



Kimberley Region Infrastructure Analysis
The Chamber of Minerals and Energy of Western Australia

 **ERNST & YOUNG**

 **CME**

Kimberley Region Infrastructure Analysis

In accordance with our agreement for the provision of services to The Chamber of Minerals and Energy of Western Australia (CME) dated 31 October 2011, this report (the Report) sets out the results of the work that we have undertaken in relation to the analysis of infrastructure in the Kimberley region project (the Project). This Report has been prepared by CME and Ernst & Young at the request of CME in Ernst & Young's capacity as advisors in accordance with the agreement.

Purpose of our Report and our approach

This report provides the results of our analysis of infrastructure status, needs and requirements for the Kimberley region. Our scope of work in relation to this Report has been to analyse the:

- ▶ current status of the major projects which are planned for the Kimberley Region
- ▶ infrastructure needs of individual projects
- ▶ timing of planned project investment, and of future phases of expansion
- ▶ implied priorities for infrastructure projects in the Kimberley, and the estimated costs
- ▶ impact of development on infrastructure capacity, and future infrastructure projects
- ▶ funding status of key infrastructure projects, and potential public/private funding sources
- ▶ development thresholds which should trigger the provision of key infrastructure.

Our ability to report on all of the scope items above was limited by the availability of data to support detailed analysis; in particular a lack of detailed quantitative data provided a significant restriction. Consequently our report does not address the final two points in the scope of work above.

Our method of meeting these requirements included six discrete steps:

- ▶ project inception
- ▶ desktop research
- ▶ meetings and interviews in Perth
- ▶ meetings and interviews in the Kimberley
- ▶ data analysis and draft report preparation
- ▶ issue of final report and project close out.

Our work was to adopt, as a time horizon, the period to 2020, but its extent has been governed largely by the data available.

Sources of information

The analysis undertaken in this Report is based on meetings with and/or information researched by Ernst & Young from:

- ▶ CME members who were mining and resources companies operating, or with planned projects, in the Kimberley Region including:
 - ▶ Kimberley Diamond Company
 - ▶ Kimberley Metals Limited
 - ▶ Kimberley Rare Earths
 - ▶ Paladin Energy
 - ▶ Pluton Resources
 - ▶ Rio Tinto – Argyle Diamonds
 - ▶ Woodside

- ▶ Government departments and agencies with policy or service provision responsibilities in or affecting the Region, including:
 - ▶ Kimberley Development Commission
 - ▶ Department of Education
 - ▶ Department of Health
 - ▶ Department of Local Government
 - ▶ Department of Mines and Petroleum
 - ▶ Department of Planning
 - ▶ Department of Regional Development and Lands
 - ▶ Department of State Development
 - ▶ Department of Training and Workforce Development
 - ▶ Department of Transport
 - ▶ Department of Water
 - ▶ Office of Energy
 - ▶ Horizon Power
 - ▶ Main Roads Western Australia
 - ▶ Tourism WA
 - ▶ Water Corporation

- ▶ other publicly available information

The sources of information are referenced throughout the Report.

A substantial part of our work was desk-top research. Where possible we confirmed and, if necessary, updated, the desk-top research results through meetings and interviews.

Limitations on our work

Our work has been limited in scope and time and we stress that a more detailed analysis may reveal material issues that this Report has not.

The information, statements, statistics and commentary (together the "Information") contained in this report have been prepared by Ernst & Young from publicly available material and information provided by CME members. Ernst & Young and CME have not sought any independent confirmation of the reliability, accuracy or completeness of this information. It should not be construed that Ernst & Young or CME have carried out any form of audit of the information which has been relied upon.

Accordingly, whilst the statements made in this Report are given in good faith, Ernst & Young and CME accept no responsibility for any errors in the information provided by industry participants or other parties nor the effect of any such errors on our analysis, suggestions or Report.

The underlying assumptions and projections contained within the Report are subject to significant uncertainties and contingencies often outside the control of Ernst & Young or CME. If events do not occur as assumed, actual financial information may vary significantly. Accordingly, Ernst & Young nor CME does not confirm or guarantee the achievement of the forecast financial information provided, as future events by their very nature, are not capable of independent substantiation.

Disclaimer

This Report has been prepared by CME and Ernst & Young at the request of the CME in Ernst & Young's capacity as advisors in accordance with the Terms of Reference and Terms and Conditions contained in the contract between the CME and Ernst & Young. This document is not intended to be utilised or relied upon for any purpose other than that articulated in the Terms of Reference. Accordingly, Ernst & Young and CME accept no responsibility in any way whatsoever for the use of this report by any other persons or for any other purpose. The information, statements, statistics and commentary (together the "Information") contained in this report have been prepared by Ernst & Young from publicly available material and information provided by industry participants. Ernst & Young and CME have not sought any independent confirmation of the reliability, accuracy or completeness of this information. It should not be construed that Ernst & Young or CME have carried out any form of audit of the information which has been relied upon.

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We trust that we have provided you with the information you require, however, should you have any queries regarding this matter please contact Russell Lamb (08) 9429 2294 or Neal Johnston on (02) 9248 4274.

Yours sincerely

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1. Introduction

Economic development in the Kimberley is accelerating. Major resource projects are scheduled to proceed. The Western Australia Government has committed to expand irrigated agriculture around Kununurra. There are important wilderness areas and tourist destinations within the region.

Economic development should benefit business, local communities and the State. However, without adequate infrastructure, some investment may not proceed, or investment may not proceed in a coordinated manner and the benefits flowing from the development which takes place will be less than could otherwise have been the case.

The infrastructure that is required includes capital intensive facilities – for communications, electricity supply, ports, roads, water supply and wastewater treatment – which will directly serve the expected resources investment, and investments in agriculture and tourism. It also includes the housing, health services, education, local roads, recreation, waste disposal and other facilities which will be required by communities within the Kimberley.

Demands for resources (mineral and energy products, including coal, oil and natural gas), for agricultural products and for tourism services are being driven by changing economic conditions outside the Kimberley.

Within the region, a new and important socio-economic dynamic has emerged, which is influencing both infrastructure requirements and the way in which infrastructure is provided. Indigenous communities with rights to land are seeking from the developers of the region's natural resources, and from the Western Australian and Australian Governments, the means of securing long term sustainable development of their communities. This includes the provision of infrastructure. It also includes training and the creation of employment opportunities, particularly for younger people, which will have the effect of lifting incomes and further lifting requirements for housing, health services, education and other community infrastructure within the Kimberley.

The Chamber of Minerals and Energy of Western Australia (CME), and its members, now need to better understand these infrastructure requirements to more effectively plan their own activities in the region.

CME has asked Ernst & Young to report on:

- ▶ the current status of projects proceeding in the Kimberley, and projects planned for the region
- ▶ the infrastructure needs of individual projects
- ▶ the timing of planned project investment and of future phases of expansion
- ▶ the implied priorities for infrastructure projects in the Kimberley and the estimated costs
- ▶ the impact of development on infrastructure capacity and future infrastructure projects
- ▶ the funding status of infrastructure projects, and potential public/private funding sources
- ▶ the development thresholds which should trigger the provision of key infrastructure.

1.1 Our approach

In carrying out our work, we have:

- ▶ reviewed the extensive, although sometimes dated, published materials on development in the Kimberley
- ▶ sought information from company documents and the web sites of companies operating in, or planning to operate in, the region
- ▶ spoken with CME members
- ▶ contacted people in government agencies involved in infrastructure provision.

We have found the making of quantitative assessments of infrastructure requirements and costs to be particularly difficult. Only general statements of requirement and broad estimates of costs were available to us from published materials, from company documents and websites, and from our meetings with CME members and our contacts with people in government.

As one project proponent explained to us, the public release of specific figures for the scale, cost and timing of infrastructure investment had a tendency to affect share price. Figures pertaining to planned investment about which there was still considerable uncertainty, not the least of which was the final decision of the board of directors on whether or not the investment was to proceed, could not be released.

Similarly, people in government agencies involved in Kimberley infrastructure provision were prepared to provide us with current budget estimates and to discuss future plans/investment, but were not able to provide us with forward projections. This was not because those agencies did not plan ahead. Rather, their forward estimates had not been through the formal processes of assessment and approval at the highest levels of government and, until that had happened, they could not be publicly released.

In consequence, our analysis of Kimberley infrastructure requirements is qualitative rather than quantitative.

The information available precluded our reporting fully on those parts of our scope of work which called for quantitative analysis. Consequently our report does not specifically address the funding status for key infrastructure projects, potential funding sources and on specific development thresholds which would trigger infrastructure provision.

1.2 Structure of our report

The findings from our work for CME are set out in this report.

In the next section of the Report we provide background to our work: we briefly describe the Kimberley, its population, economic activity in the region, and existing regional infrastructure.

In section 3, we review the drivers of Kimberley region development, including the mineral and energy resources projects now being planned by CME members.

Our principal conclusions are drawn in section 4.

Our work reinforces a number of existing views about future Kimberley infrastructure requirements, and points to four main issues in respect of which CME might play an important coordinating role through the representation of the interests of its members in the process of regional development. These four main issues are:

- ▶ the need for further development of the Great Northern Highway as the main route over which materials are transported into the Kimberley and over which the region's production is transported to its ports for export
- ▶ further development of those ports and, in particular, the Port of Wyndham

- ▶ the need for additional housing to meet the needs of a growing and more prosperous population
- ▶ the need for further investment in water supply and wastewater treatment facilities as the populations of smaller regional towns grow as part of the development process.

2. The Kimberley

This section maps the current stock of economic, social and community infrastructure in the Kimberley, and identifies capacity issues that are being experienced at present.

The Kimberley comprises the four northern-most local government areas in Western Australia. They are:

- ▶ Broome
- ▶ Derby-West Kimberley
- ▶ Halls Creek
- ▶ Wyndham-East Kimberley.

These four local government areas have a combined land area of 420,798 square kilometres, which is some 17% of the total land area of the State.

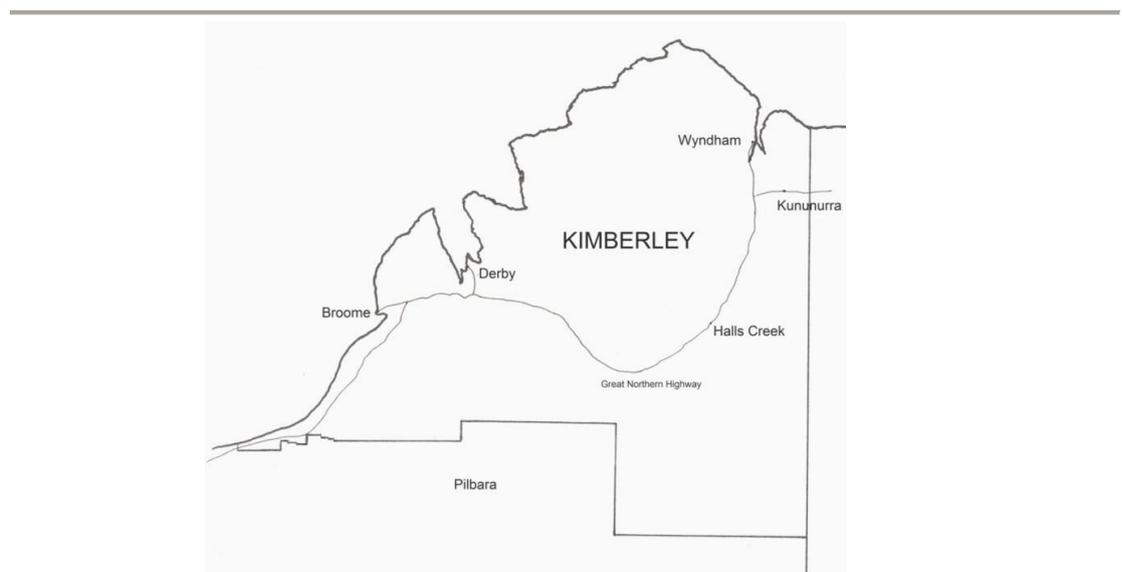
The principal towns in the Kimberley are:

- ▶ Broome
- ▶ Derby
- ▶ Fitzroy Crossing
- ▶ Halls Creek
- ▶ Kununurra
- ▶ Wyndham.

