetation and for use during early morning and late afternoon exercise. It was noted that priority areas should be identified for revegetation, as it was accepted that it's not feasible to vegetate all swale areas due to the maintenance and irrigation requirements.

Support was received the inclusion of various elements into key areas of the swale network such as seating, break out areas, shade, native planting, showcase of wildflowers, etc. Furthermore it was recommended that the City should utilise existing groups to help with maintenance and consider "adopt a..." programs to foster ownership of these areas.

Parks

On the basis of the opportunities and constraints assessment, the following opportunities were presented for discussion

- Close Ashton Way, Rex Webb and Richardson Way Parks and the 2.8 ha soccer field portion of Bulgarra Oval ('KEC oval'), and reallocate funds elsewhere to parks in the locality;
- Create new neighbourhood park in central Bulgarra with high quality facilities; and
- Move all or part of Kevin Richards Memorial Park to the coastal side of Balmoral Road.

Responses from those present included support for

reallocation of Ashton, Rex Webb and Richardson Way Parks, with the condition that value is added to Malster Place and Scout Hall Parks. The Scout Hall was identified as an important community asset with the large (non-drainage) area between Wellard Way and Lockyer Street having some of the best vegetation within the three suburbs. Enhancement of this existing asset by enlarging the Scout Hall Park to include this land was viewed as a better option than constructing a new park elsewhere.

The community response to Watters Park favoured the improvement of amenity and facilities in the southern area if the northern half was closed when the road connection between the city centre and Frinderstein Way was constructed. This would build upon the wider area including Skate Park and Youth Shed to enhance the community hub.

Concern was expressed by some attendees that whilst the new soccer pitches within the Leisureplex might fulfil the demand from Bulgarra for formal soccer games, there needed to be a junior soccer training function maintained within the Bulgarra Oval precinct because students would otherwise have to travel considerable distance to the Leisureplex and cross the very busy Dampier Avenue in the evening.

Development

The development opportunities for discussion included;

- New development on vacant land:
    1. "Lazy lands";
    2. Vacant, zoned land;
- Redevelopment / infill in existing developed areas:
    3. Subdivision;
    4. Redevelopment; and
- No further development.

Development was the most heavily discussed theme. Key discussion points included:

- Preference to increase density near City Centre and Tambrey Neighbourhood Centre to facilitate pedestrian travel;
- Consider appropriate places for development. It was supported that not all Lazy Lands should be developed, rather assessed against flood risk, design principles and overall suburb objectives;
- Design guidelines for new development are needed to retain neighbourhood character and achieve high quality housing;
- Size of lots should be appropriate for proposed form and achieve a mix of housing type;
- Recognise a perceived reduction in property values from new road connections;
- Density of development should be appropriate for the road network;
- Parking needs to be sufficient for the number of residents; and
- Keep Bulgarra mainly low density for families.

(Please note: Workshop 2 assumptions below and high percentages of Bulgarra residents attended workshop 2 therefore biased towards this suburb.

Transport

The following opportunities were presented for discussion under the transport theme:

- Slower speed limits;
- Suggestion of possible intersection upgrades and treatments;
- Proposed future road links; and
- Improving connectivity and shared path network.

Key discussion points from Workshop 2

The following points provide a summary of the issues that were raised during Workshop 2.

- residents prefer to use the external roads and want to retain the character of the internal road network. This response was a shift from the desire to have increased north – south connections that was noted during Workshop 1;
- the dual use path network is important and needs improvement to increase connectivity;
- some intersections need work e.g. Dampier Hwy and Karratha Rd;
- residents are prepared to accept increased congestion in order to retain neighbourhood amenity;
- upgrades were recommended to Balmoral, Millstream and Searipple;
- preference to build roads leading out of town so there is a reduced need to come in to town to travel to other key destinations; and
- desire to keep the highway a highway and retain speed limits.

Collaborative Map - Deployment 2

The second deployment of Collaborative Map summarised the outcomes of the second community workshop. In the second deployment of Collaborative Map, 28 comments were received from 150 unique visits, therefore only approximately 5% of users posted a comment. One conclusion of this circumstance is that people were using the software to review the developed ideas and did not feel the need for further comment (i.e. were happy with the scenario presented).

A similar pattern occurred in relation to the recorded home address of respondents:

- 53% Bulgarra residents,
- 39% Pegs Creek residents
- 4% Millars Well residents, and
- 4% other Karratha residents.

Table 2 provides a summary of the highest rated comments received from Collaborative Map deployment 2.

Appendix 5. Consultation Process and Outcomes

Organisation	Organisation Representatives	Date	Presentation Material	Theme
Department of Education (DoE)	Richard Bloor, Michael Cooper, Mal Parr	9/01/2014	Opportunities and Directions, One-on-one meeting and plan / presentation handouts	• Identification of old Karratha High School Site to be placed within the PACH system. • Primary Schools in the area have sufficient enrolment and scope for more students. • Pegs Creek PS enrolments have risen however not the school of choice. • DoE joint management over Bulgarra Oval and Kevin Richards Memorial Oval. • DoE identified shared need for oval at Mulataga PS.
LandCorp	Grant Singleton, Matt Read, Brenton Pham	9/01/2014	Opportunities and Directions, One-on-one meeting and plan / presentation handouts	• LandCorp Lazy Lands parcels likely to be mixture of single dwellings and grouped housing • Focus on Maddigan Road and Mulataga • Adjacent proposed development – Tambrey Neighbourhood Centre and Coastal Node in Mulataga • LandCorp have considered relocation of Millars Well Oval but this requires further planning • Some lots are covered by Native Title • Supportive of proposed transport links and connectivity • No guarantee that the consolidated lots and connections in KCC will be able to be delivered through current strategy of negotiation • New Hospital is planned to open 2018
Department of Housing	David McLoughlin	10/01/2014	Opportunities and Directions ,One-on-one meeting and plan / presentation handouts	• DoH major landholder • DoH supports investigating opportunities for variety of housing stock in line with Pilbara Vernacular • DoH is an 'outright' land owner – opportunity to test pilot project to demonstrate how suburbs could be redeveloped • DoH supportive of project, approach and have continued involvement
PDC	Richard Bairstow, Charlotte Douglas	10/01/2014	Opportunities and Directions, One-on-one meeting and plan / presentation handouts	• Local planning scheme rezoning for sites, relevant amendments are: Amd 29, 30 and 31 (DA 40, 41, 42, 43, 44, 45 and 46) • Supportive of project and welcomes a consolidated plan • Economics will be a key success factor in the implementation • Need for the City to prioritise development in these suburbs

Organisation	Organisation Representatives	Date	Presentation Material	Theme
Design Facilitation Workshop	Approximately 80 participants	12/02/2014	Workshop 1 - Opportunities and Directions Presentation and breakout groups	• See section 8.3 - Summary of Engagement Outcomes
Murujuga Aboriginal Corporation (MAC) and Ngarluma Aboriginal Corporation (NAC)	Ron Critchley, Paul Stenson	13/02/2014	Opportunities and Directions, One-on-one meeting and plan / presentation handouts	• MAC and NAC supportive of approach • Agreement that subject area is heavily constrained by flooding • DAA Registered cultural sites – don't rely on the data as it can be out by 400 – 500m • MAC / NAC always looking for new development opportunities. Keen to see later stages of the project
WaterCorp	Brett Coombes, Mark Busher	24/02/2014	Opportunities and Directions, one-on-one meeting and plan / presentation handouts	• WC undertaken planning reviews of water and waste water • There is likely to be capacity in system as many lots are zoned R20 but are actually R10 – R12 • Searipple pump station recently upgraded • Duplication of reticulation has been installed to cater for development in city centre • New roads proposed or changes to existing – allow access for service network • WC to advise of services in parks that are proposed to be rationalised • Consider protection (as well as upgrades) to services under developer contribution scheme
Horizon Power	Alan Porter	5/03/2014	Sketch Design options, one-on-one meeting and plan / presentation handouts	• PUP partially completed in Bulgarra and scheduled for completion in 2017 • No problem servicing additional 1000 hom es, based on rough calculations • Capacity of the substation and power stations is sufficient • Issues may arise if upgrades to the feeders are required
Design Facilitation Workshop	Approx. 50 participants	5/03/2014	Sketch Design Options, Presentation and breakout groups	• See section 8.3 - Summary of Engagement Outcomes

Organisation	Organisation Representatives	Date	Presentation Material	Theme
City of Karratha Project Control Group (PCG)	Martin Waddington, Max Thorbjornsen, Sharon Boyle, Brad Rains, Leigh Cover, Tim Marks – SS to confirm	06/03/2014	Sketch Design Options Presentation, Feedback from Workshop 2 and group discussion	Amenity • Support the idea of verge treatment brochure to encourage resident ownership and maintenance of verge • Maintenance and irrigation is key constraint – identify priority swales Parks • Support for the Scout Hall to be retained. Continue discussions with relevant stakeholders • Rex Web – planning amendment already undertaken • SoR to investigate Richardson Way and advise team • Potential opportunity to expand Bulgarra Oval to accommodate training facilities Housing & Development • Address demographic of Karratha in justification • Response to address existing capacity / current demand / forecast demand • Identify the catalyst sites and high priority sites • Diversity is required on a site by site basis Transport • Noted the difference in feedback between Workshop 1, desired for north south links, while Workshop 2 desire to retain internal character • Develop pedestrian connectivity via shared path network (note SoR Footpaths Report) and tree planting to enhance green links • Bus route is a long term direction • Identify and prioritise road links based on principles (safety, evacuation, property value, maintenance on road etc) • Address Dampier Hwy as a barrier to Karratha HS
Department of Housing	Mendo Stepanovski	13/03/2014	Sketch Design Options, One-on-one meeting and plan / presentation handouts	• DoH is going through a Statewide program of asset renewal. Within the next 6 months it is expected that all assets will be assessed and priorities identified. Karratha is not likely to be on the immediate horizon. • DoH noted current stock in Karratha is relatively new and seems to be in good condition. • When the DoH chooses to renew their housing in Karratha, they will look for opportunities to optimise the number of dwellings while still providing an economic return. • DoH supported the opportunity to partner with the City and deliver a good built form outcome where there is likely to be some economic return.
PDC	Richard Bairstow	19/03/2014	Sketch Design Options, One-on-one meeting and plan / presentation handouts	• PDC were not opposed to consideration of lots not be developed, provided there was a logical justification and rational supporting the argument. • Consider other opportunities for the drainage reserves e.g. public art, facilities, pathways/linkages. • Consider impacts on transport networks.

Organisation	Organisation Representatives	Date	Presentation Material	Theme
LandCorp	Grant Singleton, Brenton Pham	27/03/2014	Sketch Design Options, One-on-one meeting and plan / presentation handouts	• LandCorp supports the Karratha Revitalisation project process and will consider the findings of the study as part of their assessment of viability of development potential for their sites. • Initial feasibility studies for P14-16 suggested yields which are now considered too high. This reduces potential viability, especially in today's market. • Supportive of the idea of constructing road links when parcels are developed but this would reduce the viability of the smaller parcels significantly.
City of Karratha Project Control Group (PCG)	Andrew Ward, David Pentz, Martin Waddington, Max Thorbjornsen, Sharon Boyle, Brad Rains, Leigh Cover	3/04/2014	Draft Revitalisation Plan, Presentation and group discussion	**Parks** • Close Ashton, Dodd and Richardson Way parks – future development sites. • Improve amenity and facilities in Malster and Shakespeare/ Scout Hall parks. • Watters Park – close northern half when road extended and improve amenity and facilities. • Investigate location for training grounds in Bulgarra. Rationalise KEC oval when alternative location is available. **Amenity** • Develop brochures for the community to assist planting and maintenance of private verges. • Identify priority areas for planting along north side of Dampier Highway and incorporate into asset management plan. • Consider priorities for revegetation of swales and incorporate into asset management plan. • Work with the community to develop engagement programs. **Development** • Increase density in proximity to City Centre. • Lazy lands recommendations: - Low potential for development of Lazy Lands parcels that are flood constrained - with the exception of P34 (to be integrated with the old high school site) and P35 (SoR). - No development of LandCorp parcels P39 and P40 important ecological and community corridor. - Part development of P33 (when road is constructed) and P38 (LandCorp). - Reduced potential for development of P29, P46 and P59 (DRD). • Provide guidance on how flood risk should be addressed in infill area. **Transport** • Improve pedestrian and cyclist connection across Dampier Road at Broadhurst Road. • New road linkages to be limited but prioritised as follows: • Western link • Flooding/evacuation routes • Eastern link • As part of development • Duplication of Balmoral Road in the future. • Speed limits to be retained – higher on ring roads and lower in residential areas. • Dual use paths prioritised around schools and swales consistent with the City's footpaths Future Works Report. • Prioritise intersections along Balmoral Road and Dampier Road (in partnership with Main Roads WA)

Organisation	Organisation Representatives	Date	Presentation Material	Theme
RIO TINTO	Louise Thomas (RIO), John Barrett (RIO), Sharon Boyle (SoR)	08/04/2014	Draft Revitalisation Plan, one on one meeting, presentation / plan handout	• RIO has a Home Ownership Plan (HOP) with the last term expiry for the property will be in 2017. • Generous home ownership support scheme. • No new dwellings purchased in the study area. • Strategic policy target to have homes for 85% of its permanent works. Currently just under the target. • Recently undertaken internal renovations (up to $300,000 per dwelling) leaving shell unmodified. • Supportive of opportunity to increase housing densities • Note that RIO may be able to assist with catalysing new development. • Conscious of issue of maintaining supply if they were to sell older housing stock

8 Appendix

Appendix 6. Infrastructure and servicing report, May/July 2014

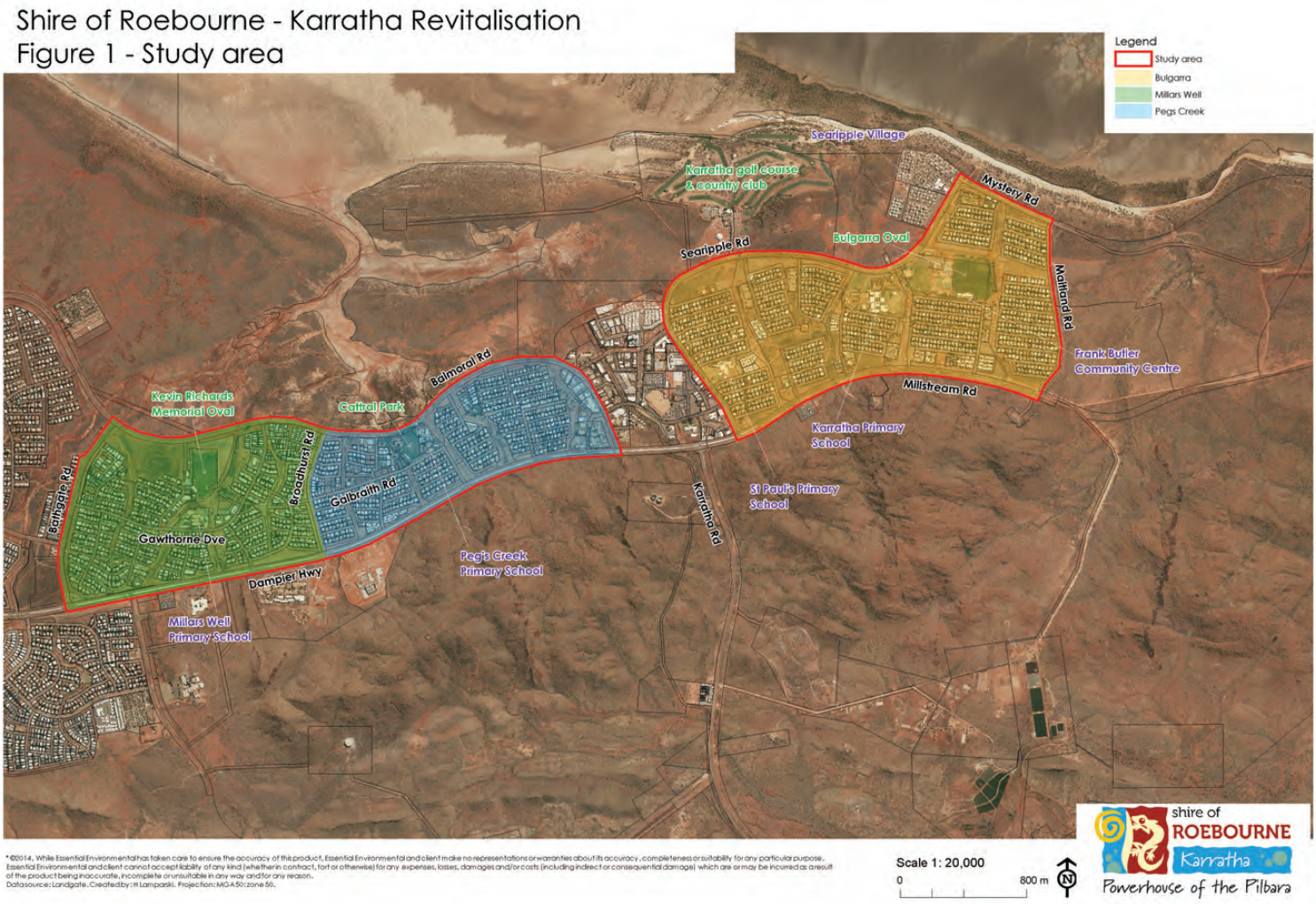


Figure 1: Study area

1. Introduction

The Karratha Revitalisation Plan project aims to identify the outcomes and key actions required to improve the liveability of the suburbs of Pegs Creek, Millars Well and Bulgarra, as Karratha grows towards its goal of becoming a Pilbara City.

This report has been prepared for the Project Reference group to meet the requirements of Task 7 of this project. It outlines the current understanding of the likely requirements for infrastructure and service upgrades, providing preliminary indications of cost, timing and delivery mechanisms. This report will provide an input into work to be undertaken as part of Stage 2 of the Karratha Revitalisation project.

The development of the report has included an assessment of the existing service capacity of current infrastructure – traffic/roads, public transport, public open space and recreational facilities, drainage, water, wastewater, power and telecommunications. The recommendations for future works are based on the preliminary revitalisation concept agreed at the Senior Officers meeting at the City of Karratha on Thursday 3 April 2014.

Consideration has been given to the identification of responsibilities for implementation and sources of funding.

1.1 Study area

The study area of the Karratha Revitalisation Plan project comprises the suburbs of Pegs Creek, Millars Well and Bulgarra in Karratha (Figure 1). It is divided into two major areas: Millars Well and Pegs Creek bound by Dampier Highway to the south, Balmoral Road to the north and west, and Bathgate Road to the east; and Bulgarra bound by Millstream Road to the south, Maitland Road to the west, and Mystery Road to the north, and Searipple Road to the north and west. It does not include the CBD between these two major areas.

The Karratha Hills are located south of the study area and the low lying mudflats of Nickol Bay are located to the north. The Karratha golf course and country club and town Back Beach parallel to Mystery Road are also located north of the study area. The existing suburb of Nickol is located to the west of the study area and the proposed Mulataga development is located to the east.

1.2. Study limitations

The information included in this report is based on:

- a preliminary concept for the Karratha Revitalisation Plan project only; and
- information issued and supplied to Essential Environmental by external sources.

Where information has been provided by external sources, the responsibility for the accuracy of this information remains with the issuing organisation, not with Essential Environmental. The information and advice provided in this report relate only to the project described. Essential Environmental accepts no responsibility for other use of this information.

All costings included in this report are preliminary only and are not to be used for planning purposes. Any costings presented in this report should be validated as part of future feasibility assessment and detailed design work.

1.3. Revitalisation concept

The revitalisation concept was prepared based on two community workshops and consultation with City of Karratha officers and associated government and industry stakeholders. The major elements of the preliminary revitalisation concept include:

- Increasing diversity and density of housing in proximity to the Karratha City Centre;
- Development of several sites that have been found to be surplus to drainage requirements;
- Redevelopment of existing housing stock;
- Rationalisation and redevelopment of several parks;
- Improvements to infrastructure and landscape in selected parks;
- Improved connectivity of the road layout through construction of additional road linkages to facilitate better emergency management access and reduce vehicle kilometres travelled;
- Review options for improvement of intersections;
- Improved path network (consistent with the City's Future Works Report Footpaths 2013-2023); and
- Improvements in landscape and amenity of streetscapes, swales and verges.

The revitalisation concept is outlined in more detail the draft Karratha Revitalisation Strategy (in preparation). Additional work will be required as part of Stage 2 of this project to further investigate the feasibility of some of the options proposed in the concept and develop appropriate planning tools and mechanisms to guide the implementation of the Strategy by the City and landowners. It is recognised that the timeframe for implementation of the Strategy may extend into the longer term, as it is largely dependent on the demand for additional housing in Karratha.

2. Existing service and Infrastructure networks

2.1. Transport

2.1.1. Road network

Karratha's road network is based upon the linear east-west layout of the townsite. It is comprised of primary distributor roads, local distributor roads and minor access roads. (Figure 3) Dampier Highway and De Witt Road are the major primary distributor roads and comprise Karratha's key transport spine, connecting Millars Well, Pegs Creek and Bulgarra with the City Centre and major employment locations including Gap Ridge, Dampier and other industry to the west as well as the Karratha Industrial Area to the south. Dampier Highway is a dual carriageway until it connects to Millstream Road at the De Witt Road intersection.

The local distributor road network forms rings around the two sections of the study area and includes Balmoral Road/Bathgate Road in the west and Searipple Road/ Mystery Road/Maitland Road in the east. Minor access roads divide the study area into individual residential cells via cul-de-sacs and loop roads, which can only be accessed from typically one or two points on the local distributor road network.

The City of Karratha is responsible for the majority of roads within Karratha, however, some are private access roads and others are owned and managed by Main Roads. With respect to the study area, the only road that Main Roads is responsible for is Dampier Highway, beginning at the De Witt Road turnoff (City of Karratha, 2014).

2.1.1. Public transport

Public transport services in Karratha are currently limited to a number of school bus routes and a twice-weekly bus that operates between Dampier, Karratha and Wickham. Consequently, the transport choices available to residents within the study area are generally limited to private vehicle, taxi, walking and cycling. Regular public transport services of a frequency sufficient to provide added mode choice for residents are not likely in the short term.

The introduction of a public transport service in Karratha will be impacted by both catchment (and therefore patronage) potential, and bus operating efficiency. At the present time, the disconnected nature of the study area means that any bus service would need to either remain on the local distributor network, thus increasing the average distance between dwellings and bus stops compared to services on a more interconnected road network. Alternatively, a bus service could follow a circuitous route, leading to higher operating costs and longer travel times when compared to services on a more interconnected road network.

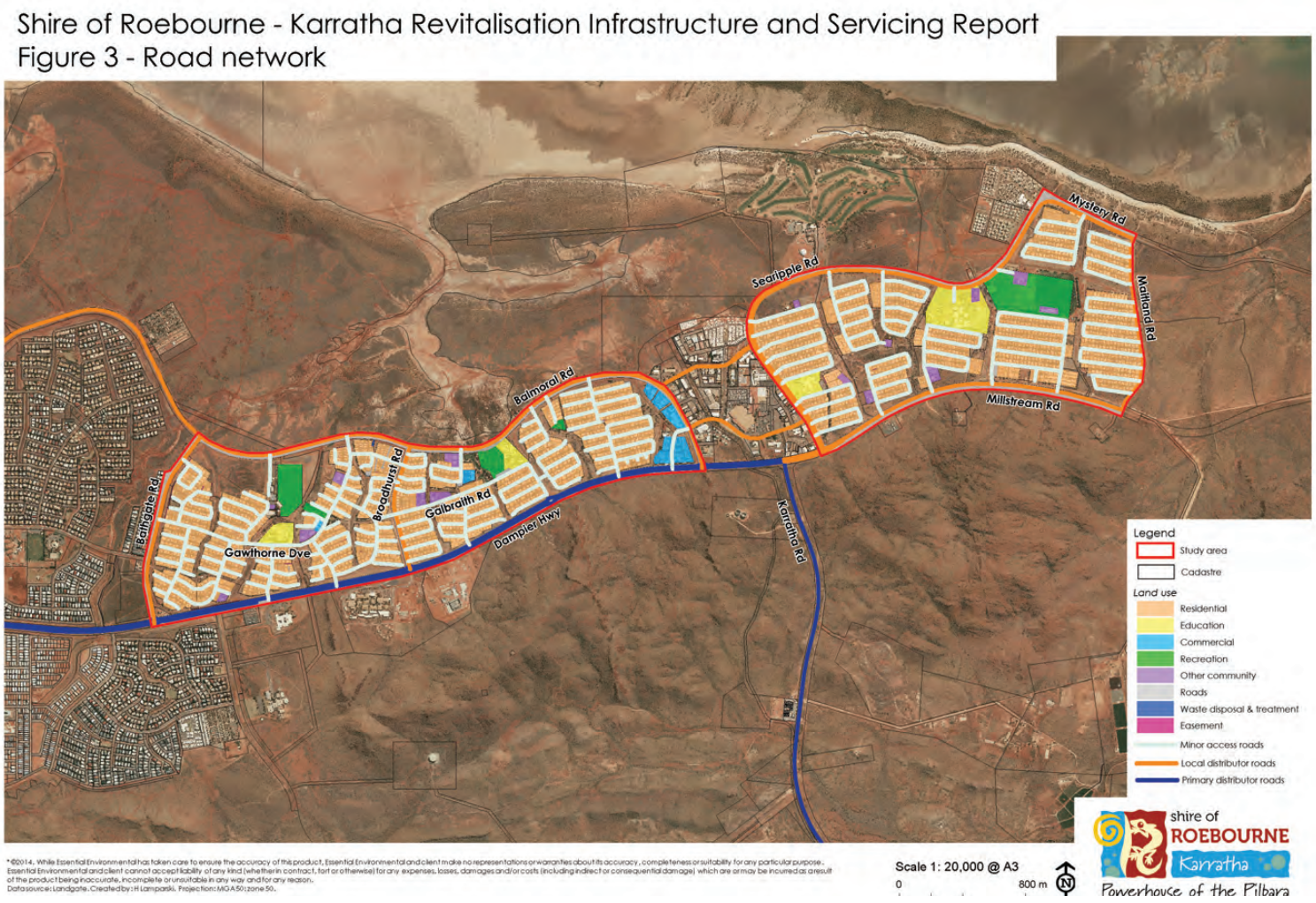


Figure 3: Transport network

2.1.2. Path networks

Existing foot and shared path networks located throughout the study area and joining the study area to the rest of Karratha are considered incomplete. In particular, most local roads do not include a footpath on either side. Connections via foot and shared path networks between residential areas and key nodes including schools, the City Centre and the Leisureplex are considered weak. The disconnection between residential cells in combination with significant gaps in the active path network mean accessing local places easily is not usually possible.

On-street cycling is considered to be relatively safe given the relatively low traffic volumes experienced on minor access roads. However, safety issues within the vicinity of schools occur during peak hours because of high rates of vehicle-based drop-off and pick-up, resulting in localised congestion.

The City of Karratha prepared a Future Works Report Footpaths 2013-2023 (City of Karratha, 2013a) which describes the City of Karratha's ten year strategic plan to enable a continuous, high quality and well used path network in Karratha, and specifically deliver Liveable Neighbourhoods principles (WAPC, 2007) including:

- Provide a safe, convenient and legible movement network for pedestrians, principally along the street network; to provide excellent accessibility between residents and safe and efficient access to points of attraction in and beyond development;
- Design street networks to optimise the walkable access to centres, schools, public transit stops and other destinations;
- Design major routes as integrator arterials with extensive and frequent opportunity for pedestrian to move safely along and across them;
- Design and detail new developments to promote and support walking to daily activities; and
- Provide pedestrian paths through parks for recreation purposes wherever practicable.

Advantages	Disadvantages
Minimisation of traffic on local streets because they offer very limited or no through-traffic function. Local streets are relatively safe for on-Istreet cycling given the low traffic volumes that use them. A clearly defined distributor network.	Inefficient traffic circulation patterns resulting in increased travel time, particularly between adjoining residential cells due to the lack of connectivity. Assignment of sub-district and district traffic to a limited number of through-traffic routes, resulting in congestion issues. Reduced opportunities for a coherent and efficient future public transport line due to the lack of direct connection between adjoining cells. Local distributor roads which ring the two study area sections offer only half a catchment for public transport, should they form part of preferred routes.

Table 1: Advantages and disadvantages of Karratha's existing road network layout

The future works plan includes upgrades to footpaths and cycle paths, landscaping, parking, and related access infrastructure. The seven major priorities of this plan are:

1. Missing links around school areas to be connected.
2. Expenditure of funding obligations.
3. Arterial links to be connected around Karratha.
4. Missing links around the bus stops, community amenities and facilities to be connected.
5. Remote mobilisation costs to be factored in when planning the works program.
6. Acknowledgment of the Pilbara Underground Power Project program and ensuring the City comes in behind their works with footpath construction.
7. To use limited funds to maximise community benefit of new footpath constructions

The Future Works Report Footpaths 2013-2023 (City of Karratha, 2013a) was endorsed by the City of Karratha Council in October 2013. It is assumed that the future works plan will be implemented as stated and the Karratha Revitalisation Plan will be consistent with the future works plan for footpaths.