These towns are remote. Broome is about 1,700 kilometres from Perth and Wyndham is some 2,200 kilometres from the State capital. Broome and Wyndham are about 1,100 kilometres and 450 kilometres, respectively, from Darwin.

The principal towns, and the Kimberley region's main transport artery, the Great Northern Highway, are shown in Figure 1.

Figure 1: Kimberley region



2.1 Economic activity

The total value of economic activity in the Kimberley in 2010-11 (the gross regional product in that year) has been estimated to be \$3.1 billion.¹

Minerals and petroleum production is the largest single component of total regional production.

2.1.1 Minerals and petroleum

The value of minerals and petroleum produced in the Kimberley, by commodity, is shown in Table 1. Table 2 shows the value of minerals and petroleum production by local government district.

Table 1: Kimberley region: value of minerals and petroleum by commodity (2010-11)

	\$ million	%
Iron ore	429.6	42.0
Nickel, copper and cobalt	221.7	21.7
Diamonds and crude oil	304.6	29.8
Gold and silver	57.6	5.6
Other	8.5	0.8
Total	1,022.0	100.0

Source: Department of Minerals and Energy Resource Data Files (available at <http://www.dmp.wa.gov.au/1521.aspx#1589>).

Table 2: Kimberley region: value of minerals and petroleum by local government area (2010-11)

	\$ million	%
Broome	6.4	0.6
Derby-West Kimberley	510.4	49.9
Halls Creek	279.4	27.3
Wyndham-East Kimberley	225.8	22.1
Total	1,022.0	100.0

Source: Department of Minerals and Energy Resource Data Files (available at <http://www.dmp.wa.gov.au/1521.aspx#1589>).

The principal resource projects contributing to the value of Kimberley region minerals and petroleum production are listed in Tables 4, 5, 6 and 7.

Table 3: Kimberley region: iron ore

Owners	Project	Description
Cliffs Asia Pacific (50%) HWE Mining (50%)	Cockatoo Island	<ul style="list-style-type: none"> Premium fines produced for Asian market Location: Cockatoo Island, Yampi Sound, approximately 200 km north of Broome Capacity of 1.4 million metric tonnes per annum (2010) Ore is hauled by haul truck to stockpiles, crushed and screened, transferred by conveyor and loaded on to ships which berth at the Island Electricity supplied by on-site diesel generation
KMG	Ridges	<ul style="list-style-type: none"> Magnetite (50%) and hematite (50%) ore body close to surface Located 165 km south of Wyndham, 3 km from Great Northern Highway Shipping of iron ore fines to China commenced in July 2011; currently exporting around 100,000 tonnes per month Confirmed mine life of four years based on production rate of 1.5 million tonnes per annum Company has developed port facilities for barge to ship operation in Cambridge Gulf

¹ Kimberley Development Commission

Owners	Project	Description
		<ul style="list-style-type: none"> Company has developed accommodation in Wyndham
Mt Gibson Iron	Koolan Island	<ul style="list-style-type: none"> High quality hematite produced for Asian market Location: Koolan Island, Yampi Sound, approximately 200 km north of Broome Ore crushed, screened and loaded on to ships which berth at the Island

Table 4: Kimberley region: nickel, copper and cobalt

Owners	Project	Description
Panoramic Resources	Savannah	<ul style="list-style-type: none"> Nickel concentrate (average 7-8% nickel, 3-4% copper and 0.4-0.8% cobalt) Location: 240 km south of Kununurra Current production: 7,273 tonnes of nickel contained in concentrate (year ended June 2010) Resource expected to support a mine life beyond 2018 Concentrate transported by road to Wyndham for export to China Process plant and associated infrastructure at mine site; concentrate shed at port
Panoramic Resources (60%) Thundelarra Exploration (40%)	Copernicus	<ul style="list-style-type: none"> Nickel concentrate Location: 50 km south of Savannah project 23 km haul road links site to Great Northern Highway to enable ore to be hauled to Savannah plant for processing Currently on care and maintenance, but operations able to be restarted at short notice

Table 5: Kimberley region: diamonds and crude oil

Owners	Project	Description
Buru Energy	Blina and Sundown	<ul style="list-style-type: none"> Oil Location: 100 kilometres south east of Derby Average production during year to 30 June 2011 was 49 barrels per day Naturally declining production
Eni	Blacktip	<ul style="list-style-type: none"> Oil and gas Location: southern Bonaparte Gulf, 150 kilometres north of Wyndham Supplies gas to Northern Territory Power and Water Corporation
Kimberley Diamond Company	Ellendale	<ul style="list-style-type: none"> High value yellow diamonds Location: about 200 kilometres east of Derby Open pit mining, crushing, screening, washing and separation Process uses large quantity of water (around 7 megalitres per annum) in a closed loop system Electricity supplied by on-site diesel generation
Rio Tinto	Argyle Diamond	<ul style="list-style-type: none"> Diamonds Location: 185 km south of Kununurra Ore from mine delivered, by haul truck, to on-site processing plant where it is crushed, scrubbed and screened Diamonds recovered from concentrate are cleaned, washed, weighed and transferred to Rio Tinto Diamonds central sales and marketing organisation in Belgium Existing open pit mine to be closed in 2012; underground mining operations to commence in 2013, extending mine life to at least 2019

Table 6: Kimberley region: other mineral products

Owners	Project	Description
Bulletin Resources	Nicholson's Project	<ul style="list-style-type: none"> • Gold • Location: 35km southwest of Halls Creek • On-site processing plant: primary and secondary crushers, ball mill, classification cyclones, leaching and adsorption (on activated carbon) circuits • Electricity supplied by on-site diesel generation • Currently on care and maintenance, but on 'fast track' for restart of operations
Tanami Gold	Tanami	<ul style="list-style-type: none"> • Gold • Location: 300 kilometres south-east of Halls Creek • Two mining operations feed centrally located 350,000 tonnes per annum Western Tanami treatment facility • Ore haulage by road • Production around 50,000 ounces

2.1.2 Agriculture

The pastoral industry has long been established in the Kimberley and the value of cattle disposals in 2008-09 was \$139 million or 74% of the total value of regional agriculture.

Crop production is largely from the Ord River irrigation area. A diverse range of crops is currently produced in the area, including bananas, borlotti beans, chickpeas, citrus fruit, maize, mangoes, melons, pumpkins and sandalwood. There is some horticulture in the West Kimberley, around Broome and Derby.

2.2 Population

The 2011 Census recorded a total population of 34,794 people residing in the Kimberley. Kimberley points of interest include²:

- Kimberley population has grown by 5,498 between 2006 and 2011, or by 19%.
- The Indigenous population has grown by 1,595.
- Kimberley median age of 30 well below the state median of 36.
- Total number of people in the Kimberley on Census night was 48,705. An extra 13,911.
- In the Shire of Broome had 21,655 people on Census night which is also regarded as the peak tourism period.
- The number of people born overseas has increased from 9% to 16%.
- The number of adults that have completed Year 12 has increased from 36% to 42%.
- The Shire of Broome and the Shire of Wyndham East Kimberley contain similar population characteristics.
- The proportion of males in the Kimberley has increased from 51.5% to 53.2% from 2006 to 2011.
- The number of dwellings with broadband has increased from 33% to 57% between 2006 and 2011

Work by John Taylor of the Centre for Aboriginal Economic Policy Research at the Australian National University has shown that, at least for the East Kimberley:

- ▶ a large proportion of the non-Indigenous population is in age cohorts between 20 and 60 years, with smaller proportions of young people and people of retirement age
- ▶ a large proportion of the Indigenous population is in age cohorts from 0 to 20 years.³

The age distribution of the non-Indigenous population is, in Taylor's view, the distribution which should be expected for a population shaped by inwards migration in response to employment opportunities. The Indigenous age distribution is that of a young population with

² Kimberley Development Commission – 2011 Census Results

³ Taylor, J (2008), *Ord Stage 2 and the Socioeconomic Status of Indigenous People in the East Kimberley Region*, Australian National University Centre for Aboriginal Economic Policy Research Working Paper No. 49/2008, page 9.

future requirements for education, employment opportunities and access to community infrastructure.

2.3 Workforce

The most recently available data on the Kimberley region workforce are summarized in Table 7.

Table 7: Kimberley region: wage and salary earners – year ended 30 June

	2005	2006	2007	2008
Broome	5,737	5,921	6,113	6,823
Derby-West Kimberley	1,798	1,831	1,793	2,051
Halls Creek	525	518	515	591
Wyndham-East Kimberley	2,814	2,916	3,013	3,449
Total	10,874	11,186	11,434	12,914

Source: Australian Bureau of Statistics, National Regional Profiles, Broome, Derby-West Kimberley, Halls Creek, Wyndham-East Kimberley.

These data are numbers of people in employment. They do not indicate the substantial potential labour resource of the Indigenous communities in the region, a resource that is being mobilised to benefit the communities themselves.

2.4 Infrastructure

2.4.1 Roads

The principal towns in the Kimberley are linked by the Great Northern Highway. The Highway is the main corridor for freight movements within the region, between the Kimberley and the south of the State, and between Western Australia and the Northern Territory.

The Victoria Highway, which joins the Great Northern Highway about 45 kilometres west of Kununurra, extends north east to Katherine in the Northern Territory, where it joins the Stuart Highway, which runs north to Darwin.

The Great Northern Highway and the Victoria Highway are parts of the National Land Transport Network. Together they form the only sealed road connecting Perth with the Northern Territory.

Although the Great Northern Highway has been constructed as a two-lane single carriageway road, there are a number of single lane bridges in the Kimberley. Recent up-grading has improved the pavement strength, road alignment, and overall flood serviceability of a number of sections of the highway between Halls Creek and Kununurra.

Near Kununurra, the Great Northern Highway crosses the Ord River on the Ord Diversion Dam. This crossing constrains heavy vehicle movements, and the Australian Government has allocated funding for construction of approximately 10 kilometres of road, and a 480 metre bridge which, when completed, will allow heavy vehicles to bypass the dam and the Kununurra township.

Access to a number of Indigenous communities, tourist developments, pastoral leases and resource projects is provided by the Gibb River Road which runs east and north across the Kimberley, from Derby to the Great Northern Highway near Kununurra. A short section of the Gibb River Road, from Derby to the Kimberley Diamond Company mine at Ellendale, has been sealed. The remainder of the road has a gravel or dirt surface, and is closed during the wet season. Recent up-grading has sought to make the road safer for road trains, and to extend the period of the year during which it can be accessed.

2.4.2 Ports and shipping

General purpose port facilities are located in Broome, Derby and Wyndham. Iron ore is shipped from port facilities at Cockatoo and Koolan Islands and from the KMG Ridges project on Cambridge Gulf.

Table 8: Kimberley region: ports

Port	Operator	Establishment
Broome	Broome Port Authority	Port Authority Act 1999
Derby	Shire of Derby-West Kimberley	Shipping and Pilotage Act 1967
Wyndham	Cambridge Gulf Ltd	Shipping and Pilotage Act 1967
Yampi Sound	Cliffs Natural Resources (Cockatoo Island) Mt Gibson Iron Ltd (Koolan island)	Shipping and Pilotage Act 1967

Source: Department of Transport, *WA Ports Handbook 2010*.

Ports established under the *Shipping and Pilotage Act 1967* (see Table 8) usually comprise one or more single user export facilities. The Port of Wyndham is unusual in this respect; it is a general cargo port.

Broome

The Port of Broome is the main deepwater port serving the Kimberley. The Port supports livestock exports, offshore oil and gas exploration supply vessels, pearling, fishing charter boats and cruise liners. Broome is the main fuel and container receipt port for the region.

The port operator in Broome is the Broome Port Authority, which was created by the *Port Authorities Act 1999*.