2.1.3. Key transport considerations

The layout of the study area and road network in combination with the external location of major employment sites have resulted in the generation of high peak hour road demand flows on a limited number of routes. Dampier Highway in particular is heavily congested during peak hours and this is forecast to worsen over time as Karratha develops. There are very limited alternative routes that traffic can be reassigned to, such as local distributors Balmoral Road and Searipple Road, meaning these are also likely to become very busy in the medium term. Critically, these alternative routes are currently single carriageway and may require upgrade.

The layout and cellular residential division of the study area provide both advantages and disadvantages, summarised in Table 1 above.

Item	Approximate unit cost ($)
6.0 m wide suburban road with in-situ concrete kerbs	$730-$790 / m
1,800 mm wide footpaths associated with suburban roads	$300 / m
Street lighting – minor roads (Sodium discharge: 70W)	$340-$900 each (typical placement is 1 lamp per 50 m)
Intersection treatment/upgrade	Unable to be generically costed. Highly dependent on type of upgrade proposed

Table 2: Approximate costs of transport upgrades (Source: Rawlinsons, 2013)

2.1.4. Transport infrastructure standards

Any transport upgrades will be required to meet IPWEA and City of Karratha standards, including:

- Local Government Guidelines for Subdivisional Development Edition 2.1 (IPWEA, 2011) – available from the WAPC by online: http://www.planning.wa.gov.au/dop_pub_pdf/IPWEA_Subdivision_Guidelines_Edition_2.1__28_July_2011_.pdf
- Specification for Subdivision, Construction of Road Works and Drainage (City of KarrathaCity of Karratha, 2013c) - these specifications are intended as an addendum to the IPWEA guidelines, and describes construction requirements particular to the City of KarrathaCity of Karratha.
- Future Works Report Footpaths 2013-2023 (City of KarrathaCity of Karratha, 2013a) – 7.0 Design Guidelines

If any upgrades are to occur to Dampier Highway, then Main Roads standards are required to be met. These are available online at

https://www.mainroads.wa.gov.au/BuildingRoads/StandardsTechnical/RoadandTrafficEngineering/Pages/home.aspx#.U0O3rVe0Tmc

2.1.5. Delivery mechanisms

Any public transport service improvements will be subject to:

- Completion of a business case by the Public Transport Authority WA and allocation of associated State funding
- Potential part-funding by the City of Karratha
- Potential part-funding by the private sector – as part of developer contributions or individual development

The Future Works Report Footpaths 2013-2023 (City of Karratha, 2013a) describes the potential use of developer contribution schemes to address possible shortfalls for funding of community infrastructure, roads and footpaths. Developer contribution schemes are described in State Planning Policy 3.6: Development contributions for infrastructure (2009). Further information on developer contribution schemes is provided in Attachment 1.

Any upgrades undertaken by Main Roads will also be funded by them.

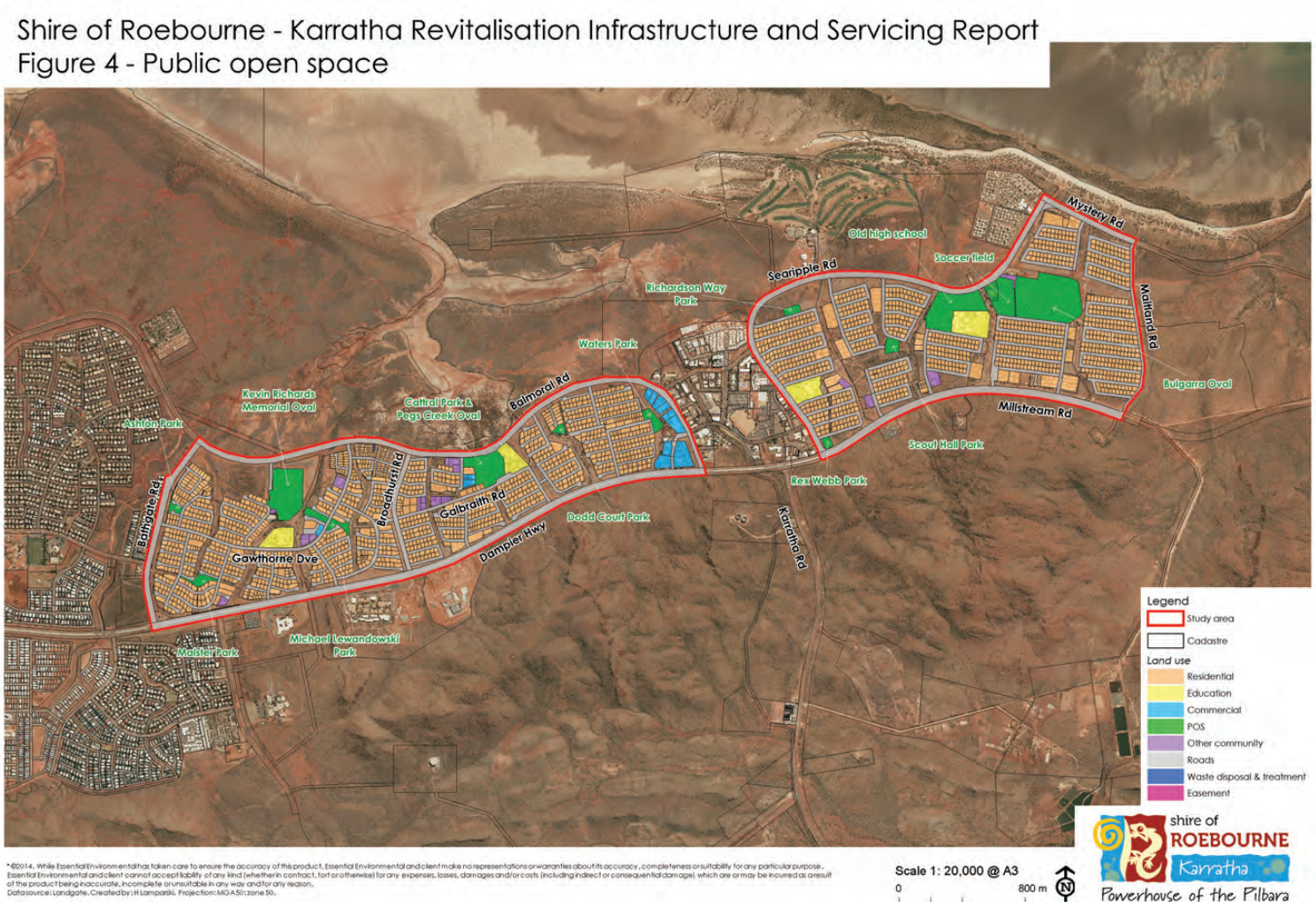


Figure 4: Public open space

2.1.6. Preliminary costs

Upgrades to the path network have been costed and described in the Future Works Report Footpaths 2013-2023. This ten year future works program will increase footpath networks in the City of Karratha by 26.90 kilometres at a cost of $8.1 million (City of Karratha, 2013a).

Table 2 presents the unit costs of road works sourced from Rawlinsons Australian Construction Handbook (2013) and assumes a regional cost adjustment for Karratha of 155% of Perth costs (as stated in Rawlinsons).

2.2 Public open space

Public open space (POS) is currently distributed throughout the study area in the form of thirteen designated parks and ovals (shown in Table 3 and Figure 4). These POS areas vary in size, configuration and use, and contain a variety of infrastructure, vegetation and equipment. Most POS areas are located either centrally or on suburb boundaries, depending on its function within the catchment it serves, such as supporting school or community facilities.

Karratha's POS system performs a dual role:

- recreation and amenity; and
- drainage.

It is also noted that there are large areas of open space throughout the study area that are part of the open swale drainage network. These areas are discussed further in section 2.3.

All POS areas are located within reserves managed by the City of Karratha, a role shared with the Minister of Education in the case of school ovals. Landgate's tenure data system defines the land use for each reserve. While most POS areas include a recreation function, many, but not all, are also defined as having a drainage function. The land use of each reserve within which the study area's parks and ovals are located, as defined by Landgate, is detailed in Table 3.

Currently 9.6% of the gross subdivisible area of the study area (10.9% in Bulgarra, 7.8% in Pegs Creek and 9.2% in Millars Well) occupies formalised public open space as parks and ovals.

Bulgarra	Function	Area of park (ha)*	Land Use - Landgate
Bulgarra Oval (including the soccer field)	Active	14.2**	Recreation / sports ground / drainage / parklands^
Old high school oval	Active	5.7**	Educational purposes
Scout Hall Park (Shakespeare Park)	Passive	0.3	Drainage / parklands / recreation
Riichardson Way Park	Passive	0.3	Drainage / parklands / recreation
Rex Webb Park (Gregory Way Park)	Passive	0.3	Drainage / parklands / recreation
Pegs Creek	**Function**	**Area (ha)**	**Land Use - Landgate**
Cattrall Park & Pegs Creek Oval	Active	4.7	Park / recreation
Dodd Court Park	Passive	0.5	Recreation
Watters Park	Passive	0.7	Park / recreation
Millars Well	**Function**	**Area (ha)**	**Land Use - Landgate**
Kevin Richards Memorial Oval	Active	5.7	Recreation
Ashton Park (Straker Park)	Passive	0.4	Public recreation
Michael Lewandowski Park	Linkage	1.3	Drainage / parklands / park
Malster Place Park	Passive	0.8	Drainage / parklands

*Source: Review of Public Open Space in Karratha (City of Karratha, 2011), Ordinary Council Meeting 16 May 2011 – Minutes
**Estimation based on cadastral information
^Drainage only for area of oval located outside

Table 3: Current formalised POS areas within the study area

An assessment of maintained POS was undertaken by a combination of staff from the City of Karratha Infrastructure services, Community services, and Planning services teams in 2011, and the outcomes presented in the Review of Public Open Space in Karratha report (City of Karratha, 2011). The outcomes of this review were then further developed in 2013 culminating in the City of Karratha Play Space Standards (2013a). The report defines POS areas using a hierarchy of four categories determined by their function, proximity to residents, and infrastructure:

1. Regional (Level 1) POS areas are typical of active spaces with multiple ovals which attract residents from across the City;
2. District (Level 2) POS areas are designed as active spaces with an oval for organised sports and infrastructure for social gatherings;
3. Neighbourhood (Level 3) POS spaces are designed for users to mainly walk or cycle there with basic play equipment; and
4. Local (Level 4) POS spaces are design primarily as linkages with only natural shade and basic seating, accessed by local residents via walking or cycling.

The criteria for each category of POS and the classification of most of the parks and ovals within the study area are shown in Table 4 below. Rex Webb Park and Ashton Park were not identified in this report but are considered Local POS spaces by the City of Karratha (pers. comm. Manager Leisure Services, City of Karratha, 1st April 2014).

The use, access and management of active POS areas are defined in the City of Karratha policy CS1: *Active Reserve Management Policy* (City of Karratha, 2007). While the general public has access to all POS areas in Karratha, the specific use of active POS areas by public schools is defined in Joint Use Agreements between the City of Karratha and the Department of Education. Clubs, community and commercial groups are required to apply to the City of Karratha for permission to use active POS areas on a casual or seasonal basis. Bulgarra Oval and Kevin Richards Memorial Oval are primarily used by local football teams, while Pegs Creek Oval is shared between Pegs Creek Primary School and the general public.

Access to Bulgarra Oval, Kevin Richards Memorial Oval and Michael Lewandowski Park was considered 'Excellent' in the 2011 *Review of Public Open Space in Karratha*. Cattrall Park and Pegs Creek Oval, Ashton Park, Rex Webb Park, Scout Hall Park, Malster Place Park, Dodd Court Park and Waters Park were classified as having 'Good' accessibility. The only park classified as having "Poor" accessibility in the 2011 Review of Public Open Space in Karratha was Richardson Way Park.

The City's *Community Facilities Plan and Matrix* (City of Karratha Local Planning Strategy Technical report 4, March 2013) makes recommendations for the provision of community facilities on the basis of population ratios (Table 5).

Criteria	Regional	District	Neighbourhood	Local
Level	Level 1	Level 2	Level 3	Level 4
Function	Active	Active	Passive	Linkage
Proximity	Community reach is City-wide.	Community reach is greater than 500 m.	Should cater to residents within a 500 m radius. Users mainly walk/cycle.	Walking/ cycling distance.
Infrastructure	Shade structures Seating – social gatherings Reticulation Lighting – sports & other activities in evening Foot/cycle path network Large playground Car parking – 20+ BBQ/picnic facilities Toilets Outdoor gym equipment Multiple senior-sized ovals – organised sports & events Clubrooms/pavillions	Shade structures Seating – social gatherings Reticulation Lighting – sports in evening Foot/cycle path network Large playground Car parking – 10-20 BBQ/picnic facilities Toilets Outdoor gym equipment Oval – organised sports	Shade structures Seating - carers Grassed area/ reticulation Safety lighting Path network Medium playground Some car parking	Natural shade Seating Reticulation Safety lighting
POS	Bulgarra Oval	Cattrall Park (including Pegs Creek Oval) Kevin Richards Memorial Oval	Scout Hall Park (Shakespeare Park) Watters Park Dodd Court Park Malster Place Park Richardson Way Park	Rex Webb Park* Ashton Park* Michael Lewandowski Park

*Source: pers. comm. Leigh Cover, Manager Leisure Services, City of Karratha, 1st April 2014

Table 4: POS hierarchy (City of Karratha, 2013)

Consideration of these ratios together with current and estimated population of the study area suggests that there is sufficient active POS (playing fields) within each suburb (Table 6). With regards to passive recreation spaces, the requirement for a playground per 1000 head of population is considered not to be met, particularly after closure of a number of parks as recommended by the City and the Karratha Revitalisation study which include Rex Webb Park, Richardson Way Park, Dodd Court Park and Ashton Way Park. It is noted that the Community Facilities Plan and Matrix (2013) is currently being updated by the City but no information on the likely changes was available at the time of writing this report.

Consideration of the proximity criteria stipulated in the City's Play Space Standards (Table 4) shows that most of the community should have sufficient access to Neighbourhood-type POS infrastructure into the future, as there are playgrounds associated with all district, sub-district and local POS areas (Figure 5, although it should be noted that this figure does not include the parks that are proposed to be closed).

Whilst the location of existing POS means that virtually all residents are within 500 metres walking distance of a Level 3 (Neighbourhood) park, the range and quality of facilities within the parks and their standard of maintenance is not optimal. The City has resolved to support the disposal of Rex Webb Park which is of poor standard and location, being at the edge of catchment and on the corner of two busy roads. The opportunity exists to consolidate these parks into one high quality park with a wider range of facilities and a higher maintenance regime.

Plate 1: Cattrall Park (left) and Scout Hall Park (right), examples of District and Neighbourhood POS areas

Facilities	Service Level	Catchment	Comments
Recreation Space Standards			
Playing fields and combined passive and active spaces	Regional	15,000	
Playing fields and combined passive and active spaces	District	8,000	
Playing fields and combined passive and active spaces	Neighbourhood	3,000	Space not required and non-functional space for future developments
Playing fields, combined passive and active spaces, local parks and playgrounds	Local	1,000	

Table 5: Community facility provision ratios for POS (City of Karratha, 2014)

Closure of some of the parks is supported by the City in order to address resource constraints associated with the ongoing maintenance of POS. This strategy is likely to be supported by the community, as indicated by the results of a survey of residents that indicated:

- respondents were willing to walk up to 1km (15 minutes) to a quality park;
- most walk or drive to parks, and spend more than 30 minutes there;
- there was general satisfaction with the quantity of parks provision, but lower satisfaction with the quality of the parks;
- there was a strong preference for better quality parks over more parks; and
- there was a strong desire for more shade, playground equipment, benches, trees, grassed areas and parking (Public Open Space Survey Analysis, Geografia, October 2011).

2.2.1. Public open space standards

The residential planning of Western Australia's urban areas has been established on the public open space provision standard of 10% of gross subdivisible area (WAPC, 2002).

The provision of public open space in urban areas of Karratha is currently informed by the following policies and guidelines:

- Development Control Policy 2.3 Public Open Space in Residential Areas (WAPC, 2002);
- Liveable Neighbourhoods (WAPC, 2007); and
- City of Karratha Play Space Standards (City of Karratha, 2013a)

State policies and guidelines provide a baseline for public open space provision in residential areas appropriate to temperate regions of Western Australia. However, Liveable Neighbourhoods (WAPC, 2007) does make specific provision for regional variations. Under Public Parkland R34 it states:

Suburb	Current population	Population estimate in 2031 (Low forecast)	POS areas
Bulgarra	3,578	4,843	District – Bulgarra Oval Neighbourhood - Scout Hall Park, Richardson Way Park* Local - Rex Webb Park*
Pegs Creek	2,718	3,679	Sub-District – Cattrall Park Neighbourhood - Watters Park, Dodd Court Park*
Millars Well	2,278	3,068	District - Kevin Richards Memorial Oval Neighbourhood - Malster Place Park, Michael Lewandowski Park Local - Ashton Park*

* POS area proposed for future closure

Table 6: Population and POS provision

"Subject to the support of the local government, the WAPC may accept a public open space contribution to a minimum of 5% of the gross subdivisible area providing:

- The public open space is designed, developed and located for the widest possible use of the community, including meeting, recreation, leisure, entertainment;
- The public open space is developed to a minimum standard including all earthworks, basic reticulation, grassing of key areas, pathways that form part of the overall pedestrian and/or cycle network and maintenance for two summers, in accordance with a landscape plan approved by the local government;
- Adequate areas are provided elsewhere for drainage and flooding, particularly overland flow;
- Public open space is readily available in the community that can be used at all hours of the day or night; and
- Does not include any restricted use public open space."

The City of Karratha Play Space Standards report (2013a) states that play spaces within the City will comply with the following standards:

- AS 4685 2004:
  - Part 1 – General safety requirements and test methods
  - Part 2 – Particular safety requirements and test methods for swings
  - Part 3 – Particular safety requirements and test methods for slides
  - Part 4 – Particular safety requirements and test methods for runways
  - Part 5 – Particular safety requirements and test methods for carousels
  - Part 6 – Particular safety requirements and test methods for rocking equipment
- ASNZS 4486 1997 – Playgrounds and playground equipment part 1 development, installation, inspection, maintenance and operation
- ASNZS 4422 1996 – Playground surfacing – Specifications, requirements and test method
- AS 2155 1982 – Playgrounds: Guide to Siting and to Installation and Maintenance of Equipment
- AS 2555 1982 – Supervised Adventure Playgrounds - Guide to Establishment and Administration
- AS 1428.3 1992 – Design for Access and Mobility - Requirements for Children and Adolescents with Physical Disabilities

Additional guidance on the provision of public open space in Karratha may be found in the draft Karratha open space strategy (City of Karratha, 2008), which provides information on public open space establishment in a context in keeping with the climatic, landform and demographic context of the Pilbara region.

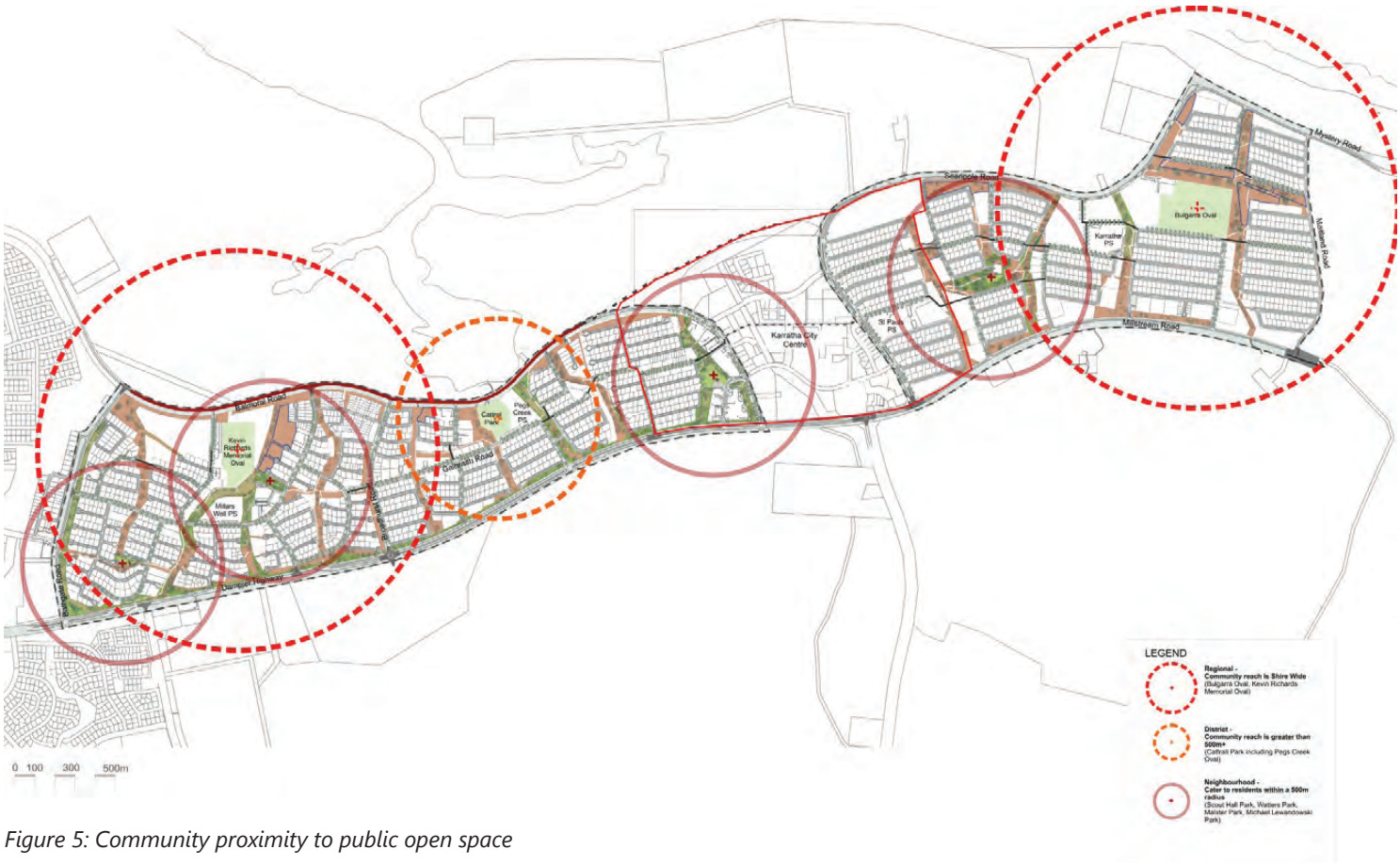


Figure 5: Community proximity to public open space

2.2.2. Delivery mechanisms

POS is provided as part of the subdivision and development process, as the State Government requires that a minimum of 10% of the gross subdivisible land be allocated by the developer for recreational purposes and provided to the local government at no cost. Where it is considered that there may be sufficient POS or the land area to be provided is too small for practical use, a cash-in lieu contribution may be acceptable to the City. This contribution is not generally required; however, where the subdivision is for five lots or less.

The establishment of new POS areas within existing Parks, Recreation and Drainage reserves does not require any changes to Town Planning Scheme No. 8. However, if new parks and ovals are proposed in areas not reserved for this purpose, amendment to the local scheme will be necessary.

2.2.3. Preliminary costs

Karratha's parks and ovals maintenance budget from 2007-2008 and 2010-2011 provides some indication of the costs associated with maintaining Karratha's active, passive and linkage POS areas.

A budget of $238,507 was set by the City of Karratha Council to maintain Karratha's parks and ovals for the 2010-2011 financial year (City of Karratha, 2011). This included services and insurances for maintained POS areas in Nickol and Baynton, as well as Bulgarra, Pegs Creek and Millars Well. This budget was used to maintain approximately 35.3 ha of active, passive and linkage POS area, equating to approximately $6,750 per hectare per annum. It is very likely that a significant proportion of the budget was used to maintain the infrastructure of only the more active POS areas; however, this level of detail is not included for all parks in ovals in the 2011 Review of Public Open Space in Karratha report.

Park classification	POS space	Function/vegetation	Cost per annum	Cost per ha per annum (2013)
District	Cattrall Park, Pegs Creek	~50:50 turf and mulch plantings	$262,974	$123,115
Neighbourhood	Tambrey Oval, Nickol	High use soccer oval	$233,867	$98,837
Neighbourhood	Scout Hall Park, Bulgarra	Minimal grass, natural plantings and small playground	$22,629	$79,648

Table 7: Estimated maintenance costs for three POS spaces in Karratha

For example, the budget to maintain Ashton Park (4,102 m2), Richardson Way Park (3220 m2) and Rex Webb Park (3,152 m2) in 2010-2011 was provided, at $45,786, $25,682 and $12,661, respectively. This equates to approximately $111,600 per hectare, $79,800 per hectare and $40,200 per hectare, respectively. These figures indicate the range in costs to maintain different parks in Karratha.

In comparison, the 2007-2008 the annual maintenance for Karratha's parks and ovals was significantly higher than for 2010-2011 at $608,740 for the same listed parks and ovals (City of Karratha, 2008). The 2007-2008 budget allowed $21,835 per hectare per annum to maintain the four major ovals in Karratha.

The annual maintenance budget for drainage reserves in Karrratha in 2007-2008 was $403,719 and over double this amount in 2010-2011 at $846,750. The Coordinator of Parks and Gardens estimated the current cost of maintaining drainage reserves within the Karratha townsite is approximately $5,700 per hectare per annum. This covers the cost of slashing, spraying, debris removal, tree pruning, irrigation maintenance, and some litter removal.

Current park maintenance costs generally range between $70,000 to $250,000 per hectare per annum depending on their size, utilisation, condition, and planting requirements (pers. comm. Coordinator Parks and Gardens, City of Karratha, 3rd April 2014). Current maintenance cost estimates for some specific parks and ovals provided recently by the City of Karratha are presented in Table 7 above.

Rawlinsons Australian Construction Handbook (2013) states that the establishment of a new sports oval, including light to moderate earthworks, grassing, fertilising, water and maintenance for twelve months, irrigation and flood-lighting, costs between approximately $1,350,000 and $2,100,00, assuming a regional cost adjustment for Karratha of 155% of Perth costs. This does not include the construction of any ancillary buildings or parking areas.

The use of a developer contribution scheme may be an option for the funding of public open space upgrades which will benefit the wider community, for example, in areas of proposed development where recreational amenity is not considered sufficient. However, as the provision of POS within the study area is considered to be sufficient, it is unlikely that developer contributions scheme to add to this would be required.

Plate 2: An arterial, collector and small branch drain, Karratha (Source: GHD, 2010)

2.3. Drainage

Karratha is subject to high intensity rainfall often associated with cyclonic activity resulting in high stormwater runoff rates from the Karratha Hills to the south and the silty clays of the town itself. As a result the drainage network in Karratha was developed around the need to rapidly remove stormwater away from key infrastructure within developed areas, to prevent and minimise flooding. The Karratha townsite is drained by a series of short trunk drainage courses, generally running in a north-south direction consistent with the north-south topographical profile of Karratha's suburbs. The drainage network is based on natural creek lines augmented, where necessary, with constructed drainage channels. The topographic gradient of the town generally decreases from east to west, with Bulgarra in the east possessing a steeper gradient and making the most use of natural creek lines. In the more recently constructed suburbs, the north-south gradient tends to be shallower and the majority of the drainage channels are constructed (City of Karratha, 2008).

Stormwater runoff is conveyed from developed areas via a series of lateral drains to roads with high kerbs designed to contain high volumes of water. Road runoff is then directed to topographic low points and discharged through kerb breaks to a network of open, mostly unlined, drainage channels located throughout the townsite. There are no kerb drains or piped drainage in Karratha and the roads also serve as surface water courses during flash floods. The drainage channel network discharges stormwater from the town site northwards to the low lying mudflats and into Nickol Bay. The Karratha Open Space Strategy (City of Karratha, 2008) indicates that the kerbed road system is designed to accommodate the 1 in 10 year ARI flood event, and the drainage channels are designed to accommodate the 1 in 100 year ARI flood event.

Drainage channels vary in depth and width, depending on the volumes of water they convey and include no bioretention structures. The low lying flats provide detention for runoff, slowing velocities and allowing the settling of suspended sediment prior to water discharging to Nickol Bay (GHD, 2010).

Plate 2: An arterial, collector and small branch drain, Karratha (Source: GHD, 2010)

All drainage channels are located within reserves zoned as Parks, Recreation & Drainage under the City of Karratha Town Planning Scheme No. 8 and are managed solely by the City of Karratha. No drainage networks are owned or managed by the Water Corporation within the study area. The drainage network was developed within drainage reserves in order to cater for the 1 in 100 yr ARI event flows, and includes land on either side of drainage channels that extend to the fringe of urban areas. Drainage reserves within the Karratha townsite typically range from widths of 20 m up to 100 m depending on stormwater conveyance within the drainage line (GHD, 2010).

Vegetation in drainage reserves is maintained by the City of Karratha Parks and Gardens branch on an informal basis. Understory vegetation is kept to an approximate height of 50 mm, either by slashing or spraying by sub-contractors on average of 2-3 times per year. Vegetation in reserves that are steep, hard to get to, or around culverts are sprayed and not slashed. Larger sections of drainage reserve through Millars Well and around Scout Hall Park in Bulgarra are not maintained in their entirety due to their lack of visibility, and only the edges of these reserves are sprayed or slashed. Trees and wildflowers growing in suitable locations within drainage reserves are preserved and the City is currently trialling the native seeding of the swale from Cattrall Park with wildflowers (Tim Marks, Coordinator Parks and Gardens, City of Karratha, 9th April 2014).