An outer berth is 331 metres long, and two inner berths have lengths of 170 metres and 96 metres. The maximum size of vessels that can use the port is determined by the depth in the entrance (minimum 12.3 metres) and the depth alongside outer berth (minimum 8.6 metres). Shipping operations are restricted by a tidal range of about 9.5 metres, and strong tides across the entrance channel and at the berth.

Derby

Derby wharf was closed by the Department of Transport in 1994 but reopened as an export facility in 1997 for barges exporting lead and zinc concentrates from the Cadjebut Mine near Fitzroy Crossing. Today, the wharf is used mainly by pleasure and tourist craft.

Wyndham

Exports through the Port of Wyndham include live cattle, agricultural products from the Ord River irrigation area and nickel concentrate. Fuel, ammonium nitrate for the mining industry (in particular, for the Argyle Diamond Mine) and general cargo are brought in to the East Kimberley through the port.

The largest ships that visit the port are 50,000 tonnes deadweight with a draft of 8.5 metres and a length of 190 metres.

Shipping operations are restricted by a maximum tidal range of 8.2 metres and tidal streams that run at up to 7 knots through the narrower sections of the Cambridge Gulf passage.

In 2010, the State Government announced the upgrading of facilities at the Port of Wyndham. Funding of \$10 million was provided under the East Kimberley Development Package (see section 0 below) with approximately \$6 million to be spent on improvements to the jetty, and the remainder to be used to upgrade cargo handling facilities and electrical infrastructure.

2.4.3 Airports and air services

Seven regional airports and a number of community and private airfields serve the Kimberley. The main regional airports are at Broome and Kununurra. Others are at La Grange

(Bidyadanga Aboriginal Community), Camballin, Marion Downs Station, Bellburn-Purnululu and Kalumburu.

Airnorth, Qantas/Qantas Link, Skywest and Virgin Blue provide scheduled services from Perth to Broome and Kununurra. Golden Eagle Airlines services Broome, Derby, Fitzroy Crossing and Halls Creek.

Broome Airport, which is owned by Pearl Coast Properties and operated by Broome International Airport Pty Ltd, is the largest regional airport in Western Australia handling 372,634 passengers in 2006/07 and 33,610 aircraft movements. The current facilities can handle Boeing 737-00 and Airbus A321-200 aircraft.

Munggalalu Truscott Airfield, which is owned by the Wunambal Gaambera Aboriginal Corporation and operated by ShoreAir Pty Ltd, is located on the Anjo Peninsula about 600 km north east of Broome. The airfield is currently a staging base for the pearling and oil and gas industries, with workers flown in by fixed wing aircraft and transferred to helicopters for transport to site.

2.4.4 Energy supply

Horizon Power supplies electricity, which it purchases from Energy Developments Limited, in each of the five principal towns in the Kimberley, and to remote Indigenous communities in the region.

Regional electricity supplies are generated by Energy Developments Limited, an international provider of remote area energy supply systems and by Pacific Hydro, a wholly owned subsidiary of the Industry Funds Management Australian Infrastructure Fund. Horizon Power has worked with Indigenous communities to develop power supplies at Yungngora and Kalumburu. Kimberley region generation infrastructure listed in Table 9.

Table 9: Kimberley region: electricity generation

Generator	Location	Installed capacity (MW)	
Energy Developments Limited	Broome	39.55	Gas/Diesel
Energy Developments Limited	Derby	12.53	Gas/Diesel
Energy Developments Limited	Fitzroy Crossing	4.06	Gas/Diesel
Energy Developments Limited	Camballin/Looma		Gas/Diesel
Energy Developments Limited	Halls Creek	3.69	Gas/Diesel
Energy Developments Limited	Remote Aboriginal communities: - Bidyadanga - Beagle Bay - Djarindjin/Lombardina - Ardyaloon - Warmun	4.6 (total)	Diesel
Horizon Power/Local Community	Remote Aboriginal communities: - Yungngora - Kalumburu		Diesel
Pacific Hydro	Lake Argyle	30	Hydro

Source: Energy Developments Limited, Horizon Power and Pacific Hydro websites.

Pacific Hydro's Lake Argyle hydro-electric plant supplies base-load electricity to Horizon Power for nearby Kununurra and to Rio Tinto's Argyle Diamond mine. Horizon Power's distribution system in Wyndham is supplied via a 132 kV transmission link from the Pacific Hydro plant.

Individual projects within the Kimberley have their own electricity supply facilities and, in some cases, contract with other parties for some of their electricity requirements.

2.4.5 Water supply and wastewater treatment⁴

Volumes of water used in the Kimberley are shown in Table 10.

Table 10: Kimberley region: estimated water use by sector: 2008

Sector	ML/year	%
Irrigated agriculture (pasture, crop, horticulture)	350,474	82
Industrial (including mining and mineral processing)	39,757	9
Rural (livestock, domestic, aquaculture)	22,222	5
Domestic (public water supply to households)	11,368	3
Commercial (general commercial, parks and gardens)	3,876	1
Total	427,697	100

Source: Department of Water, *Kimberley Regional water plan 2010-2030*, draft for public comment, December 2010, page 13.

Water for irrigated agriculture is supplied from the Ord River. Outside the Ord irrigation area, water supplies are mostly from groundwater sources. Broome, Derby, Halls Creek, Fitzroy Crossing and Kununurra are supplied from bore fields near each town. Wyndham is supplied from the Moochalabra Dam. A hot climate and, in consequence, high evaporation rates, limit opportunities for surface water storage. Groundwater is available from an extensive network of aquifers but the quantity and quality of water in these aquifers varies considerably. Much of the Kimberley is a water-limited environment.⁵

The Department of Water has advised that, in many parts of the Kimberley, secure water supplies are available for existing settlements. Some towns, including Broome and Halls Creek, are, however, facing water supply issues. The rapid growth of Broome is placing pressures on groundwater resources that are susceptible to increased salinity.⁶

The Kimberley is a proclaimed ground water resource under the *Rights in Water and Irrigation Act 1914* and, where water use is high or increasing, the Department of Water is authorised to develop water allocation plans to manage groundwater abstraction.

Much of the infrastructure for water supply in the region, and for wastewater treatment, is provided and operated by the Water Corporation. The Corporation has recently invested some \$37 million in a new wastewater treatment plant in Broome, which should facilitate further growth of the town and support the increasing tourist population.

2.4.6 Community infrastructure

Housing

Australian Bureau of Statistics 2006 Census data indicated 7,925 dwellings in the Kimberley, and a relatively high 3.2 occupants per dwelling. (For all of Western Australia, the number of occupants per dwelling was 2.5).

Table 11 and Table 12 show the number of building approvals for dwellings in each of the Kimberley local government areas. Between 2006 and 2009, the total number of dwellings increased at approximately the same rate of as the region's population. About 55% of additional dwellings were private sector houses.

⁴ Information on was sourced from the Department of Water website (<http://www.water.wa.gov.au/>), and from a teleconference, held on 29 November 2011, with Department of Water staff responsible for water planning in the Kimberley.

⁵ Department of Water, *Kimberley Regional water plan 2010-2030*, draft for public comment, December 2010, page 13.

⁶ Department of Water, *Kimberley Regional water plan 2010-2030*, draft for public comment, December 2010, page 16.

Table 11: Kimberley region: building approvals: total dwelling units – year ended 30 June

	2005	2006	2007	2008	2009	2010	2011
Broome	150	164	177	173	122	183	136
Derby-West Kimberley	25	53	86	26	45	57	151
Halls Creek	54	32	13	37	20	40	21
Wyndham-East Kimberley	93	84	67	73	66	170	118
Total	322	333	343	309	253	450	426

Source: Australian Bureau of Statistics, National Regional Profiles, Broome, Derby-West Kimberley, Halls Creek, Wyndham-East Kimberley, and data cubes 87310DO020_201110 Building Approvals, Australia, October 2011, and 87310DO019_201110 Building Approvals, Australia, October 2011.

Table 12: Kimberley region: building approvals: private sector houses – year ended 30 June

	2005	2006	2007	2008	2009	2010	2011
Broome	87	110	103	123	88	134	113
Derby-West Kimberley	6	10	27	12	8	35	131
Halls Creek	11	28	2	4	5	10	21
Wyndham-East Kimberley	34	51	35	33	40	141	49
Total	138	199	167	172	141	320	314

Source: Australian Bureau of Statistics, National Regional Profiles, Broome, Derby-West Kimberley, Halls Creek, Wyndham-East Kimberley, and data cubes 87310DO020_201110 Building Approvals, Australia, October 2011, and 87310DO019_201110 Building Approvals, Australia, October 2011.

There is a shortage of housing in the Kimberley. A *Regional HotSpots Land Supply Update*, prepared by the Western Australian Planning Commission in 2008, noted pressures on housing and on land available for housing in Broome, resulting from increased tourism, growth in government services provision and new resources projects. It identified growth in tourism as creating employment opportunities, but noted that this was also increasing demand for residential accommodation, particularly rental accommodation. Woodside's Browse Basin LNG Project was expected to add to this demand.

The housing shortage in Broome has been alleviated by the Western Australian Land Authority (LandCorp) release of land for residential development, for commercial and light industrial use, and for community facilities in the Broome North precinct. Some 4,000 lots, providing for the housing of around 13,000 people, are expected to be created over the next 10 to 30 years.⁷

Housing development in Broome was seen as being constrained by native title issues, the recognition of Indigenous heritage sites, and the limited capacity of the building and construction industry in the Kimberley.⁸ In Broome North, the constraints of native title and Indigenous heritage have been overcome through LandCorp and the Shire of Broome working closely with the local Yawuru People.

In Derby, increased levels of government service provision (a new regional prison), mineral and petroleum exploration and a number of resource projects at feasibility stage are, similarly, creating demands for additional housing in an area with a small existing housing stock.⁹ In 2008, there was little undeveloped land which had been zoned for residential development, although the local planning scheme for Derby identified some 60 hectares as land for residential development. In addition to the constraints imposed by native title issues and the limited capacity of the building and construction industry in the Kimberley, the development of housing in Derby is further constrained by the town's location. Derby is located on a narrow peninsula and is low-lying with a risk of inundation from cyclonic storm surges.

⁷ LandCorp, *Annual Report 2009/2010*, page 22.

⁸ Western Australian Planning Commission, *Broome Regional Hotspots Land Supply Update*, November 2008.

⁹ Western Australian Planning Commission, *Derby Regional Hotspots Land Supply Update*, November 2008.

The age structure of the Indigenous population noted in section 0 above has been identified as the principal factor driving requirements for additional housing in Fitzroy Crossing and Halls Creek.¹⁰ The existing housing stock in each town is small, and there are few vacant residential lots. A (draft) Fitzroy Crossing Town Plan has identified some future development sites but the availability of land for housing in the town is severely constrained by the prospect of periodic major flooding of the Fitzroy River. Some 100 hectares has been identified as future land for residential development in a Shire of Halls Creek local planning strategy.

The 2009 summary report for the East Kimberley Development Package (noted below) advised that serious housing shortages in Kununurra had driven rental prices beyond the means of many people, particularly members of the Indigenous community. In addition, long waiting lists for public housing, and the difficulty of finding housing in Kununurra, and other centres, has created disincentives for people to take up and retain local employment opportunities.¹¹

On 9 November 2011, the Western Australian Government announced that it would fund twenty six new houses in the Kimberley, to provide affordable accommodation for the staff of non-government organisations delivering services critical to the region.

Health services¹²

Remoteness and a small population, which may change substantially as major resource projects proceed, have made the planning and provision of health services in the Kimberley difficult.

There are few private medical practitioners in the region with almost all GPs and specialists employed by hospitals, Aboriginal Community controlled health organisations or the Royal Flying Doctor Service. Specialist services are provided from the larger regional centres and, where necessary, patients are flown to Perth or Darwin for treatment that cannot be provided by region-based or visiting specialists.

Only a single hospital would be required to service the health needs of the regional population if that population were located in one centre. The low population density, the extent of the region and the climate all contribute to six hospitals now servicing the Kimberley, and to the replication of other facilities to ensure access to basic health care. Regional hospitals, providing Aboriginal health and liaison, general practice, maternity, outpatient, general surgical and other services, are located in Broome, Derby, Fitzroy Crossing, Halls Creek, Kununurra and Wyndham.