2.3.1. Identified drainage issues

A preliminary assessment of the hydraulic capacity of Karratha's drainage system was undertaken by GHD in 2010. The Karratha Drainage Assessment and Drainage Management Plan (GHD, 2010) identified that overall the existing drainage network is in very good condition and well maintained.

In 2013, JDA undertook a more detailed flood assessment over the Karratha townsite including the study area (Lazy Lands, Karratha, 2D Flood Study and Local Water Management Framework) to determine the current impact of flooding from rainfall runoff in the town, with a focus on the 61 Lazy Lands sites. Results from modelling the existing local stormwater drainage system in 1 in 5 year and 1 in 100 year ARI events revealed that:

for the 1 in 5 year ARI event, the flood extent is contained within most of the drainage reserve area;

for the 1 in 100 year ARI the majority of flooding in Pegs Creek and Millars Well is contained within reserves and conveyed as overland flow by the road network to the existing reserves; and

results for Bulgarra indicate several areas where the road network has insufficient capacity to convey overland flow of the 100yr ARI event to drainage reserves and flooding of adjacent residential areas occurs. However, the stormwater management strategy for the future Mulataga development site to the east of Bulgarra proposes to convey part of the existing flow away from Bulgarra to Mulataga Creek, thereby reducing the flood extent in this area.

Modelling was also undertaken under a proposed development scenario where the 61 Lazy Lands sites were developed. The elevation for these sites was raised above the adjacent 1 in 100 year ARI flood level from existing conditions to represent fill on the lots. Results from the modelling of the proposed development scenario identified that:

filling of the Lazy Lands sites reduces the available flow area in surrounding areas resulting in increased flood levels at the sites and upstream, as well as an increased flood extent in comparison to existing conditions; and

flood rise associated with filling of Lazy Lands sites may be up to approximately 0.25 m but is expected to exceed 0.8 m in some locations.

A number of Lazy Lands sites were identified as being hydrologically constrained and potentially requiring additional engineering works to mitigate their development impact on drainage flood levels. This includes three sites in Millars Well, two sites in Pegs Creek and ten sites in Bulgarra (JDA, 2013). However, the majority of the Lazy Lands sites were determined to be not required as part of the Karratha townsite drainage corridor (JDA, 2013).

2.3.2. Drainage upgrades

The identification of existing flooding issues in the Bulgarra suburb from the 2013 2D Flood Study has resulted in further investigation into the extent of flooding in this area as well as a part of Pegs Creek. JDA have undertaken more detailed modelling and analysis over these areas to identify more precisely what is causing runoff from the 1 in 100 year ARI event to breach road networks and therefore, what drainage infrastructure upgrades are necessary to prevent existing flooding (JDA, 2014). Upgrades might include the redesign or realignment of an adjacent drain, increase in the drainage corridor capacity downstream of a site (i.e. increase in culvert/ spillway size or number), realignment of a site or development boundary, or the provision of drainage flow paths within a development site.

A formal drain maintenance schedule for Karratha is currently absent (GHD, 2010). The development and implementation of regular and scheduled maintenance of the current drainage network will assist in maintaining its functionality, which will be particularly important as runoff flow increases with development. GHD has previously recommended that the following be included in a formal maintenance schedule:

- Vegetation maintenance – to prevent blockages;
- Vegetation establishment – to prevent erosion of new drainage channels;
- Infrastructure repair; and
- Blockage / sedimentation removal.

The Karratha Drainage Management Plan also recommends that landscaping at property boundaries or at the development scale in the form of landscaped detention areas will assist in reducing the overall pressure on the stormwater network (GHD, 2010).

2.3.3. Infrastructure standards

The Institute of Public Works Engineering Australia (IPWEA) has prepared Local Government Guidelines for Subdivisional Development (IPWEA, 2011) which outlines specifications for drainage management. These guidelines encompass current legislation and were developed in conjunction with the Department of Planning with the intention of ensuring best practice minimum engineering standards are practised in Western Australia. They are intended to guide local government and the development industry through engineering specification, construction and post-construction subdivision approval. The Local Government Guidelines for Subdivisional Development (IPWEA, 2011) are available online by subscription through IPWEA (http://www.ipwea.asn.au/).

Item	Approximate unit cost
Site preparation (inc. top soil excavation – in clay, trimming, and soiling/grassing)*	$27 / m^2
Trench excavation – in clay	$62.90 / m^3
Pre-cast concrete box culvert laid on ground:	
375 x 225 mm	$395 / m
600 x 450 mm	$601 / m
750 x 600 mm	$874 / m
1200 x 1200 mm	$1,736 / m
Pre-cast concrete pipe culvert laid on ground:	
300 mm dia.	$180 /m
450 mm dia.	$281 / m
600 mm dia.	$367 / m
750 mm dia.	$609 / m
1200 mm dia.	$1,197 /m
Pre-cast concrete headwall laid on ground:	
300 mm dia.	$871 / headwall
450 mm dia.	$871 / headwall
600 mm dia.	$1,164 / headwall
750 mm dia.	$1,566 / headwall

*Top soil excavation of 0.3 m assumed

Table 8: Costs of drainage network upgrades (Source: Rawlinsons, 2013)

The City of Karratha sets out its specifications for the construction of drainage networks in its Specification for Subdivision Construction of Road Works and Drainage (City of Karratha, 2013c). These specifications are intended as an addendum to the IPWEA guidelines, and describe construction requirements particular to the City of Karratha. The specification recognises local construction materials and local drainage requirements, and that there are no piped stormwater drainage systems, other than road culverts, used within the City of Karratha.

This document is available from the City of Karratha online at http://karratha.wa.gov.au/Assets/Documents/Document%20Centre/specification_road_footpath_drain.pdf

Permission is required to undertake any works within a City reserve. A permit application to work within a City of Reserve is available from the City of Karratha online at http://karratha.wa.gov.au/Assets/documents/infrastructure/permit_to_work_within_a_City_reserve.pdf

2.3.4 Delivery mechanisms

Through the application of the design standards outlined above, new development cannot impact on the capacity and/or function of the defined drainage network unless permitted by the City. Any development within or adjacent to the Parks, Recreation & Drainage reserves within the study area should consider the findings and recommendations of the Lazy Lands, Karratha, 2D Flood Study and Local Water Management Framework (JDA, 2013).

The preparation of a Detailed flood assessment for the development of a hydrologically constrained site is recommended prior to, or with the submission of a Town Planning Scheme amendment, to provide a summary of existing hydrological constraints and outline the proposed strategies to minimise or reduce flood impact from the development of the site.

If an increase in flooding as a direct result of a proposed development is identified, then the developer will be required to fund, design and construct additional drainage infrastructure necessary to manage stormwater runoff.

2.3.5. Preliminary costs

Costs associated with upgrading the existing drainage network to adequately manage flooding within the existing townsite will be borne by the City of Karratha. A summary of preliminary unit costs to upgrade drainage networks is presented in Table 8 (see left) These costs were obtained from Rawlinsons Australian Construction Handbook (2013) and assume a regional cost adjustment for Karratha of 155% of Perth costs.

Table 8: Costs of drainage network upgrades (Source: Rawlinsons, 2013)

*Top soil excavation of 0.3 m assumed

2.4. Drinking water

Water for Karratha townsite is sourced from the Water Corporation's West Pilbara Water Supply Scheme (WSS). The West Pilbara WSS also supplies water to the Burrup Peninsula, Dampier and its port, Roebourne, Wickham, Point Samson and surrounding areas.

Water for the West Pilbara WSS is sourced from the Harding Dam (approximately 40 km inland) and the Millstream Wellfield (approximately 100 km inland). These two sources operate together throughout the year, while water from Harding Dam is used as the preferential source when availability and quality allow. The water source has been recently augmented through a $330million investment by Rio Tinto which extracts water from the Bungaroo Valley borefield, transferring it into the existing water supply scheme.

Water from these sources is treated and then transferred by large trunk mains to the storage tanks at the various townsites.

Karratha's water is currently stored in one 25 ML storage tank at the town's western tank site, two 9 ML tanks at the eastern tank site close to the town centre, and two small 225 kL tanks near the Karratha Light Industrial Area (see Figure 6). The 9 ML tanks have recently been refurbished. The water supply network for Karratha is shown on Figure 6.

In 2011 and 2012, the Water Corporation reviewed its long-term water planning for the West Pilbara WSS and for the Karratha scheme, based on a planning horizon of 2040. The long term plan for Karratha identifies the need and approximate timing of various upgrades and expansions to the town's water storages and distribution network to meet anticipated demands. The water scheme plan provides for staging of capital works and includes options to vary the planning based on the rate and spatial distribution of demand over time.

For a proposed population of 50,000 (based on the Pilbara Cities vision (DRDL, 2012)), it is estimated that the town's water storage tanks will need to be expanded to achieve a total storage volume of around 100 ML, which is likely to be distributed equally between the eastern (50 ML) and western (50 ML) tank sites, subject to need and available space at each site.

The long-term water scheme plan also schedules approximate dates for capital expenditure on various upgrades and extensions to the town's water distribution pipes (generally major water mains greater than 300 mm in diameter).

The Water Corporation's planning also considers concepts for further system expansion (storage expansion and distribution improvements) for a longer-term population of approximately 78,000 people, based upon the August 2010 Karratha Regional HotSpots Land Supply Update which predicts 36,000 dwellings.

Planning for water service provision will be reviewed by the Water Corporation in future years as growth and demand conditions change.

2.4.1. Infrastructure standards

Any water supply infrastructure installed for a new development should be designed and constructed in accordance with Water Corporation design standards. Design standards and technical manuals are available on request from the Water Corporation (idb.standardsenquiries@watercorporation.com.au).

In addition, the Water Corporation has published a Developer's Manual which provides a comprehensive guide for designing, constructing and handing over infrastructure assets by land developers. http://www.watercorporation.com.au/-/media/files/builders%20and%20developers/subdividing/developers-manual.pdf

Additional information on infrastructure standards is available online at http://www.watercorporation.com.au/Home/Builders%20and%20developers/Subdividing/Land%20development?pid=bd-sd-np-ld

2.4.2. Delivery mechanisms

To determine whether the water supply needs required for a proposed development will be able to be supplied from the existing water supply system, a developer should contact the Water Corporation's Development Services branch (land.servicing@watercorporation.com.au).

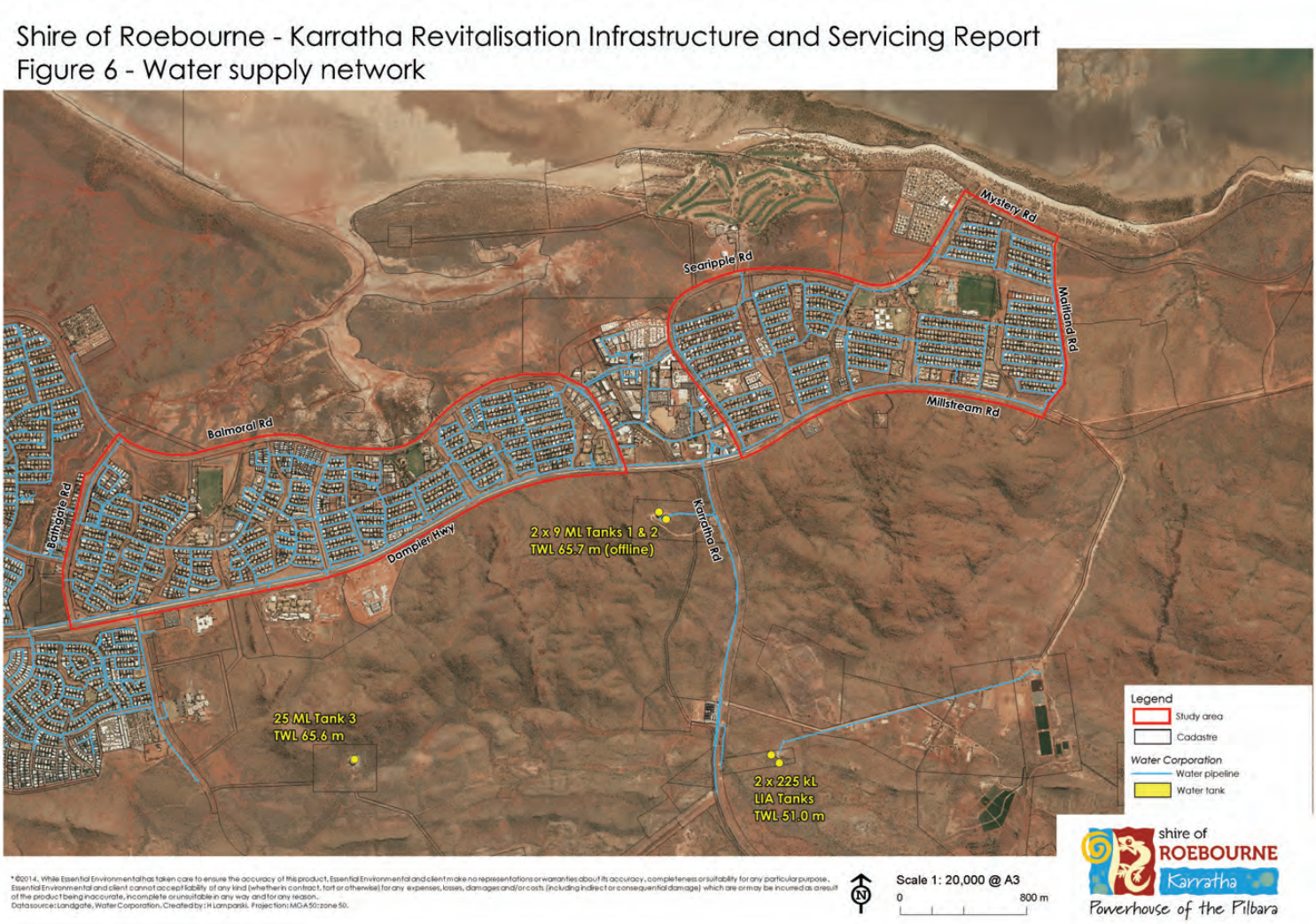


Figure 6: Water supply system

Provided that the timing of a development is in line with the Water Corporation's planning, any infrastructure upgrades required to accommodate this planned population growth should be delivered through the Water Corporation's scheduled works via management of their capital program, and paid for through headworks charged to the developer. However, where this is not the case and reticulation upgrades are required for larger developments before the Water Corporation has planned for them, the cost of upgrading the necessary infrastructure will usually be borne by the developer. The Water Corporation generally expects capacity in the system to be available due to the fact that many of the lots within the study area zoned R20 have actually been developed at a much lower density.

A proposed development should consider the presence of existing Water Corporation assets and separations required, particularly where proposed infrastructure (e.g. new roads) may cross over assets such as water mains. If changes are proposed to existing roads or new roads are proposed to be built, access must be preserved to the service network. The provision of an easement or road is likely to be acceptable provided the separation to infrastructure is adequate, and this should be confirmed with the Water Corporation's asset manager (Water Corporation, 24th February 2014).

The design and construction of water supply infrastructure as part of a land development should follow the process outlined below.

1. Consider whether the concept and capacity of the proposed works are compatible with the Water Corporation's overall planning requirements
2. Design infrastructure in compliance with Water Corporation standards and prepare and submit initial and final submissions
3. Receive external approvals and preliminaries to undertake works in accordance with the Water Corporation's External approvals manual (http://www.watercorporation.com.au/-/media/files/suppliers/external-approvals-manual.pdf) and with the statutory requirements outlines in the Water Services Act 2012
4. Obtain acceptance and meet pre-construction requirements
5. Construct infrastructure in line with Water Corporation requirements

6. Arrange inspections with a Water Corporation asset inspector
7. Connect to Water Corporation infrastructure
8. Submit as-constructed information and arrange takeover by the Water Corporation

Further details on the requirements of water supply infrastructure provision for a development are available online: http://www.watercorporation.com.au/Home/Builders%20and%20developers/Subdividing/Land%20development?pid=bd-sd-np-ld

2.4.3. Headworks contribution costs

Headworks contributions for connection to Water Corporation water services, also referred to as Standard Infrastructure Contributions (SICs), are one-off charges, exempt of GST, payable to the Water Corporation for works up to the connection point on a property that will increase the potential demand on existing water supply schemes.

The current headworks contribution fee for connection to water services is $4,031 per lot for green-title residential and non-residential subdivisions. Headworks contribution fees for connection to water services in strata subdivisions depend on the metering option choice made by the developer. Generally, strata lots that are served individually will normally pay higher water contributions than strata lots served by common services (Water Corporation, 2014). Non-standard contributions for water services are currently not required to be paid in Karratha.

Additional fees may apply to a subdivision depending on administrative, planning and design requirements. The connection of new infrastructure will also incur additional fees, depending on the type and size of connections. Further information on the calculation of headworks contribution fees as well as land servicing and development fees is available at: http://www.watercorporation.com.au/home/builders-and-developers/subdividing/fees-and-charges

It is noted that where headworks charges exist, it is unlikely that developer contributions charges would be sought to pay for infrastructure upgrades. Any upgrades that are required premature to those planned by the Water Corporation are usually required to be paid for by the developer.

2.5. Non-drinking water

There is an existing non-drinking water (treated effluent) distribution network operating within Karratha delivering water for irrigation of public open spaces. The public open spaces within the study area of the Karratha Revitalisation Plan that are currently irrigated with treated effluent are:

- Bulgarra Oval
- Old KEC oval, west and central horse paddocks
- Pegs Creek Oval
- Cattrall Park
- Kevin Richards Memorial Oval (Millars Well)

Upgrades to the level of treatment provided at the wastewater treatment plant as well as an increase in capacity will increase the availability of this resource. However, there is substantial competition for this resource and as a result only limited expansion of the treated effluent irrigation system is likely and currently no additional sites within the study area of the Karratha Revitalisation Plan are proposed for irrigation with treated effluent.

A separate Karratha Effluent Reuse Scheme investigation is currently underway which will prioritise public open spaces for irrigation with treated effluent and develop designs for expanded and more efficient distribution and irrigation systems.

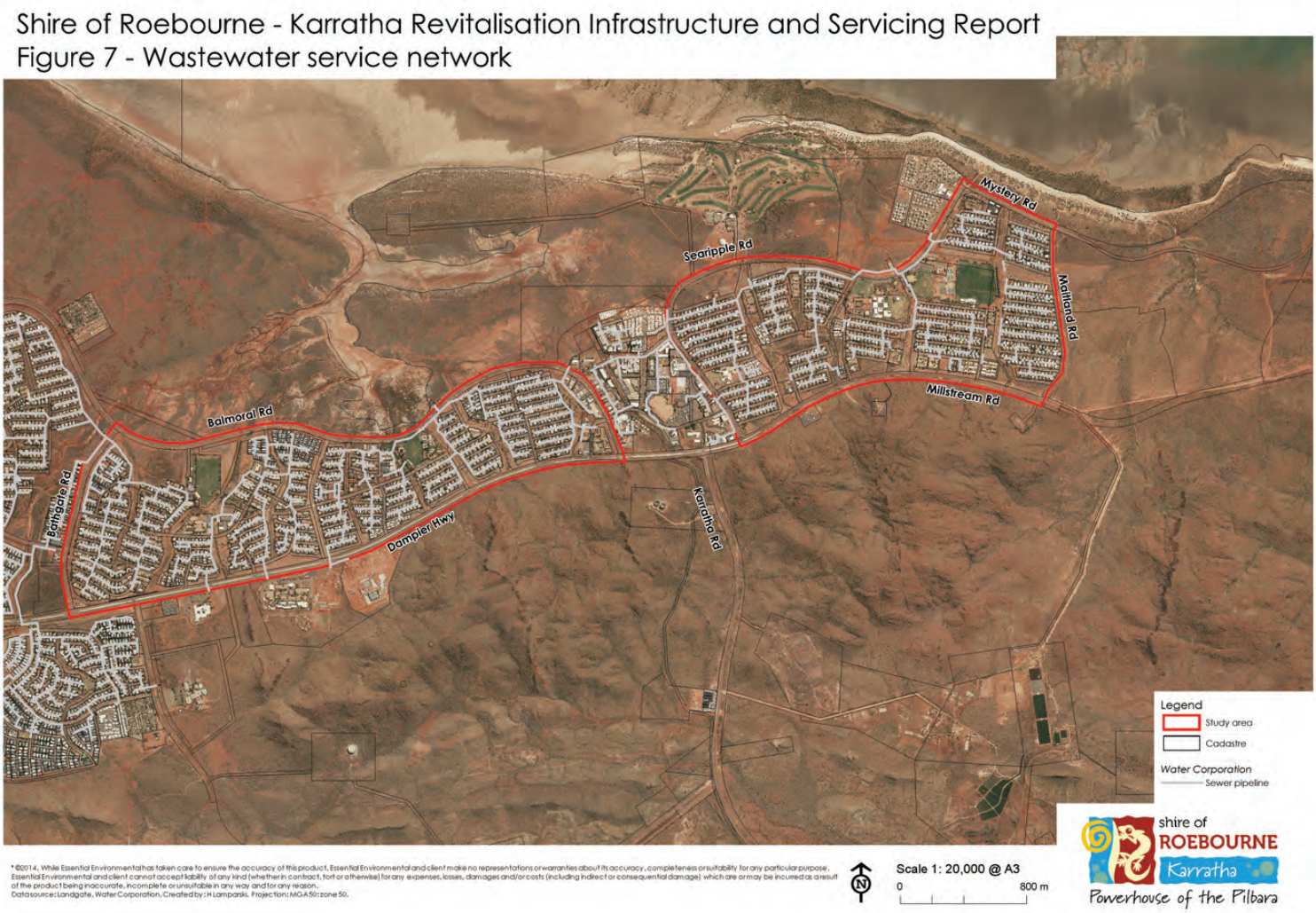


Figure 7: Waste water service network

2.6. Wastewater

To meet the demands arising from the proposed high development growth in Karratha over the next 25 years, several parts of the town's wastewater system, including the treatment plants, major gravity sewers, wastewater pressure mains and wastewater pumping stations will need to be upgraded and/or replaced to deal with the additional wastewater flows.

In 2010 and 2011, the Water Corporation undertook a substantial review of its long-term wastewater infrastructure planning and capital expenditure program for the town. The main driver for this planning review was the rapid increase in development in the town on the back of the resources boom in the Pilbara, as well as projected future increases in townsite population and in particular the shift towards higher density and mixed use development in the town centre.

The Water Corporation's planning review was based on a number of land use planning studies and inputs including:

- State Government's Pilbara Cities initiative;
- WAPC's 2010 Karratha Regional Hotspots Land Supply Update;
- City of Karratha TPS No.8 and known scheme rezoning amendments;
- City of Karratha's Karratha City Centre development plan, LandCorp plans for various development sites notably Mulataga and city centre development sites; and
- various site-specific land development and feasibility queries received by the Water Corporation.

This planning review took a 50 year horizon to approximately 2060. The planning considers various options into the future and provides a guide for the Corporation's capital investment decisions on upgrading of existing infrastructure and establishment of new infrastructure.

The Corporation's planning is based on a wide range of sustainability principles including: minimising potential environmental impacts, minimising the impacts on the community, determining the best long-term option, minimising whole-of-life asset costs, maximising the life of existing assets, and staging the cost of new assets and upgrades over time.

2.6.1. Wastewater treatment plants

Karratha currently has three wastewater treatments plants ():

- K1 is situated to the south-east of Karratha and accepts and treats wastewater flows from the eastern half of the town. K1 has a licensed capacity of 2.3 ML/day.
- K2 is situated to the south-west of the town and treats flows from the western half of the town. K1 has a licensed capacity of 3 ML/day.
- K3 is small light industrial area treatment plant located to the south of K1 abutting the Karratha LIA. This WWTP treats wastewater flows from a limited catchment comprising mainly workers accommodation located in the LIA as well as effluent from a number of septic tanks in the LIA. K3 has a very limited capacity and is registered to accept 70 KL/day.

K1 and K2 WWTPs are operating close to their maximum capacity and the Corporation has undertaken separate planning and committed substantial capital towards upgrading to improve treatment capacity and treatment wastewater management capacity at K1. The upgrading and expansion of K1 WWTP to a maximum capacity of 10 ML/day, is currently underway. The long-term planning for the system also has an option to consolidate the WWTPs at one location and to possibly decommission K2.

The City of Karratha currently uses some treated waste water to irrigate public open spaces throughout the city, some of which are within Bulgarra, Pegs Creek and Millars Well, as discussed in section 2.5. Disposal of the remainder is into evaporation ponds.

2.6.2 Wastewater conveyance

The town's wastewater conveyance system consists of a vast system of small-scale gravity sewers that collect wastewater from the town's houses, schools, businesses and other land uses. These reticulation-sized sewers move wastewater under gravity to a series of eight wastewater pumping stations that pump via pressure mains to various discharge locations (usually to larger pump stations downstream). Wastewater is then pumped from the main pump stations up to the K1 and K2 wastewater treatment plants for treatment, disposal and re-use as necessary. The wastewater network for Karratha is shown on Figure 7.

The pump station at Searipple Rd has recently been upgraded, together with the installation of duplicate reticulation and other additional works to facilitate the planned development in the Karratha City Centre.

The Water Corporation's adopted long-term wastewater conveyance planning provides a plan for capital expenditure on the progressive upgrade of wastewater headworks infrastructure including existing and new pumping stations, pressure mains and gravity sewers generally 300 mm or larger.

2.6.3. Infrastructure standards

Any wastewater infrastructure installed for a proposed development should be designed and constructed in accordance with Water Corporation design standards. Design standards and technical manuals are available on request from the Water Corporation (idb.standardsenquiries@watercorporation.com.au).

Additional information is provided in the Water Corporation's Developer's Manual and infrastructure standards available online at http://www.watercorporation.com.au/-/media/files/builders%20and%20developers/subdividing/developers-manual.pdf

http://www.watercorporation.com.au/Home/Builders%20and%20developers/Subdividing/Land%20development?pid=bd-sd-np-ld

2.6.4. Delivery mechanisms

To determine whether the wastewater services required for a proposed development will be available from the existing wastewater system, a developer should contact the Water Corporation's Development Services branch (land.servicing@watercorporation.com.au).

Provided that the timing of a development is consistent with the Water Corporation's wastewater planning, any upgrades required to accommodate the development should be delivered through the Water Corporation's capital program of scheduled works, and paid for through headworks charged to the developer. However, where this is not the case and reticulation upgrades are required for larger developments before the Water Corporation has planned for them, the cost of upgrading the necessary infrastructure will usually be borne by the developer.

The Water Corporation generally expects capacity in the system to be available due to the fact that many of the lots within the study area zoned R20 have actually been developed at a much lower density.

The design and construction of wastewater services should be undertaken in a similar manner to that of water, as described in Section 2.4.

2.7.2. Hedland Precinct Power Project

Further details on the requirements of wastewater infrastructure provision for a development are available online http://www.watercorporation.com.au/Home/Builders%20and%20developers/Subdividing/Land%20development?pid=bd-sd-np-ld

2.6.5. Headworks contribution costs

Headworks contributions for connection to Water Corporation wastewater services, also referred to as Standard Infrastructure Contributions (SICs), are one-off charges, exempt of GST, payable to the Water Corporation for works up to the connection point on a property that will increase the potential demand on existing wastewater schemes.

The current headworks contribution fee for connection to wastewater services is $1,352 per lot for green-title and strata residential and non-residential subdivisions (Water Corporation, 2014). Non-standard contributions for wastewater services are currently not required to be paid in Karratha.

A reimbursement of $600 per meter from the Water Corporation is payable to developers who construct a 300 mm diameter sewer (reticulation) as part of their project. The reimbursement is automatically issued to the developer recorded on the subdivision agreement, when work has been completed and the Water Corporation has taken over the assets.

Additional fees may apply to a subdivision depending on administrative, planning and design requirements. The connection of new infrastructure will also incur additional fees, depending on the type and size of connections. Further information on the calculation of headworks contribution fees as well as land servicing and development fees is available at: http://www.watercorporation.com.au/home/builders-and-developers/subdividing/fees-and-charges

2.7. Power

Horizon Power is the State-government owned corporation that supplies and distributes power in regional and remote Western Australia, including Karratha, through its North-West Interconnected System (NWIS). This NWIS grid is partially interconnected by high voltage power transmission lines owned by both Horizon Power and mining companies (City of Karratha, 2010).

The Karratha townsite power high voltage supply scheme is a network of a combination of 11 kV overhead power cables and underground feeder cables fed from zone substations located on Millstream Road in Bulgarra and Dampier Highway in Millars Well. These zone substations are known as the Bulgarra Substation and Pegs Creek Substation, respectively (City of Karratha, 2010). Existing high voltage overhead power transmissions lines are located along Dampier Highway linking the Bulgarra and Pegs Creek zone substations to the existing Stovehill Road switchyard. The existing transmission and distribution networks in Karratha are shown in Figure 8.

A large proportion of Bulgarra, Pegs Creek, Millars Well are currently serviced by overhead power lines. The majority of 11 kV high voltage overhead and underground feeder cables within the townsite are currently at capacity (City of Karratha, 2010). To address this issue, accommodate expected population growth and deliver the Pilbara Cities vision of approximately 50,000 in the townsite, Horizon Power has completed a number of planning reviews of the power supply in Karratha. To meet the growing demand, two major upgrade projects are currently underway in the region, the Pilbara Underground Power Project and the Hedland Precinct Power Project, described below.