Very remote communities, such as Kutjungka, have their own clinics, and depend on access, by air, to regional hospitals and to facilities outside the region in the event of emergency. Road transport is unreliable due to the condition of roads, particularly in the wet season.

The Western Australian Country Health Service provides ambulance services in Derby, Fitzroy Crossing, and Halls Creek. St John Ambulance provides ambulance services in Broome, Kununurra and Wyndham.

Kimberley Aged Care and Community Services, which has offices in Broome, Derby, Fitzroy Crossing, Halls Creek and Kununurra, provides aged care services across the region.

Community based mental health, alcohol and other drug services are provided by the Kimberley Mental Health and Drug Service.

A programme of redevelopment of health services facilities across the Kimberley region has been initiated by the Department of Health. Although consideration has been given to the

¹⁰ Western Australian Planning Commission, *Fitzroy Crossing Regional Hotspots Land Supply Update*, November 2008, and Western Australian Planning Commission, *Halls Creek Regional Hotspots Land Supply Update*, November 2008.

¹¹ Australian Government and Government of Western Australia, *Joint Assessment for the East Kimberley Development Package, Summary Report*, 2009, page 12.

¹² Information sourced from the Department of Health website (<http://www.health.wa.gov.au/home/>) and from Department of Health staff responsible for planning the provision of health services in the Kimberley.

needs of a growing regional population, this consideration has not extended to the population changes which might occur as a result of major project implementation within the region. Rather, the focus appears to be on satisfying current demands for health care services, including a requirement for widely distributed services to members of communities who are in lower income groups and who, in spite of subsidies, struggle to afford the costs of travel to access those services.

In Broome, the first stage of redevelopment of hospital wards and a specialist centre has recently been completed, and paediatric and acute psychiatric units are under construction. Planned projects include emergency department redevelopment, a mental health centre transitioning facility and a renal hostel (to address the lack of community accommodation for patients coming to Broome for dialysis and treatment).

A renal dialysis unit is being established in Derby, and a renal hostel and maternity ward redevelopment are planned (with funding being sought from the Royalties for Regions program).

Planned health projects for Fitzroy Crossing include a renal dialysis unit, a renal hostel and housing for health care professionals.

In Kununurra, work on a \$20 million primary healthcare facility, short stay unit, renal dialysis unit and 10 new staff houses is in progress. A long-stay renal unit is planned.

Renovations to the Wyndham hospital have recently been completed.

A new clinic is planned for Warman as a replacement for one which was washed away during recent floods, and an aged care facility may also have to be rebuilt.

Clinics are to be redeveloped in the remote communities of Mulan, Billiluna, Bayulu, Wangkatjunka and Nookenhah.

Education

Primary and secondary education facilities and services in the Kimberley are provided by both public and private sector providers. Existing primary and secondary schools in the region are listed in Table 13 (below).

Post-secondary education is offered by the Kimberley Training Institute through its campuses in Broome, Derby, Fitzroy Crossing, Halls Creek, Kununurra and Wyndham. The Institute is expanding its services to the region, and has recently completed the construction of Stage 2 of the Broome Campus. The Broome Campus includes an Aquaculture annexe at the Broome Tropical Aquaculture Park. Facilities have been upgraded in Halls Creek, Kununurra and Wyndham, significantly increasing opportunities for post-compulsory education in the region.¹³

Table 13: Kimberley region: primary and secondary schools

School	Location	Classification	Year Groups		Number of Students
			Low	High	
Bayulu Remote Community School	Fitzroy Crossing	Remote Community	KIN	Y07	148
Birlirr Ngawiyiwu Catholic School	Via Kununurra	School	KIN	Y07	40
Broome Primary School	Broome	Non-government school	KIN	Y07	387
Broome Senior High School	Broome	Primary school	Y08	Y12	492
Cable Beach Primary School	Broome	Senior high schools	KIN	Y07	469
Dawul Remote Community School	Kununurra	Primary schools	KIN	Y09	30
Derby District High School	Derby	Remote community	KIN	Y12	566
Djarindjin Lombadina Catholic School	Broome	School	KIN	Y10	84
Djugerari Remote Community School	Fitzroy Crossing	District high school	KIN	Y11	21

¹³ <http://www.kti.wa.edu.au/contactusandcampuses/Pages/ContactUs.aspx>

School	Location	Classification	Year Groups		Number of Students
			Low	High	
Fitzroy Valley District High School	Fitzroy Crossing	Non-government school	KIN	Y12	297
Halls Creek District High School	Halls Creek	Remote community	KIN	Y12	400
Holy Rosary School	Derby	School	KIN	Y07	216
John Pujajangka-Piyirn School	Via Halls Creek	District high school	KIN	Y08	13
Jungdranung Remote Community School	Kununurra	District high school	PRP	Y08	152
Kalumburu Remote Community School	Wyndham	Non-government school	KIN	Y12	49
Kimberley School of The Air	Derby	Non-government school	KIN	Y07	79
Kulkarriya Community School	Fitzroy Crossing	Remote community	KIN	Y12	848
Kununurra District High School	Kununurra	School	KIN	Y12	80
Kururrungku Catholic Education Centre	Via Halls Creek	Remote community	KIN	Y10	226
La Grange Remote Community School	Broome	School	KIN	Y12	125
Looma Remote Community School	Derby	Primary school	KIN	Y12	118
Luurnpa Catholic School	Halls Creek	Non-government school	KIN	Y10	33
Muludja Remote Community School	Fitzroy Crossing	District high school	KIN	Y06	121
Ngalangangpum School	Kununurra	Non-government school	KIN	Y10	24
Ngalapita Remote Community School	Fitzroy Crossing	Remote community	KIN	Y06	34
Nyikina Mangala Community School	Derby	School	PRP	Y10	104
One Arm Point Remote Community School	Broome	Remote community	KIN	Y12	26
Purnululu Aboriginal School	Kununurra	School	PRP	Y09	624
Roebuck Bay Primary School	Broome	Non-government school	KIN	Y07	130
Sacred Heart School	Broome	Remote community	KIN	Y10	195
St Joseph's School	Kununurra	School	KIN	Y07	79
St Joseph's School	Wyndham	Non-government school	KIN	Y07	625
St Mary's College	Broome	Remote community	KIN	Y12	10
Wanalirri Catholic School	Derby	School	PRP	Y04	31
Wananami Remote Community School	Derby	Non-government school	KIN	Y12	70
Wangkatjungka Remote Community School	Fitzroy Crossing	Remote Community	KIN	Y12	78
Warlawurru Catholic School	Halls Creek	School	KIN	Y07	35
Wulungarra School	Fitzroy Crossing	Non-government school	PRP	Y07	148
Wyndham District High School	Wyndham	Primary school	KIN	Y10	56
Yakanarra Community School	Fitzroy Crossing	Non-government school	PRP	Y10	148
Yiyili Aboriginal Community School	Halls Creek	Non-government school	KIN	Y10	70

Source: Department of Education, *Alphabetical list of Western Australian Schools by Education District (Kimberley Region)*

The University of Notre Dame established a Broome Campus in 1998 and has been expanding the range of courses offered. These courses include the Certificate III in Education Teacher Assistant (Indigenous), and the Diploma of Enrolled Nursing Vocational Education and Training programs. A Tertiary Enabling Program provides an alternative entry program for those wishing to study at tertiary level but who do not currently meet admissions criteria. Undergraduate bachelor degrees are available in Education and Nursing. Graduate studies can be completed at the Graduate Certificate and Graduate Diploma level in Education and Aboriginal Studies. Masters programs in Education and Aboriginal Education are also offered.

Edith Cowan University has a School of Indigenous Studies in Broome, and provides Indigenous students with tutorial support, administration, computer access and library services. Courses are available in Business, Education, Social Sciences, Indigenous Services and Arts. An Indigenous University Orientation Course is designed for Indigenous students who wish to gain access to tertiary studies.

Other education support facilities in the region include telecentres located in Broome, Halls Creek, Wyndham and Kununurra, which offer access to courses, programs and information through video-conferencing and other electronic facilities.

2.4.7 East Kimberley Development Package

In December 2008, the Prime Minister announced the Australian Government's preparedness to invest \$195 million in social and common-use infrastructure to support development in the East Kimberley. Commonwealth investment would, however, be conditional on a joint assessment, with the State, of the most effective infrastructure projects to meet regional needs. A joint assessment report, published early in 2009, identified some 27 priority infrastructure projects in the health, education, housing, transport and community sectors. In July 2009, the Commonwealth and the State of Western Australia signed a National Partnership Agreement on the East Kimberley Development Package. In accordance with the terms of this agreement:

- ▶ the Commonwealth is to fund social and open-access, common-use infrastructure which targets economic and social disadvantage and which seeks to bring long term sustainable benefits to the East Kimberley
- ▶ the State is to invest an equivalent amount in infrastructure directly related to the development of additional irrigated land in the Ord irrigation area.

The State has now provided \$220 million to increase the size of the Ord irrigation area to about 22,000 hectares of agricultural land. Projects funded by the Commonwealth are summarised in Table 14.

Table 14: East Kimberley Development Package: summary

Project	\$ million
Health	
Wyndham health facilities refurbishment	3.4
Kununurra Hospital expansion	20.0
Short stay patient accommodation in Kununurra	4.0
Residential rehabilitation facility in Wyndham	3.2
Remote aged care services in Kalumburu and Warmun	5.0
Remote clinics in Kalumburu and Warmun	2.0
Environmental health measures in Kalumburu, Warmun and Oombulgurri	6.8
Sobering Up Centres in Kununurra and Wyndham	0.6
Health service providers housing in Kununurra	5.0
Education and training	
Wyndham Early Learning Centre Activities	1.6
Warmun Early Learning centre	0.6
Kununurra Primary School	25.0
Kununurra District High School upgrade	15.0
Kununurra School Community Library expansion	5.0
East Kimberley Teacher Training Facility within Kununurra High School	3.5
Kimberley TAFE upgrade in Kununurra and Wyndham	10.0
Community meeting rooms in Kununurra, Kalumburu, Oombulgurri and Dawul	2.3
Early Childhood Building for Jungdranung Community	1.0
Housing	
Social Housing in Kununurra and Wyndham	30.0
Transition Housing in Kununurra and other locations	20.0
Transport	
Wyndham Port facility upgrade	10.0
Kununurra Airport - Terminal upgrade	5.4
Community	
Community sporting facilities - hostel oval in Kununurra and Wyndham	4.2
Waringarri Art Centre in Kununurra	1.6
Wyndham Picture Gardens	0.3
Wyndham Community Jetty	5.0
MG Corporation - Gelganyem Trust shared facility in Kununurra	4.5

Project	\$ million
Total	195.0

Source: Australian Government and Government of Western Australia, *Joint Assessment for the East Kimberley Development Package, Summary Report*, 2009, page 16.

2.5 National heritage listing

On 31 August 2011, an area of some 192,000 square kilometres in the west and north of the Kimberley (about 45% of the land area of the region) was included in the National Heritage List.

National heritage listing does not preclude further economic development but may impede that development due to vague draft referral guidelines from the Department of Sustainability, Environment, Water, Population and Communities. At the time of this report, these guidelines, which project proponents use to assist in deciding whether their project plan must be assessed by the Commonwealth Government in addition to the WA State Government, is in the process of being finalised.

3. Kimberley region development

At any time, there will be a large list of potential projects which might be undertaken in a resource-rich region such as the Kimberley. Not all of these projects will have been announced by proponents and many of those for which information is publicly available will not proceed beyond initial feasibility studies.

Those projects which proceed will have specific infrastructure requirements, and will contribute to further expansion of community infrastructure in the region.

In this section of our report, we briefly examine each of the projects which might drive Kimberley economic development requirements over the next decade, and where these projects put additional capacity strain on existing infrastructure. In the following section, we draw conclusions for infrastructure requirements in the region.

3.1 Ord-East Kimberley Expansion Project

As a major part of its contribution to the East Kimberley Development package, the State is providing \$220 million to expand the Ord River irrigation area from 14,000 hectares to 22,000 hectares.

The Western Australian Government has indicated its intention to create a major agricultural precinct in the Kimberley.¹⁴

Work has commenced on a further 19 kilometres of irrigation channels including irrigation control facilities and 14 kilometres of access roads.

Production trials are being carried out for the purpose of establishing rice as a base crop for the expanded irrigation area, which may be transported, for processing and subsequent sale, through the Port of Wyndham. In comments on the trials, Ord River District Co-operative spokesman, David Cross, drew attention to the need for infrastructure to support the development of industry:

*... the critical factor in that is infrastructure, so if we are to have a continued large scale rice industry going forward, then we'll need the post harvest infrastructure to support an industry.*¹⁵

3.2 Tourism

The Kimberley is an internationally recognised wilderness area with an increasing number of visitors exploring its unique terrestrial and marine ecosystems, and learning about its rich Aboriginal culture.

Economic conditions may have slowed longer term growth in tourism. The Western Australian Tourist Commission has reported a three year average annual growth rate in the number of visitors to the North West (which includes the Kimberley) of -0.8%. However, the increase in the number of visitors to the North West between December 2009 and December 2010 was +6.2%.¹⁶

In May 2011, the Western Australian Government sought to secure the long term potential of the region as a tourist destination through its Kimberley Science and Conservation Strategy and associated investment expected to amount to some \$63 million over the next five years. Implementation of the Strategy will lead to the creation of a large system of interconnected marine and terrestrial parks – the Kimberley Wilderness Parks – which will cover some 3.5 million hectares. Land management, including the management of threats to the region's

¹⁴ Government of Western Australia, *2010-11 Budget Statements, Budget Paper No. 1 (Budget Speech)*, page 12.

¹⁵ ABC Rural, "Ord River Rice to Triple", 22 March 2011, at <http://www.abc.net.au/rural/news/content/201103/s3170374.htm>.

¹⁶ Tourism Western Australia, *Australia's North West, Overnight Visitor Fact Sheet, Years Ending 2008/09/10*, page 3 (available at http://www.tourism.wa.gov.au/Research_and_Reports/Regional_Fact_Sheets/Pages/Visitor_Fact_Sheets_Tourism_Region_Level.aspx).

biodiversity, is to be through partnerships between government, industry, pastoralists, conservation groups, traditional owners, and other landholders.¹⁷

3.3 New minerals and energy projects

Table 15 lists those new minerals and petroleum projects which, during the second half of 2011, were seen as potentially proceeding in the Kimberley during the following five years.¹⁸

Each of these projects, and its infrastructure requirements, are discussed below.

Table 15: New resource projects

Proponent	Project	Location	Description
Anglo Australian Resources	Koongie Park	Halls Creek	Zinc, copper mine
Rio Tinto	Argyle Diamond underground mine	Wyndham-East Kimberley	Development of underground mine to replace existing open pit diamond mining operation in 2013
Buru Energy	Great Northern Pipeline	Broome	Broome to Port Hedland gas transmission pipeline
Kagara	Admiral Bay	Broome	Lead, silver, zinc mine
Kimberley Metals	Sorby Hills	Wyndham-East Kimberley	Lead, silver mine
Kimberley Rare Earths	Cummins Range	Halls Creek	Rare earths mining
Northwest Mining	Lennard Shelf	Halls Creek	Zinc, lead mining
Paladin Energy	Oombagooma	Derby-West Kimberley	Uranium mine
Platinum Australia	Panton	Halls Creek	Platinum group metals mining
Pluton Resources	Irvine Island	Derby-West Kimberley	Iron ore mining
Rey Resources	Canning Basin	Derby-West Kimberley	Thermal coal mining
Woodside Energy	Browse Basin LNG (James Price Point)	Broome	Browse Basin oil and gas

The projects listed in Table 15 are only some of the projects which might proceed in the Kimberley. Other future projects, most of which are currently only at the exploration stage, are listed in Table 16.¹⁹

Table 16: Potential future projects

Project	Proponent	Description
Admiral Bay	Kagara Ltd	Zinc Substantial deposit 250 kilometres south of Broome Assessment not expected to be completed until after 2015
Canning Basin	Cullen Resources Ltd	Coal Exploration
Cape Bougainville	Alcoa of Australia Ltd	Bauxite Substantial resource identified
Eastman Base Metals	Navigator Resources	Zinc, base metals Exploration

¹⁷ Government of Western Australia, *Kimberley Science and Conservation Strategy*, May 2011, available at <http://www.dec.wa.gov.au/content/view/6558>.

¹⁸ The project list has been compiled from Department of Mines and Petroleum MINEDEX database, a continuously updated database containing information on mines, mineral deposits and prospects; Australian Bureau of Agricultural and Resource Economics and Sciences *Minerals and energy Major development projects - April 2011 listing*, and company reports.

¹⁹ As noted above, at any time, there will be a large list of potential projects which might be undertaken in a region such as the Kimberley and not all of these projects will have been announced by proponents. Tables 15 and 16, together, may not provide a comprehensive list of Kimberley natural resource projects.

Eastman Bore – Louisa Downs	Navigator Resources	Platinum, precious metals Exploration
Gardiner Range	Manhattan Corporation Ltd	Uranium, gold Exploration
Granites – Lady Helen	3D Resources	Gold, silver, copper Exploration
Granites – Lady Helen	Legacy Iron Ore Ltd	Gold, precious metals Exploration
John Galt – Corkwood Yard	Northern Minerals Ltd	Rare earths Exploration
Lower Smoke Creek	Venus Metals Corporation	Alluvial diamonds Exploration and assessment
Mad Gap	U3O8 Limited	Uranium Exploration
McLarty Range Copper	Pegasus Metals Ltd	Copper Early stage exploration
Mitchell Plateau	Alcoa of Australia Ltd	Bauxite Substantial resource identified
Mt Angelo North	3D Resources	Copper, zinc, lead Exploration
Mt Angelo Porphyry	3D Resources	Copper Exploration
Ord-East Kimberley Expansion Project	Department of State Development	Post Stage 2 expansion of irrigated agriculture (from 28,000 hectares to 44,000 hectares)
Speewah Copper	Speewah Metals Lt	Copper Exploration
Speewah Vanadium	Speewah Metals Lt	Vanadium Exploration, large resource defined

3.4 New resource projects

3.4.1 Anglo Australian Resources: Koongie Park²⁰

In October 2008, Anglo Australian Resources, a gold and base metals explorer, completed a preliminary feasibility study for the underground and open pit mining of zinc and copper ores, and concentrate production using a 300,000 tonnes per annum processing plant, at Koongie Park some 25 kilometres south west of Halls Creek.

Further scoping and feasibility studies for the project have been undertaken since 2008. The company's November 2011 AGM Presentation advised a potentially viable project, and Anglo Australian Resources is anticipating pre-stripping for an open pit mine, and construction of the processing plant during 2013.

Although the Koongie Park site is close to Halls Creek, the existing gas fired generating plant serving the town does not have sufficient capacity to supply a mining operation and Anglo Australian Resources is expecting to develop its own on-site electricity generation.

Road access to the site is not expected to be an issue. The Great Northern Highway transects the proposed location of the open pit mine, and the road will have to be relocated as part of mine development.

Anglo Australian Resources expects to transport concentrate from Koongie Park, via the Great Northern Highway, to the Port of Wyndham for export.

Proximity to Halls Creek, and the employment of locally resident staff, are expected to reduce the need to build a project specific accommodation camp. Some staff may be flown in, via the all weather airport at Halls Creek, on scheduled airline services from Broome.

²⁰ Information on the Koongie Copper-Zinc project was sourced from the Anglo Australian Resources web site (<http://www.anglo.com.au/default.asp>).

3.4.2 Rio Tinto: Argyle Diamond Underground Project²¹

Rio Tinto's existing Argyle open pit mine is scheduled to be closed in 2012, and the company is investing some US\$800 million in the development of underground mining that is expected to commence in 2013, and which should extend the life of its diamond mining operations until at least 2019.

Operations at the mine site, 185 kilometres (by road) south west of Kununurra, have been largely self sufficient since 1985. The Argyle site has its own water supplies, on-site accommodation for its workforce, and an airfield which can be used by Boeing 737 and similar aircraft.

Rio Tinto currently purchases most of the electricity used in the Argyle mining and processing operations from Pacific Hydro. Electricity is supplied from Pacific Hydro's generating plant on the Ord River Dam via a 95 kV transmission line, which is also owned and operated by Pacific Hydro.

Electricity supply from Pacific Hydro is, however, limited by conditions in Lake Argyle. Low water levels reduce generating capacity and high water levels require generation to be curtailed to protect the turbine.

Rio Tinto therefore maintains, at the Argyle mine site, 30 MW of diesel-fired power generation facilities, and has on-site storage for about 1.6 million litres of distillate. The company expects to make greater use of its own generating facilities in the future in continuing existing mining operations and, subsequently, in rehabilitating its open pit, and in more energy intensive underground mining. Diesel consumption is expected to increase from 2015 to 2020.

Road access is via Lissadell Road, some 17 kilometres of gazetted road linking the mine site with Great Northern Highway. Lissadell Road is maintained by Rio Tinto.

Road access is critically important for the supply of distillate, parts and materials to the mining operation. Distillate is shipped into Wyndham and transported by road to the Argyle mine. Parts and materials are supplied by road from Perth. Roads in the east Kimberley, with their single lane bridges, are seen as being "weak links" in the Argyle operation. Following a period of heavy rainfall in 2010, the Great Northern Highway was cut at two points, preventing access to the Rio Tinto's mine site for about five weeks.

The Port of Wyndham is also seen as a weak link in the Argyle supply chain. The volume of freight is increasing, but the capacity of the port to handle additional volumes is limited, and there are constraints on moving additional trucks through the town of Wyndham.

Rio Tinto maintains a workforce of around 500 employees at Argyle (and, at the present time, there are about 1,200 construction workers at the mine site). All are accommodated on site. Currently, around 70% of employees are recruited from within the Kimberley, with some 30%, employed on a fly in, fly out basis, routinely flying in from Perth. A company bus service transports Indigenous employees resident in remote communities to and from site on an approximately weekly cycle.

Rio Tinto has an explicit "localisation" policy for Argyle, recruiting from within the Kimberley, sourcing materials and services in the region, and supporting regional Indigenous businesses. Relationship committees have been established with Indigenous communities, and a range of training programs has been provided to assist in preparing members of those communities for entry into the workforce via employment opportunities at the mine. Rio Tinto is of the view that localisation not only provides a positive legacy of economic and community development when its mining operations cease; it is also a sound business decision.

²¹ Information on Argyle Diamonds was sourced from Rio Tinto's web site (<http://www.argylediamonds.com.au/>), and from a meeting with Argyle's General Manager Operations on 5 December 2011.

Expanding regional employment, particularly the employment of Indigenous people, was, however, placing pressure on existing community infrastructure. Residents of Indigenous communities transitioning into the workforce were finding that community housing, provided by the Department of Housing, was no longer available to them once they found employment (and their incomes exceeded maximum levels set by the Department). Moreover, they could not establish privately owned housing on community land, which was crown land which had been leased to the communities with restrictive covenants. One option potentially available to these employees is to move away from their communities into the main regional towns.

However, there are limited numbers of privately owned dwellings available for rent in these towns, and rents are high and rising. Halls Creek, for example, has only about seven privately owned dwellings. The need for people to move away from their communities, and the difficulty of finding housing if they were to move, were, in Rio Tinto's view, acting as disincentives to Indigenous people seeking to take advantage of employment opportunities that were available in the region.

Rio Tinto had assisted with the provision of health services in the East Kimberley by providing housing and facilities for a general practitioner in Kununurra, and by supporting a number of regional health organizations and initiatives designed to address health problems among Indigenous people. The company was, however, flying people out of the region for medical treatment, and was of the view that existing health services were "stretched".