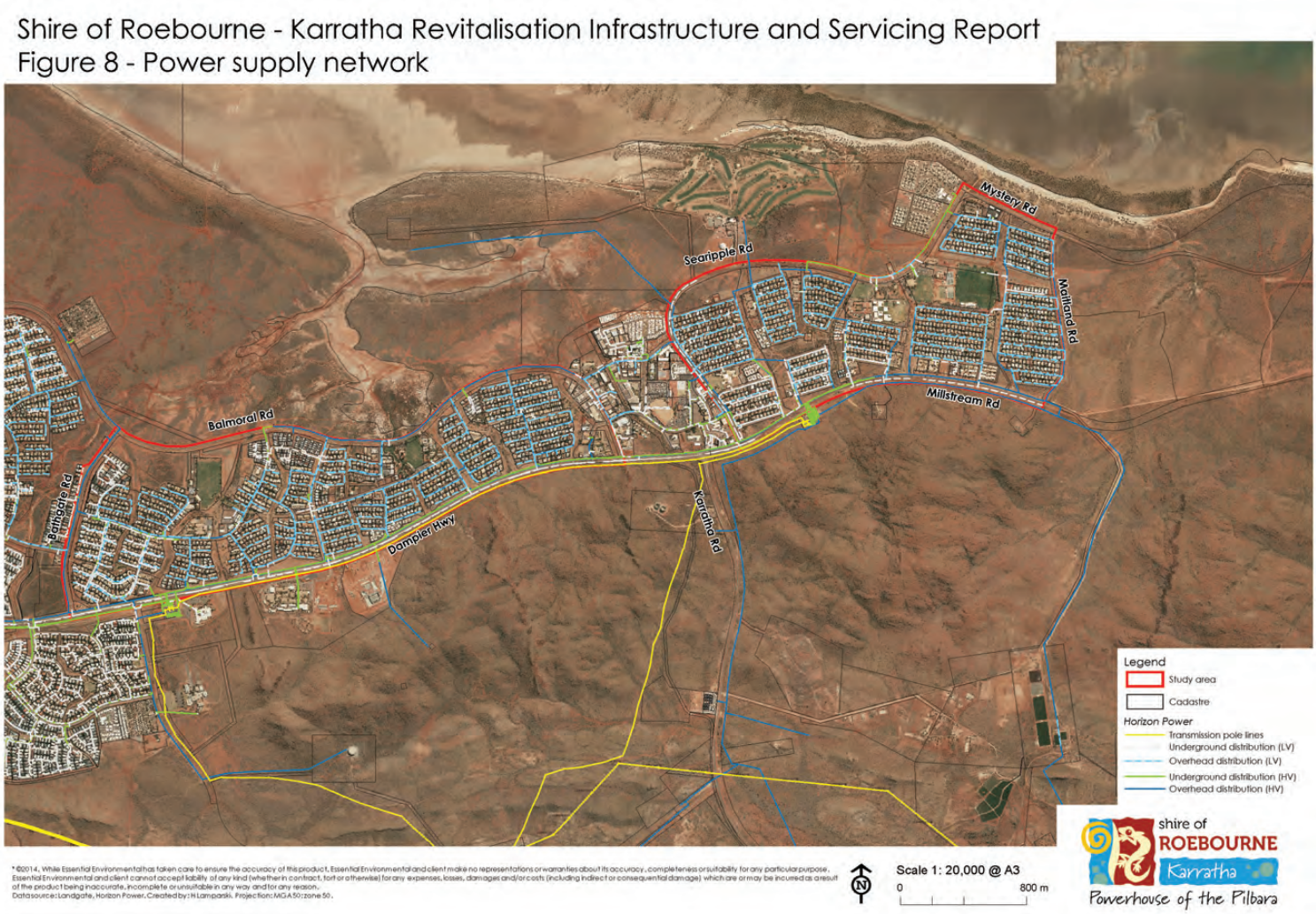


Figure 8: Power supply network

2.7.1. Pilbara Underground Power Project

The Pilbara Underground Power Project (http://www.horizonpower.com.au/pupp.html) is a partnership between the Royalties for Regions, Pilbara Cities initiative and Local Government to better ensure a reliable power supply in cyclone affected areas, by replacing ageing overhead electricity infrastructure

with underground networks. This project is being undertaken in Karratha, as well as South Hedland, Onslow and for the remaining overhead network in Roebourne. The distribution voltage and therefore capacity of the electrical distribution network will be upgraded from 11 kV (above ground power lines) to 22 kV (underground power lines). These upgrades will increase the capacity of the system from 5 MVA to 8.5 MVA, approximately a 40% increase in capacity.

Horizon Power allows for a usage of 10 kVA per household and 7 kVA per unit in Karratha (pers comm. Horizon Power, 10th January 2014).

Based on this allowance a maximum of 3,000 additional houses, approximately 1000 houses per suburb, could be serviced by Karratha's distribution network once underground power line upgrades are completed. The current capacity of the existing and temporary power stations and substations is considered sufficient to meet this increase in demand. However, 3,000 houses is considered the capacity limit of the system (pers comm. Horizon Power, 5th March 2014).

The replacement of the existing overhead power network has been partially completed in Bulgarra and the full program is scheduled for completion in Bulgarra, Pegs Creek and Millars Well in 2017.

The Hedland Precinct Power Project involves the construction of a 67 MW power station in South Hedland to increase the generation capacity of the NWIS and an additional 220 kV transmission line. This project was developed as a result of forecasts predicting peak demand from Pilbara customers associated with residential, commercial and industrial growth in Port Hedland and Karratha.

Gas turbines totalling a capacity of 67 MW will be installed at Boodarie Industrial Estate in South Hedland and the 220 kV transmission line will extend 7 km from the new power station to the Horizon Power Hedland Terminal. The power station has been designed to be modular for future expansion as required (City of Karratha, 2010).

Construction of the power station and transmission line is due to be completed by the end of 2014 and will ensure power demands for the region are met until 2016. The amount of energy these upgrades will supply is approximately half of the electricity currently used in Karratha, Port Hedland, South Hedland, Point Samson and Roebourne.

2.7.3. Infrastructure standards

Horizon Power and Western Power have published a Western Australian Distribution Connections Manual (Horizon Power and Western Power, 2013) which provides a comprehensive single point of reference for industry and the community for an electrical connection of a customer's installation to the major distribution networks in Western Australia, including Horizon Power's North West Interconnected System (NWIS). This manual is available online at http://www.horizonpower.com.au/1676.html

The manual provides details on statutory requirement and obligations, roles and responsibilities, general safety requirements, easements, equipment, supply characteristics, metering, low and high voltage distribution specifications, substation requirements and embedded generation requirements and responsibilities.

Manuals and standards for network contractors working on Horizon Power's electrical network are available from Horizon Power online at http://www.horizonpower.com.au/network_contractors_manuals_standards.html

Contractors intending to work on or near Horizon Power's electrical networks must have the appropriate Horizon Power authorisation prior to the commencement of the work. This can be obtained by submitting an application for individual employees.

2.7.4. Delivery mechanisms and preliminary costs

In order to connect a proposed development to Horizon Power's distribution network authorisation must first be obtained from Horizon Power using their Connection Application form available online at http://www.horizonpower.com.au/documents/1831446_21rlg04_.PDF

This process allows Horizon Power to understand development requirements for electricity supply, assess whether any electrical infrastructure upgrades are required to supply electricity and estimate the cost of supply and any necessary upgrades on a per lot basis.

A developer will be charged by Horizon Power for the installation of infrastructure required to physically connect their network to the development, including the planning for and installation of extension poles and transformers, underground cabling and any associated works.

No network augmentation costs will be charged if the existing system has the capacity to supply to a proposed development. However, a developer will be required to pay for infrastructure to increase the capacity of the existing distribution and transmission network if a proposed development requires greater than the standard allowance of typically 32 amps per phase (pers. comm., Horizon Power, 10th January 2014). Infrastructure upgrades that may be required include replacement or addition of existing transformers, distribution feeders, substation components, poles, wires and underground cables.

Developers can also install their own power infrastructure in the ground and then arrange for hand over to Horizon Power. This process is likely to be more expensive due to 42% gifting tax associated with the transfer of infrastructure (pers. comm. Horizon Power, 5th March 2014).

Further information on pricing for developers is available from Horizon Power online at http://www.horizonpower.com.au/documents/Developer_Pricing_Information3695165.PDF; http://www.horizonpower.com.au/electrical_contractors_fees_charges.html; and http://www.horizonpower.com.au/network_contractors_fees_charges.html

2.8. Telecommunications

2.8.1. Telstra

Telstra's Karratha telecommunications exchange and communications tower is located on Balmoral Road, between Welcome Road and Morse Court. An extensive network of optic fibre and copper cable connect to the telephone exchange and radiate about the townsite, with major cables typically located on the local connector and distributor roads. Hard wired data transmission currently available at a household level is based on Telstra's ADSL technology (City of Karratha, 2010).

Under Telstra's universal service obligation, all people in Australia, no matter where they live or conduct business, are required to be provided with reasonable access, on an equitable basis, to standard telephone services and payphones. The Minister for Communications has determined that Telstra is the primary universal service provider and is responsible for fulfilling the universal service obligation throughout the whole of Australia. As such, Telstra is considered a Provider of Last Resort and must comply with any telecommunications network connection requests.

In accordance with the Telecommunications (Consumer Protection and Service Standards) Act 1999, Telstra has sets out how it will fulfil this obligation in its Universal Service Obligation Policy Statement (Telstra, 2005, http://www.telstra.com.au/abouttelstra/commitments/uso/).

If any shortfall in copper cabling occurs in Karratha where development is proposed, Telstra will haul cables from an external source to the proposed development area to ensure it meets its universal service obligation at no cost to the developer (pers. comm. Melissa Nielsen, Smart Communities Telstra, 1st April 2014). A copper cable network is currently available throughout most of Bulgarra, Pegs Creek and Millars Well (pers. comm. Melissa Nielsen, Smart Communities Telstra, 1st April 2014). Telstra is not responsible for the provision of pits and pipes to allow household access to its copper network within a privately owned area, and these infrastructure costs are borne by the land developer.

2.8.2. National Broadband Network

The Australian Government is currently upgrading Australia's existing telecommunications network by providing infrastructure for affordable, high-speed internet and phone access across the country, known as the National Broadband Network (NBN). These upgrades are being managed by the NBN Co (1800 687 626, http://www2.nbnco.com.au/)

Karratha is considered a 'fibre' area by the NBN Co., which is an area considered to be of a high enough density for current copper wiring to be replaced with fibre optics. Existing subdivisions will receive a mixed technology system consisting of fibre to the node (the pit on the street connecting fibre optics to copper wiring for individual houses), with existing copper from the node to households remaining in place.

However, new subdivisions (where subdivisions comprise of 100 houses or greater) will receive a fibre connection directly to each household.

No fibre optics will be installed directly to households in the study area of Millars Well, Pegs Creek or Bulgarra. Households within the study area will receive fibre to the node only, with existing copper from the node to the household to remain. Mixed technology fibre to node upgrades have not yet been in constructed in Karratha and it is not known when these upgrades will take place (pers. comm. 1st April 2014, NBN Co. 1800 687 626).

New subdivisions in Karratha which have fibre optics installed directly to the household or are currently being constructed include:

- Gap Ridge Industrial Area
- Madigan Rd
- Baynton West
- Nickol West
- Pelago East

2.8.3. Infrastructure standards

Developers are required to install telecommunications infrastructure according to the following guidelines provided by the Communications Alliance and the NBN Co.:

- G645:2011 Fibre Ready Pit and Pipe Specification for Real Estate Development Projects (http://www.commsalliance.com.au/__data/assets/pdf_file/0014/32450/G645_2011.pdf)
- New Developments: Deployment of the NBN Co Conduit and Pit Network - Guidelines for Developers (NBN Co, 2013) (http://www.nbnco.com.au/content/dam/nbnco/documents/installing-pit-and-conduit-infrastructure.pdf)

Additional technical guidelines relating to the preparation of new developments for the installation of a fibre network are available at http://www.nbnco.com.au/industry/new-developments/new-developments-technical-guidelines.html

2.8.4. Delivery mechanisms

The assessment of infrastructure requirements to connect proposed developments to the Telstra copper network is undertaken by Telstra via their Smart Communities program. Telstra requires a minimum of 3 months' notice for all applications. An assessment of a proposed development will determine the pipe and pit construction requirements required for provision of telecommunications services. Construction may be undertaken by the developer to Telstra standards or Telstra may be engaged to undertake the infrastructure program at cost to the developer.

In developments of less than 100 households where

developers have an agreement with Telstra to provide telecommunications infrastructure, developers will need to transfer ownership of pit and pipe to Telstra as a commercial condition of Telstra serving the development (Department of Communications, 2014).

Any developers undertaking a subdivision in an NBN Co. active area can apply to install and connect fibre irrespective of their development size. To confirm whether a subdivision is within an NBN Co. active area, a pre-qualification application is available online http://www2.nbnco.com.au/industry/new-developments.html?icid=pub:hme:new-devs:bod:txt

If a proposed subdivision falls within an NBN Co. active area, then a developer is required to undertake the following process:

Register the development for NBN Co. fibre infrastructure via NBN Co's online process:

https://www2.nbnco.com.au/new_developments/developments/terms_and_conditions

Submit a Master Plan for the overall development;

Sign and return the Master Developer Agreement (MDA) - NBN Co will not install and connect fibre to a new development without a Master Developer Agreement in place;

Provide NBN Co with at least three months' notice prior to the commencement of construction/civil works to ensure it has adequate time to plan the installation of fibre;

Design pit and pipe infrastructure to NBN Co specifications and standards and submit to NBN Co for review prior to installation (http://www.nbnco.com.au/content/dam/nbnco/documents/installing-pit-and-conduit-infrastructure.pdf)

Install pit and pipe infrastructure to NBN Co specifications and standards; and

Transfer ownership of pit and pipe infrastructure to NBN Co.

2.8.5. Preliminary costs

Pit and pipe installation costs will be incurred by the developer and are dependent on existing infrastructure, and the size and layout of their subdivision. This information will not be available until the subdivision plan has been assessed by Telstra and the NBN Co.

3. Future infrastructure requirements

As described in section 1.3, the Karratha Revitalisation Strategy proposes to improve the liveability and amenity of the suburbs of Bulgarra, Pegs Creek and Millars Well through a number of strategies including increasing the density and diversity of housing particularly in proximity to the Karratha City Centre.

Increasing the number of people and dwellings in the study area will result in an increased need for services such as power, water, wastewater, drainage and telecommunications and infrastructure such as roads, pathways and public open space.

An assessment of the existing and future capacity of the service and infrastructure systems suggests that there is unlikely to be a need to increase the capacity of any of the services within the study area beyond that being planned for by the service providers to deliver the proposed revitalisation concept. Some upgrades will; however, be required to transport infrastructure networks and POS as outlined below.