Regional education facilities and services were also "stretched". Secondary school options were limited, and Rio Tinto was aware that community representatives were lobbying for a private secondary college in the East Kimberley.

3.4.3 Buru Energy: Great Northern Pipeline²²

Buru Energy is an oil and gas explorer and producer operating in the Canning Basin. The company currently produces oil from its Blina and Sundown fields but production levels are in natural decline. A large exploration program has been initiated, including the drilling of appraisal wells in the Yulleroo field, and testing at nearby Ungani-1, some 200 kilometres east of Broome.

A proven gas resource at Yulleroo, and gas from Ungani-1, would support Buru Energy's proposal for a Great Northern Pipeline which would extend approximately 550 kilometres south to interconnect with the Dampier to Bunbury Natural Gas Pipeline. This would allow Canning Basin gas to be transported to major end-users in the south west of the State.

Buru has established a foundation gas sales contract with Alcoa of Australia, and has completed "pre-FEED" scoping design, construction and commercial studies for the pipeline. Main Roads Western Australia has given approval in principle for location of parts of the proposed pipeline within highway road reserves, and an application for a pipeline licence, to be issued by the Department of Mines and Petroleum, has been prepared. Once gas reserves sufficient to support the pipeline have been identified, possibly in 2012 or 2013, and a final investment decision has been made, construction is to proceed over a period of about two years, allowing first gas to flow through the Great Northern Pipeline in 2015. The total cost of the pipeline is expected to be around \$550 million.

The Great Northern Pipeline would be a significant addition to infrastructure in the Kimberley. However, little public information appears to be available, at the present time, on plans for construction and operation of the pipeline that would assist understanding its potential impact on the other infrastructure requirements of the region.

3.4.4 Kimberley Metals: Sorby Hills²³

Sorby Hills is a silver-lead deposit at the northern extent of the Ord–East Kimberley Expansion Project land release and about 50 kilometres north of Kununurra. Kimberley

²² Information on the Great Northern Pipeline has been sourced from Buru Energy's website (<http://buruenergy.com.au/>), in particular from *Corporate Update*, 14 November 2011, and *New Australian Frontiers Presentation*, 28 July 2011.

²³ Information on the Sorby Hills project has been sourced from Kimberley Metals' website (<http://www.kimberleymetals.com.au/>), and from discussions with the company's Project Manager on 25 November 2011.

Metals has submitted, to the Department of Mines and Petroleum, a proposal for mining the deposit and, subject to approvals being obtained, is planning to commence mine and processing plant construction at the end of 2012. Commercial production of silver-lead concentrate is then expected to commence during 2013. Initial planning is for mining over a period of 10 years and the initial investment in the project is expected to be around \$30-40 million.

Concentrate is to be transported in containers, by road, to the Port of Wyndham, where the containers will be unloaded into ships before being returned to the mine site. A hard stand of about 3,000 square metres (but no other facilities) will be required at the port.

Kimberley Metals is examining the possibility of the concentrate trucking operation also being used to backload distillate, brought in through Wyndham, for electricity generation. On-site generation is being planned but a final decision has not been made on fuel supplies. Discussions are being held with potential gas producers in the Kimberley with a view to using gas fired generation if the option is available.

Other consumables used in mining and processing operations are expected to be brought in, either from Wyndham or Darwin, by road, but the scale of requirements will be small (around 1 semi-trailer load per week, as compared with about 12 truck loads per week if distillate is used for power generation).

Given the importance of an efficient road transport operation for its business, especially if distillate is to be brought in by road, Kimberley Metals was concerned about vehicle movements around Kununurra. The company saw, as a priority for the Shire of Wyndham-East Kimberley and the State Government, the bringing forward of planned work on a proposed bypass road.

Kimberley Metals will not undertake its own extensive road development. The company will be able to use the road, constructed by the State, which is part of the infrastructure of the Ord-East Kimberley Expansion Project.

Kimberley Metals expects to employ between 30 and 50 people in the construction of its mine and processing plant, and to employ about 80 in subsequent operations. Construction workers and most employees are expected to reside in Kununurra. The company is not proposing to develop a camp at its mine site, and is not considering a fly in, fly out operation. Project timing should allow use to be made of accommodation developed for the Ord irrigation expansion, and accommodation is not considered to be a major issue.

3.4.5 Kimberley Rare Earths: Cummins Range²⁴

Kimberley Rare Earths has identified a rare earths deposit at Cummins Range about 130 kilometres south of Halls Creek. The company is currently proceeding with further exploration to establish the scale and metallurgy of the ore body, and with project feasibility studies, with a view to commencing production in 2017.

Planning is on the basis of the remote location of the ore body requiring relatively "self contained" mining and processing operations. The initial investment in mining and processing is expected to be between \$100 million and \$300 million.

Electricity will have to be generated on site using distillate. Water supply and materials waste disposal options are still being investigated.

A workforce of about 500 is expected to be required for mine and processing plant construction, with a permanent workforce of around 200 required for subsequent operation. The workforce will be employed on a fly in, fly out basis, which will require an all-weather airstrip at the mine site. Current expectations are for fly in, fly out from Perth and Broome.

²⁴ Information on the Cummins Range project has been sourced from Kimberley Rare Earths' website (http://www.kimberleyrareearths.com.au/), and from discussions with the company's Managing Director on 1 December 2011.

Investigations are still being carried out into the processes which will be used for production of rare earth oxides from the mined ore. Those processes are likely to require significant quantities of acids, alkalis and ammonia, all of which will need to be brought in by road from Broome, Wyndham or Darwin. Distillate for electricity generation, and for the generation of process heat, will also have to be brought in by road.

Rare earth oxide production, expected to amount to between 1 and 2 sea container loads per day, is to be bagged and transported by road to a port – possibly Wyndham – for export.

Access to roads which are serviceable throughout the year will therefore be important for Kimberley Rare Earths. Road access would be improved by the sealing of the Tanami Road which links Halls Creek and Alice Springs. The Western Australian section of the road is currently under the control of the Shire of Halls Creek, which has advanced an economic case for the work.

The company will also require access to a port with container handling facilities for the export of its product.

Kimberley Rare Earths expects that local businesses in Halls Creek will supply food, minor materials, and laundry and transport services to its project. This is likely to lead to an increase in the number of people in the community which, although small, may put pressure on housing and other facilities.

3.4.6 Northwest Nonferrous Australia Mining: Lennard Shelf²⁵

Meridian Minerals had been developing the Lennard Shelf zinc-lead project, proposing to re-open the Kapok mine, and commencing new underground mining operations at Kapok West and Cadjebut Splay, approximately 80 kilometres south east of Fitzroy Crossing. Late in 2011, Northwest Nonferrous Australia Mining acquired Meridian Minerals. Project development was placed on “care and maintenance” following the signing of a binding Heads of Agreement between Meridian Minerals and Northwest on 19 August 2011.

No public information appears to be available, at the present time, which would assist understanding the potential impact of the Lennard Shelf project on Kimberley infrastructure requirements.

3.4.7 Paladin Energy: Oombagooma²⁶

Paladin Energy has been assessing uranium rich mineralisation at Oombagooma some 75 kilometres north east of Derby. Oombagooma is on freehold land owned by the Australian Government and used by the Department of Defence for training purposes. In 2010, Paladin Energy initiated negotiations with the Commonwealth and the Department of Defence to secure the consent required for the granting of mining tenements. Discussions are being held with the Western Australian Department of Mines and Petroleum regarding the granting of those tenements.

Paladin Energy expects to continue exploration at Oombagooma for another two to three years, and to commence mining operations in about 2017. The uranium resource is expected to support mining over a period of about 10 years.

If mining is to proceed, Paladin Energy will establish processing and service facilities, including accommodation, at Oombagooma. Operations will be of a relatively small scale, requiring around 30 people on site. Total production will amount to about 1 container load of uranium oxide per month.

The company will install diesel power generation on site and will obtain water supplies (required for, among other things, the uranium ore extraction process) from bore fields at Oombagooma.

²⁵ Information sourced from Meridian Minerals website (<http://www.meridianminerals.com.au/>).

²⁶ Information sourced from Paladin Energy web site (<http://www.paladinenergy.com.au/>), and from meeting with Paladin Energy's Land Access Manager on 15 December 2011.

Access is via the Gibb River Road, and a road into Oombagooma that is currently maintained for defence purposes. These roads do not provide year-round access; they can be traversed with certainty only during the “dry season”. Road upgrading would be required to transport materials (fuel, chemical reagents, food and other supplies) in to an ongoing mining operation, and to transport product out. Oombagooma is close to the coast, and Paladin Energy is examining the option of using barges for materials transport.

An existing airstrip at Oombagooma will also require upgrading, allowing the company to fly in professional employees from Perth, via either Broome or Derby.

Paladin Energy is examining the use of local labour for its mining operation, and is building relationships with local communities. Oombagooma is in an area in which Indigenous people have not yet benefitted from resource development in the Kimberley. Although native title has been extinguished around Oombagooma, the company has found in its negotiations that the Commonwealth is sensitive to the way in which the expectations of the Indigenous people are dealt with.

Training for local people is a potential issue. Training facilities in Derby are very limited. Broome has the required training infrastructure and may also have people who could be recruited on a fly in, fly out basis.

Paladin Energy’s preference is, however, to see the Derby area develop as a source of labour and services for its operations. The company is aware that if Derby develops as a supply centre, both for its own operations and for those of other resource companies, there will be an impact on community infrastructure in the town.

3.4.8 Platinum Australia: Panton²⁷

Platinum Australia is proposing to mine, and produce a platinum group metals concentrate, at its Panton site 60 kilometres north of Halls Creek. Current studies envisage ore processing at a rate of 600,000 tonnes per annum. The company is updating a 2003 bankable feasibility study for the project using a different mining plan and current platinum group metals prices. A decision on the next stage of the project is to be taken following completion of this review.

No public information is available at the present time on mining plans and plans for construction and operation of the planned processing plant that would assist understanding the potential impact of the Panton project on Kimberley infrastructure requirements.

3.4.9 Pluton Resources: Irvine Island²⁸

Pluton Resources is planning to commence the mining of high grade iron ore deposits on Irvine Island within the next 2 – 3 years. The company is also in the process of acquiring the iron ore assets of Cliffs and HWE on nearby Cockatoo Island with a view to continuing their operations until the ore body is exhausted in around 2014.

Operations on Irvine Island are to be largely self-contained. In addition to the mine and associated facilities (blending, screening, crushing and separation), Pluton Resources is planning to develop a marine loading facility which will use barges for the transshipment of product to larger Panamax and Cape Class vessels for subsequent shipping to markets in Asia. A 40 MW diesel power plant and tank farm are to be developed, and fuel for power generation and mining operations is to be brought in from Singapore in three or four shipments a year. Water supply on Irvine Island will be provided by a 3 gigalitre desalination unit.

Pluton Resources expects to invest around \$700 million in developing Irvine Island and continuing operations on Cockatoo Island.

²⁷ Information on the Panton project has been sourced from the Platinum Australia website (<http://www.platinumaus.com.au/>).

²⁸ Information on Irvine Island and Cockatoo Island was sourced from the Pluton Resources web site (<http://www.plutonresources.com/>) and from meeting with the company’s General Counsel on 22 November.

The company is relatively small and expects to contract out most of the mine development and infrastructure construction work planned for Irvine Island. Mining is also expected to be undertaken by a contractor.

Pluton Resources will retain the existing accommodation facilities and airstrip on Cockatoo Island. A ferry service will transport staff from Cockatoo Island to the new mining operations on Irvine Island.

About 140 people will be employed in continuing operations at Cockatoo Island. Construction work at Irvine Island is expected to employ about 600 and ongoing operations will require around 220 people.

Staff will be employed on a fly in, fly out basis with regular flights planned from Broome and Derby to Cockatoo Island.

Pluton Resources is working closely with the traditional owners of Irvine Island, the Mayala people, and expects to recruit around 20-30% of its workforce from nearby Indigenous communities. Provision of housing for people in these communities may be an issue. Individuals do not have title to lands designated Aboriginal reserves, and cannot privately finance their own housing.