3.1. Infrastructure and servicing upgrades

3.1.1. Transport

The preliminary revitalisation concept includes the following upgrades to transport infrastructure as depicted in Figure 9:

- improving east-west and north-south connectivity through the study suburbs through the construction of additional road linkages;
- implementation of The Future Works Report Footpaths 2013-2023 (City of Karratha, 2013a);
- selected intersection reviews and resultant upgrades; and
- duplication of Balmoral Rd.

Main Roads has identified that traffic signal upgrades will be undertaken before 2021 at De Witt Road and Dampier Highway. While upgrades are not considered a requirement for Maitland Road and Mystery Road, upgrades of Searipple Road, Balmoral Road and Millstream Road may occur in the long term (pers. comm. Main Roads, 20 February 2014).

Other future upgrades will need to be considered as part of a strategic assessment of the road network and current and future demands. It is not possible to estimate the types of upgrades that will be required at this stage.

Any future road upgrades or modifications required as a part of individual developments are to be funded, designed and constructed by developers in accordance with IPWEA and City of Karratha standards.

If any upgrades are to occur to Dampier Highway, then designs are to be in accordance with Main Roads standards.

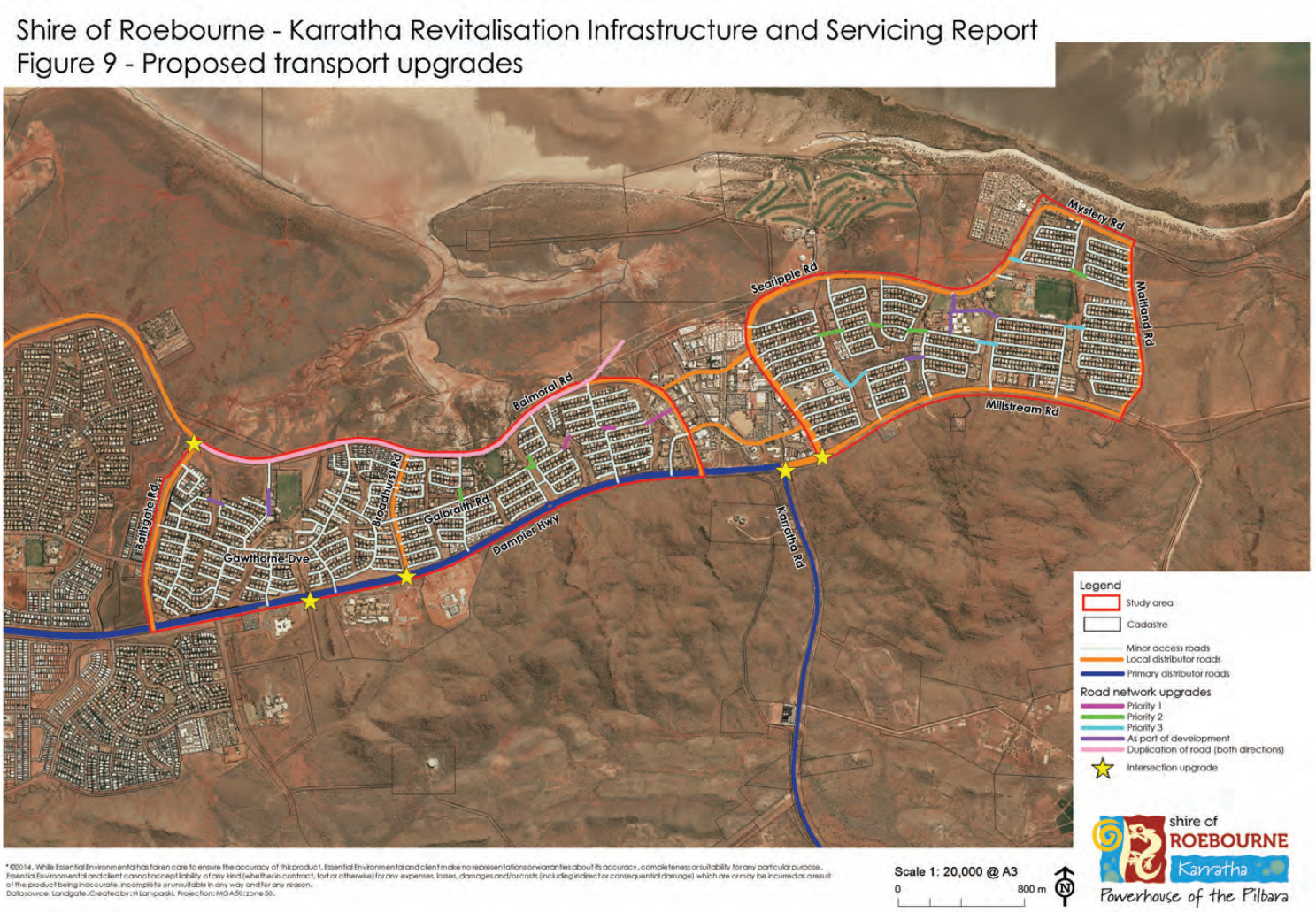


Figure 9: Proposed transport upgrades

Any changes to existing roads or construction of new roads must preserve appropriate access and separation distances to existing service networks including water, wastewater, drainage, power and telecommunications.

3.1.2. POS upgrades

The preliminary revitalisation concept includes the following changes to public open space and associated infrastructure:

- Close Rex Webb and Richardson Way Parks;
- Upgrades to Scout Hall Park
- Close the 2.8 ha soccer pitch ('KEC Oval') portion of the Bulgarra Oval after making provision for a soccer training function in the balance of the Bulgarra oval precinct;
- Close Ashton Park and enhance Malster Place Park;
- Minor upgrades to Kevin Richards Memorial Oval;
- Improve shade at Michael Lewandowski Park;
- Improve shade at Cattrall Park; and
- Close Dodd St and Watters Park north and enhance Watters Park south.

Although these actions have been broadly agreed, no landscape concepts have been developed for the enhancements or the type of shade structures. It is therefore not possible to provide cost estimates for the work required at this stage.

Any changes to public open spaces containing service infrastructure including water, wastewater, drainage, power and telecommunications must preserve appropriate access and separation distances.

Infrastructure item	Unit cost	Amount	Total cost
Transport			
Road connectivity improvements			
Road pavement	$790 / m	2500m	$1,975,000
Culverts (assume average of 3 x1200x1200 culverts and 20m road reserve)	$1,736 / m	900m	$1,562,400
Implementation of The Future Works Report Footpaths 2013-2023 (City of Karratha, 2013a)	$301 / m	26.90 kilometres	$8.1 million
Intersection reviews as part of a strategic transport study			$100,000
Resultant upgrades	Cost is dependent on the outcome of the review as this will vary markedly		
Public Open Space			
All upgrades to public open space require the preparation of concept landscaping plans			Unable to be estimated at this stage
Drainage			
No upgrades are currently proposed			
Water			
No upgrades are currently proposed			
Wastewater			
No upgrades are currently proposed			
Power			
No upgrades are currently proposed			
Telecommunications			
No upgrades are currently proposed			

Table 9: Summary of preliminary estimated upgrade costs for infrastructure for the Karratha Revitalisation concept

3.1.3. Drainage

On the basis of the current agreed scenario there are no district scale upgrade requirements for drainage infrastructure. Any local upgrades which are required to manage increases in rainfall runoff resulting from development within the study area will be borne by the developers. Any proposals to connect to or modify existing drainage infrastructure should demonstrate that there are no adverse impacts to up-and/or downstream parts of the drainage system and surrounding land areas to the satisfaction of the City of Karratha.

Development of hydrologically constrained sites will require preparation of a detailed flood assessment prior to, or with the submission of a Town Planning Scheme amendment, to provide a summary of existing hydrological constraints and outline the strategies proposed to minimise or reduce flood impact from proposed development of the site.

3.1.4. Water

On the basis of the current agreed scenario there are no upgrade requirements for water infrastructure beyond that which would be normally funded and delivered by the Water Corporation through collection of headworks charges. Future infrastructure requirements are limited to local scale provision of reticulation systems and individual lot connections which are to be funded, designed and constructed by developers in accordance with the Water Corporation's design standards.

3.1.5. Wastewater

On the basis of the current agreed scenario there are no district scale upgrade requirements for wastewater infrastructure beyond that which would be normally funded and delivered by the Water Corporation through collection of headworks charges. Future infrastructure requirements are therefore limited to local scale provision of reticulation systems and individual lot connections which are to be funded, designed and constructed by developers in accordance with the Water Corporation's design standards.

3.1.6. Power

On the basis of the current agreed scenario there are no upgrade requirements for power infrastructure beyond that which would be normally delivered by Horizon Power and funded by direct charges to developers.

Horizon Power has indicated that it will be installing underground power in Pegs Creek as part of the Pilbara Underground Power Project in 2015 and the program across the study area is scheduled to be completed in 2017.

3.1.7. Telecommunications

On the basis of the current agreed scenario there are no upgrade requirements for telecommunications infrastructure beyond that which would be normally delivered by Telstra and funded by direct charges to developers.

3.2. Staging issues

It is recommended that a 'live' strategic traffic demand model is developed to assess the feasibility of the proposed transport scenario prior to any preliminary design and/or assessment of required works. This will also enable the assessment of requirements for intersection upgrades.

Consideration should be given to the construction of road linkages when associated Lazy Lands parcels are being developed.

Horizon Power has indicated that it will be installing underground power in Pegs Creek as part of the Pilbara Underground Power Project in 2015 and therefore any transport upgrades should occur from 2016 onwards (City of Karratha, 2013a).

3.3. Costs

Table 9 provides a summary of the costs for infrastructure works currently proposed as a part of the Karratha Revitalisation project to be delivered by the City of Karratha and funded through their capital works budget and/or grants as appropriate.

All other costs associated with development in the study area are to be borne by the developer.

3.4. Responsibilities

Table 10 provides a summary of the responsibilities and timing for infrastructure works associated with the Karratha Revitalisation project. This table includes responsibilities for works that are outside the current scope of the revitalization project but that will be required to occur as a part of future development in the study area.

Infrastructure item	Responsibility	Timing
Transport		
Road connectivity improvements	City of Karratha	As priorities, funding and development permit
Implementation of The Future Works Report Footpaths 2013-2023 (City of Karratha, 2013a)	City of Karratha	2014 - 2023
Intersection reviews and resulting upgrades	City of Karratha	As part of the development and assessment of a 'live' strategic traffic demand model
Traffic signal upgrades at De Witt Road	Main Roads	Before 2021
Public Open Space		
Provide training ground in the Bulgarra oval precinct	City of Karratha	Prior to closure of the KEC oval
Upgrades to Scout Hall Park	City of Karratha	As funding permits but prior to closure of Richardson Way Park
Enhance Malster Place Park	City of Karratha	As funding permits but prior to closure of Ashton Way Park
Minor upgrades to Kevin Richards Memorial Oval	City of Karratha	As funding permits
Improve shade at Michael Lewandowski Park and Cattrall Park	City of Karratha	As funding permits
Enhance Watters Park south	City of Karratha	Nearing completion
Drainage		
Known hydraulically constrained sites: preparation of a detailed flood assessment and resulting upgrades	Developers	Prior to, or with the submission of a Town Planning Scheme amendment
All other sites: Investigation of development impacts and resulting upgrades	Developers	prior to, or with the submission of a Town Planning Scheme amendment or development application
Water		
Design and construction of district scale system upgrades in response to development	Water Corporation (funded through headworks charges)	At the time of development

Infrastructure item	Responsibility	Timing
Design and construction of water reticulation systems and lot connections in accordance with the Water Corporation's design standards	Developers	At the time of development
Wastewater		
Design and construction of district scale system upgrades in response to development	Water Corporation (funded through headworks charges)	At the time of development
Design and construction of wastewater systems and lot connections in accordance with the Water Corporation's design standards	Developers	At the time of development
Power		
Completion of underground power installation	Horizon Power	Expected 2017
Design and construction of district scale system upgrades in response to development	Horizon Power (funded by direct charges to developers)	At the time of development
Telecommunications		
Design and construction of district scale system upgrades in response to development	Telstra (funded by direct charges to developers)	At the time of development

Table 10: Summary of infrastructure responsibilities and timing for preliminary Karratha Revitalisation concept

4. References

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Attachment 1: Background information on development contributions schemes

State Planning Policy 3.6: Development contributions for infrastructure (2009) (SPP 3.6) notes that development contributions may be appropriate for "Infill development and redevelopment, where common standard conditions of subdivision, strata subdivision or development still apply, but where significant changes in the type or intensity of land use may require new infrastructure and facilities or the augmentation of existing infrastructure and facilities beyond the normal scope of standard subdivision conditions."

Although the policy provides a number of principles, it is recognised that the foundation principle is that the 'beneficiary' pays.

SPP 3.6 notes that:

Developers will only fund the infrastructure and facilities which are reasonable and necessary for the development and to the extent that the infrastructure and facilities are necessary to service the development. Development contribution plans will, therefore, need to identify growth trends based on service catchment areas, translate these trends into the infrastructure and facilities necessary to meet these increasing needs within the catchment, and allocate the costs of meeting these needs to existing residents and new residents proportional to their contribution to the need for the infrastructure and facilities.

The SPP provides a framework for the preparation of contributions plans, which suggest that they be calculated on the basis of—

1. the need for that infrastructure based on an analysis of the demand;
2. the nexus where the relationship between the need for infrastructure and the new development is clearly established;
3. catchment areas that the infrastructure would service, identifying both existing demand and new demand that is associated with the development; and
4. the cost of providing the infrastructure, which should be based on the latest or best estimates available to the local government and should include provision for regular adjustments to account for cost escalation over time.

Where a local government is seeking contributions for community infrastructure, these need to be supported by—

- a community infrastructure plan for the area, identifying the services and facilities required over the next 5 to 10 years (supported by demand analysis and identification of service catchments);
- a capital expenditure plan (with at least 5 out years), which identifies the capital costs of facilities and the revenue sources (including capital grants) and programs for provision;
- projected growth figures, including the number of new dwellings to be created at catchment level (suburb or district); and
- a methodology for determining the proportion of costs of community infrastructure to be attributed to growth and the proportion to be attributed to existing areas.

Possible requirements which may be considered by the Karratha Revitalisation study include:

- Roads (including land for new roads, widening and costs of works)
- Infrastructure for—
  - water (upgrades via headworks);
  - sewerage; (upgrades via headworks);
  - drainage works (upgrades); and
  - electricity supply infrastructure (upgrades) including consideration of underground power.
- Community infrastructure such as footpaths, cyclone-proof shading, recreation spaces, playgrounds, a library and community hall.

It will be necessary, therefore, to ensure that sufficient information is available to enable the estimation of the costs of the required infrastructure.