3.4.10 Rey Resources: Duchess Paradise Project²⁹

Rey Resources is investigating the mining of thermal coal in the Canning Basin and export the product to markets in Asia. A definitive feasibility study for the project – the Duchess Paradise Project - was completed in June 2011.

The company is proposing to develop a mine and a coal handling and preparation plant, with a production rate of up to 2.5 million tonnes per annum, at a site approximately 175 kilometres south east of Derby. Project approvals are being sought for a mine with an estimated life of 20 years, and for slot mining operations extending over about 10 years, with the prospect of underground mining of deeper coal for a further period of about 10 years. Construction of the mine and associated plant is scheduled for 2013, subject to the timing of government approvals. Production is expected to commence in 2013. The initial project investment is expected to be in the order of \$199 million (2011 dollars).

The proposed mine site is on land which has been extensively grazed for over 100 years, and is located outside the area covered by the Kimberley National Heritage Listing. Water supplies are available at the site.

The Duchess Paradise Project mine is proposed to be located some 30 kilometres from the Great Northern Highway and an access road will be a part of project specific facilities. Rey Resources is planning to transport coal, over this road and over the Great Northern Highway, to the Port of Derby for export. Road trains, of 100 tonnes capacity, are expected to be required for the transport task.

Rey Resources has taken over a sublease on no-longer used mineral export facilities at the Port of Derby, agreeing with the Shire of Derby-West Kimberley to carry out site remediation in accordance with a closure plan which had been prepared by the previous operator. That remediation was substantially completed in 2011 at a cost of about \$1.5 million. Rey Resources plans to use an existing wharf and conveyor loader to transfer coal from a port stockpile to a fleet of barges. The barges will carry the coal to self-loading ships (around 55,000 tonnes), which will anchor about 12 nautical miles (about 22 kilometres) north of the loader.

The Duchess Paradise Project is expected to employ some 300 people during construction, and around the same number once operations commence. Rey Resources expects to recruit some staff locally and to employ others on a fly in, fly out basis.

²⁹ Information on the Duchess Paradise Project has been sourced from the Rey Resources website (<http://reyresources.com/>), in particular from *Managing Director Presentation to AGM*, November 2011; *Fact Sheet: Duchess Paradise Project*, October 2011; *Investor Presentation – Positive Definitive Feasibility Study*, June 2011; and *Fact Sheet: Derby Export Facility Remediation*, June 2011.

The company has formally recognised the Nyikina and Mangala people as the traditional owners of the project area, and has established an employment program specifically drawing on local Indigenous communities. The project site is about 60 kilometres from the Indigenous communities of Jarlmadangah and Looma.

Rey Resources intends to use local contractors and suppliers wherever possible, and aims to offer substantial training and job creation for Indigenous people.

3.4.11 Woodside: Browse Basin LNG³⁰

Woodside Energy Limited's proposed LNG production and export facility at James Price Point, based on significant gas reserves the company has identified in the Browse Basin, is a unique project in the context of Kimberley development. The proposed Browse LNG Development is a joint venture by Woodside, BHP Billiton, BP, Chevron and Shell. The scale of the investment is expected to be in the order of \$30 billion.³¹

The Browse Basin LNG Precinct at James Price Point, approximately 60 kilometres north of Broome, is being developed by the Government of Western Australia. The Browse LNG Precinct will accommodate a minimum of two proponents and should provide a location for processing gas and associated products from the Browse Basin with an LNG production capacity of up to 50 million tonnes per annum. The precinct is expected to include common-user facilities such as the port, roads, infrastructure corridors and workers' accommodation.

Woodside has committed to the Browse LNG Precinct as the foundation proponent and is proposing to locate there:

- ▶ up to three onshore processing trains with 12 million tonnes of LNG production capacity per annum
- ▶ 280,000 m³ of LNG storage, and 300,000 m³ of condensate storage
- ▶ an integrated marine facility
- ▶ power generation infrastructure
- ▶ effluent treatment plant
- ▶ accommodation village.

Basis of design studies for the Browse LNG Development were completed in November 2010, and Woodside is currently (February 2012) completing front end engineering and design work for the project. Key invitations to tender for downstream and upstream work were issued in 2011, and a final investment decision is targeted during the first half of 2013.

Access to the James Price Point site is to be provided by a new sealed road corridor off the existing Cape Leveque Road, which will be constructed by Main Roads Western Australia. Road construction will be financed by the Government of Western Australia as part of its commitments to develop the Browse LNG Precinct.

Woodside expects to use existing facilities at the Port of Broome for the offloading of accommodation units and the first construction modules. Once the integrated marine facility has been progressed, it will be used for the offloading of further onshore construction requirements. On the commencement of production, the facility will be used for LNG and condensate loading, and will provide a base for supply vessels.

Woodside also expects to use Broome Airport and anticipates there will be additional air traffic and vertical movements associated with the construction phase of the Browse LNG Development. The airport has adequate runway capacity but limited capacity in its terminal and other facilities. Woodside is considering a number of workforce management options for personnel flying in and flying out, both during the construction phase of the Browse Basin

³⁰ Information on the Browse Basin Project was obtained from Woodside's website (<http://www.woodside.com.au/Pages/default.aspx>), during a meeting with Woodside's Manager Government Relations and Strategic Infrastructure Manager on 30 November 2011, and from the report *Browse Liquefied Natural Gas Precinct: Infrastructure Assessment Study*, prepared, by AECOM Australia, for the Department of Planning in May 2010.

³¹ Department of State Development, *Significant Resource Projects in Western Australia December 2011*, available at <http://www.dsd.wa.gov.au/6656.aspx>.

LNG Project, and once LNG production commences. Helicopter support for offshore construction will require access to suitable hangars and landing zones.

The Browse LNG Development is expected to have a peak construction workforce of about 6,000 onshore, and 1,500 to 2,000 offshore. A workforce of between 400 and 600 persons will be required to operate the gas plant, which is anticipated to remain in operation for at least 30 years.

A self-contained accommodation village at James Price Point will accommodate 6,000 workers during the peak construction phase, many of whom will work on a fly in, fly out basis. It is likely a dedicated bus service will transport those personnel from the Broome Airport to site.

Some Woodside employees are expected to live in Broome (as are some subcontractors) but this number will be limited to senior management. Additional housing will be required and Woodside is currently considering its housing requirements for both the construction phase and the operations phase of the Development. Any decision on housing will take into strong consideration ways in which to minimise pressure on the Broome housing market.

Woodside is also seeking to create opportunities for the employment of Broome locals and Kimberley Indigenous people. The company is developing strategies that will explore and develop training and employment opportunities for the local workforce (both Indigenous and non-Indigenous), but which minimise the impact on labour requirements of other local industries.

Woodside has recognised community concern about the effects the Browse LNG Development could have on Broome, the Dampier Peninsula and the wider Kimberley and is committed to the responsible development of the proposed Browse LNG Development. Woodside is currently undertaking a Social Impact Assessment to understand and address the potential impacts that may occur on the local economy, land and housing, infrastructure and transport, tourism, marine, recreation, community services and Indigenous capacities during the life of the project. A Browse Social Impact Management Plan will be developed to ensure all potential impacts are minimised and appropriately addressed by Woodside and its contractors.

A Health Impact Assessment is also underway to demonstrate that appropriate health assessment and response tools have been applied to manage any risks to human health, and that impacts on health services associated with the proposed Development are appropriately managed. Woodside will implement a health, emergency and security services strategy to ensure the safety of workers, contractors and the public. It is anticipated that the company will be primarily self-sufficient in providing health services for workers at the construction site and accommodation camp.

4. Infrastructure requirements

Three main factors are shaping the infrastructure requirements of the Kimberley region. These three factors are:

- ▶ a regional economy that is resource-based, and which will expand largely through the further development of mineral and petroleum resources
- ▶ a small but growing population, located largely in five main regional towns and in some 200 Aboriginal communities, spread over some 421,000 square kilometres
- ▶ communities and resourced-based activities that are isolated from each other, and which are remote from the main centres of population and economic activity in the south of the State.

One of the characteristics of infrastructure is that it provides services to multiple users. Coordination of the provision of infrastructure services with the requirements of multiple users of those services can often act as a barrier to infrastructure investment.

In the Kimberley, that coordination problem is absent for a number of the usual categories of infrastructure. The new projects which will develop the region's mineral and petroleum resources are isolated, both from each other and from regional communities, requiring that project proponents develop facilities such as access roads, electric power generation, water supplies, wastewater treatment, accommodation for staff and airfields for the movement staff to and from site. Investments in these facilities, which would often be made by "third parties" to serve multiple users in other locations, will become project specific investments in the Kimberley. The facilities created will be an integral part of the production facilities of individual projects and will not have all of the normal characteristics of infrastructure.

Other facilities required in the Kimberley will, however, have the usual characteristics of infrastructure and, if investments in these facilities are not coordinated with the requirements of users of infrastructure services, further development of the region may be constrained. Our examination of the projects that might proceed in the Kimberley, and our discussions with CME members with operations or planned operations in the region, indicate four types of infrastructure investment likely to be required to promote development. These four types of investment are:

- ▶ investment in the region's roads and, in particular, in the Great Northern Highway
- ▶ investment in the region's ports and, in particular, in the Port of Wyndham
- ▶ investment in housing
- ▶ investment in water supply and wastewater treatment.

4.1 Roads

Increased production from an expanded Ord irrigation area will add to the road transportation task in the East Kimberley and add to traffic moving over the Victoria and Great Northern Highways.

Projects which further develop mineral resources across the Kimberley will have requirements for the transport to site of:

- ▶ materials and supplies for mine operation and the processing of ore
- ▶ distillate for electricity generation.

Those projects will also have requirements for the transport of processed ore to ports for export, probably to markets in Asia.

Within the Kimberley, these transport requirements are likely to be requirements for road transport. Project proponents can be expected to invest in the roads which provide access to specific sites (they are project specific investments). They can also be expected to make use of public road infrastructure in the region.

Anglo Australian Resources at Koongie Park, Rio Tinto at Argyle, Kimberley Metals at Sorby Hills, Kimberley Rare Earths at Cummins Range, and Rey Resources (Duchess Paradise Project) all anticipate increased use of the Great Northern Highway. Not all of these projects may ultimately proceed but, even if they do not, others are likely to emerge with similar demands for use of the Highway.

Increasingly, use of the Great Northern Highway will become an integral part of “production” in the Kimberley. Flows of distillate, materials and supplies into the region, will need to be maintained to ensure efficient production operations. Flows of agricultural and mineral products to the region’s ports will need to be maintained to meet shipping schedules and the requirements of end-users.

In addition, the Great Northern Highway is likely to be used by at least some of the personnel needed on development sites.

Investment in the Great Northern Highway, to allow the safe and dependable movement of larger volumes of traffic all year round, is likely to be necessary to facilitate the further development of the Kimberley.

4.2 Ports

Large volumes of materials for increased agricultural production, for mine operation and for the processing of ore, and large volumes of distillate required for electricity generation, will need to be brought in to the Kimberley by ship.

Some new projects (for example, Woodside’s Browse Basin LNG Project) will be of sufficient scale to allow provision of dedicated port facilities. The isolation and remoteness of other projects (for example, the Pluton Resources development of the Irvine Island iron ore deposits) will require the development of project-specific port facilities. Still others will seek to make use of the existing port facilities in the Kimberley.

Existing port facilities at Derby and Wyndham are of limited scale, as indicated by:

- ▶ Rey Resources’ intention to use barges at Derby to transfer coal for export to ships anchored some 12 nautical miles from the barge loader
- ▶ KMG’s development of its own facilities for the barge to ship transfer of iron ore from its Ridges Project on Cambridge Gulf, south of Wyndham.

Derby, with its tides and absence of anchorage depth, presents some challenges if further development is to proceed in the West Kimberley which requires access to port facilities. However, barging and transshipment could allow continued use of facilities at the port. Port Torment, some 60 kilometres north of Derby, which the Western Australian Government has proposed developing as a supply base for the Browse Basin oil and gas projects, offers deep-water prospects as the site for a regional port.³²

The Port of Wyndham is expected to be important for the export of additional agricultural production from an expanded Ord River irrigation area. Moreover, minerals project proponents like Anglo Australian Resources (Koongie Park), Rio Tinto (Argyle Diamonds), Kimberley Metals (Sorby Hills) and Kimberley Rare Earths (Cummins Range) have all indicated intentions to use the Port of Wyndham.

Again, not all of these projects may ultimately proceed. However, even if they do not, others are likely to emerge with similar demands for use of port facilities at Wyndham. Additional

³² See Department of State Development, *Infrastructure Australia 2009 Fact Sheet 3 - Kimberley Supply Base Point Torment*, available at <http://www.dsd.wa.gov.au/7647.aspx>.

investment in the Port of Wyndham is likely to be necessary to facilitate the further development of the Kimberley.

Further development of the Port of Wyndham and of the other Kimberley ports will be an issue for the proposed Kimberley Ports Authority. The new authority, which will manage port operations at Broome, Derby, Cockatoo Island, Koolan Island, and Wyndham, and operations at the proposed port at James Price Point, will be one of four regional port authorities to be established during 2014. Creation of the four regional port authorities is part of plans for reform the State's ports sector which were announced by the Western Australian Government on 2 March 2012. These plans are being implemented to ensure that efficiently managed port operations continue to contribute to the generation of wealth from increased commodity exports.

4.3 Housing

Even small increases in population – whether the result of inwards migration in response to new employment opportunities, or the result of natural increase - quickly create demands for additional housing in towns with small existing housing stocks.

The demands for land and housing which Browse Basin oil and gas projects are expected to create in Broome have been recognised by project proponents like Woodside and are documented in the Department of State Development's *Browse LNG Precinct Strategic Social Impact Assessment*.³³

Both the Australian Government and the Western Australian Government have recognised demand for housing in the East Kimberley, and have committed to providing social and transition housing under the East Kimberley Development Package. Some \$30 million is being invested in the Commonwealth funded and State managed provision of social housing in Kununurra and Wyndham for people on low incomes. The increase in the stock of public housing is expected to reduce housing stress for Indigenous residents of the towns. A further \$20 million is being provided for transition housing, housing needed to support the transition of Indigenous people into the workforce (with the consequent loss of access to public housing provided in remote communities).

Less well recognised is the demand for housing which will be created if some of the smaller mineral projects proceed in the Kimberley. Anglo Australian Resources (Koongie Park), Kimberley Rare Earths (Cummins Range) and Platinum Australia (Panton) are proposing projects in the vicinity of Halls Creek. If they, or projects like them, proceed, they will create demand for additional housing in a town with very limited housing stock. If, like Kimberley Rare Earths, the proponents of these projects anticipate sourcing food, minor materials, transport and other services from local businesses, "downstream" employment opportunities will be created, with the potential for further demand being placed on already limited housing resources.

A similar situation could emerge in Derby if projects like those being proposed by Paladin Energy (Oombagooma) and Rey Resources (Duchess Paradise Project) proceed.

Significant barriers to the provision of additional housing in the Kimberley have been recognised. They include:

- ▶ native title and Indigenous heritage issues
- ▶ complex and anomalous land tenure arrangements, resulting in complex and lengthy land assembly processes
- ▶ capacity constraints in the building and construction industry requiring the need to attract an adequate supply of builders and associated trades to undertake construction projects
- ▶ housing affordability (with building costs in the Kimberley significantly higher than elsewhere in Western Australia)

³³ Government of Western Australia, Department of State Development, *Browse LNG Precinct Strategic Social Impact Assessment, Volume 2: Assessment of Impacts and Specialist Studies*, November 2010, pages 27-32.

- ▶ high costs of development and relatively low market values, resulting in low rates of return on housing investment
- ▶ the absence of private investors in the housing sector
- ▶ the uncertain demand for housing at an early stage of regional development.³⁴

If these barriers are not overcome, and additional housing investment is not forthcoming, particularly in those regional towns with small existing housing stocks, development may be impeded.

Not only may certain projects not proceed, or not proceed as early as is currently planned. Development more generally may be restricted because, as Rio Tinto and the Kimberley Development Commission advised us, the difficulty of finding housing was acting as a disincentive to Indigenous people taking advantage of employment opportunities which were becoming available in the Kimberley.

Lowering of a number of the barriers to the provision of additional housing – in particular, those that arise from native title and Indigenous heritage issues, and from existing land tenure arrangements – are matters for the Western Australian Government. Through the continued provision of housing for the staff of government agencies – as is happening under the Royalties for Regions program – the Government can reduce the pressure on existing, limited, housing stocks. More importantly, through its continued financing of the provision of housing and public buildings, the Government can support development of the building and construction industry in the Kimberley. It can support the maintenance, within the region, of a workforce equipped with the requisite range of building, construction and associated trade skills, which is likely to reduce building costs in the longer term.

4.4 Water supply and wastewater treatment

The project proponents with whom we spoke did not raise limited water supplies as a factor impeding further development in the Kimberley. However, as we were advised by the Department of Water, much of the Kimberley should be regarded as a water-limited environment. Some towns, like Broome and Halls Creek, are facing issues with maintaining supplies of potable water as populations increase.³⁵

If new resource projects proceed, the populations in smaller regional towns are likely to increase from inwards migration in response to the business and employment opportunities which will be created. Pressure will be placed on existing water supply and wastewater treatment facilities. If development is not to be impeded, further investment in those facilities will be required. This will, at least initially, be an issue for the Water Corporation, which currently provides and operates water supply and wastewater treatment infrastructure in towns across the Kimberley.

4.5 Development, rising incomes and rising expectations

Development in the Kimberley is resulting in rising incomes in the region, particularly for members of Indigenous communities able to access employment opportunities created by minerals and petroleum projects.

Rising expectations tend to accompany rising incomes and, our attention was drawn to this by a number of the CME members with whom we met, and by the Chief Executive Officer of the Kimberley Development Commission.

Those rising expectations were becoming evident in the demands for housing which we noted earlier in this report, and contributed to the requirement for additional housing investment noted in section 4.3 above.

³⁴ See Western Australian Planning Commission *Regional Hotspots Land Supply Updates* referred to in footnotes 6, 7 and 8.

³⁵ See page 12 above.

Less evident from our desk-top investigations into Kimberley development, and from our meetings and discussions with CME members and others, was the effect rising incomes and rising expectations were having on the demand for education services and facilities in the region. However, a number of the interviewees drew our attention to an emerging potential issue. People in the region and, in particular, Indigenous people, whose incomes now allowed them to meet the expense, send their children to (usually) private schools in the Perth metropolitan area. Those for whom this option was not available were becoming concerned with perceived low standards of the education facilities and services which were available in the region.

4.6 The role of Government in infrastructure provision

The Great Northern Highway is an asset of the State of Western Australia. The Port of Wyndham is operated by Cambridge Gulf Ltd (a company formed as part of restructuring of the Ord River District Cooperative Ltd), but is owned by the State. The release of land for housing in the Kimberley will be, at least initially, a matter for Western Australia Department of Regional Development and Lands.

If further investment is required in the Great Northern Highway, in the Port of Wyndham, and in the provision of housing in the Kimberley, the Government of Western Australia is likely to be called upon to make at least a part of that investment.

Would investment in public infrastructure in the Kimberley represent a sound use of the economic resources of the State at a time when there are many demands being placed on those resources? A precise answer to this question cannot be given in the absence of specific information on the scale of the investment required and its economic impact.

However, the question might be answered in broad terms by reference to recent economic studies which indicate that public infrastructure investment has a positive impact on the productivity of the private sector.

From a study of Australian data for the period 1966/67 to 1989/90, Otto and Voss found that a 1% increase in the public capital stock increases the aggregate output of the private sector by 0.4%.³⁶ They concluded that public investment has a positive and statistically significant impact on private sector production. Otto and Voss also examined the industry sector effects of public investment and found the percentage change in mining sector output as a result of a 1% change in the public capital stock to be high. However, their results by sector were generally of poor quality, which suggested inadequacies in the models that they were using.

A more recent study by Paul which addressed some of the limitations in the methods used by Otto and Voss, confirmed the positive and statistically significant impact of public investment on private sector production in Australia.³⁷ Paul found that a 1% increase in the public capital stock increased the aggregate output of the private sector by about 1.2%. He explained the difference between this and the Otto and Voss result in terms of his use of a different model, some differences in the data used and the use of different statistical methods.

Paul also made estimates of the rate of return from public infrastructure investment, finding that the rate varied between 54.6% and 111.9% over the period 1968/69 to 1995/96. In advancing these estimates he:

- ▶ cautioned that they were obtained using potentially controversial estimates of the marginal cost of public funds
- ▶ noted that they were obtained by assuming that public infrastructure provided no benefits to final consumers when, in fact, most public infrastructure (highways, roads, water supply and sewerage systems) provided benefits to those consumers.

³⁶ Otto, Glenn, and Graham M Voss (1994), "Public Capital and Private Sector Productivity", *Economic Record*, vol. 70, no.209, pages 121-132.

³⁷ Paul, Satya (2003), "Effects of Public Infrastructure on Cost Structure and Productivity in the Private Sector", *Economic Record*, vol. 79, no. 247, pages 446-461.

Paul also examined the industry sector effects of public investment, and found that a 1% increase in the public capital stock increases the output of the mining sector by about 1.2%.

These studies, by Otto and Voss and by Paul, suggest (they use highly aggregated data) that further investment in infrastructure by the State will have a strong positive effect on the economy of the Kimberley. They do not, however, provide any indication of the net economic benefits from that investment.

4.6.1 Potential project funding sources

The role of the government is, of course, not limited to the creation and ownership of infrastructure assets. They may also play an important role in facilitating and financing infrastructure provision. Whilst there is increasing levels of private sector investment in developing infrastructure projects in the region there is no one funding source or solution that is capable of meeting the infrastructure needs of the region. However, there are a number of initiatives that have been introduced that could assist to address some of the funding challenges for development of regional infrastructure.

The *East Kimberley Development Package* and the Western Australian Government's *Royalties for Regions* program have been, and continue to be, important vehicles for infrastructure facilitation and financing, as well as for its creation. Some \$25.9 million of investment in Kimberley region infrastructure, to be financed through the *Royalties for Regions* program has been planned for 2011-12. The projects and the planned expenditures are listed in Table 17.

Table 17: Kimberley Royalties for Regions projects 2011-12

Project	\$ million
Regional mobile communications project	0.9
Community safety network	4.7
Housing for workers	7.0
Conservation parks infrastructure and roads	1.3
Regional Schools Plan: Derby District High School	7.0
Regional Schools Plan: Broome Senior High School	5.0
Total	25.9

Source: Department of Regional Development and Lands, *Royalties for Regions 2011-12 Budget: Estimated Regional Breakdown*, available at <http://www.rdl.wa.gov.au/publications/Documents/Royalties%20for%20Regions%202011-12%20Budget-%20Regional%20Breakdown.pdf>.

The Australian Government's *Regional Infrastructure Fund* is potentially important for the future provision of Kimberley infrastructure. Over the decade 2010–11 to 2020–21, the Regional Infrastructure Fund is expected to provide some \$6 billion, sourced mainly from the proceeds of the Minerals Resource Rent Tax, for investment in urgently needed infrastructure to support the mining industry, boost export capacity and develop regional economies.

The broad objectives of the Australian Government, when it established the Regional Infrastructure Fund, were:

- ▶ promotion of development and job creation in mining communities, and in communities which support the mining sector
- ▶ provision of a clear benefit to Australia's economic development, and to investment in Australia's resource or export capacity
- ▶ removal of potential capacity constraints arising from export production and resource projects.³⁸

³⁸ Australian Government, Department of Infrastructure and Transport, *Regional Infrastructure Fund*, at <http://www.infrastructure.gov.au/infrastructure/rifp/>.

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